

Vision in Art and Neuroscience

Fall 2018

U: 9.S52 G: 9.S916 | 2-2-8

TR 3-5 | 10-150

Instructors :

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Course Description

This course seeks to introduce and engage students hands-on with core concepts in visual perception through the lenses of art and neuroscience. The material has been selected both to expose students to the study of brain and cognitive sciences and to engage those already within the neuroscience community in the use of art as a method to explore and visualize core principles of perception. A combination of seminar and studio work will create the foundation for fostering valuable interdisciplinary dialogue between visual art and vision neuroscience, culminating in an exhibition of students' semester-long projects.

The course treats the processes of visual perception and the creation of visual art in parallel, making use of the fact that both are constructive. We suggest that the act of visual perception is that of creating an internal representation of the external world, and the act of artistic creation is that of creating an external representation of the internal world. In the seminar, we will explore the hierarchy of visual processing, from the time that the light strikes the retina to the internal experience of a rich visual world. In the studio, we will examine how each stage of this process manifests in the experience of art, wherein the perceptual system observes itself. Using light as a medium and the darkroom as a canvas, students will externally visualize and experience stages of internal neural processing, and through tutorials and training receive the skills necessary to ultimately synthesize the material into their own studio project.

Course Structure

The course consists of one two-hour seminar (Tuesday) and one two-hour studio workshop (Thursday) per week. Seminars will include slide talks, demonstrations, video documents, etc. by the team as well as invited guests. Carefully chosen readings and student presentations will fuel discussions. The seminar will be divided into six modules that build, one upon the next, introducing core principles of vision neuroscience, the experiential parallels of which will be pursued in the studio workshops. In the first weeks of class, studio workshop will be spent in a dark room where students will be guided through experiments and demonstrations visualizing the fundamental interactions of light and vision. As the semester progresses, studio sessions will be devoted to individual student project development: design, prototyping/testing and construction for exhibition. At the end of the semester, there will be a public exhibition opening in Compton Gallery where students will be expected to give brief talks revealing their works from theoretical and experiential angles. This presentation, together with the semester project and the project write-up, will replace a final examination for the course.

Module 1 *The origins of structure in perception & art*

Tues 9/11 Lecture

Reading due:

Perception Viewed As An Inverse Problem (Pizlo 2000)

Stabilized Images On The Retina (Pritchard 1961)

Prologue: $x 18^3$ and Excursus: Homage To The Square³ (Robert Irwin 1998) exhibition pamphlet,
Dia center for the arts

Liberating Light: A Contemplative and Scientific Encounter (Zajonc 2013) from James Turrell
Guggenheim exhibition catalogue

Thurs 9/13 Studio demos, discussion and experimentation

Module 2 *Early (low and intermediate-level) visual processing*

Tues 9/18 Lecture and discussion: Pawan Sinha

Thurs 9/20 Studio demos, discussion and experimentation

Tues 9/25 Seminar:

Reading due:

Points (Koenderink 2017)

Notes On a Total Light (Lippard 1967) from Focus on Light, NJ State Museum

Perceptual Geometry (Schwettmann 2018) slide talk

Thurs 9/27 Studio demos, discussion and experimentation

Module 3 *Binocular vision: depth and motion perception*

Tues 10/2 Lecture and discussion: Pawan Sinha

Thurs 10/4 Studio demos, discussion and experimentation

Tues 10/9 Columbus day holiday; no class

Thurs 10/11 Seminar: Student presentation

Reading due:

Perceived Lightness Depends On Perceived Spatial Arrangement (Gilchrist 1977)

Why We See Things The Way We Do: Evidence For A Wholly Empirical Strategy of Vision
(Purves et al. 2001)

Pictorial Space (Koenderink 2012)

Gauge Fields in Pictorial Space (Koenderink, Van Doorn 2012)

Module 4 *Color and light*

Tues 10/16 Guest lecture: Rosa Lafer-Sousa

Thurs 10/18 Individual progress meetings & project proposal discussion

Tues 10/23 project proposal due (1 page write-up incl. preliminary material list)

Seminar: student presentation

Reading due:

