

# Psy. 5-031W. Perception

Syllabus: Fall Semester 2009

(Last updated Sept. 1, 2009)

Tu, Th 2:30-3:45

Elliott Hall S160

Teaching Staff					
		Office	Phone	Email	Office Hours
Gordon Legge	Professor	N257 Elliott	625-0846	<a href="mailto:legge@umn.edu">legge@umn.edu</a>	Tues. 4:00-5:00 or by appointment
Amy Kalia	Instructor	S246 Elliott	626-7762	<a href="mailto:kali0080@umn.edu">kali0080@umn.edu</a>	Thurs. 4:00-5:00 or by appointment
Zhicheng Lin	T.A.	N8 Elliott basement	625-2470	<a href="mailto:linxx443@umn.edu">linxx443@umn.edu</a>	Fri 5:00-6:00 or by appointment

## Class Web Site

<http://vision.psych.umn.edu/~gellab/5031>

For access to some items, you will need a Username and Password. These will be distributed in class.

## Other Useful Web Sites

Minnesota Laboratory for Low-Vision Research (Gordon Legge's Lab):

<http://vision.psych.umn.edu/~gellab>

Gordon Legge's Home page: <http://vision.psych.umn.edu/~legge>

Vision Science Home Page: <http://www.visionscience.com/>

Pub Med (Medline database of journal citations and abstracts):

<http://www.ncbi.nlm.nih.gov/pubmed/>

Low Vision Gateway: <http://lowvision.org/>

Eye Diseases (Karolinska Institute): <http://www.mic.stacken.kth.se/Diseases/C11.html>

WebVision – Organization of the Retina and Visual System: <http://webvision.med.utah.edu/>

ViperLib: Visual Perception Library (contains many illusions): <http://viperlib.york.ac.uk/index.asp>

Optical Illusions and Visual Phenomena (Michael Bach): <http://www.michaelbach.de/ot/>

<b>Grade Distribution</b>		
<b>REQUIREMENT</b>	<b>DATE</b>	<b>% OF GRADE</b>
Problem Sets or Lab Reports for Units 1-6	Due on the first class day for the following unit	12
Adopt An Illusion	5-min Class presentation (3) and Short Paper (5), to be scheduled.	8
Term Paper Title and Brief Plan	Oct. 13	2
Midterm Exam	Oct. 29	24
Term Paper – 1 <sup>st</sup> submission	Nov. 10	3
Term Paper Reviews	Nov. 19	3
Term paper – Final Submission	Dec. 10, 2:30 p.m.	24
Final Exam	Dec. 22, 10:30 AM – 12:30 PM.	24
Total		100

### **Exams**

The exams will be open book, and administered by e-mail.

Exams will have short answers, essays, and questions from the material in the problem sets/lab reports. They will cover material from the *required readings* and the *lectures*. Content of the lectures will usually differ from the content of the readings and will be emphasized on the exams. It is important for students to attend lectures to do well on the exams.

A sample midterm exam will be distributed by e-mail approximately one week before the midterm exam. It is imperative that all students establish reliable e-mail contact with the TA to ensure that they receive the e-mail exams. More details of the procedure will be discussed in class.

No make-ups or incompletes will be given except for documented medical reasons.

### **Adopt an Illusion**

Each student will identify an illusion of his or her choice, find or prepare an example, give a 5-minute class demonstration, and write a short paper on the illusion (1-2 pages.) More details are given at the end of this syllabus.

## **Term Papers**

See the detailed description at the end of the syllabus.

## **Unit Outlines**

The outline for each unit of the course will be distributed as hard copy in class and posted on the class website. The outline will contain a list of the readings for the unit, an outline of material covered in lecture, and instructions for a brief Problem Set or Lab Report. Problem Sets will typically consist of one or two mathematical problems and one or two discussion questions. Problem solutions will be discussed in two class sessions.

Your lab reports or solutions for the problem set for a particular unit are due by the first class period for the following unit.

## **Readings**

### Recommended for Purchase.

Palmer S.E. *Vision Science: Photons to Phenomenology*. MIT Press, Cambridge MA, 1999.

Grad Readings, Optional Readings, and Web Readings. Some of the readings, designated (G) in the following outline, are required readings for graduate students only. Undergrads are encouraged to read them as interesting optional material. Readings designated (O) are optional for everyone. Most required readings will be available on the web.

