



# USC

## ITP 351 – 3D Character Modeling for Games

**Units: 4**

**Spring 2022**

**Lecture/Lab: Tuesday, Thursday: 6:00 - 7:50 pm**

**Location:** KAP 107

**Instructor:** Mayan Escalante

**Office:** Zoom

**Office Hours:** TBD

**Contact Info:** [mayanesc@usc.edu](mailto:mayanesc@usc.edu)

**CTA:** TBD

**Contact Info:** TBD

### Course Description

Extrapolate unique design needs of a 3d video game character and then construct that character in 3d polygons. Learn the technical and artistic process to approximate not just topology of a character, but polygon count, UV unwrapping for textures, and edge flow to have them deform realistically within a realtime game engine. This course takes the biological studies of natural muscle, bone and skin and uses it in conjunction with newer technologies such as photogrammetry, voxel scanning, and AI retopology to define new video game character 3d model creation for 21<sup>st</sup> century games.

### Catalogue Description

Model a complete 3d polygonal character Examine and assimilate game character design, mass and weight. Students mold and modify using both artistic design and technical construction.

### Course Interrelations

The basic differences between the classes of modeling, rigging and animation for a 3d character can be applied to the centuries-old tradition of marionette puppetry: Modeling is the carving and painting of the character from wood, rigging is the addition of hinges and strings to allow controls for a puppeteer, and animation would be the puppeteer using the various controls to simulate life in the marionette.

### Learning Objectives and Outcomes

- Apply 3d methods to 'break down' limited drawn 2d character concepts into solid 3d models.
- Organize and construct polygon edge flow into edge loops for smooth body and face deformation.
- Determine and arrange UV space for even texturing and maximize detail efficiently.
- Combine established modeling methodologies with newer techniques (photogrammetry, voxels).

**Prerequisite(s):** ITP 215 or CTAN 452

**Recommended Preparation:** Any experience with polygonal modeling.

### Course Notes

This course will assign a letter grade.

Students will submit work via Blackboard, and by showing builds to instructors and peers in class.

### Technological Proficiency and Hardware/Software Required

The class uses the 3D software Maya 2019. Students are required to sign up for the three-year free trial.

## Lecture and Lab

Class will be divided between lecture and lab. Lecture is in the first half of class (Tuesday 9:30 am – 12:30 am) and the lab is the second half of the class (Friday 12:00 am – 2:00 pm).

## Description and Assessment of Assignments

Items listed as 'Homework' are assignments that the student should be finished with to keep up in class, whereas items listed and underlined as 'Deliverables' are assignments to be handed in (using either Blackboard or a Google Drive as set up by the CTA) as a graded project.

**Course project:** the purpose of the class project is to be able to build a unique 3d character for animation in a video game. You need to identify the issues specific to any characters' unique topology; sample models will be provided to students in the first half of class, and a unique model will be assigned per student in the latter half. Working as a group is encouraged if the 3d models are similar enough in topology with the express understanding each student turns in a separate and unique 3d character mesh. A team can consist of no more than 4 persons.

Project Timeline:

- Week 2: In-class check of Maya installation and Google Drive access
- Week 4: Prototype model Baseman due
- Week 9: Mid-term Unique Model due (Equidistant polygon edges, matches guide, deformation poly flow)
- Week 14: Unique Character UV layout (issues with topology, proposed solutions)
- Final: Final Character model due (review from assignee, problems, and pivot solutions)

**Sample Project:** Student constructs a polygonal 3d character model from scratch after identifying the polygon budget, deformation needs of joins, and detailing for prop and/or facial animation to complete it within an agreed deadline for that assignment.

**Project Purpose:** Each 3d character model has unique needs, and the modeler needs to create solutions for that character's identification and movement within a video game. The modeler must communicate with the person or team who needs the 3d character to and collect all relevant data for the end-goal of the character. The student will become familiar with identifying and executing all modeling needs for any 3d video game character.

## Grading Breakdown

Assignment	% of Grade	Due
Weekly Deliverables	50	Ongoing
Midterm Model Deliverable	20	Week 10
Final Model Deliverable	30	Week 15
TOTAL	100	

## Assignment Rubrics

Assignments and Homework are due at the beginning of class of the assigned week and expected to be clear of extra or 'rogue' polygons, groups, history, dead-link texture references or other unaccounted objects in Maya to gain full points on the above breakdowns for deliverables.

