USC School of Cinematic Arts
Institute for Multimedia Literacy

IML 454
Advanced Techniques of 3D Representation

Fall 2018
4 units
Time: Thursday 6:00-8:50 pm
Location: SCI 104
Instructor: Andreas Kratky
Teaching Assistant: Biayna Bogosian

Prerequisites: IML 354
Recommended Prep: None
Restrictions: None
Email: akratky@cinema.usc.edu
Office hours: Thursdays, 4-5pm, SCI 201Q

COURSE DESCRIPTION

In recent years, methods of 3D representation have gone through tremendous development and redefined what computer-users can do with their desktop or laptop computers. Based on the computer graphics techniques of modeling, rendering, and animation, new possibilities have emerged that go beyond the confines of the screen and make it easy to engage with real space through 3D fabrication and real time through powerful rendering engines. These developments have far reaching implications for design, art, entertainment, industrial production, and culture at large. Familiarity with these techniques, their philosophies and procedures, enables students to make their own contribution to this growing field and critically reflect their impact on our culture.

Until recently, technologies of real-time graphics, parametric modeling, and 3D fabrication have been reserved for professionals who were able to invest significant amounts of money and resources into computing and fabrication hardware. Many of these tools are now available through powerful software, accessible hardware, and intuitive interfaces. In particular the open-source, open-hardware, and maker movements have shifted the established paradigms to prepare a democratization of production resources and enabled designers and artists to work in new areas of expression. Several theorists and practitioners, such as Chris Anderson or Moreshin Allahyari, have compared this development to a new industrial revolution that reframes or understanding of power and privilege.

The course introduces students to the history, theory, and practice of spatial representation and conveys foundational authoring skills in modeling, fabrication and interactive 3D spaces. The class builds on the knowledge acquired in IML 354, which provides a basic introduction to the concepts and procedures of computer graphics. Extending this knowledge to an advanced level, IML 454 is focused on the exploration of space in a practical sense: the exploration of parameter spaces through parametric modeling; the exploration of tangible space through projection mapping and 3D fabrication; and the exploration of virtual space through game engines and mixed reality. Besides practical hands-on exercises the class discusses concepts and theories of the maker movement and activism, the history and critique of industrial production, and the emerging aesthetics of these new forms of representation.

The exercises, readings, discussions and assignments in this class are designed to support three main goals: 1.) Convey knowledge about spatial representation and its cultural implications; 2.) Develop authoring skills in 3D modeling, fabrication and interaction with programs like Autodesk AutoCAD, MadMapper, and Unity3D, as well as laser cutting and 3D printing; 3) Acquire a basic understanding of mixed reality experiences.

COURSE STRUCTURE

The course is conceived as a studio class in which students get a practical hands-on introduction to multiple approaches of 3D fabrication, parametric modeling and real-time rendering. Over the course of the semester students will complete three projects designed to provide scaffolding toward an advanced understanding and practical design ability in 3D representation. The projects can be carried out either individually or in small groups. Each project consists of a practical assignment and a written component that reflects the process of conceptual and practical realization of the project. The course will be held in a computer lab with all necessary software tools installed on lab computers. Students are expected to post responses to the assigned readings on the class wiki. Readings will provide the conceptual foundations for practical instruction.

DESCRIPTION OF ASSIGNMENTS AND ASSESSMENT

• **Assignment #1**	25%
• **Assignment #2**	25%
• **Assignment #3**	25%
• **Reading responses**	15%
• **Participation in Class Discussions**	10%
Total:	**100%**

Assignment #1: Parametric Metamorphosis. The first assignment combines an exploration of parametric modeling and projection mapping. Students will use parametric modeling techniques to design dynamic 3D graphics to serve as the visual source material for a presentation using projection mapping. The computer generated 3D shapes should be designed to fit to simple geometric shapes that will be set up as tangible projection surfaces in the presentation space. Through parameter modifications these visuals will gradually transform the perceived shape of the tangible objects they are projected upon. The output of the parametric visuals can be either interactive or pre-rendered.