**SUMMARY COURSE OUTLINE (Fall 2009)**

Sept. 8	Introduction
Sept. 10	Unit 1
Sept. 15	Unit 2
Sept. 17	Unit 2
Sept. 22	Unit 2
Sept. 24	Unit 2
Sept. 29	Unit 3
Oct. 1	Unit 3
Oct. 6	Unit 3
Oct. 8	Unit 3
*Oct. 13	Term Paper Title Due; Discussion of scientific writing, and Discussion of Labs or Problem Sets from Units 1,2,3
Oct. 15	Video - "Island of the Color Blind"
Oct. 20	Unit 4
Oct. 22	Unit 4
Oct. 27	Unit 4
*Oct. 29	Midterm Exam – covers Units 1, 2 and 3
Nov. 3	Unit 5
Nov. 5	Unit 5
*Nov. 10	1 <sup>st</sup> submission of Term Paper Due, Unit 5
Nov. 12	Unit 5
Nov. 17	Unit 6
*Nov. 19	Term Paper peer Reviews Due, "Stereo, Binocular Rivalry and Consciousness"
Nov. 24	Unit 6
Dec. 1	Unit 6
Dec. 3	Unit 7
Dec. 8	Discussion Session – Lab Reports/Problem Sets from Units 4, 5 and 6
*Dec. 10	Final Term Paper Due (2:30 p.m.), Unit 7
Dec. 15	Unit 7
*Dec. 22	Final Exam: Tues. (10:30 a.m. - 12:30 p.m.) covers Units 4-7.

\* indicates the due date for one of the course requirements.

## DETAILED COURSE OUTLINE AND ASSIGNED READINGS

### Introduction and Overview (Sept. 8)

"A beautiful human eye! Any beautiful eye—a dog's, a deer's, a donkey's, an owl's even!  
To think of all that it can look, and all that it can see!" --George du Maurier: *Trilby*.

### Unit 1. Light (Sept. 10)

"Let there be light" --*Genesis*

#### Readings:

- Legge, *Low-Vision Perception, Class Notes* (Introduction, Incidence & Prevalence)
- Palmer, Preface and Ch. 1 (pp. 3-15)
- Schaumberg, D. A., & Nichols, K. K. (2006). The global sex disparity in blindness and visual impairment. *Optom Vis Sci*, 83(10), 700-701.
- (G). Cheung, S.-H., Fang, F., He, S. & Legge, G.E. (2009). Retinotopically-specific reorganization of visual cortex for tactile pattern recognition. *Current Biology*, 19, 596-601.
- (O) DiLaura, D. (2008) A brief history of lighting. *Optics and Photonics News (OPN)*, September. Provides a nice historical overview of the technologies people have used for lighting since antiquity.

### Unit 2. Physiological Optics and Perception (Sept. 15, 17, 22, 24)

"To suppose that the eye, with all its inimitable contrivances for adjusting to focus at different distances, for admitting different amounts of light, and for the correction of spherical and chromatic aberration, could have been formed by natural selection seems, I confess, absurd in the highest degree." --Charles Darwin

#### Readings:

- Legge, *Physiological Optics & Perception, Class Notes*.
- Legge, *Low-Vision Perception, Class Notes* (section on Disorders of the Eye's Optics)
- Palmer, Ch. 1 (pp. 15-28), Ch. 2 (pp. 45-59, skim pp. 59-70)
- Tailor-Made Vision Descends to the Eye of the Beholder. *Science*, 299. 2003, 1654-1655. Discusses the use of adaptive optics in pursuit of "perfect vision."

### Unit 3. The Retinal Machine (Sept. 29, Oct. 1, 6, 8)

"Her presence in the left corner of his vision feels like a dark, damp cloth approaching that side of his face." --John Updike, *Rabbit, Run*

#### Readings:

- Legge, *Low-Vision Perception*, Class Notes (section on Aged-Related Macular Degeneration)
- The Retina. In: *The Brain from Top to Bottom*: [http://thebrain.mcgill.ca/flash/i/i\\_02/i\\_02\\_cl/i\\_02\\_cl\\_vis/i\\_02\\_cl\\_vis.html](http://thebrain.mcgill.ca/flash/i/i_02/i_02_cl/i_02_cl_vis/i_02_cl_vis.html)
- Palmer, Ch. 1 (pp. 28-44), Ch. 4 (Retina and LGN pp. 145-151), Optional: Ch. 2 (pp. 70-93)
- (G) Zrenner, E. (2002). Will Retinal Implants Restore Vision? *Science*, 295, 1022-1025.

