

Experiments in Stereoscopic Imaging

USC School of Cinematic Arts, CTIN/CTAN 502a

Instructor: Perry Hoberman

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Course Objectives and Description

This class is an intensive hands-on initiation into the techniques and practices of stereoscopic 3D, exploring the aesthetic, conceptual and technical issues involved in the design and production of 3D images, animations, and interactive experiences.

After many false starts, stereoscopic 3D movies are being produced and exhibited with increasing regularity, leading some observers to wonder if we might not be headed for a future in which monoscopic 2D movies become the exception. Whether or not this comes to pass, it is clear that this time, 3D is more than a passing fad. The technological mishaps of past systems have been overcome, due to new single-projector digital systems that can produce headache-free stereo with little room for operator error. Simultaneously, with the continued development of new and ever-improving display technologies, stereoscopic-enabled home theatre systems are becoming available, and it has become increasingly feasible to apply stereoscopic technologies to games. These technologies are also driving the development of new personal viewing systems, which are poised to become popular peripherals for mobile devices such as iPods and portable DVD players.

Filmmakers need to learn an entirely new language as they delve into 3D moviemaking, with new possibilities for structure, depiction of space, narrative and experience. Stereoscopic media is an arena that is ripe for innovation and creativity. This is a pivotal moment, with opportunities to make lasting and significant contributions to the field. Like earlier innovations such as sound and color, stereo opens up new possibilities for the structuring of cinematic space and time. New aesthetic and formal strategies and new forms of storytelling need to be explored and developed. As stereoscopic productions become more common, there will be a growing need for professional artists, filmmakers, animators and designers with experience and training in this new medium.

The course will cover the basic principles of binocular vision, the history and development of stereoscopic systems and practices, and the various available methods for creating and displaying stereoscopic images. We will address the hardware, technologies and techniques for content creation and playback, as well as perceptual, aesthetic and cognitive issues. The course will also include screenings of relevant material, guest presentations from a number of stereoscopic experts, and one or more field trips to local production facilities.

As a general introduction to 3D, the course has been structured to move sequentially through five sections, each corresponding to a division of the School of Cinematic Arts. Classwork and assignments will progress from basic one-week exercises - designed to bring students up to speed quickly with basic concepts, techniques and tools - to more ambitious and extensive projects, giving students the chance to put their new skills and knowledge into practice for expressive and creative purposes. The semester will culminate with one or more collaborative final projects to be screened and critiqued by several invited visiting critics.

Meeting Information

Location: RZC 201

Time: M 10:00AM-12:50PM

Units: 2

Pre-requisites: Open to USC undergraduate 3rd & 4th year & graduate students

Course Texts

3D Movie Making: Stereoscopic Digital Cinema from Script to Screen, Bernard Mendilburo, Focal Press, 2009

Stereoscopic Cinema and the Origins of 3-D Film, 1838-1952, Ray Zone, University Press of Kentucky, 2007

These texts are available in the USC bookstore or online at amazon.com and barnesandnoble.com. Additional readings listed in the syllabus will be available as handouts in class or as digital files on the course website.

Evaluation and Grading

Grades will be based on class participation and project work. Criteria for grading will include conceptual clarity, creativity, and the application of concepts discussed in class to assigned projects. Grades will be allocated as follows:

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| Class participation: | 10% |
| Blog postings (reading & research reports) : | 10% |
| Weekly assignments 8 @ 6% each: | 48% |
| Midterm Project: | 16% |
| Final Project: | 16% |
| Total: | 100% |

Course overview

Section 1: Critical Studies (weeks 1-3)

Concepts, issues, history, context. What is stereoscopic media, where did it come from, what can it do, what is its significance? Understanding the perceptual and cognitive contexts of binocular vision.

Section 2: Production (weeks 4-6)

Techniques, equipment, workflow, practices. How to work with 3D. Acquiring necessary skills and technical knowledge. Integrating 3D into existing production practices.

Section 3: Writing (weeks 7-9)

Thinking, designing and writing for 3D. The relationship of 3D to narrative and storytelling. Modulating 3D design for dramatic impact.

Section 4: Animation (weeks 10-12)

Construction, composition, control. The fabrication of space in stereoscopic media. Generating, compositing and integrating 3D images. How 3D works with time and motion.

