Catalogue Description	This advanced 3D animation and rigging course explores the process of bringing 3D characters to life; from concept, through production, to finished performance.
Objective	Students will begin with a crash course in performance and animation fundamentals. Subsequent projects will take the student through the entire production of an original 3D character including organic modeling, character setup, and texturing. Students will learn how to plan out a rigging strategy based on script and storyboard. They will then build skeletons, apply skin deformation and weights for proper flexion, incorporate constraints, customized controls for arc based FK and goal based IK movements, scripted and keyed connections, and build in controls for added performance efficiency. The final phase of the class will take the animation production process full circle. Characters will be animated and composited along with live action, dynamics, and visual effects into a complete short animated film.
Prerequisites	ITP 215
Instructor	Lance S. Winkel E-mail: winkel@usc.edu Tel: 213/740.9959 Office: OHE 530 H Office Hours: Tue/Thur 8am-10am Lab Assistants: Qingzhou Tang: qingzhot@usc.edu
Hours	4 hours
Course Structure	• There are eleven weekly assignments build to lead up to a series of benchmarks for each phase of production. Details are listed in the Class Outline sections below, and on Blackboard. • Details and instructions for all projects, benchmarks, and assignments will be available on Blackboard. • The grading values for each assignment and benchmark are listed in the Grading section below • There will be a capstone Final Project due for presentation at the beginning of the Final Exam session. • The Final Exam will be conducted at the time dictated in the Schedule of Classes. Thursday, December 7, 2-4pm, OHE 542
Textbook(s)	Blackboard Autodesk Maya Documentation Resources online and at Lynda.com and knowledge.autodesk.com Adobe online resources where necessary for Photoshop and After Effects

Grading	Animation Project One (1 of 3) = 10 points
	Animation Project One (2 of 3) = 10 points
	Animation Project One (Finished) = 20 points
	Character Project (1 of 4) = 10 points
	Character Project (2 of 4) = 10 points
	Character Project (3 of 4) = 10 points
	Character Project (Finished) = 20 points
	Rigging Project (1 of 5) = 10 points
	Rigging Project (2 of 5) = 10 points
	Rigging Project (3 of 5) = 10 points
	Rigging Project (4 of 5) = 10 points
	Rigging Project (Finished) = 20 points
	Final Animation Project (1 of 3) = 10 points
	Final Animation Project (2 of 3) = 10 points
	Final Animation Project (Finished) = 50 points
	Final Exam = 50 points
	Attendance and Participation = 30 points
	Total = 300 points
Grading Scale	Letter grades will be assigned according to the following scale:
	93%+ A
	90-92% A-
	87-89% B+
	83-86% B
	80-82% B-
	77-79% C+
	73-76% C
	70-72% C-
	69 D+
	67-68 D
	66 D-
	65 and below F
	Half percentage points will be rounded up to the next whole percentage. So for instance, 89.5% is an A-, but 89.4% is a B+.
Homework	All homework will be submitted on Blackboard. Detailed instructions and resources for each assignment will be posted on Blackboard along. http://blackboard.usc.edu
Policies	*Make-up policy for exams:* To make up for a missed exam, the student must provide a satisfactory reason (as determined by the instructor) along with proper documentation. Make-up exams are generally only offered in emergency situations.
	Before logging off a computer, students must ensure that they have saved any work to either a USB drive or a service such as Dropbox. Any work saved to the computer will be erased after restarting the computer. ITP is not responsible for any work lost.
	ITP offers Open Lab use for all students enrolled in ITP classes. These open labs are held beginning the second week of classes through the last week of classes. Hours are listed at: http://itp.usc.edu/labs/.

