Programming 3D Animation Tools

Anim 340-01, -02 (Anim 398-01, -02 for 201510)
CMSI 340-01, -02 (CMSI 398-01, -02 for 201510)

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Programming 3D Animation Tools

ANIM 340 – 01 / LMU ANIMATION / SCHOOL OF FILM & TELEVISION/ SPRING 2015
CMSI 340 – 01 / LMU ELECTRICAL ENGINEERING AND COMPUTER SCIENCE / SEAVER COLLEGE OF SCIENCE AND ENGINEERING/ SPRING 2015

Course: ANIM 398 - 74758	**Units:** 3	**Session:** session 1	**Meets:** Mondays/Wednesdays, 9:00 – 10:20 a.m.
CMSI 398 - 75802	**Units:** 3	**Session:** session 1	**Meets:** Mondays/Wednesdays, 9:00 – 10:20 a.m.
ANIM 398 - 75493	**Units:** 3	**Session:** session 2	**Meets:** Mondays/Wednesdays, 10:30 – 11:50 a.m.
CMSI 398 - 75803	**Units:** 3	**Session:** session 2	**Meets:** Mondays/Wednesdays, 10:30 – 11:50 a.m.

Room / Lab: COM 301 (PC Lab)

Instructor: Adriana Jaroszewicz **Email contact:** Adriana.Jaroszewicz@lmu.edu **Telephone:** (310) 338-5841
Office Hours: Xavier 209, Tuesdays 1:30pm - 3:30pm, Wednesdays: 1:30pm – 2:30pm and by appointment

Instructor: Stephanie E. August **Email contact:** Stephanie.August@lmu.edu **Telephone:** (310) 338-5973
Office Hours: Doolan 201b, Tuesdays: 2pm – 4pm, Fridays: 3-5pm and by appointment

Prerequisites: Instructor approval
Laboratory: To be arranged during course of the week.

Course Description: In this course students will learn how to automate animations, write tools and customize user interfaces using Python scripting. This will allow them to expand Side Effects' Houdini, a 3D Animation and Visual Effects software package used in the Animation and VFX industries. Students will complete individual and team projects creating animated agents, visualizations, and tools that interact in a simulated environment.

Course Format/Methods: P3DA is an interdisciplinary 3D animation curriculum that enhances the technical skills of animation students; it provides training in animation for Computer Science majors, and training in Computer Science for animation majors, increasing the literacy of all students in both fields, thus valuing the connection these disciplines. The curriculum consists of classroom and lab exercises that guide teams of students through the process of developing sophisticated 3-D animation tools in a 3D application such a Houdini. Learning modules will include animation and computer science principles, tool design, implementation and testing in a collaborative environment.

Teaching Goals/ Objectives:

1. To introduce students to computational thinking, software engineering, and basic programming concepts.
2. To introduce students to 3D computer software and programming applications used in animation / vfx processes.
3. To discuss the history of Computer Graphics and terminologies as they relate to computer science, animation, and visual effects, and the impact of Computer Graphics in culture, art and society.
4. To examine various approaches to animation workflows and see how tools are commonly used in a collaborative animation / vfx production pipeline.
5. To analyze how to build custom animation tools using programming and custom interfaces.
6. To present concepts from animation and computer science in a holistic fashion, stressing the interdependence of the two fields in technical animation

Student Learning Outcomes:
Upon completion of this course, students will:

- **LO 1:** Articulate programming principles:
  - **LO 1.1:** Object oriented languages, variables, data types, functions, operators, classes
  - **LO 1.2:** Python scripting and integration of Python in Houdini
  - **LO 1.3:** The Houdini Object Model (HOM) as an *application programming interface* (API)
- **LO 2:** Understand Animation Principles and 3D applications:
  - **LO 2.1:** Application of timing, anticipation, and slow in and slow out
  - **LO 2.2:** 3D Space and coordinate systems
  - **LO 2.3:** Creating and modifying objects in Houdini

LO 2.4: Learning about the 3D Animation Pipeline (sequence from creation to delivery)
LO 2.5: Application of scripting in 3D tools

