

# The Seen and Unseen in Science

IDSEM 1534, Fall 2015

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MW 9:30-10:45  
Waverley 566A

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This class explores how science sees. How do scientists decide when they have seen something? How do they work with those things that cannot be seen? We will examine how scientists convince themselves that new, strange, or unseen things are real. We ask questions about what it means to “see” or “observe” the world around us, how best to represent those things that are seen, and grapple with the basic question of how we gain scientific knowledge at all. We will pay special attention to how scientists are trained to see in particular ways, and how culture and worldview can shape, restrict, or enhance the way we observe.

Our goals are:

- Learn how scientists see and represent the world around us
- Learn to think about science in an interdisciplinary way
- Develop critical thinking skills
- Develop communication skills

The class is structured around four major units. Each unit will end with an in-class debate. Everyone will be assigned a side in the debates, and will also write an individual short assessment (4 pages) of the evidence for and argument of each party in the debate.

Everyone will be required to post a brief response to each day’s reading on the class website’s discussion forum. The response should be about a paragraph, and can consist of your thoughts on the material, questions you have, or issues you would like to discuss. These posts must be made by 9 am on each day class meets and will be used to help frame our class discussions.

A final project will be due at the end of the course, on a topic of your choice relating to the themes of the class. The default form of the final project is a research paper (12 pages), but I am open to other ideas. In the past students have written short stories, performed songs, investigated field sites anthropologically, and authored plays. Any project that involves outside research, has an argument, and displays intellectual rigor is acceptable.

The course grade will be determined as follows:

|  |                |
|--|----------------|
| Debate papers:                           | 10% (each)     |
| Forum responses:                         | 15% (combined) |
| Final project:                           | 15%            |
| Project proposal:                        | 5%             |
| Class participation (including debates): | 25%            |

It is expected that you know how to write clearly. Everything you write for this class should have an argument, a thesis statement, and sources cited with quotations marks and footnotes. If you are not confident in your ability to do these things, contact me right away.

**Do not plagiarize.** If you take more than two or three words directly from a textbook or another source (including the Internet), you must put them in quotation marks and cite their source in a footnote.

As a Gallatin student you belong to an interdisciplinary community of artists and scholars who value honest and open intellectual inquiry. This relationship depends on mutual respect, responsibility, and integrity. Failure to uphold these values will be subject to severe sanction in accordance with the Student Discipline Rules of the Gallatin School of Individualized Study. Familiarize yourself with Gallatin's academic integrity and plagiarism policies at <http://gallatin.nyu.edu/academics/policies/integrity.html>

Late policy: Late assignments will lose a full letter grade for every 24 hours they are late. Assignments five days late will not be accepted.

If you have a documented disability and anticipate needing accommodations in this course, please make arrangements to meet with me soon.

We will be using these books, all available at the bookstore:

- Galileo Galilei, *Sidereus Nuncius*, Albert van Helden, ed. (University of Chicago, 1989)
- Edward Tufte, *The Visual Display of Quantitative Information* (Graphics Press, 1983)
- Lorraine Daston and Peter Galison, *Objectivity* (Zone, 2007)

Other readings are available electronically on the course website.

### **Class Schedule**

Sept 2            Introduction to the class

#### **I.        Things newly seen**

Sept 7            No class – Labor Day

- Sept 9 Telescope I (*Sidereus Nuncius*, 29-57; Samuel Edgerton, “Galileo, Florentine Disegno, and the Strange Spottedness of the Moon”)
- Sept 14 Telescope II (*Sidereus Nuncius*, 57-86; I.B. Cohen, “What Galileo saw: The experience of looking through a telescope”)
- Sept 16 Microscope (Robert Hooke, *Micrographia*, John Harwood, “Rhetoric and graphics in *Micrographia*”)
- Sept 21 X-Rays (Pasveer, "Representing or mediating" )
- Sept 23 Subatomic particles (Peter Galison, *Image and Logic*; L.W. Alvarez, “Analysis of a reported monopole event” )
- Sept 28 “Seen” Debate. **Debate paper due.**

## II. Things unseen

- Sept 30 Atoms (Ernst Mach, *The Science of Mechanics*; Max Planck, “Unity of the physical world-picture” ; Ernst Mach, “Guiding principles of my scientific theory of knowledge” ; Mary Jo Nye, "The Nineteenth Century Atomic Debates and the Dilemma of an 'Indifferent Hypothesis'" )
- Oct 5 Electricity and magnetism (Henry Adams, “The Virgin and the Dynamo” )
- Oct 7 Imaginary things (Tyndall, “Scientific Use of the Imagination” )
- Oct 12 No class
- Oct 13 Intelligence (Stephen J. Gould, *Mismeasure of Man* )
- Oct 14 The unconscious (Sigmund Freud, *Introductory Lectures on Psycho-Analysis*)
- Oct 19 No class
- Oct 21 Dark Matter (Marcia Bartusiak, *Through a Universe Darkly*)
- Oct 26 “Unseen” Debate. **Debate paper due.**

### III. Scientific Representation

- Oct 28 Representing theories (Julia Voss, *Darwin's pictures*, chapter 2 )
- Nov 2 Persuasive pictures (Myers, "Illustrations in sociobiology")
- Nov 4 Contesting representations (Maria Lane, "Geographies of Mars")
- Nov 9 Photography (Jennifer Tucker, "Photography as witness")
- Nov 11 Brain scans (Joe Dumit, "Picturing personhood")
- Nov 16 Presenting data (Tufte, *Visual Display* 1-77, 108-159, 178-191). **Final project proposal due.**
- Nov 18 "Representation" debate. **Debate paper due.**

### IV. How a scientist sees

- Nov 23 Seeing (Dudley Shapere, "Concept of Observation in Science and Philosophy" *or* Trevor Pinch, "Towards an analysis of scientific observation")
- Nov 25 Thanksgiving break
- Nov 30 Paradigms (Kuhn, *Structure of scientific revolutions*)
- Dec 2 Gender (Lisa Cartwright, *Screening the body*)
- Dec 9 Objectivity I (Daston and Galison, *Objectivity* 11-34, 42-49, 55-68, 115-138)
- Dec 14 Objectivity II (Daston and Galison, 234-246, 273-289, 309-320, 357-361, 363-382)
- Dec 21 (Final exam date) "Observation" debate. **Debate paper due.**
- Dec 23 **Final project due.**