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct/.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu/ or to the *Department of Public Safety* http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage sarc.usc.edu describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information http://emergency.usc.edu/* will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

A Further Note on Plagiarism *NOTE: This is a custom blurb that I use in my classes. You can remove this if you don't want it.*	In this class, all homework submissions will be compared with current, previous, and future students' submissions using MOSS, which is a code plagiarism identification program. If your code significantly matches another student's submission, you will be reported to SJACS with the recommended penalty of an F in the course. It is okay to discuss solutions to specific problems with other students, but it is not okay to look through another student's code. It does not matter if this code is online or from a student you know, it is cheating. Do not share your code with anyone else in this or a future section of the course, as allowing someone else to copy your code carries the same penalty as you copying the code yourself.

Course Outline

Week 1 – Introduction and review of animation principles

Day 1

Introduction to the class
Overview of course plan and objectives
Review of basic animation principles

Day 2

Planning a performance based on story
Thinking through and breaking down motions
Weight, mass, and physicality
Arced verses linear motion
Staging and animation layout in a 3D scene
Posing to the camera

Reading

Reference Slides
Character Creation, Chapter 1

Project

Animation Project One (Week 1 of 3): Using a video camera, record several takes of a five to ten second performance that reveals a character dramatically changing emotions. While using another person as an actor is okay, for the purposes of understanding the physicality of the performance, it is much more preferable for you to act out the performance yourself. Also, shoot several subsequent shots of the action with the actor emoting to the camera for facial study. Isolate the best performance. Using the supplied character rig, block out the actions for the performance as key poses. Strong gesture and silhouette are encouraged. Due Week 2.

Week 2 – Intermediate Animation and Timing Techniques

Day 1

Initial layout critique
Building stronger poses and factoring in timing
Speed, performance, and the illusion of motion
Persistence of vision

Day 2

Review of animation curve editing tools and techniques
Understanding "what is real?"
Predicting the audience's innate sense of expectations
Anchoring limbs
When to move, when not to move
The illusion of friction

Reading

Reference Slides
See Blackboard for additional slides and assigned reading.

Project

Animation Project One (Week 2 of 3): Based on initial critique, refine and improve the key poses to enhance and push the performance. Continue adding keys and fleshing out the main physical performance. Due Week 3.

Week 3 – Facial Animation Techniques

Day 1

Preparing and importing audio for facial animation timing

Animating faces for emotion and dialogue

Facial GUI vs. facial joint array vs. blend shape driven expressions

Day 2

Performance critiques – in class

Fine tuning performance

Reading

Reference Slides

Character Creation, Chapter 2

Project

Animation Project One (Week 3 of 3): With the physical performance captured, and a camera setup to center on the face, import the audio and animate the facial phonemes. Due Week 4.

Week 4 – Fundamental Character Modeling Techniques

Day 1

Character design fundamentals

Defining "what is the story?" and "who is the character?"

Designing a character to directly support the story

Day 2

3D Modeling fundamentals

Building a smart and efficient character base mesh

Overview of pipelines and software tools for character modeling (Maya, Mudbox, ZBrush, Poly, Subdiv, NURBS, etc.)

Planning the modeling process

Reading

Reference Slides

See Blackboard for additional slides and assigned reading.

Project

Character Project (Week 1 of 4): Based on a rough concept and the story details handed out in class, design the character to support the modeling, rigging, and animation that will be required throughout the remainder of the course. Block out the character using the techniques demonstrated in class. Due Week 5.

Week 5 – Musculature and Detail Modeling Techniques

Day 1

Intermediate 3D character modeling concepts and techniques

Edge loops

Details, contours, and profile

Day 2

In-class character in-progress model critiques

Silhouette and staying on character

Musculature and anatomy

Flexion, range of motion, and structure to support movement

Reading

Reference Slides

Character Creation, Chapter 3

Project

Character Project (Week 2 of 4): Fix any early design issues, overly complex geometry, proportion problems, and/or bad edge loops. Add in details and musculature evenly across the entire character, taking care not to overwork any specific area too heavily too quickly. Remember that every vertex should contribute to the shape of the object. Vertices that are not contributing to shape are a waste and should be removed, or adjusted. Fingers, muscles, and details should be complete. Due Week 6.

