



BROWN

Department of Cognitive, Linguistic &
Psychological Sciences

RI School of Design

Foundations Studies Department

CLPS 0530 Making Visual Illusions

Semester I, 2012-2013

Instructors: Leslie Welch (Brown) Carl Fasano (RISD)
Contact: leslie_welch@brown.edu fasano@gmail.com
Office: 336 Metcalf
Office hours: TBD

Class: MWF 10:00 – 10:50 am,
107 Metcalf Chemistry
Studio/Lab: M 1:00 - 4:50 pm
210 List

Course web page: <http://canvas.brown.edu>

Textbooks: Gregory, R.L. (1997) *Eye and Brain, the psychology of seeing* 5th edition, REQUIRED (Brown bookstore)
Gregory, R.L. (2009) *Seeing Through Illusions*, RECOMMENDED (Brown bookstore)

Course description:

Visual illusions are vivid examples of how what we see is not a faithful representation of what is in the world. This interdisciplinary course is designed for art and science students with interests in visual perception to explore how and why visual processing sometimes does not match the world. Course work will include hands-on art construction exercises and laboratory experiments. Topics will include color, brightness, and contour illusions. Enrollment limited to 15.

Rationale:

This course is explicitly interdisciplinary as reflected in the two course instructors, one a vision scientist and one a visual artist. It is designed to bring together two different ways of exploring visual perception. Within Brown's Cognitive, Linguistic, & Psychological Sciences Department, it serves as an introductory perception course. There are no prerequisites.

This course challenges students to reconsider preconceptions they may have about visual perception. Visual illusions provide vivid examples of how what we see is sometimes not what is in the world. This contradicts our intuition that the visual system faithfully reflects or represents all of the objects and scenes we view. Through discussions, hands-on studio and lab exercises, students travel toward a deeper understanding of how the visual system works. (That's not a bug; that's a feature!) Students' questions lead the way toward new explorations.

Any field of study (e.g. physics, painting, zoology, literature, etc.) strives to know itself and its world in much the same manner. By necessity, individual words, phrases, and entire lexicons (jargons) evolve within each distinct field. This is a great challenge to communication for people who work in different fields and for an interdisciplinary course, and finding a common vocabulary is an obvious solution to the problem. The effort spent constructing a common understanding, wrestling with phrases and words also yields a fertile synthesis of ideas. These ideas present novel

implications in terms of how we use words to convey context and content. The goal is ostensibly translation, but an unexpected benefit is made available. In addition to gaining comprehension of another jargon from a previously distinct field, one may gain a new perspective on one's own jargon and how it reflects on one's own field. For both the artist and the scientist, recognizing the alternative ways to explore a question may serve as inspiration for further study. Becoming aware of the similarities between disparate fields can go a long way toward bridging the gap between the two. Finding a common language opens the door to discovering these similarities.

Aims:

1. Develop an appreciation of the strengths and weaknesses of visual perception
2. Develop skills for exploring visual appearance

Objectives:

1. Make visual illusions and explore what features are needed for the illusions to work.
2. Discuss possible causes of illusions.
3. Explore relationships between objective measures and perceptual appearance.
4. Demonstrate skills necessary for producing examples.
5. Demonstrate how an image can be analyzed by utilizing knowledge of visual processes.

Course requirements:

1. Keep a daily sketchbook/journal in a loose-leaf format so you can hand in pages each week. Record thoughts and questions about: in-class labs, studio projects and any other color, light or illusion phenomena that you notice. Wherever you happen to be, you may observe relevant material. Entries may include sketches, diagrams, data, photographs, collected samples of colored material such as fabric, paper and examples from the natural world. Think of your journal as a place to record investigatory processes as well as the outcomes. Add at least one entry each day. Each week you will be asked to share with the class your favorite entry from the previous week. (10% course grade)
2. Class participation is required. (10% grade)
3. Weekly assignments (constructions and/or papers based on the week's readings (1-2 p.), 3 lab reports (5-10 p.))(55%)
4. Final project (10-12 p. paper and/or construction)(25%)

Course goals:

The primary goal is for students to learn about visual perception. Visual illusions provide vivid examples of where our visual systems do something unexpected and hence provide evidence about how visual processing works. The study of illusions is central to understanding many aspects of visual perception, both from an artistic point of view and from a scientific point of view. Students will explore these ideas through studio and laboratory exercises. The first part of the semester will include explicit skill building and the topics will be explored in an overlapping fashion rather than in sequence.

