Vision in Art and Neuroscience

Fall 2023
U: 9.72 G: 9.720
TR 3-5
10-150
Course website: vision.mit.edu
Office hours: Wednesdays 1-3 p.m. 10-150

Instructors:
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Course Description

We will treat perception as an act of creation, the creation of an individual's world of experience. From limited and noisy data incoming through the senses, our brains construct the rich world we perceive. Creating visual art throws that world of experience back to the outside, and in it we find reflected mechanisms of the constructive process of vision. As such, we can find examples in art which allow us to "perceive perception." Through readings, lectures, discussion, and project-based work, the course will explore the neural and computational mechanisms of vision and their parallel manifestations in visual art. Working together, we will translate different levels of the visual processing hierarchy into the domain of experience, using the power of the interaction of light and simple materials to foreground visual perception in experience. The course is divided into one seminar-style lecture and one session of studio instruction per week. Each student will have access to studio materials and equipment for creating and documenting visual experiences. Students will be expected to share their work processes with the class and to contribute to the content, design, and installation of a group exhibition of individual final projects. Your final project and the collaborative exhibition will replace a final exam.

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, and video documents by the team, as well as invited guests. Carefully chosen readings and student presentations will fuel discussions. Studio hours during the first weeks are spent in a dark room where students will be guided through experiments visualizing fundamental interactions of light and vision. Processes of visual perception and artistic creation are treated in parallel, making use of the fact that both are constructive. As the semester progresses, studio sessions will serve preparation of individual final projects for exhibition. The seminar will be divided into six modules that build, one upon the next, to introduce principles of vision neuroscience and their parallels in the creation of visual art. Toward the end of the semester, we will collaboratively design, install and open a public exhibition of projects in the Compton Gallery.

Thurs. 9/7 Course introduction

Module 1 ***The origins of structure in perception & art***
Tues 9/12 Seminar
Reading due:
Perception Viewed as An Inverse Problem (Pizlo 2000)
Stabilized Images on The Retina (Pritchard 1961)

Thurs 9/14 Studio demos, discussion and group experimentation

Module 2 ***Early (low and intermediate-level) visual processing***
Tues 9/19 Lecture and discussion: Pawan Sinha
Thurs 9/21 Studio demos, discussion and group experimentation
Tues 9/26 Seminar
Reading due:
Theory of Edge Detection (Marr/Hildreth 1980)
What Line Drawings Tell Us About the Visual Brain (Cavanagh/Sayim 2011)

Thurs 9/28 Studio demos/early project development

Module 3 ***Binocular vision: depth and motion perception***
Tues 10/3 Lecture and discussion: Pawan Sinha
Thurs 10/5 Studio demos, discussion and group experimentation
Tues 10/10 Indigenous Peoples' Day—no class
Thurs 10/12 Studio: demos and early project development
Reading due:
Perceived Lightness Depends On Perceived Spatial Arrangement (Gilchrist 1977)
Perception and Reality: Why a Wholly Empirical Paradigm is Needed to Understand Vision (Purves et al 2015)

Module 4 ***Color and light***
Tues 10/17 Guest lecture: Rosa Lafer-Sousa
Thurs 10/19 Individual progress meetings & project proposal discussion
Tues 10/24 project proposal due (1 page write-up incl. preliminary material list)
Seminar: two group presentations: Binocularity and Color
Reading due:
#□*thedress: A Tool for Understanding How Color Vision Works* (Conway/Lafer-Sousa 2017)
Sensory, Computational, and Cognitive Components of Human Color Constancy (Smithson 2005)
Thurs 10/26 Studio: individual project work

Module 5 ***Recognition (compositionality, perceptual primitives)***
Tues 10/31 Guest lecture: Daniel Kersten
Reading due: The Perception of Cast Shadows (Mamassian, Knill, Kersten 1998)
Seeing faces is necessary for face-domain formation (Livingstone 2017)
Paul Cézanne: The Process of Sight, excerpt *Proust Was a Neuroscientist* (Lehrer 2007)
Thurs 11/2 Studio: 1st critique
Tues 11/7 Studio: project work
Thurs 11/9 Seminar