Week 6 – Facial Modeling Techniques

Day 1
Defining facial features and anatomical primitives
Modeling eyes
Modeling teeth and mouth
Modeling eyelids and anatomical face structure (NURBS vs. polygon)

Day 2
Facial modeling and edge looping techniques
Assembling all the pieces
Seamlessly integrating and unifying all the pieces

Reading
Reference Slides
See Blackboard for additional slides and assigned reading.

Project
Character Project (Week 3 of 4): Fix any problems. Work out any shape or proportion problems before moving on to the facial features. Starting with anatomical primitives, model in the eyes and mouth with attention to strong evenly distributed edge loops. With eyes and mouth complete, model in the remainder of the facial details, and then combine all of the facial features into the head. Due Week 7.

Week 7 – Character Model Cleanup and Rigging Preparation

Day 1
Final cleanup considerations
Clothing, armor, and prop building
Preparing to make the character move

Day 2
In-class character full model critiques
World centering the character
Freezing transforms
Deleting history
Node orientation

Reading
Reference Slides
Character Creation, Chapter 4

Project
Character Project (Week 4 of 4): Refine and add any final anatomical details to the character. Build in any remaining clothing, armor, and props. Cleanup the model and complete final preparations to rig the character beginning next week. Due Week 8.

Week 8 – Character Skeleton Construction

Day 1
Cursory overview of the range of available character rigging tools and techniques

Understanding character movements and kinematics
Predicting the needs of a character rig based on story necessity
Building skeletons to drive 3D character movement

Day 2

Review of hierarchies, history, and deformation order
Goal vs. arc based motion
How to plan and organize an efficient, durable, and sound character node network

Reading

Reference Slides
See Blackboard for additional slides and assigned reading.

Project

Rigging Project (Week 1 of 5): Assess the needs of story and begin rigging the character model by building a skeleton joint hierarchy. Completely name all joints. Freeze transforms, orient joints, incorporate IK/FK to address the performance needs, and any additional controls as necessary. Due Week 9.

Week 9 – Character Skinning Techniques

Day 1

Proper posing for healthy character deformation
Relaxed Pose vs. T-Pose
3D Character skinning techniques

Day 2

Painting and refining character skin weights
Deformation systems
Cables, hoses, clothing armor, and other accessories

Reading

Reference Slides
Character Creation, Chapter 5

Project

Rigging Project (Week 2 of 5): Properly align the character rig and joint skeleton. Bind the character to the rig and begin resolving any problems with the initial bind. Due Week 10.

Week 10 – Facial Rigging Techniques

Day 1

Techniques for facial deformation
Blend shape based facial movement
Modeling facial deformation targets
Joint based facial movement

Day 2

Hybrid facial rigs
Advanced topics on deformation order
When to GUI or not to GUI

Reading

Reference Slides
See Blackboard for additional slides and assigned reading.

Project

Rigging Project (Week 3 of 5): Assess the needs of the performance to determine which expressions need which type of deformer based on the character model. Temporarily

zero out the influence of the bind deformation. Duplicate the geometry of the character, and begin modeling facial expressions and phoneme targets. Once complete, apply the expressions to the character using a blend shape deformer. Build and add joint influence for any additional joint driven expressions. Due Week 11.

Week 11 – Advanced Character Rigging and controls

Day 1

Modeling custom wire controllers

Wire controller generators, scripts, and plug-ins

Day 2

Character control and integration

Custom attributes and advanced control techniques

Connecting attributes, expressions, and set driven keys

Reading

Reference Slides

Character Creation, Chapter 6

Project

Rigging Project (Week 4 of 5): Add attributes and control nodes as necessary to streamline performance. Use expressions and driven keys to better automate animation of the character. Due Week 12.

Week 12 – Character Rig Final Phase Testing Methods

Day 1

Hands on testing of the completed character rig

Day 2

Customizing interface and camera controls to optimize the animation process.