### **Missing an Assignment Deadline, Incompletes:**

The only acceptable excuses for missing an assignment deadline or taking an incomplete in the course are personal illness or a family emergency. Students must inform the instructor ***before the assignment due date*** and present verifiable evidence in order for a deadline extension to be granted. Students who wish to take incompletes must also present documentation of the problem to the instructor or student assistant before final grades are due.

For assignments turned in after the assignment deadline without prior permission from the instructor, a penalty will be imposed equal to 10% of the total available points for the assignment, for each day or part of a day that the assignment is late, up to a maximum of seven days.

### **Attendance Policy:**

Punctual attendance at all classes is preferred to provide the best feedback loop for your character models, but accommodations can be made for asynchronous attendance if the student contacts the instructor early in the semester. Please contact the instructor before any absence from class or communicate as early as possible any special exception to attend class asynchronously. Make sure to also communicate equally with the CTA.

Social media, including text messaging and internet messaging, are excluded from class unless explicitly permitted by the instructor.

### **Diversity**

In making games and interactive media in a professional and ethical way, it is important that you consider diversity. When looking at your projects, you should consider who is depicted and how this work will impact others. What kinds of individuals and communities are represented in your work? What point of view does your work express? This class may assist you in learning how to make work that includes diverse viewpoints, and may discuss racial, religious, gender and sexual orientation issues in the context of games and interactive media.

### **Creating an Inclusive Space**

In this class, we make a commitment to foster a welcoming and supportive environment where students of all identities and backgrounds can flourish. This means that you will be expected to offer content warnings when appropriate, use students' stated pronouns, and respect self-identifications. While debate and discussion are welcome, please remain aware of the implications of your words and the images that you include in your work. If the instructor or another student points out something problematic, avoid being defensive; this is a valuable opportunity for us to grow and learn together. If you have a concern about any aspect of the class, you are welcome to speak with the instructor or the advisor for the division.

### **Additional Policies**

This course emphasizes teamwork, and one of the desired learning outcomes is for students to develop communication and leadership skills. Students are expected to treat each other with respect, listen to each other, and work together towards a shared, collaborative, healthy work culture. Any student found to be disruptive or engaging in behavior that does not meet the standards of respectful teamwork may be asked to leave by the instructor.

If you experience any problems with a fellow student regarding their work, please bring up your concerns with the instructor.

### **Course Schedule: A Weekly Breakdown**

Below is the detailed course calendar that includes a list of deliverables (homework assignments, examinations, etc.) broken down on a weekly basis. It includes:

- Subject matter, topic and activity
- Required preparatory reading or tasks (e.g., viewing videos)
- Deliverables and when each deliverable is due.

	<b>Topics/Daily Activities</b>	<b>Readings/Preparation</b>	<b>Deliverables</b>
<b>Week 1</b>	<p><b>Introduction to course</b> Special hours to accommodate orientation, asynchronous learning, and video resources.</p> <p><i>Part 1 content:</i> USC code of conduct USC Blackboard, USC Lynda.com</p>	<p><b>Lecture:</b> Basic tenants of character design: Readability, distance, silhouette. Familiarity with Polycount forums. Need turnaround guides – make sure body aligns in images. Also: Greyboxing first to allow the rest of your team to work as you make a better model. Outline areas of concern for next weeks.</p> <p><b>Lab:</b> Choose from provided drawings of front, side and back character turnaround guides to build.</p> <p>Choose teams, create guides and start blocking in entire character geo over the guides using poly cubes.</p>	<p><b>Homework:</b> Create 3d ‘guides’ from drawings in Maya Blocked out cubes for greyboxed character. Create red BG lines from side front using pixlr or photoshop for matching major body parts in guides</p>
<b>Week 2</b>	<p><b>Introduction to Maya</b> Maya and web support resources: Online help, class webpage, tutorials, etc. Lab times, contact hours.</p>	<p><b>Lecture:</b> Modeling with primitives and creating a base body shape using cylinders. Focus on edge flow and existing UV layouts from default geometry.</p> <p><b>Lab:</b> Finish first pass of character avatar model using simple ‘cube’ Maya geometry Create <b>new</b> Maya cylinder body in T-pose</p>	<p><b>Deliverable:</b> Save greyboxed building-block avatar to online portfolio. This ‘greyboxing’ allows others to do their work as you continue.</p>
<b>Week 3</b>	<p><b>Complex Maya Modeling</b></p> <p><b>Level of detail for characters and areas of focus (Ex: Head for talking games, body for fighting)</b></p>	<p><b>Lecture:</b> Studying poly loops and UV layout of selected SDKs of professional character models from polycount. LOD for larger characters and poly limits</p> <p><b>Lab:</b> Sort rings of cylinder all over the body for character, completing legs, torso, and arms.</p>	<p><b>Drawing:</b> Sort out new base model using combined cylinder geometry</p> <p><b>3D:</b> Create ‘baseman’ simple character in Maya. Tutorial on class website.</p>
<b>Week 4</b>	<p><b>Sorting UVs in Maya</b></p> <p><b>Making the texture intone detail versus modeling</b></p>	<p><b>Lecture:</b> UVs versus polygon modeling. Distinct advantages of modeling half, laying out UVs, mirroring. Order of operations and how it saves time and rework.</p> <p><b>Lab:</b> Sort out the UVs in Baseman model for texturing using 3d UV tools. In-class tutorial and video tutorial.</p>	<p><b>3D:</b> UV layout ‘baseman’ in Maya (video tutorial on class website)</p>