Another goal of this course is to bring together two types of students: Those who are interested learning about perception via scientific methods and students who are inclined toward an artistic or "studio" approach. These ostensibly divergent learning styles are in fact complimentary; both perspectives have rich histories and well-developed knowledge bases. These two groups tend to have different comfort zones, and students can choose different modes of output. For example, students who prefer to write can organize their final projects around a research paper that describes a particular visual illusion or class of illusions. Students who prefer making things can organize their final project around constructions or graphically-oriented presentations. This hybridized classroom culture engenders a fertile exchange: two types of students to share a variety of perspectives and methodologies mutually oriented toward the study of visual perception.

Tentative course overview:

Topic	Reading	Exercises
1. Introduction	Gregory ch 1, 10 Eagleman	lenticular images
2. Brightness/lightness/value illusions	Gregory ch 2, 3, 5 Adelson Stevens Cornsweet ch 11 Blake & Sekuler	make and measure gray scales discuss 9/10 brightness experiment lab report
3. Drawing exercises		
a. Measured drawing	Gregory ch 9	
b. Linear perspective	Juricevic and Kennedy	
c. Anamorphic projection	Edwards and Whale	
d. Tonal areas		
e. Illusory contour experiment		lab report
4. Color contrast illusions		
a. Color theory	Gregory ch 7 Cornsweet ch 8	color studies color wheel
b. Transparency	Shevell & Kingdom Anderson & Winawer Brown & MacLeod	
c. Objective measurement	Shevell & Monnier McCann et al.	color measurements
5. Design an experiment to measure illusion strength		lab report
6. Review of final projects		

Bibliography:

Books:

- Albers, J (1963) *The interaction of color*, unabridged. New Haven: Yale University Press (special collections - Hay, 2-SIZE ND1489 .A4)
- Blake, R. and Sekuler, R. (2006) Appendix – Behavioral methods for studying perception. in *Perception* 5th ed. Boston: McGraw Hill, pp 553-568. (on reserve Sciences Library)
- Cornsweet, TN (1970) *Visual perception*. Orlando: Academic Press. (on reserve Sciences Library)
- Gombrich, E.H. (1960) *Art and illusion: a study in the psychology of pictorial representation*. Princeton, NJ: Princeton University Press.
- Gombrich, EH (1978) *The sense of order: a study in the psychology of decorative art*. Ithaca, NY: Cornell University Press.
- Gregory, R.L. (1997) *Eye and Brain, the psychology of seeing* 5th edition. Princeton, NJ: Princeton University Press. (Required textbook)
- Gregory, R.L. (2009) *Seeing Through Illusions*. NY: Oxford University Press. (Recommended textbook)
- Fasano, C (1994) A perspective manual.

Articles:

Introduction:

Eagleman, DM (2001) Visual illusions and neurobiology. *Nature Reviews Neuroscience*, 2 (Dec), 920-926.

Brightness:

Adelson demos: <http://web.mit.edu/persci/gaz/main-frameset.html>

Adelson, EH (2000) Lightness perception and lightness illusions. in *The New Cognitive Neurosciences*, 2nd ed., M. Gazzaniga, Ed. Cambridge, MA: MIT Press, pp. 339-351.

Stevens, SS (1960) The psychophysics of sensory function. *American Scientist*, 48 (2), 226-253.

Perspective:

Juricevic, I. and Kennedy, J.M. (2006) Looking at perspective pictures from too far, too close, and just right. *Journal of Experimental Psychology General*, 135 (3), 448-461.

Anamorphic projection:

Edwards, J. and Whale, G. (2004) Defining an alternative picture space. *Digital Creativity*, 15 (3), 129-142. (horizontal plane anamorphosis)

Color appearance:

Anderson, BL & Winawer, J (2005) Image segmentation and lightness perception. *Nature*, 434 (March 3), 79-83.

Brown, RO & MacLeod, DIA (1997) Color appearance depends on the variance of surround colors. *Current Biology*, 7 (11), 844-849.

McCann, JJ, McKee, SP & Taylor, TH (1976) Quantitative studies in Retinex Theory, a comparison between theoretical predictions and observer responses to the “color Mondrian” experiments. *Vision Research*, 16 (5), 445-458.

Shevell, SK & Kingdom, FAA (2008) Color in complex scenes. *Annual Review of Psychology*, 59, 143-166. (doi: 10.1146/annurev.psych.59.103006.093619)

Shevell, SK & Monnier, P (2005) Color shifts from S-cone patterned backgrounds: contrast sensitivity and spatial frequency selectivity. *Vision Research*, 45 (9), 1147-1154.

Tilt:

Hamburger, K, Hansen, T, & Gegenfurtner, KR (2007) Geometric-optical illusions at isoluminance. *Vision Research*, 47, 3276-3285.

Space:

Kleffner, DA & Ramachandran, VS (1992) On the perception of shape from shading. *Perception & Psychophysics*, 52 (1), 18-36.

Rupertsberg, AI, Bloj, M & Hurlbert, A (2008) Sensitivity to luminance and chromaticity gradients in a complex scene. *Journal of Vision*, 8 (9): 3, 1-16.