Assignment #2: Positive and Negative. The second assignment explores a variety of techniques of 3D fabrication. It will differentiate between additive and subtractive form creation through 3D printing and cutting and milling. Basis for the production process will be a dataset modeled in AutoCAD and prepared for the different techniques of 3D fabrication. The assignment is supposed to combine aspects of both additive and subtractive shaping and part of the challenge is appropriate process planning so that the work-piece can go through a complex shaping procedure. The design prompt for the object to be created in this way encourages students to focus on the combination of positive and negative space to create an aesthetic object that invites viewers to explore it spatial properties. This can either be a tangible model of a space, an object that intervenes in real space, a tool that enables viewers to perceive space, or another creative incarnation of the assignment prompt.

Assignment #3: Reactive Landscape. The third assignment explores the possibility of augmenting real physical environments with additional virtual information to create mixed reality experiences. Building on the skills acquired in the first two projects students will create a project in Unity3D and Vuforia that overlays Augmented Reality content triggered by a real, physical object. The design of the object and the augmented content should add to each other in a meaningful way. This assignment uses the 3D manufactured objects from the previous assignment and makes them part of a mixed reality experience.

Assignments have to be posted to the course wiki by the day they are due in the syllabus. The posts should contain the image, movie-clip, or application that is assigned and a short process description of ca. 500 words.

TECHNOLOGICAL PROFICIENCY AND HARD-/SOFTWARE REQUIREMENTS

The class will provide introductions into all techniques and technologies relevant to the class. Pre-existing knowledge about 3D modeling is desirable, e.g. as provided by the IML 354 class. If you have specific questions about tools or potential project plans please contact the instructor.

REQUIRED TEXTBOOKS

The readings for this course come from various sources and will be made available through the course wiki.

EVALUATION

In general, you will be graded using these criteria:

Conceptual Core
- The project's controlling idea must be apparent.
- The project must be productively aligned with one or more multimedia genres.
- The project must effectively engage with the primary issue/s of the subject area into which it is intervening.

Research Component
- The project must display evidence of substantive research and thoughtful engagement with its subject matter.
- The project must use a variety of credible sources and cite them appropriately.
- The project ought to deploy more than one approach to an issue.

Form and Content
- The project's structural or formal elements must serve the conceptual core.
- The project's design decisions must be deliberate, controlled, and defensible.
- The project's efficacy must be unencumbered by technical problems.

Creative Realization
- The project must approach the subject in a creative or innovative manner.
- The project must use media and design principles effectively.
- The project must achieve significant goals that could not be realized on paper.

POLICIES

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. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on 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 or to the Department of Public Safety. 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 provides 24/7 confidential support, and the sexual assault resource center webpage describes reporting options and other resources.

Citation Practices
Fair use is a legal principle that defines certain limitations on the exclusive rights of copyright holders. Media Arts + Practice seeks to apply a reasonable working definition of fair use that will enable students and instructors to develop multimedia projects without seeking authorization for non-commercial, educational uses. Four factors that should be considered when determining whether a use is fair: (1) the purpose and character of use, (2) the nature of the copyrighted work, (3) the amount and substantiality of the portion used in relation to the copyrighted work as a whole, and (4) the effect of the use upon the potential market for or value of the copyrighted work. In general, we regard the reproduction of copyrighted works for the purposes of analysis or critique in this class to be covered by the principle of fair use.

All projects will need to include academically appropriate citations in the form of a Works Cited section, which covers all sources, in order to receive a passing grade. The Works Cited is either included in the project or as a separate document, as appropriate to your project. There are several different citation styles and practices; please ask your professor(s) what style manual s/he would prefer. Below you'll find some online resources for the most popular options.