LO 3: Understand the nature and process of software development, including design, implementation, and test
LO 3.1: Design an algorithm or series of steps that can be used to solve a problem
LO 3.2: Transform an algorithm into a working program
LO 3.3: Demonstrate knowledge of basic programming constructs through implementing programs in Python
LO 3.4: Design, document, implement, and test a computer program
LO 3.5: Adhere to established programming style
LO 3.6: Test a software program

LO 4: Extend the capability of Houdini using:
LO 4.1: Shelf tools
LO 4.2: Python expressions
LO 4.3: Customized Houdini Digital Assets with user interfaces

LO 5: Carry out critical thinking in oral discussion and writing
LO 5.1: Write short research paper
LO 5.2: Write a short technical paper on final project tool
LO 5.3: Document approaches to solving tool design
LO 5.6: Document a software program
LO 5.7: Explain the function of the program at an abstract level
LO 5.8: Present a 3D animation project incorporating Houdini and Python

LO 6: Acquire research skills:
LO 6.1: Use the on-line library catalog and electronic databases to retrieve books or articles
LO 6.2: Differentiate between scholarly, popular sources and support forums

Course Requirements:

1. Regular attendance and active participation in class and group projects.
2. Timely completion of blogs/ tool documentation, homework and quizzes as assigned.
3. Midterm: A written and practical test on concepts and terms learned up to this point
4. Final: A group project pipeline breakdown presentation and technical paper/ documentation of tool

Work Load Expectations

Students are expected to spend an average minimum of six to nine hours per week on class-related learning activities. This is consistent with LMU's Credit Hour Policy (http://www.lmu.edu/Assets/LMU+Credit+Hour+Policy_Final.pdf). Programming assignments might require additional time for some students to complete.

Required texts: Handouts, journals, all noted websites, electronic books and online video tutorials are **required** to be read and viewed. Below are online resources to be used for this class:

- Python Scripting with the Houdini Object Model
- Python for Animators
- Python 2 tutorial
- ***ThinkCSPy****: How to Think Like a Computer Scientist: Learning with Python 3, by B. Miller, D. Ranum. Interactive Edition 2, Runestone Interactive, 2014*Python 3 tutorial
- Python 3 Integrated Development Environment (IDLE) and Python Launcher
- VFX world
- Fxguide.com
- Cinefex quarterly magazine

Materials Required: External Firewire/USB Hard drive and headphones. Workstations provided in the Animation lab.

Grading:

Attendance and participation (50 pts) discussion/documentation blogs (50 pts)	10%
Assignments and Quizzes (300 pts) 3 quizzes (20 pts, 40 pts, 40 pts) 6 homework assignments (20 pts, 20pts, 40 pts, 40 pts, 40 pts, 40 pts))	30%
Midterm: A written and practical test on concepts and terms (300 pts)	30%
Final Project: Tool documentation and Pipeline breakdown group presentation (300 pts)	30%
Total	**100%**

Rubrics with grading criteria will be provided for each assignment.

Absences: Students are responsible for class work, lectures and class discussions missed. Since the discussions and lectures are important to the understanding of the content and course objectives, your attendance is essential. Unexcused absences will result in a lower grade. If possible, inform the instructor ahead of time if you know you will be absent. Excused absences will be determined on a case-by-case basis. The instructor may give a FAILING Final Course Grade for more than 2 times absent. Coming to class late or leaving early twice will be counted as one absence.

Note: Late work will result in a lower grade (each class meeting late will lower your homework grade by 10%). No presentations will be accepted after the last class meeting and will result in a failing grade. No incomplete grades will be given.

Homework weeklies: For homework review, students are required to turn in assignments using MyLMUConnect and as Python files, source files, Houdini files or QuickTime files. Additionally, **all assignment files** must be copied over to the class directory in the network under the week number.