Size:

McCready, D (1985) On size, distance, and visual angle perception. *Perception & Psychophysics*, 37 (4), 323-334.

McKee, SP & Welch, L (1992) The precision of size constancy. *Vision Research*, 32, 1447-1460.

OPTIONAL READINGS:

(the following 2 articles belong together)

Krieger, M. (1984) The ambiguities of representation and illusion: An E.H. Gombrich retrospective. *Critical Inquiry*, 11 (2), 181-194.

Gombrich, E.H. (1984) Representation and misrepresentation. *Critical Inquiry*, 11 (2), 195-201.

Cornsweet chapters 9 & 11

Gregory chapter 11

Kris, E & Kurz, O (1979) *Legend, myth and magic in the image of the artist: a historical experiment*. New Haven: Yale University Press.

da Vinci, L. (1957 translation) *The art of painting*. New York: Philosophical Library. (ND1130. L6 Rock lvl A)

da Vinci, L. (1970) *The Notebooks of Leonardo da Vinci*. Compiled and edited from the original manuscripts by JP Richter, vol 1, New York: Dover. (on reserve Hay, Request at the Readers' Services desk.)

Attneave, F (1975) Multistability of perception. *Scientific American*, 225 (6), 62-71.

Barlow, HB (1990) A theory about the functional role and synaptic mechanism of visual after-effects. in *Vision coding and efficiency*, C. Blakemore, Ed. Cambridge, UK: Cambridge University Press, pp 363-375.

Bruggeman, H., Yonas, A. and Konczak, J. (2007) The processing of linear perspective and binocular information for action and perception. *Neuropsychologia*, 45, 1420-1426.

Busby, A. and Ciuffreda, K.J. (2005) The effect of apparent depth in pictorial images on accommodation. *Ophthalmological and Physiological Optics*. 25, 320-327.

Cavoto, B.R. and Cook, R.G. (2006) The contribution of monocular depth cues to scene perception by pigeons. *Psychological Science*, 17 (7), 628-634.

Saunders, J.A. and Backus, B.T. (2006) Perception of surface slant from oriented textures. *Journal of Vision*. 6 (9) 3, 882-897.

Schiller, PH & Carvey, CE (2005) The Hermann grid revisited. *Perception*, 34, 1375-1397.

Wollschläger, D & Anderson, BL (2009) The role of layered scene representations in color appearance. *Current Biology*, 19, 430-435. (see also supplemental data and four movies online: [http://www.current-biology.com/supplemental/S0960-9822\(09\)00625-3](http://www.current-biology.com/supplemental/S0960-9822(09)00625-3))

Holidays: Oct 8, Monday, Fall weekend
Nov 21-23, Wed-Fri, Thanksgiving

Supply list:

1. Pocket folders and unlined paper for sketchbook (8.5 x 11 in. minimum size)
2. 4 x 6 in. box of Color-Aid paper, may be divided between two people.
3. Small can of rubber cement.
4. X-acto knife.
5. Cutting mat for x-acto knife – may also use chip board or cardboard backing found on most drawing tablets.
6. Metal ruler (18+ in.)
7. T square (18+ in.)
8. Plastic triangle (30, 60, 90 deg)
9. White smooth illustration board for mounting projects (2- or 4-ply) – buy one large sheet approx. 30 x 40 in. Pieces will be cut to smaller sizes as needed.
10. Graph paper (linear).
11. Pad of disposable palette sheets or plastic palette.
12. Brushes: synthetic “sable” or other soft synthetic in round 1/4 in., flat 1/2 in., flat 1/4 in.
13. Small plastic containers for storing paint. These are sold in the RISD store for ~ 5 cents each. or use film canisters – free from many photo shops.
14. Flexible palette knife.
15. Smooth watercolor paper about 120 lbs. One large sheet – pieces will be cut from this as needed.
16. Paint colors: If you already have acrylics or acrylic gouache you can use those.
Otherwise I suggest acrylic paint. Hues: ivory or lamp black titanium white
 ultramarine blue phthalo or cerulean blue spectrum red or cadmium red (a stop-sign type red)
 magenta lemon yellow cadmium yellow yellow ochre raw sienna
17. “Gel matte medium” to use with acrylic paint to eliminate shine.
18. Drawing pad: 18x24” in. white drawing bond
19. Drawing board large enough to accommodate drawing pad
20. Bull clips (for holding paper or pads in place)
21. Graphite pencils: HB 2b and 4b (two each)
22. Rectangular graphite sticks: 4b and 6b (two each)
23. Erasers: soft white (Faber RaceKleen or Staedtler)
24. Tracing paper
25. Portfolio: folding or envelope style 18 x 24 in. (approx.)

You may want additional materials as we go along.