

Vision in Art and Neuroscience

Fall 2021

U: 9.72 G: 9.720

TR 3-5 | MIT Museum Studio 10-150

Instructors :

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Course Description

The fall 2021 course offering is in-person with remote as needed, i.e., we will incorporate virtual activities as needed. 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 some mechanisms of the constructive process of vision. As such, we can find examples in art which allow us to "perceive perception." Through readings, lecture, 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 follow "recipes for seeing" to translate different levels of the visual processing hierarchy into the domain of experience, using the power of simple materials to foreground direct visual perception. 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 prepare simple captures of work and work processes to share with the class as needed and to contribute to the exhibition content that will have physical and online aspects. A final project and exhibition of student work 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, video documents, etc. by the team as well as invited guests. Carefully chosen readings and student presentations will fuel discussions. In previous years, workshop hours during the first weeks of class were spent in a dark room where students were guided through experiments visualizing the fundamental interactions of light and vision. As the semester progresses, studio sessions will serve preparation of 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 design, install and open a public exhibition of projects in the Compton Gallery.

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

- Tues 9/14 Seminar | Studio demos: *point and line refrain*
Reading due:
Perception Viewed As An Inverse Problem (Pizlo 2000)
Bayesian Models of Object Perception (Kersten and Yuille 2003)
- Optional: *Stabilized Images On The Retina* (Pritchard 1961)
Experimental Phenomenology: Art and Science (Koenderink 2012)
Multiple Worlds (Koenderink 2012)
- Thurs 9/16 Studio demos, discussion and experiments

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

- Tues 9/21 Lecture and discussion: Pawan Sinha
Reading due:
Primer: Receptive Fields (Lennie 2003)
'Art and The Limits of Neuroscience' from *Strange Tools: Art and Human Nature* (Noë 2015)
- Thurs 9/23 Studio demos, presentation + discussion
ingredients of vision
- Tues 9/28 Seminar
Reading due:
Points (Koenderink 2017)
Perceptual Geometry (Schwettmann 2018) talk
- Thurs 9/30 Studio demos, presentation + discussion
perceptual geometry

Module 3 *Binocular vision: depth and motion perception*

- Tues 10/5 Lecture and discussion: Pawan Sinha
- Thurs 10/7 Studio demos, presentation + discussion
- Tues 10/12 Holiday
- Thurs 10/14 **Seminar: student presentation** (no pres. software + must include demos)
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*

Tuesday 10/19 Seminar: Color and Light

Thurs 10/21 Color studio

Tues 10/26 **Project proposal due** (1 page write-up incl. preliminary material list)

Seminar: student presentation (no pres. software + must include demos)

Reading due:

Selections *Interaction of Color* (Albers 1963)

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

*Perception of Three-Dimensional Shape Influences Colour Perception through Mutual
Illumination* (Bloj et al. 1999)

Thurs 10/28 Individual student project meetings

Module 5 *Recognition (compositionality, perceptual primitives)*

Tues 11/2 Seminar

Reading due:

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

Thurs 11/4 Studio: project work

Tues 11/9 **Seminar: student presentations** (no pres. software + must include demos)

Reading due:

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

Paul Cezanne: The Process of Sight (Lehrer, excerpt from *Proust Was a
Neuroscientist*)

Thurs 11/11 **Holiday: veterans day**

Module 6 *Art and Associative Recall*

Tues 11/16 Lecture and discussion: Pawan Sinha

Thurs 11/18 **First project crit**

Tues 11/23 **Seminar: student presentation** (no pres. software + must include demos)

Reading due:

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

Thurs 11/25 Thanksgiving holiday

Preparing for Exhibition

Tues	11/30	Second project crit
Thurs	12/2	Project work
Tues	12/7	Final project day
Thurs	12/9	<i>Last day of classes: exhibition opening</i>

Grading and Evaluation

Activity	Percentage
Final project	50
<i>Studio work (35%)</i>	
<i>Write-up detailing relevance to course material (15%)</i>	
Participation	
<i>Student-led discussion, question submission, presentation</i>	20
Recipe assignments	20
Attendance/Class participation	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 virtual exhibition opening: Thursday, December 9, 2021. There will be no written final exam.
- The final project will be an individual artwork which communicates to others, in terms of experience, your interests and findings. 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. We will learn about this in class, exploring the artistic method and creating together. Thus, your investment in the hands-on learning process, and not the success of the project as an artwork, will be the evaluation-measure of your studio work.
- Final projects are limited to virtual works, but wide open in terms of what equipment, software, techniques, etc. are used. For example, you could work with a camera, simple materials and controlled lighting, as the in-class demos will show, or you may choose to

create animations using software. In any case, the result will be visual as and documented and displayed as such. The project will be your original concept and lead, and we will work together to solve artistic and technical challenges using Studio resources and support.

- At key points in the semester, we will have one-on-one meetings. These will be opportunities for instructors to provide feedback on the student's work and, equally, for students to provide feedback on course structure, content and the instruction. The first meeting will allow students to discuss project ideas with instructors.
- Students will submit a written assignment detailing their artistic approach to the project and its basis in course material. This statement will be published in the catalog accompanying the exhibition. The final project and accompanying write-up will together take the place of a final exam for the course.

Student-led discussion

Four student-led seminars 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. The presentations will be discussion and visual demo-based, and may not be not slide-based (though may use digital material). The content of the discussions will be structured around questions submitted by all non-presenting course members **by 5pm two days before the seminar**. Each student must submit (at least) one question extending or challenging a key idea in the reading. The student seminar facilitators will curate the submitted questions and use their presentation time to lead a structured discussion of the material by *(a)* briefly (~5 min) summarizing the readings, *(b)* engaging the class in discussion of the submitted questions (~45 min) *(c)* concluding by synthesizing the content of the live discussion and suggesting potential future avenues for investigation (~10 min). The presenting group is also responsible for creating (at least) one visual experience extending ideas from the reading, and engaging the rest of the class in this demo during their presentation. The presenting group must find independent time to prepare this demo. Studio facilities and staff will provide resources and support.

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 participation in seminar discussions, and on attendance in virtual studio sessions where students will share pre-prepared snapshots of home-studio work.
- Your grade for class participation is not calculated based on simply how much you speak, but rather how you contribute to a lively, useful, and sustained conversation and community of learning both in and out of class.
- If you experience concerns or difficulties participating, accessing materials, working at home, etc. please reach out: via email, or using the pseudonymous Threads tool. We are here to create this semester together – and 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 the 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 and outside of the virtual classroom.
- Your experiences, ideas and leadership are important in creating a good learning environment and course experience. We look forward to working together this semester.