If a QuickTime is required, render at HD 720 resolution with the following codec: **H.264**, unless otherwise indicated, with a **slate** including the following information:

- Class Number
- Session Number
- Professor name
- Artist name
- Sequence /Shot
- Category (ex. Research and development, modeling, animation, ref, etc)
- Comments

If a Python file is required, upload:

- .py file containing Python source code
  - adherent to all Python Coding Standards
  - with a completed file header that includes
    - Class number
    - Section number
    - Professor name
    - Student name
    - Assignment

    in addition to standard file header data
  - comments, per Python Coding Standards
- README in an ASCII text file
- Brief description of the task that the code performs and how it accomplishes the task, as a PDF
- Additional documentation as required by assignment, as a PDF file

The homework files must follow this naming convention:

username_class#_section#_week#_descriptor_v#.ext
example: ajarosze_anim399_01_week1_particles_v1.mov

Homework is due the following week. If the work is assigned on Monday, it is due the following Monday. If it is assigned on Wednesday it is due the following Wednesday. Revisions might be required showing in the comments what changes have been

implemented for the grade to be assigned.

IMPORTANT NOTE:

a) Students are required to pay attention in class and during in-class demonstrations and are encouraged to ask questions relating to the lesson if they do not understand the material.
b) All cells phones must be turned off during class time. No instant messaging, text messaging, emailing, or internet (including facebook) use will be allowed, unless said activity is directly connected to the class.
c) **STORAGE OF DATA IS A STUDENT RESPONSIBILITY**
Always save a copy of your data and project files to (i) a network location accessible from any classroom computer, AND (ii) a backup drive. Loss of data or project files due to a failure to follow the aforementioned steps is no excuse! Always save multiple versions to avoid complete loss.
d) Student are to keep a weekly blog in **MyLMUConnect** ANIM/CMSI 340 course to write about their contribution to their group project, to document tools and processes, and as reflection writing for readings and assignments work.
e) Students are required to use **MyLMUConnect** for information on class announcements, schedule changes, class details, assignment information and to turn in homework.
f) We will communicate with the entire class using campus email systems, so it is essential that you regularly check your **lion.lmu.edu email address** or forward your Lion account email to your preferred email address.

Academic Honesty: Academic dishonesty will be treated as an extremely serious matter, with serious consequences that can range from receiving no credit for assignments/tests to expulsion. It is never permissible to turn in any work that has been copied from another student or copied from a source (including Internet) without properly acknowledging the source. It is your responsibility to make sure that your work meets the standard of academic honesty set forth in the "LMU Honor Code and Process" which appears in the *LMU Bulletin 2010-2011* (see http://www.lmu.edu/about/services/registrar/Bulletin/Bulletins_in_PDF_Format.htm.)

Respect for self and others: (see http://www.lmu.edu/AssetFactory.aspx?vid=30313) based on the *Lion's Code*: As an LMU Lion, by the Lion's code, you are pledged to join the discourse of the academy with honesty of voice and integrity of scholarship and to show respect for staff, professors, and other students.

Disability Support Services/Student Accommodations: Students with a disability (including learning, physical or psychiatric disorders as well as ADD/ADHD) who need reasonable accommodations in this course should contact the Disability Support Services (DSS) Office. All discussions will remain confidential. Please call (310) 338-4216 to set up an appointment, or stop by their offices in Daum Hall, 2nd floor.

SAFETY: Since the School of Film and Television is fully committed to safety and sensible risk management, every student will be required to adhere to all safety and risk management policies. The School considers violation of the Safety and Risk Management policies infractions of the LMU Student Honor Code (Cf. Undergraduate and Graduate Bulletin 2010-2011, pg. 59). In accordance with the Honor Code guidelines and process, disciplinary measures may range from warnings, to failure in the course, to expulsion from the University. Additionally, any footage acquired during the commission of a violation of these policies will be disallowed from the project.

Students in violation of SFTV policies also risk suspension of Privileges. Privileges include access to SFTV Production and Post-Production resources and equipment and participating at the end of the semester screenings. When a violation occurs, the Instructor, the appropriate Department Chair, HOPA and the Graduate Director will meet to determine whether and to what extent the student shall incur temporary loss of privileges, or they may jointly make a recommendation to the Dean for permanent loss of privileges.