Interaction of Color (Albers 1963) excerpt

Sensory, Computational, and Cognitive Components of Human Color Constancy (Smithson 2005)

Thurs 10/25 Studio: project work

Module 5 *Recognition (compositionality, perceptual primitives)*

Tues 10/30 Lecture & discussion

Reading due:

Recognition-by-Components, A Theory of Human Image Understanding (Biederman 1987)

Thurs 11/1 Studio: project work

Tues 11/6 Seminar: student presentations

Reading due:

Seeing faces is necessary for face-domain formation (Livingstone 2017)

Paul Cézanne: The Process of Sight (Lehrer 2007) excerpt from *Proust Was A Neuroscientist*

Thurs 11/8 Studio: project work

Module 6 *Art and Associative Recall*

Tues 11/13 **First project crit**

Thurs 11/15 Seminar: Pawan Sinha

Tues 11/20 Seminar: student presentation

Reading due:

On the Perception of Probable Things: Neural Substrates of Associative Memory, Imagery, and Perception (Albright 2012)

Inventing Abstraction (Dickerman 2012) from *Inventing Abstraction: How a Radical Idea Changed Modern Art*

Piet Mondrian: Toward the Abolition of Form (Bois 2012) from *Inventing Abstraction*

Thurs 11/22 Thanksgiving holiday: no class

Preparing for Exhibition

Tues 11/27 Studio work

Thurs 11/29 **Second project crit. + wall-text paragraph due**

Tues 12/4 Studio work

Thurs 12/6 **Final check-in**

Mon 12/0 Pieces must be installed in the studio by midnight

Tues 12/11 Exhibition opening (evening): projects due + student talks

Tues 12/11 Final write-up due (minimum 5 pages)

Grading and Evaluation

Activity	Percentage
Final project	50
<i>Studio work (30%)</i>	
<i>Write-up detailing relevance to course material (20%)</i>	
Student-led discussion	20
Experimental design	20
Attendance/Class participation	10

Final project

Over the course of the semester, students will use studio time to work individually on a final project. There will be no final exam. The semester-long project is considered equivalent to a comprehensive exam, and will be due at the opening of the exhibit at the end of the semester, date TBD. Final projects may make use of, but are not limited to, LEDs, electronics and programming; optical system design and construction; material design and fabrication with CAD, laser cutting, 3D printing, CNC for shaping and surfacing, etc. The studio workshops and some outside, optional sessions (e.g., in fabrication shops) will provide tutorials and training for work on the project. The project submission will be accompanied by a minimum 5-pg written report describing the creative process behind the piece and the incorporation of principles discussed in class.

Student-led discussion

Once during the semester, each student will select a paper from the reading materials for a particular module and lead a 1-hour group discussion on the material, making cross disciplinary connections to either visual art or neuroscience, depending on the nature of the paper.

Written Assignment

Each student will also be responsible for contributing one post to the course website that documents the seminar and studio sessions for that week in the class. The written assignment, in conjunction with the student-led discussion will hone students' skills at communicating the concepts covered in the course.

Attendance/Participation

We expect full attention in class and participation in discussions after completing the required reading. As the seminar will only meet once a week, repeated absence will not be tolerated; all absences after the first must be explained and excused. Participation in the studio work process will also be taken into account. While students will be creating work for exhibition, they are not expected to be or become artists or designers. Rather, they will be expected to learn and grow from the experience of simultaneously engaging artistic/design, neuroscientific, and engineering principles.

Two-way feedback

At two different points in the semester, we will schedule meetings with students as progress checkpoints for both students and instructors. This will be a key opportunity for instructors to provide feedback on the quality and character of students' work in the studio and seminar, and equally, for students to provide feedback on course structure, materials, and instruction. The first meeting will allow students to individually discuss potential project ideas with instructors, and the second meeting will serve as a checkpoint to ensure that students are making good progress toward work for exhibition.

Course Location

The course will take place at the MIT Museum Studio and Compton Gallery, 10-150. Students registered for the course will have 24-7 card access to the studio space and light lab after completing brief safety training (offered during course).