### **Discussion Session (Oct. 13)**

- Discussion of scientific writing. To prepare, please read: Gopen GD, Swan JA (1990) The science of scientific writing. *American Scientist* 78, 550-558.
- Review and discussion of Lab Reports/Problem Sets for Units 1, 2 and 3. The problem sets include both mathematical problems, and discussion questions from the readings.

### **Due: Term Paper Topic Submission (Oct. 13)**

Students should submit a working title and a paragraph describing their term paper topic. Submit to Zhicheng Lin by email [linxx443@umn.edu](mailto:linxx443@umn.edu). You should discuss your term paper topic with Zhicheng, Amy, or Gordon prior to submission of your title.

### **Midterm Exam – Oct. 29. Covers lectures & readings from Units 1-3.**

A sample midterm exam will be distributed by e-mail approximately one week before the actual midterm exam. Every student should confirm receipt of this sample exam, or discuss with the TA why it wasn't received. We want to be sure that all students receive the actual midterm safely.

### **Video: “Island of the Color Blind,”: *The Mind Traveler* (Oliver Sacks, 1998): Oct. 15)**

### **Unit 4. Color Vision (Oct. 20, 22, 27).**

“How different is blue from every kind of color. For blue is like the sea, the sea is like the firmament and the firmament is the throne of glory!” –Babylonian Talmud

Readings:

- Palmer, Ch. 3 (treat as optional the subsections on “Retinex Theory” p. 128, “Illumination vs Reflectance Edges Revisited” p. 134, and “A Fuzzy Logical Model” P. 140)

- HHMI News: “Genetic studies endow mice with new color vision.” March 23, 2007. <http://www.hhmi.org/news/nathans20070323.html> This online news article provides an overview of the Jacobs et al. (2007) article listed next.
- (G) Jacobs, G. H., G. A. Williams, et al. (2007). Emergence of novel color vision in mice engineered to express a human cone photopigment. *Science*, 315 (5819): 1723-1725.
- (O) Palmer, Appendix C Color Technology (pp. 689-700)

### **Unit 5. Visual Coding of Patterns (Nov. 3, 5, 10, 12)**

“My object in living is to unite my avocation with my vocation as my two eyes make one in sight.” –Robert Frost

#### Readings:

- Palmer, Ch. 4 but with the following subsections designated (G): Edge Operators and Convolution p. 173, Marr-Hildreth p. 175, Neural Implementation p. 179.
- (O) Palmer: Scale Integration p. 180, 4.3.3 Alternative Computational Theories pp. 182-186, Exploiting the Structure of Natural Images pp. 188-192.
- Legge, *Low-Vision Perception*, Class Notes (Three Dimensions of Vision Loss, Some Visual Abnormalities)
- (G) Campbell F.W. & Robson J.G. Application of Fourier analysis to the visibility of gratings. *Journal of Physiology*, 197, 1968, 551-566. This is a classic paper on the use of Fourier analysis in pattern vision.

### **First Submission of Term Paper (Nov. 10)**

All students are required to submit a complete term paper in “final form.” The paper will be reviewed. Students will be asked to revise their papers in response to the reviews prior to the final submission.

### **Special Lecture: Stereo, Binocular Rivalry and Consciousness (Nov. 19)**

### **Unit 6. Space, Motion, and Action (Nov. 17, 24, Dec. 1)**

“She had a cousin in the life guards, with such long legs that he looked like the afternoon shadow of somebody else.” –Charles Dickens, *David Copperfield*

#### Readings:

- Palmer, Ch. 5 (skim 5.5 but know what these cues are, optional: 5.3.3: Computational Theories)
- Palmer, Ch. 10 (skip 10.1.5: Computational Theories, 10.4.3: Intuitive Physics)

- Wexler, M. & van Boxtel, J.J.A. (2005). Depth perception by the active observer. *Trends in Cognitive Sciences*, 9(9), 431-438.
- Legge, *Low-Vision Perception*, (Perceptual Disorders).

**Discussion Session (Dec. 8)**

- Review and discussion of Lab Reports/Problem Sets for Units 4, 5 and 6.