Grading Screenings: The Final Screenings are grading sessions. They are open to and welcome all SFTV and CMSI students, the entire SFTV and CMSI community, and invited guests, including key crew and alumni. There will be a special screening for crew members, friends and family at the end of the grading week. The procedures for the Final Screenings will be announced. In accordance with departmental policy, student projects will not be screened past the maximum length specified in the syllabus.

See the **Teaching Philosophy and Course Policies** document for additional information. Students are responsible for being aware of the information in this document.

Programming 3D Animation Tools Course Schedule

Week	Assignment / Lecture
1	Academy awards VFX winners, production pipelines, naming conventions, version control, and project management. Houdini and Python introduction. **Required reading:** HOM Introduction, ThinkCSPy: General Introduction, Simply Python Data, additional readings TBA **Homework 1a:** Python (5 pts)
2	Python continuation **Required reading:** Ice Age 4: riding the new wave, Puss in Boots: head in the clouds, ThinkCSPy: Debugging Interlude 1, Turtle Graphics, additional readings TBA **Homework 1b:** Python (15 pts)
3	Houdini workflows and python integration **Required reading:** ThinkCSPy: Python Modules, additional readings TBA **Homework 2:** Houdini procedural network (20 pts)
4	Creating assets, parameters and nodes. Importing modules, variables, constants, random, loops, and functions. **Homework 3:** Research paper (40 pts)
5	Continuation from week 4. **Required reading:** Scripting Hou, additional readings TBA **Quiz 1:** Readings and assignments to date (20 pts)
6	Controlling parameters in Houdini. Expressions. **Homework 4:** Houdini and Python. (40 pts)
7	String parameter expressions and variables. **Required reading:** An Interview with Guido van Rossum, additional readings TBA
8	Midterm Review – covering from week 1 through week 7
9	**Midterm** (300 pts) **Required reading:** Digital Assets, additional readings TBA **Homework 5:** Houdini and Python. (40 pts)
10	Houdini Digital Assets (HDA), accessing modules. **Required reading:** Running PyQt inside Houdini's event loop, additional readings TBA **Quiz 2:** Readings and assignments to date (40 pts)
11	Using 3rd party data and 3rd party GUI tools **Required reading:** PyQT Example: Writing Custom GUIs inside Houdini, Paths Example: Dynamically Creating Object Nodes., additional readings TBA **Homework 6:** Houdini and Python. (40 pts)
12	Spring Break
13	Animation and VFX tools case studies. Form teams for final group projects. Select tool to build for final project. **Required reading:** Research a SIGGRAPH article relating to your project
14	Work on Final Project – one on one **Quiz 3:** Readings and assignments to date (40 pts)
15	Work on Final Project - one on one
16	**Final Project** Due (300 pts) **Note:** This schedule is subject to change at any time.

FINAL PROJECT – Programming 3D Animation Tools

ANIM CMSI 398

Due date: Monday 4/27
30% of your grade

Final Project requirements:

As a group, develop a tool that simplifies a repetitive task or improves the animation / visual effects pipeline. This tool has to be functioning and be able to connect at least two areas of the animation and visual effect pipeline.

Be professional - come prepared knowing your material, using correct terminology when speaking about your role and when using technical terms. For the audience, be attentive, courteous and respectful of the presenter. You will be answering questions provided for all presentations

10 minutes minimum, 15 minutes maximum, presenting as a group

1. **Description of your responsibilities in your group (10 %)**
   This is what I will be looking for:

   What was your project about and what were your contributions to your project? Describe your role and explain how you managed the project (google docs, version control tools, etc)

   What is the reasoning and logic behind building this tool? How will Animators and Visual Effects Artists benefit from this?

   How can this be integrated into a pipeline?

2. **Tool Demonstration (10 %)**
   Demonstrate in the teacher station your tool and workflow process, talking about the concepts you used to build the tool, and its application in production.

3. **Write a short technical paper of final project tool (10%)**
   Address a specific use for tool
   Identify the question addressed
   Relate the response to information covered by the course
   Be a minimum of 500 words in length
   Cite at least one reference beyond the text to support the points made in this paper
   Include the full citation of the article(s) at the end of the paper.