Section 5: Interactive (weeks 13-15)

Interaction, immersion, navigation. Using 3D for interactive experiences and games. 3D for non-sedentary viewers and audiences.

Course content by class meeting

Week 1

- Welcome & overview of semester. Basic definitions & terms. Basic principles of vision & binocular vision. Terms, definitions, etymology, formats. How to view 3D. Focus and attention.
- Reading: from *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century*, Jonathan Crary, MIT Press, 1991
- Assignment: Shoot twenty single-camera handheld stereo photographs.

Week 2

- 2D and 3D depth cues. Binocular parallax. Interocular distance, hyper/hypostereo. Accommodation/convergence, comfort/limits. Side-by-side vs. superimposed formats. Introduction to single-camera stereoscopic photography. Optical exercises. Free-viewing. Analyzing parallax
- Reading: from *Stereoscopic Cinema and the Origins of 3-D Film, 1838-1952*
- Assignment: Dual-camera photography. Assemble a stereoscopic slideshow.

Week 3

- Limits, anomalies & defects (vertical parallax, ghosting). Persistence of vision, frame rates. Implied motion & change blindness, stereo blindness, viewer vs scene vs object motion, size constancy.
- Reading: from *Fixing My Gaze: A Scientist's Journey Into Seeing in Three Dimensions*, Susan R Barry, Basic Books, 2009
- Assignment: Controlled hyperstereo and hypostereo photography. Shoot first stereoscopic video footage.

Week 4

- Optics, lenses, filters, polarizers. Single & dual camera systems. Baseplates & beam splitters. Camera and image registration. Parallel vs. toed-in photography. Polarized and anaglyph projection, front and rear projection. Mathematics & calculations.
- Reading: from *3-D Filmmakers: Conversations with Creators of Stereoscopic Motion Pictures*, Ray Zone, Scarecrow Press, 2005
- Assignment: Shoot and edit short video. Write proposal and storyboard for midterm project.

Week 5

- Displays and eyewear. Time-multiplexed displays (StereoGraphics, RealD, Dolby/Infitec). Planning a project. 2D and 3D software packages. Repurposing 2D software for 3D. 3D software tools for production.
- Reading: from *Foundations of the Stereoscopic Cinema*, Lenny Lipton, Van Nostrand Reinhold, 1982
- Assignment: Preproduction and testing for midterm project.

Week 6

- Focal length, depth of field, lighting for 3D. Dynamic (animated) 3D shots. Rules & rules of thumb. Asset management, compression and proxies. Previews and dailies.
- Reading: from *3D Movie Making: Stereoscopic Digital Cinema from Script to Screen*
- Assignment: Production and shooting for midterm project.

Week 7

- Planning & writing for stereo. Appropriate content for 3D. Cuts, transitions, continuity in 3D. Stereoscopic grammar.
- Reading: from *Visual Intelligence: How We Create What We See*, Donald Hoffman, Norton, 2000
- Assignment: Post production and editing for midterm project.

Week 8

- 3D art direction & aesthetics. Composing and setting up shots. Composition in depth, parallax measurement. Midterm presentations.
- Reading: from *Seeing in Depth*, Ian P Howard & Brian J Rogers, Oxford University Press, 2008
- Assignment: Produce two versions of same footage for small and large screens.

Week 9

- 3D as a tool for emotional emphasis. Depth scripts and budgets. Scale and size, redundancy and contradiction. The stereowindow and its violation. Presentation & projection. Screen & theatre space.
- Reading: from *Visual Thinking for Design*, Colin Ware, Morgan Kaufmann, 2008, ISBN 0123708960
- Assignment: Produce footage that explores a range of stereoscopic strategies.

Week 10

- History of stereoscopic animation and art. Methods for digital stereoscopic drawing and collage. Modeling & animation software. Stereo CGI workflow. Previews & rendering.
- Reading: from *Stereoscopic Drawing*, Arthur Girling, Reel Three-D Enterprises, 1990
- Assignment: Produce first short stereoscopic animation

Week 11

- The mathematics of perspective transformations. Introduction to OpenGL. Basic math for stereo imaging. Off-axis perspective projection. Motion in 3D space. Compositing + FX in 3D.
- Reading: from *Understanding Comics*, Scott McCloud, Harper, 1994
- Assignment: Composite live-action and CGI animation.