**Unit 7. Recognizing Objects, Letters and Faces (Dec. 3, 10, 15)**

“HAMLET: Do you see yonder cloud that's almost in shape of a camel?  
POLONIUS: By the mass, and 'tis like a camel, indeed.  
HAMLET: Methinks it is like a weasel.  
POLONIUS: It is backed like a weasel.  
HAMLET: Or like a whale?  
POLONIUS: Very like a whale.” –Shakespeare, *Hamlet*

Readings:

- Palmer Ch. 7 (Treat as optional Secs. 7.3 “Orientation”, and 7.4 “Position”).
- Palmer Ch. 8 (Treat as optional Sec. 8.2.3 “Features and Dimensions” (pp. 385-394) and “Figural Goodness and Pragnanz”)
- Palmer Secs. 9.2.1 “Categorical Hierarchies” (pp. 416-420), 9.3.1 and 9.3.2 (pp. 433-444: describes Biederman’s model)
- (G) Goodale M.A. & Milner D. Separate visual pathways for perception and action. *Trends in Neuroscience*, 15, 1992, 20-25.
- (O) Sacks, O. To see and not see. *The New Yorker*, 10 May, 1993, 59-73. This article tells the compelling story of Virgil, a man whose vision was restored late in life.

**Final Version of Term Paper Due Dec. 10, 2:30 p.m. Deadline**

**Final Exam – Tuesday, Dec. 22, 10:30-12:30 Covers lectures and readings in Units 4-7.**

## TERM PAPER AND WRITING-INTENSIVE REQUIREMENTS

### Introduction

Good writing is a key component of success in science and most other disciplines. Sometimes people regard scientific writing as a kind of afterthought, something that's done after the "real science" leaves the lab. But most scientists agree that the process of articulating their ideas in clear, written form is one of the most challenging and creative parts of research or teaching. You really don't know what you know until you have to write your ideas down so that someone else can understand them.

Psy. 5-031W is designated *Writing Intensive*. In addition to our study of the principles of visual perception, our goals for the course will include exploration and implementation of principles of good scientific writing.

Some class time will be devoted to discussion of key elements of scientific papers, and the nuts and bolts of the peer-review system of scientific publishing.

There will be two scientific writing assignments, a short one on your choice of visual illusion, and a term paper.

### Adopt An Illusion

Each student will be asked to identify a visual illusion (or visual "effect.") Some touch illusions parallel visual illusions. You can adopt a touch illusion, but select one that has a parallel in vision and describe the parallel.

To avoid redundancy, we want each student to adopt a different illusion. As soon as you have decided on an illusion, report it to Zhicheng Lin ([linxx443@umn.edu](mailto:linxx443@umn.edu)) and your illusion will be listed in a table on the class website. Students who select first will have the widest range available.

Students will be given five minutes to demonstrate their illusion in class, either by showing an example they have prepared, or by showing an example from a website. We will schedule students to do these presentations throughout the semester, typically on Tuesdays at the beginning of class.

Students will be required to submit a short paper in electronic form on their illusion by the end of the week in which they give their class demo. The paper should be one or two pages, and should contain the following elements:

- Name of the illusion or "effect".
- Example of the illusion (url for a web site is ok, but include a full credit)
- Citation or discoverer of the illusion.

- Paragraph describing the illusion.
- Paragraph describing the significance for visual perception.
- Where appropriate include citations in APA format.

The Adopt An Illusions assignment will be graded as follows: 3 points for a concise and interesting class demo, and 5 points for the written paper. Students will lose one point per day for a late paper.

We hope to compile the written reports and illusions on the class website.

### **Term Paper**

The main part of the *writing-intensive* program will be a 2,000-word term paper. Students will 1) identify a topic in consultation with the teaching staff; 2) make a first submission of a complete term paper; 3) receive reviews of their paper and participate in reviewing other students' papers; and 4) revise their papers in response to the reviews for final submission. The goal is to show how the process of review and revision can strengthen scientific writing.

### **Term Paper Topics**

The paper must describe the principles of vision science relevant to some vision disorder or condition, or the operation of vision in some challenging environmental domain. Examples of some possible areas are:

- ❑ Dyslexia.
- ❑ Visual neglect.
- ❑ Hemianopia.
- ❑ Monocular vision (when a person has good vision in only one eye).
- ❑ Prosopagnosia (face blindness).
- ❑ Acquired Achromatopsia or Rod Monochromatism (life without color vision).
- ❑ Inherited color deficits.
- ❑ Low-vision problems (The focus could be on tasks such as reading or driving, or the effects of specific diseases such as macular degeneration or glaucoma.)
- ❑ Aging and vision.