<p><b>Week 5</b></p>	<p><b>Sorting UVs in Maya</b></p> <p><b>New toolsets and efficiency (Ex: tearoff UV layout menu)</b></p>	<p><i>Lecture:</i>  <i>Making an object 'LIVE' to draw polys over it. Process of creating simpler geometry base meshes and then focusing on poly loops. (Ex: faces)</i></p> <p><i>Lab:</i>  <i>Use 3d obj model projection of face from image and make 'live' to lay out polys.</i></p>	<p><b>3D:</b>          Layout original character using more complex shapes in Maya</p>
<p><b>Week 6</b></p>	<p><b>Laying out 'Shoebbox Garage'</b></p> <p><b>Hard surfaces vs characters</b></p>	<p><i>Part 1:</i>          Edge loops and design unique to the character's needs (action vs static). Goal is to understand poly flow.</p> <p><i>Part 2 Lab:</i>  <i>Complete hands, feet.</i></p>	<p><b>3D:</b>          Precision Measurement for accurate 3d creation. Build half of the chosen character. (See details on class webpage)</p>
<p><b>Week 7</b></p>	<p><b>Choose textures for 3D model</b></p> <p><b>What 'pops' in game and why. Palettes of color and their communication to the player</b></p>	<p><i>Part 1:</i>          Training of using image using pixlr.com or Photoshop to find and use images for texturing the polygon layout.</p> <p><i>Part 2 Lab:</i>          Texture the built 3d character model. Prioritize head, body, props</p>	<p><b>Drawing/3D:</b>          Utilize online images for texture for 3d modeled character. Texture the chosen character, mirror finished product.</p>
<p><b>Week 8</b></p>	<p><b>Character Modeling vs Prop Modeling</b></p> <p><b>What do you need versus visibility - can animation compensate (Ex: Throwing grenade)</b></p>	<p><i>Part 1:</i>          Training of using Maya for edge flow modeling and connecting cylinders for organic modeling vs. extrusions. Edge flow for deformation. 'Real estate' for important areas.</p> <p><i>Part 2 Lab:</i>          Redraw character using edge flow. Study existing polycount SDK models.</p>	<p><b>Drawing:</b>          Download/study polycount SDKs for edge flow. Draw edge flow of character on 2d printout or digital printout of character.</p> <p><b>3D:</b>          Rebuild/modify character polylines according to new edge flow</p>
<p><b>Week 9</b></p>	<p><b>Review of Character in Class Groups. Show to other groups for feedback and critiques.</b></p>	<p><i>Part 1:</i>          Form teams for instructor review of character modeling. Advice of trimming flow down to match the defined role. Second drawover in class.</p> <p><i>Part 2 Lab:</i>          Start modeling character according to new image planes.</p>	<p><b>Drawing:</b>          Rebuild edge flow of character.</p> <p><b>3D:</b>          Start modeling character body according to new image planes</p>

