Course Brief

Optics can be used as a design too to transform architectural spaces. While recent architectural theories and tools have focused on the quantitative aspect of space and design, the geometry and associated algorithms of formal aspects of space and matter, optics in its relationship to architecture operates on the qualitative aspect of our physical reality. By carefully exploring the potentials of science, technology, art and the culture of optics to alter our surroundings, designers can develop means to alter space. The optical relationship between light, material and space is a concept with a high degree of flexibility and fidelity, and through empirical performance operations can be a formidable architecture design element.

This course will seek to explore this relationship by starring at the foundations and first principles of optics, covering the electromagnetic spectrum, interaction with materials through transmission, reflections & absorption. From this foundation the lectures will evolve to incorporate the applied aspect of optics such as perception, construction, and other elements of the physical act of lighting. Finally the practice of lighting in architecture will be explored through the introduction of both simulation and analysis software, design methods for integrating light and design, and control systems. Optics will be thought of as a science, a technology and a philosophical and social concept.

The logistics of the course are based on a project-oriented goal. The first half of the semester will consist of lectures, field trips and in-class demonstrations, while the second half of the course will concentrate on a student defined project. The results of the course will be presented at the GSAPP End of the Year Show. Work will progress through a series of phases from a presentation of a conceptual idea, research and experiments developed in class with the instructor, guest lecturers and critics, and the other students in a rigorous scientific method, and followed by the production of a small scale optical object and finally the design of a space with the use of light.

For questions please contact Professor Anzalone at pra6@columbia.edu

Course Schedule

Week 0 Preparation
Readings: Allegory of the Cave from the Republic, Plato
Probemata Book XXX1, Aristotle
Optics, Euclid

Week 1 Monday, January 27
Discussion: History of the Philosophy of Optics (philosophy of perception, cosmological concepts, perspective, early scientific development, particle / wave duality, Albn al-Haytham + Arabic Writers, Roger Bacon + Medieval Writers)
Readings: J. Kepler, R. Descartes and W. Snellius
I. Newton and C. Huygens and the wave / particle debate
E. Mach, The Principals of Physical Optics
Assignment: Abstract on Architecture / Optics relationship (Due Week 4)

Week 2 Monday, February 3
Discussion: Science of Optics (geometric & physical optics, electromagnetism, wave / particle, quantum effects)
Readings: I. Newton, Opticks (excerpts)
J. W. Goethe, Theory of Colors (excerpts)
Due: Discussion and Abstract of Week 1 Readings

Week 3 Monday, February 10
Discussion: Technology of Optics (lenses, luminaries, measurement, simulation software)
Readings: M. Egan, Concepts in Architectural Lighting
Handouts in Class
Filed Trip: Columbia University Optics Laboratory and Laser Shock-Peening Facility

Week 4 Monday, February 17
Discussion: Optics + Materiality (color, energy / heat, surfaces & thin-films, analysis
Readings: Handouts in class
Assignment: Form Teams and prepare proposal (Due Week 6)
Field Trip: Materialconexion and The Dream House

Week 5 Monday, February 24
Discussion: Optics + Control (technical design, energy, lighting systems, coherency, fiberoptics, simulation)
Readings: Handouts in class
Due: Writing Assignment
Field Trip; Lutron Experience Showroom and Bloomberg Building Control Center

Week 6 Monday, March 3
Discussion: Optics + Design (architecture + light, optical architecture, art, visualization, cinema)
In Class: Review of team projects
Readings: J. Lacan

Due: Presentation of Final Project concept
Field Trip: James Turell's exhibition at PS1 and installation at 505 Fifth Avenue

Week 7 Monday, March 10
KINNE WEEK - No Class

Week 8 Monday, March 17
SPRING BREAK - No Class

Week 9 Monday, March 24
Goal: Demonstration of Final Project

Week 10 Monday, March 31
Goal: Computer Modeling and Simulation of Final Project

Week 11 Monday, April 7
Goal: Material Prototyping of Final Project

Week 12 Monday, April 14
Goal: Mid-review of Final Project

Week 13 Monday, April 21
Goal: Individual Reviews of Final Project

Week 14 Monday, April 28
FINALS WEEK - No Class

Week 15 Monday, May 5
EXAM WEEK - No Class (Papers due this week)
Due: Draft of Research Paper on Final Project

Week 16 Monday, May 12
Due: Final version of Research Paper on Final Project
Grades Due Wednesday May 14

Week 16 Saturday, May 17
END OF THE YEAR SHOW - Presentation of Final Project

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