ACCAD 7104 Syllabus: Procedural Animation

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Summer Session 1, 2016: Rm 349A Sullivant Hall, Mon/Wed/Fri 1:30-3:05PM, 3 credits
Prerequisites: graduate standing or permission of instructor.
Not open to students with credit for ArtsCol 763.
Description: The investigation of procedural methods for modeling and animating 3D computer graphics.

Course Objectives and/or Student Learning Outcomes:

This course will broadly investigate ways to analyze, design, and implement procedural approaches for modeling and animating 3D objects and environments, as well as their behaviors. Instead of sculpting, key-framing, and painting computer graphics assets, procedural techniques generally involve the construction of processes for generating design solutions.

Students will gain experience identifying and understanding opportunities for creating efficient parametric representations of designs so that changing a handful of numeric values modifies their model or motion's creation process. Students will be exposed to current technologies that enable the creation of complex procedural relationships and generative systems without requiring extensive programming experience. They will gain an awareness of the relative computational expenses involved in managing complexity.

Course Methodology:

Students will be introduced to an evolving set of procedural techniques and concepts through design exercises and labs. The course will survey recent advances in generative interfaces and representations. Students will be shown existing procedural work primarily from film effects, design, art, and architecture. Examples of varying levels of complexity will be presented to demonstrate different techniques. Students will be required to use the techniques and examples presented to design their own procedural systems. Previous experience with creating and presenting digital images, video, 3D animation, and web pages will be assumed. The assignments will be flexible enough to allow students from different disciplines to create projects appropriate for their disparate fields and goals (e.g. architecture, art, CS, design, etc.) Collaboration will be encouraged.

While images, videos, and web sites illustrating different approaches will be presented throughout the course, students will learn primarily by creating and experimenting with their own projects. The class format will take on a variety of styles as the disparate subjects dictate. Examples will be presented in lectures and demonstrations, and in-class hands-on labs will allow students to work together on problem solving. Assignment results will be presented in group critique sessions.

Students must demonstrate satisfactory achievement of course objectives through fulfillment of course projects and by contributing to class discussions and critiques. Course projects will require students to use a variety of software and equipment at ACCAD. Collaboration between students in the course and other faculty, staff and students at ACCAD is encouraged. Course evaluation will be based on the following:

Projects one through three:	20% each
Final Project (project four):	30%
Class Participation:	10%

Grading Policy:

All students are required to be on time and in **attendance** for each and every class. Students arriving to class more than 10 minutes late will be counted as absent. Two absences will lower a final grade by 1/2 a letter, three absences will lower a final grade by one letter and four absences will result in failure of the course.

Adherence to deadlines is expected. It is the individual student's responsibility to keep track of deadlines and to present the work to the class and instructor on the specified dates. 15% per day will be subtracted from late assignments.

Students choosing to use "at home" hardware and software must have their current working files on the system and available for review at the beginning of each and every class. Problems with home systems and/or incompatibility will not be an acceptable excuse for missed goals. Technical problems will happen

frequently during the quarter and students may have trouble accessing the computer lab during "prime time" hours. Students must make their own arrangements for overcoming these difficulties and submitting their work on time. Unless there is a complete system failure in a computer-related course, technical difficulties are never an acceptable excuse for not meeting a deadline. Students should plan their time and work so as to anticipate the technical hurdles that are a part of this profession.

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5- 487). For additional information, see the Code of Student
Conduct http://studentlife.osu.edu/csc/.

"Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; http://www.ods.ohio-state.edu/."

Topics and Assignments:

While exact topics will vary from year to year based on student background and interests, as well as emerging software capabilities, the topics will be a subset of:

- Interactive tools for building procedural systems
- Construction history based hierarchical parametric modeling, animation, dynamics, and behavior
- Procedural geometry: e.g. L-systems, subdivision, isosurfaces, superquads, fonts, expressions
- Cross-context procedural mapping: e.g. shape drives shading, motion affects form, etc.
- Dynamics: rigid/soft body, fluid, wire, cloth
- Behavioral animation

Example weekly course calendar: (8 week summer session)

1. Parametric modeling:
    1.1. generative geometry, construction history
    1.2. hierarchical structure, form drives surface
2. Generative animation:
    2.1. functions, algorithmic manipulation, variation
    2.2. parametric assignment due
3. Particle systems:
    3.1. creation, control, modeling
    3.2. behavioral animation: attraction/repulsion, conditions and state change
4. Animation
    4.1. rigid and soft body dynamics: forces, collisions, fracture, wire, cloth
    4.2. particle systems assignment due
5. Volume effects
    5.1. smoke and fluids
    5.2. fire
6. Advanced/Emerging Simulation; Effects assignment due
7. Procedural shading and compositing integration
8. Final Projects

Assignments during the class will require the use of the procedural techniques covered in lectures to generate images and animations. A final project allows students to choose which area is most applicable to their interests for further in-depth study.

Example Assignments:

1. **Parametric Model**: construct a geometric, hierarchical structure; provide a set of both high and low level parametric controls for adjusting the structure's form which should be generated using the techniques discussed in class.
2. **Particle Systems**: render an animation showing a range of behaviors that demonstrate several of the procedural animation system techniques and strategies presented in class.
3. **Effects**: create a short animation showing a combination of three of the different dynamics systems covered in class.
4. **Final Project**: explore, extend, and/or integrate one or more of the previous concepts or projects.

Reading List:

There are no required textbooks. Software documentation, tutorials, and examples are provided with the software installation and are available for download, on the class web pages, and on ACCAD computers. Links to blogs, artist web sites, etc. are updated constantly reflecting current technologies.

Bibliography and Related Resources:

Fry, Ben and Casey Reas. "Processing", http://processing.org
Gilland, Joseph. Elemental Magic: The Art of Special Effects Animation. 2009.
Gilland, Joseph. Elemental Magic, Volume 2: The Technique of Special Effects Animation. 2011.
Hodgin, Robert. "Robert Hodgin Portfolio", http://roberthodgin.com
Prudence, Paul. "Data is Nature", http://www.dataisnature.com
Side Effects Software. "Houdini", http://www.sidefx.com
Universal Everything. "Advanced Beauty", http://advancedbeauty.org
Watz, Marius. "Generator.x", http://www.generatorx.no
Zerouni, Craig. Houdini On the Spot. Focal Press, 2007