Developing the story for the final animation project

Reading

Reference Slides

See Blackboard for additional slides and assigned reading.

Project

Rigging Project (Week 5 of 5): Based on the in-class testing and feedback for the character rigs, make final changes and improvements as necessary. Lock and hide unnecessary or vulnerable aspects of the rig. Story concepts and storyboards are also due. Due Week 13.

Week 13 – Preparing to animate

Day 1

Camera and scene setup

Props

Blocking in for elaborate movement and interaction

Day 2

Actor accessories (swords, guns, devices, ropes, ladders, vehicles, platforms, etc)

Transitioning between hand, holster, and free movement

Working with dynamics and other scene complexities

Reading

Reference Slides

See Blackboard for additional slides and assigned reading.

Project

Final Animation Project (Week 1 of 3): Make story changes and improvements to storyboards and layout based on in-class critique. Begin animating the final project. See the Final Project details below.

Week 14 – Enhancing character performance with dynamic effects

Day 1

Critique of blocked-in animation

Day 2

Adding Dynamic effects to enhance character performance
Object emission characteristics
Surface matting techniques
Dust, rain, sweat, splashing, fire, and wind techniques

Reading

Reference Slides
See Blackboard for additional slides and assigned reading.

Project

Final Animation Project (Week 2 of 3): Continue work on the final project. Incorporate dynamic effects to the final as necessary.

Week 15 – Special Topics in Character Animation and 3D Special Effects

Day 1

Combining a 3D character convincingly into a live action scene
Matching lighting, texturing, and surface details
Special topics in character animation and visual effects
Integrating effects with live actors

Day 2

Critique of full performance
Remaining time will be Final Exam Study Session

Reading

Reference Slides
See Blackboard for additional slides and assigned reading.

Project

Final Animation Project (Week 3 of 3): Finish the final animation for turn-in and class critique during the final exam meeting.

Final Exam – Thursday, December 7, 2-4pm, OHE 542

All students must attend Final Exam session!
Multiple choice, Bring pencil and eraser, No make-ups!

ITP 315 – Final Project:

Create an animated sequence using your rigged 3D character puppet. The animation must be at least twenty seconds long, but can be made up of many separate consecutive shots.

Performance:

A significant event is about to occur. This can be something positive or negative, heartwarming or bone chilling, sublime or action packed. You may choose the event, but the character must express a significant emotional response and dramatically respond to this event. Throughout the performance, your animated character performance should demonstrate the following:

- The animated character cannot stand in place and it must move and rotate outside of a single axis.
- Feet and other limbs must not slide relative to the stage, ground plane, or background plate, when they are in contact with the ground.
- Limbs must remain registered to any props when they are in contact with them.
- Character facial gestures should be synchronize with some dialogue or audio track or go through a significant range of expression that is APPROVED BY THE INSTRUCTOR if not synced to audio.
- Camera setup and placement to enhance performance
- Furthermore, the performance must demonstrate the fundamental animation principles that we have discussed:
    o Squash and stretch
    o Anticipation
    o Follow through
    o Overlapping
    o Staging
    o Slow in and slow out
    o Arcs
    o Secondary motion or action
    o Timing
    o Exaggeration
    o Aesthetic quality
    o Appeal

Staging:
To finish the project, the Character will need to be performing and interacting relative to a simple environment. Even a simple set will do, but you can use other models you have made, or sets, or footage. Try to make sets look clean. If using footage, make it look quality. This space will serve as a stage or set for the performance, and can be created with any or a combination of the following methods:
- 3D geometry
- Composite Sets made up of 2D images projected against 3D Geometry
- 2D background plates

Grading Criteria:
The Final project is worth 50 points.
- Demonstrated effort (10 points)
- Complexity, range, and effective use of tools (10 points)
- Quality of the finished product
    o Animation performance (20 points)
    o Visual quality (10 points)