Week 12

- Multirigging, creating a coherent space. Depth maps. 2D-to-3D conversion. Titles & subtitles. Color correction & grading. Rescuing shots & fixing problems.
- Reading: from *Seeing in Depth*, Ian P Howard and Brian J Rogers, Oxford University Press, 2008
- Assignment: Write proposal and storyboard for final project.

Week 13

- Navigating stereoscopic space. Immersion and embodied experience. Peripheral vision. Authoring systems and game engines. Available authoring software. Scripting 3D modeling/animation programs.
- Reading: from *Visual Intelligence: How We Create What We See*, Donald Hoffman, Norton, 2000
- Assignment: Preproduction and testing for final project.

Week 14

- Designing for interaction. Virtual camera setup. Cursors & pointers, 2D & 3D. Input devices: physical, virtual, hybrid.
- Reading: from *Spatial Augmented Reality*, Ramesh Raskar & Oliver Bimber, AK Peters, 2005,
- Assignment: Production and shooting for final project.

Week 15

- Virtual reality concepts & definitions. Simulation, virtuality, cyberspace, presence, telepresence. Force feedback and haptic devices.
- Reading: from *The Ecological Approach to Visual Perception*, James J. Gibson, Lawrence Erlbaum, 1987
- Assignment: Post production and editing for final project.

Exam Week

- Final project presentations with guest critic/s. Open to the SCA community.

Attendance:

Attendance at all classes is mandatory, and punctuality is expected. If a student misses a class, they must provide a valid excuse, and they must meet with the instructor to discuss a make-up assignment.

Missing an Exam, Incompletes:

Both the mid-term and final exam in this seminar are projects rather than written exams. However, USC standards still hold: The only acceptable excuses for missing an exam or taking an incomplete in the course are personal illnesses or a family emergency. . Incompletes may only be given after the 12th week of the semester. Students must inform the professor before the exam and present verifiable evidence in order for a make-up to be scheduled. Students who wish to take incompletes must also present documentation of the problem to the instructor before final grades are due.

Academic Integrity:

The School of Cinema-Television expects the highest standards of academic excellence and ethical performance from USC students. It is particularly important that you are aware of and avoid plagiarism, cheating on exams, submitting a paper to more than one instructor, or submitting a paper authored by anyone other than yourself. Violations of this policy will result in a failing grade and be reported to the Office of Student Judicial Affairs. If you have any doubts or questions about these policies, consult "SCAMPUS" and/or confer with the Professor or Department Chair. The Student Conduct Code can be found in Section 11.00. Recommended sanctions are located in Appendix A: <http://www.usc.edu/dept/publications/SCAMPUS.gov>

Students with Disabilities:

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure that the letter is delivered to the Professor as early in the semester as possible. DSP is located in STU 301 and is open 8:30am – 5:00pm, Monday through Friday. The phone number for DSP is (213) 740-0776.

Instructor Bio:

Perry Hoberman has worked with stereoscopic media for several decades, beginning in the early 1980s with his award-winning 3D slide performances and installations, including *Out of the Picture*, which was included in the 1985 Whitney Biennial, and *Smaller Than Life*, performed worldwide throughout the 1980s. Hoberman has incorporated 3D media into widely-exhibited sculpture, installations, performances and spectacles, including works such as *Interstate*, exhibited at Art Futura (Barcelona, 1989) and *Systems Maintenance* at Ars Electronica (Linz, 1999). His 3D installation *Bar Code Hotel* received the top prize at the Interactive Media Festival (Los Angeles, 1995), and is in the collection of the ZKM Mediamuseum in Karlsruhe. In the mid-1990s, Hoberman was the Art Director at Telepresence Research, where he designed a number of virtual reality installations, including *The Virtual Brewery*, exhibited for years by Sapporo in Tokyo. Last year he presented *Denial Clinic*, a 3D projection performance at the Manual Archives and at the Velaslavasay Panorama, both in Los Angeles. He has taught a number of classes and workshops in stereoscopic imaging at USC and elsewhere, and is a recognized expert in the field.