Module 6 ***Art and Associative Recall***
Tues 11/14 Lecture and discussion: Pawan Sinha
Reading due: TBD
Thurs 11/16 Studio: 2nd critique
Tues 11/21 Seminar: two group presentations: Recognition and Associative Recall
Reading due:
Associative Learning Mechanisms in Vision, excerpt *Visual Memory* (eds. Luck/Hollingworth 2008)

Proposed update: Words Jump-Start Vision: A Label Advantage in Object Recognition (Boutonnet and Lupyan 2015)

Thurs 11/23 Thanksgiving Day Holiday

Preparing for Exhibition
Tues 11/28 project write-up and exhibit label due
Thurs 11/30 individual project work
Tues 12/5 individual project work
Thurs 12/7 individual project work
Tues. 12/12 last day of classes/exhibition opening

Grading and Evaluation

Activity	Percentage
Final project	50
Studio work (35%)	
Write-up detailing relevance to course material (15%)	
Participation	
Student-led discussions, question submissions, presentations, critiques	20
Assignments	20
Attendance	10

Final project

- In the studio sessions, group work and demos early in the semester will foster and give way to individual final projects as the semester progresses. The final project is considered equivalent to a comprehensive exam and is due at the time of the exhibition opening: Tuesday, December 12, 2023. There will be no written final exam.
- The final project will be an individual artwork that communicates to others your interests and findings in perceptual terms, i.e., it will stimulate percepts in the viewer, called out and informed by label text you will write to accompany your project. The project will complement your discursive work in the course. Much time and attention will be given in class to the process of conceiving and creating these artworks.
- You are not expected to be, or become, an artist. Evaluation of your work will be based on your investment in the hands-on learning process and the progress you make relative to your individual starting point.
- Final projects are wide open in terms of equipment, software, techniques. The project will be your original concept and lead. We will work with you to solve artistic and technical challenges, using studio methods and resources.
- At a key point in the semester, we will have a one-on-one meeting. This will be an opportunity for us (instructors) to provide feedback on your work and, equally, for you to provide feedback on course structure, content and instruction.
- Students will submit a two-part written assignment, 1. A project write-up detailing their artistic approach and its intellectual basis in the course material and 2. Exhibit label text (100 words) drawn from the project write-up. The exhibit label and an image of the project in development will be published in the catalog accompanying the exhibition.

Student-led experiences/discussions

Four student-led presentations will take the place of lectures over the course of the semester. During the second week of class, each student will sign up to participate in one of four presentation groups. These presentations are not slide talks, but demo-led, visual events that embody the key concepts from research papers into visual experiences that the class can perceptually explore and intellectually interpret. The presenting group must find independent time to prepare the demos. Studio resources and staff support will be available.

All non-presenting class members must come prepared to engage with the group presentations by having completed the readings and prepared questions. The student-led presentations are pronouncedly interactive; the whole class contributes to the learning experience, and your informed participation is expected.

Attendance and Participation

Students are expected to attend all classes. If you must be absent, alert us in advance. Any unexcused absences will affect your final grade.

- Participation grades will be based on contributions to seminar discussions and engagement in the individual and group hands-on work sessions in the studio.
- The participation grade is not based on quantity, but quality of contribution to a lively, useful, and sustained discussion and community of learning.
- Studio sessions will often involve visual presentations of prepared work. It is expected that this work will be ready to show by the start of class.
- If you experience concerns or difficulties participating, accessing materials, working in-person for any reason, please reach out right away, e.g., via email, or using the pseudonymous Threads tool. We are here to create this semester together, and the teaching team will be flexible and open to any necessary adjustments.
- In the spirit of a flexible semester, we are prepared to update schedules and expectations given whatever challenges this fall may bring, for any one or all of us. We are approaching this semester with the mindset of building a community of practice which functions in both physical and virtual classrooms, as needed.
- Your observations, ideas and leadership are important in creating a good learning environment and class experience. We're looking forward to working with you this semester.