<b>Week 10</b>	<b>Review of Character Body Modeling</b>	<p><i>Part 1:</i> Discussion of unwrapping body UVs versus face. Planar unwrap vs. spherical.</p> <p><i>Part 2 Lab:</i> Begin modifying unwrapped UVs. Optimize using 'relax' function in Maya</p>	<b>3D:</b> Finish unwrapping body UVs Paint over image projection.
<b>Week 11</b>	<b>UI and UX – Clear Communication with Player is Key</b>  <b>Are you guiding the player?</b>	<p><i>Part 1:</i> Teach transfer of projected image to texture map for character body. How many sides and when to use it.</p> <p><i>Part 2 Lab:</i> Painted Image projections for body texture map – transfer 3d image to 2d flat image.</p>	<b>3D:</b> Transfer painted image planes into 3d UV texture map.
<b>Week 12</b>	<b>Game Art vs Animation – Indicate to Player What is 'Malleable' in Game.</b>  <b>Are you communicating to the player?</b>	<p><i>Part 1:</i> Teach transfer of projected image to texture map for character body.</p> <p><i>Part 2 Lab:</i> Painted Image projections for body texture map – transfer 3d image to 2d flat image. Photoshop, Pixlr, Gimp</p>	<b>3D:</b> Finish texture for body  Drawing: Add painted image projection onto Online Portfolio
<b>Week 13</b>	<b>Presenting portfolio work and best practices</b>	<p><i>Part 1:</i> Teach poly loops for face – mouth bag, teeth if necessary. (Also: Tongue)</p> <p><i>Part 2 Lab:</i> Model the 3d character head.</p>	<b>3D:</b> Model the 3d character head
<b>Week 14</b>	<b>Tracking the Player's Eye and Animating to it</b>  <b>Guiding and communicating to player is the goal.</b>	<p><i>Part 1:</i> UV unwrap the head to be accessed by one texture map layout (1 x 1).</p> <p><i>Part 2 Lab:</i> Texture the head. Using projections vs. hand-painted on the UV snapshot</p>	<b>3D:</b> UV unwrap the 3d character head
<b>Week 15</b>	Export finished creature moves	Single-mesh 3d model character accessing one .jpg texture exported in following formats: FBX file and ASCII Maya file. Turntable movie and screenshots included. Uploaded to Google Drive Folder for class.	<b>Final Deliverables:</b> <b>Uploaded into class Google Drive</b>

<b>FINAL</b>	<b>Present final 3d character model and texture to class</b>	<b>Model and texture for 3d character shown to class as wireframe, hard-shaded and diffuse-shaded character as well as any props. Emphasis on deformable joint construction.</b>	<b>Final Presentation:</b> Presentation and showcase of one custom character mesh with matching texture, presented separately in both color and wireframe. Also presented is any character research, deformation areas and list of critiques and improvements for the character throughout the semester.
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### 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 Part B, Section 11, “Behavior Violating University Standards” [policy.usc.edu/scampus-part-b](http://policy.usc.edu/scampus-part-b). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, [policy.usc.edu/scientific-misconduct](http://policy.usc.edu/scientific-misconduct).

#### Support Systems:

*Counseling and Mental Health - (213) 740-9355 – 24/7 on call*  
[studenthealth.usc.edu/counseling](http://studenthealth.usc.edu/counseling)

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

*National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call*  
[suicidepreventionlifeline.org](http://suicidepreventionlifeline.org)

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

*Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press “0” after hours – 24/7 on call*

[studenthealth.usc.edu/sexual-assault](http://studenthealth.usc.edu/sexual-assault)

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

*Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298*

[equity.usc.edu](http://equity.usc.edu), [titleix.usc.edu](http://titleix.usc.edu)

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

*Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298*

[usc-advocate.symplicity.com/care\\_report](http://usc-advocate.symplicity.com/care_report)

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity | Title IX for appropriate investigation, supportive measures, and response.

*The Office of Disability Services and Programs - (213) 740-0776*

[dsp.usc.edu](http://dsp.usc.edu)

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

*USC Campus Support and Intervention - (213) 821-4710*

[campussupport.usc.edu](http://campussupport.usc.edu)

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

*Diversity at USC - (213) 740-2101*

[diversity.usc.edu](http://diversity.usc.edu)

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

*USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu), [emergency.usc.edu](http://emergency.usc.edu)

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

*USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu)

Non-emergency assistance or information.

*Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)*

[ombuds.usc.edu](http://ombuds.usc.edu)

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.