CourseNo: ARCHA4743_001_2013_1
Meeting Location: AVERY HALL 114
Meeting Time: M 06:00P-08:00P

Instructor Information:
John Christopher Whitelaw

Session A: A4743 - Animated Computation 2 (Interactive Computational Modeling)
Professor: Christopher Whitelaw (cwhitelaw@gmail.com)

Animation & Computation 2 focuses on transforming traditional digital animation techniques into form generation devices for architectural design. In particular, students will focus on building interactive, performative models. *Animated Computation 02 will exclusively be taught using Autodesk Maya. No previous Maya experience is required.*

Architects have been employing "computation" as a design strategy and/or tool for years. It is a way to engage design problems that are too complex to engage without the use of algorithms. The implementation of computation in architecture has typically been through a set of tools to manage data as bits and bytes, more specifically through scripting.

The employment of computer algorithms (scripting) is, however, preceded by the use of analog computational models to engage issues of complexity in architecture. Popular early examples of this are Antoni Gaudi's catenary models using strings and bags of sand to find the structural solutions that would become the lines of his structural arches, and Frei Otto's thin film soap bubbles used to develop minimal surfaces for use as structural shells.

Animated Computation 2 will introduce students to a fluid and visually responsive method for engaging the power of computation as a design tool through the transformation of traditional animation tools into computational modeling devices. These computer models will be visually responsive and intuitive, capable of responding to sets of external and internal stimuli (their environment, other computer models, user input, themselves). The models will be interactive.

Lectures will focus on introducing students to a range of animation tools, traditional and dynamic, available in Autodesk Maya. These tools will be taught in the context of replicating and then reimagining existing analog models (such as Gaudi's) within the computer. Lectures will include techniques for simulating material realities, tracking motion, responding to external stimuli, computing geometrical relationships and tracking motion. They will be both transformative and generative. The tools learned and used will include cloth, kinematics, rigid-body dynamics, particle dynamics and hair. Lectures will also include an ongoing discussion and use of scripting as a tool to rapidly deploy larger, more complex, models.

Student projects will focus on the design and development of original analog models, testing and implementing them to answer to a defined set of performance criteria; the final result of which will be a 30 second video showing the potential range equilibriums the model is capable of achieving.

Please note: Video demonstrations will be available at www.christopherwhitelaw.us

Schedule:

Class 1, Jan 28 **Demo: Animaris**

Key Toolset: Inverse Kinematics
Additional Concepts: Point Constraints, Parenting, Assets, Keyframing, Playblast Animation, Polygon Modeling, Skinning

References:
http://youtu.be/Y2KkGFuRLew
http://youtu.be/bFlJ7Qo8LO0
http://www.ted.com/talks/lang/eng/theo_jansen_creates_new_creatures.html

Weekly Tutorial Exercise: (Due Before Class Feb 4, 2013)
Working individually, complete the Mechanical Motion – Animaris Demo using Kinematics in Maya. Each student will produce one working maya model and one playblast animation due in class.
Deliverable: 10 Second Playblast animation, 24 FRP, 720×480 resolution, .mpg file (submitted to the course dropbox, named according to this convention SP2013_A4743_uni_description.ext)
Use this tutorial to help making a playblast animation in Maya.

Class 2, Feb 4 **Demo: Animaris**

Key Toolset: Mental Ray Rendering
Additional Tools & Concepts: Polygon Modeling, Render Settings, Hardware Rendering, Image Sequences, Camera Bookmarks, Render Window, Paint Effects, Compiling video from image sequences

Working individually, create a 6 second rendered animation of the Animaris. The working steps are as follows (starting with the model completed in week 01.)

1. Using this tutorial as a reference create and skin your own geometry onto the working skeleton.
2. Using the Asset Introduction (Animaris) demo, prepare the working leg as a deployable asset.
3. Using the Mental Ray Quick Start demo set up lighting and rendering settings for the model.
4. Using this tutorial as a reference, batch render and composite the video in photoshop.

Deliverable:
6 Second rendered animation, 24 FRP, 720x40 resolution, .mpg file (submitted to the course dropbox, named according to this convention SP2013_A4743_uni_description.ext)

For additional rendering techniques, go here. For additional polygon modeling demos, go here.

Class 3, Feb 11 **Demo: Spirograph Hypotrochoid**

Key Toolset: nParticles (nDynamics)
Additional Tools & Concepts: nucleus settings, particle rendering , Assets & Rigging, Expressions, Connections, Custom Attributes, File Referencing

References:
http://youtu.be/KJeCMTwJnlE
http://mathworld.wolfram.com/Hypotrochoid.html

Working individually, create a 6 second rendered animation of a Hypertrochoid using this demo as a reference.

Deliverable:

6 Second rendered animation, 24 FRP, 720x40 resolution, .mp4 file (submitted to the course dropbox, named according to this convention SP2013_A4743_uni_description.ext)

For additional information on particle trails, go here. For an introduction to nParticles from autodesk go here and choose "nParticles". You can download the lesson files for those tutorials here.

Class 4, Feb 18 **Demo: Gaudi's Catenary Structures (Gaudi)**

Key Toolset: nCloth (nDynamics)
Additional Tools & Concepts: Wrap Deformers, Lattice Deformers, Dynamic Constraints, nHair, perParticleAttributes

References:
http://youtu.be/sAo0U81gi_A

Working individually, complete the Catenary Model using nCloth in Maya. Render the animation using Toon Wireframes. Each student will produce one working maya model and one rendered animation due in class.

Deliverable:
6 Second rendered animation, 24 FRP, 720×40 resolution, .mp4 or .mpg file (submitted to the course dropbox, named according to this convention SP2013_A4743_uni_description.ext)

You may wish to utilize render layers to enhance your renderings. For additional nCloth tutorials, try this bubble level simulation, this coin simulation, and this pouring water simulation.

Class5, Feb 25 **Demo: Point Attractors**

Key Toolset: Expressions
Additional Tools & Concepts: Assets, Connections, File Referencing, Distance Tool, Edits

INDIVIDUAL PROJECT MEETINGS

Class6, Mar 4 **Demo: Multi-Point Curve and Surface Attractors**

Key Toolset: Expressions
Additional Tools & Concepts: Assets, Connections, File Referencing, Distance Tool, Edits

INDIVIDUAL PROJECT MEETINGS

Final Assignment:

Develop an animated model.

All projects will begin with the selection of an existing piece of design, art, architecture or other. Original works of art can be realized or not. Original works of art can be computational systems already capable of reacting to stimuli or they can suggest an inherent capacity to become reactive. These works of art will act as points of departure for developing a functional computational model of your own.

This is a two part project.

Part I(Due Feb 11) will be to define the performance criteria (what it does and how it does it) for your model/system. Part I will culminate in a single 11x17 pdf page.

Part II(Due date TBD) will focus on the implementation of this model in Maya, to develop a medium to large scale deployment of the analog computers to understand test and describe their performance in multiple.

Deliverables:

- 30 second animation 1024x768 resolution, .mov format, mpeg4 compression, showing the model solving a minimum of 4 equilibrium states.
- All computer files associated with the production of the final product