- Vision under water or in flight.

Most of these topics will be discussed (at least briefly) in class or in the *Low Vision* Class Notes. But you will probably have to get started on your paper before we reach them in lecture.

These topics are broad with surprising amounts of research. You will have to identify a key question or theme to narrow the scope of your paper. Typically, it is challenging for students to identify a sufficiently clear and well-focused theme. We strongly urge you to consult the teaching staff for help and guidance. The schedule in the syllabus indicates the date on which you are required to submit a working title and paragraph describing your topic.

Your paper should identify the question or issue being addressed, the principle(s) from vision being applied, and the strengths and weaknesses of the solution.

### **Submission, Review, and Revision**

On the first-submission date (see syllabus), you should turn in a complete version of your term paper. This version should obey all the rules given below, and should represent your best effort to complete a high-quality paper. You should **not** submit a partial draft, outline, or work in progress. In short, the first submission should be like a final submission for most other courses. Remember that the stronger your first submission, the less work you'll have to do in revising the paper.

Each paper will be reviewed by one member of the teaching staff and one or more student peers in the class. In addition to having your own paper reviewed, you will be asked to review the paper of at least one other student. We will distribute guidelines and a "Reviewer's Form" to help you structure your review. The idea of peer review is to provide the author with objective, helpful comments to improve the content or structure of the paper. The teaching staff will read the reviews and award points based on the extent to which these goals are achieved. The peer reviews are due on the date listed in the syllabus.

Students should take the reviews into account in revising their papers. A cover note should accompany the final submission of the term paper explaining how the author addressed the reviewers' comments. You are not obliged to accept all of the reviewer's suggestions. If you disagree with the reviewer, explain why you have decided not to implement the suggested change. Think of the reviewer as a sample reader. He/she may have misunderstood one of your points, but the misunderstanding may be a clue that you need to explain your point more clearly.

This system of first submission, review, and final submission is commonly used by peer-reviewed scientific journals.

## **Rules for the Term Paper**

Maximum Length. The maximum length of the paper is 2,000 words, not counting title page, references, and figure captions. Papers exceeding 2,000 words may receive grading penalties. Specify the word count on your title page.

Format. Papers must be typed in a standard font, single-spaced, with a page number on each page.

References. You are expected to consult the research literature beyond the assigned readings in preparing your paper. You should use citations in your paper to justify your claims. Cite authors by name and date, e.g. (Smith & Jones, 1922). Include complete references at the end of the paper in some standard format, preferably APA format. If you consult websites, be sure to cite the source of the information, the URL, and download date. Remember that websites vary widely in the reliability of information they convey. Be cautious in relying on websites for your literature review.

Late Papers. One point will be deducted for each day late, including weekends.

Electronic Version. You should submit an electronic version of your paper by e-mail to Zhicheng Lin ([linxx443@umn.edu](mailto:linxx443@umn.edu)). Acceptable formats include Microsoft Word, RTF, pdf, or html. Use a standard extension on the filename to identify the format, e.g., .doc, .rtf, .pdf or .html. We hope to rely on e-mail for distributing electronic versions for the peer reviewing.

## **Writing Support on Campus**

Student Writing Support (SWS) provides free writing instruction for all University of Minnesota students—graduate and undergraduate—at all stages of the writing process. In face-to-face and online collaborative consultations, SWS consultants help students develop productive writing habits and revision strategies.

SWS consultants are teachers of writing: graduate and undergraduate teaching assistants and professional staff. Some consultants specialize in working with non-native speakers, and others have experience with writing in specific disciplines.

Consulting is available by appointment through SWS.online and in 15 Nicholson Hall, and on a walk-in basis in 9 Appleby Hall. For more information, go to [writing.umn.edu/sws](http://writing.umn.edu/sws) or call 612.625.1893.

In addition, SWS offers a number of web-based resources on topics such as documenting sources, planning and completing a writing project, and addressing punctuation and grammar questions. See [http://writing.umn.edu/sws/quick\\_help.htm](http://writing.umn.edu/sws/quick_help.htm)