Style Manuals

American Psychological Association (APA)
Purdue OWL: http://owl.english.purdue.edu/owl/resource/560/01/

Modern Language Association (MLA)
Purdue OWL: https://owl.english.purdue.edu/owl/section/2/11/

Chicago Manual of Style
Purdue OWL: https://owl.english.purdue.edu/owl/section/2/12/

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, which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs 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 will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

Emergency Plan
In the event that classes cannot convene at the university, all IML courses will continue via distance education. Specifically, the IML portal and course wikis will be deployed to enable faculty-student interaction (asynchronously and also via virtual office hours), complete syllabi, course readings and assignments, software tutorials, project assets, parameters and upload instructions, peer review processes and open source alternatives to professional-level software used in the IML curriculum. Further details are available on the course wiki.

Disruptive Student Behavior
Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students' ability to learn and an instructor's ability to teach. A student responsible for disruptive behavior may be required to leave class pending discussion and resolution of the problem and may be reported to the Office of Student Judicial Affairs for disciplinary action.

WEEKLY SCHEDULE

The following weekly schedule is subject to change. Please consult the course wiki for the most current information, assignments and due dates.

Week 1
Jan 11, 2018:
Introduction: Concepts of spatial representation and fabrication
Course overview

Reading for next week:
P. Morel, *Computation or Revolution*

Part 1: Creating Space

Week 2
Jan 18, 2018:
Introduction to 3D Modeling for construction
Overview of AutoCAD software

Reading for next week:
C. Anderson, *Makers – A New Industrial Revolution*, (excerpt)

Week 3
Jan 25, 2018:
Introduction to 3D Modeling for construction
Continued AutoCAD workshop
Assignment #1: "Parametric Metamorphosis"
Generation of variations and targeted exploration of parameter-spaces

Reading for next week:
C. Salter, *Entangled: Technology and the Transformation of Performance*, (excerpt)

Week 4
Feb 1, 2018:
Introduction to projection mapping
Overview of MadMapper software and connection to video projectors

Reading for next week:
I. Bogost, *Alien Phenomenology*, (excerpt)

Week 5
Feb 8, 2018:
Introduction to 3D acquisition
Overview of 3D scanning techniques and photogrammetry using MadMapper, MS Kinect, Autodesk Recap 360

Week 6
Feb 15, 2018:
- Assignment #1 due
Presentation and peer review of “Parametric Metamorphosis”

Reading for next week:
M. Hatch, *The Maker Movement Manifesto: Rules for Innovation*, (excerpt)

Part 2: Fabricating Space

Week 7
Feb 22, 2018:
Introduction to tangible spatial representation through cutting / folding and additive / subtractive techniques
Assignment #2: “Positive and Negative”

Reading for next week:
Ahlquist/Menge, *Computational Design Thinking*

Week 8
Mar 1, 2018:
Introduction to laser cutting
Class-location: *Maker-space*

Reading for next week:
Allahyari /Rourke, *The 3D Additivist Cookbook*, (excerpt)

Week 9
Mar 8, 2018:
Introduction to 3D-printing
Modeling techniques for 3D-printing

Reading for next week:
J. Bennett, *Vibrant Matter: A Political Ecology of Things*, (Excerpt)

Mar 15, 2018: Spring Break

Week 10
Mar 22, 2018:
3D-printing workshop, workflows
Class-location: *Maker-space*

Week 11
Mar 29, 2018:
- Assignment #2 due
In-class presentation, peer review

Part 3: Exploring Space

Week 12
Apr 5, 2018:
Introduction to Augmented Reality spatial representation
Assignment #3: “Reactive Landscape”

Reading for next week:
M. de Landa, *Material Evolvability and Variability*, in L. Spruybroek, *The Architecture of Variation*

Week 13
Apr 12, 2018:
Introduction to Unity3D and Vuforia
Interface overview, import pipeline, and programming basics

Week 14
Apr. 19, 2018:
Unity3D and Vuforia Workshop
Techniques for Augmented Reality spatial representation

Week 15
Apr. 26, 2018:
- Assignment #3 due
In-class presentations of final projects, peer review
Class round-up