Experimental Game Topics: Stereoscopic 3D Game Design

USC School of Cinematic Arts, CTIN 492

Spring Semester 2011, Monday & Wednesday 4:00-5:50pm

Instructors: Peter Brinson, Perry Hoberman

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Course Objectives and Description

This 4-unit class will give students the opportunity to develop games that utilize stereoscopic 3D as an essential component of game design. Both technically and artistically, stereo 3D promises to represent an important skill set and creative position in the game industry, and so students will be encouraged to create experimental prototypes and games. Stereo 3D can be seen as part of a larger reconfiguration of media and games towards greater immersion and more intuitive interaction, and thus is a natural complement to emerging gestural and multitouch interfaces, and larger high-resolution displays.

Because most existing 3D (non-stereoscopic) games are actually a composite of 3D (models, lighting, cameras) and 2D elements (HUDs, particle effects, textures, etc), effective Stereo 3D demands more than simply adding a second camera. All kinds of design and render 'cheats' that have worked perfectly well in 2D can suddenly become patently obvious when viewed in stereo 3D, creating confusion, and even eyestrain. New conventions are only now emerging to bring stereo 3D to various game genres, and this class will be an opportunity to experiment and discover new approaches and solutions. The class will also explore techniques for converting 2D games into stereo 3D space, as well as hybrid techniques that utilize stereo 3D as an arena for imaginative and innovative representation, navigation and play.

A goal of the class is to approach stereo 3D not as a simple add-on to existing 2D games, but as a catalyst for new kinds of games that incorporate stereo 3D as essential and fundamental element - to make games that can only be played in stereo 3D. While this may seem foolhardy given the current state of the game industry, it is only a matter of time until stereo 3D becomes widespread enough to support stereo 3D-specific games, and thus this class provides a rare chance to explore some new and uncharted territory.

The class will be taught using Unity, a capable and user-friendly 3D engine that can accomodate stereo 3D.

Meeting Information

Location: RZC 201
Time: Th 3:00PM-5:50PM
Units: 4
Pre-requisites: Open to USC undergraduate (3rd & 4th year only) & graduate students.

Course Texts

TBA

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:

Class participation:	10%
Blog postings (reading & research reports) :	10%
Milestones 3 @ 5% each:	15%
Assignments 3 @ 15% each	45%
Final Project Video:	20%
Total:	100%

Course content by class meeting

Week 1

- Welcome & overview of semester. Basic definitions & terms. Basic principles of vision & binocular vision. Terms, definitions, formats. 2D and 3D depth cues. Binocular parallax. Interocular distance, hyper/hypostereo. Accomodation/convergence, comfort/limits.
- Exercise: Shoot single-camera stereo photo pairs.

Week 2

- Overview of authoring systems and game engines. Scripting 3D modeling/animation programs. Introduction to Unity. Stereoscopic grammar. Optical exercises and free-viewing. Analyzing parallax.
- Assign Project 1: *options:*
  - Incomplete Information: Develop a two player S3D game in which the core mechanics revolves around discovering something that the other player already knows
  - Music Video Game: Develop a S3D game that encourages the player to time or otherwise coordinate visuals and music.
  - Confinement/Escape: Develop a game that moves from a tight enclosed space to a wide-open, unbounded one, using S3D to emphasize states of claustrophobia and freedom.
  - 3D Premium: Develop a game that uses varying degrees of flatness and stereo 3D, where the reward system for the user is more or better 3D.

Week 3

- Basic Unity workflow for stereo. Approaches to configuring virtual 3D cameras. Parallel vs. toed-in cameras. Binocular parallax vs motion parallax. Limits and workarounds (divergence, ghosting). Rules & rules of thumb.
- Project 1 proposals

Week 4

- Modeling and animation software. Other useful 2D and 3D software production tools. Repurposing 2D software for 3D. Scripting in Unity. Debugging.
- Project 1 milestone

Week 5

- Input devices: physical, virtual, hybrid. Navigation in 2D and 3D. Optics, lenses, filters. OpenGL and DirectX.
- Project 1 due

Week 6

- The mathematics of perspective transformations. Basic math for stereo imaging. Off-axis perspective projection. Motion in 3D space.
- Assign Project 2: *pick one option*
  - Self Referential Cinema in 3D: Develop a S3D game about S3D. For example, in the game, the player is asked to make a S3D movie using two virtual cameras, uncooperative actors, and inconsistent lighting.
  - Failure is an Option: Develop a S3D game in which winning conditions are met by achieving goals that are traditionally considered a losing state, such as falling into holes, using up your resources, or grinding to a halt.
  - Necessary 3D: Develop a game in which S3D provides a significant advantage, so that it is much more difficult to win when played in 2D.
  - Hopping Dimensions: Develop a game that repeatedly transitions between flat sprite-like 2D gameplay and fully modeled stereo 3D space.

Week 7
- Shaders in Unity. Interaction design. Overview of displays and eyewear. Navigating stereoscopic space. Screen vs user space.
- Project 2 proposal

Week 8
- Unity's GUI layer. Combining 2D and 3D elements. Focal length, lighting and composing in 3D. Dynamic (animated) 3D shots.
- Project 2 Milestone

Week 9
- Particles and FX. Benchmarking. Effective content for 3D. Cuts, transitions, continuity in 3D. Custom shaders.
- Project 2 due
- Assign Project 3: Free choice

Week 10
- 3D art direction & aesthetics. 3D as a tool for emotional emphasis. Depth scripts and budgets. Scale and size, redundancy and contradiction. The stereowindow and its violation.
- Project 3 proposal

Week 11
- Compositing + FX in 3D. 2D-to-3D conversion. Text and titles.
- Project 3 milestone

Week 12
- Immersion and embodied experience. Peripheral vision. Cursors & pointers, 2D & 3D.

Week 13
- Headtracking and gestural interfaces. Virtual reality concepts & definitions. Simulation, virtuality, cyberspace, presence, telepresence. Force feedback and haptic devices.
- Project 3 due

Week 14
- Final expository video of best project due

Week 15

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

Exam Week

- Final Examination

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.

Statement for 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 the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *Scampus,* the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: HYPERLINK "http://www.usc.edu/dept/publications/SCAMPUS/gov/" http://www.usc.edu/dept/publications/SCAMPUS/gov/. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: HYPERLINK "http://www.usc.edu/student-affairs/SJACS/" http://www.usc.edu/student-affairs/SJACS/.

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.

Peter Brinson is a game developer, filmmaker and educator living in Los Angeles. His work explores the narrative possibilities found in animal protagonists, documentary play and collective ownership. His films and games have exhibited in numerous venues, including the Museum of Modern Art, SIGGRAPH, Ars Electronica, Slamdance, Indiecade, Yerba Buena Center for the Arts, The Kitchen and the Telluride Film Festival. Brinson attended the University of North Carolina and the California Institute of the Arts.