"All people by nature desire to know. An indication of this is the delight we take in our senses; for even apart from their usefulness they are loved for themselves; and above all others the sense of sight. For not only with a view to action, but even when we are not going to do anything, we prefer seeing (one might say) to everything else. The reason is that this, most of all the senses, makes us know and brings to light many differences between things."

Aristotle: *Metaphysics Bk. I* 980a20-28

**Teaching Staff**

Instructor  Prof. Gordon E. Legge  
Office  N257  Elliott Hall  
Phone  625-0846  
E-mail  legge@eye.psych.umn.edu  
Office Hours  Tues. 12:15-1:30 or by appointment

T.A.  Alberto Ortiz  
Office  309 Elliott Hall  
Phone  624-7537  
E-mail  orti0015@tc.umn.edu  
Office Hours  Mon. 11:00 - 12:00 or by appointment.

**Class Web Site**

http://vision.psych.umn.edu/www/people/legge/perception.html  
For access to some items, you will need to enter a Username and Password. For both, use 5031.

Some of the class documents are in PDF (Portable Document Format). They require Acrobat Reader (version 3.0), available free from http://www.adobe.com/acrobat/readstep.html

**Other Useful Web Sites**

Psych Vision Labs: http://vision.psych.umn.edu  
Low-Vision Network (LOVNET) http://vision.psych.umn.edu/lovnet.html  
Vision Science Home Page:  
http://vision.arc.nasa.gov/VisionScience/VisionScience.html  
Pub Med (Medline database of journal citations and abstracts):  
http://www4.ncbi.nlm.nih.gov/pubmed/
**Requirements**

<table>
<thead>
<tr>
<th>REQUIREMENT</th>
<th>DATE</th>
<th>% OF GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Set 1</td>
<td>Oct. 7</td>
<td>1</td>
</tr>
<tr>
<td>Term Paper Topic</td>
<td>Oct. 14</td>
<td>1</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>Oct. 26</td>
<td>30</td>
</tr>
<tr>
<td>Term Paper – 1st submission</td>
<td>Nov. 11</td>
<td>4</td>
</tr>
<tr>
<td>Term Paper Reviews</td>
<td>Nov. 23</td>
<td>3</td>
</tr>
<tr>
<td>Problem Set 2</td>
<td>Dec. 2</td>
<td>1</td>
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<tr>
<td>Term paper – Final Submission</td>
<td>Dec. 14</td>
<td>30</td>
</tr>
<tr>
<td>Final Exam</td>
<td>Dec. 20 10:30a.m. -12:30p.m.</td>
<td>30</td>
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</tbody>
</table>

**Exams**

The exams will be open book, and administered by e-mail or internet. Exams will have short answers, essays, and one problem to solve. They will cover material from the required readings and the lectures. Content of the lectures will often 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.

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

**Term Papers**

See the detailed description at the end of the syllabus.

**Readings**

Recommended for Purchase.


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. This syllabus, and some readings, designated with * in the outline, are available on the class web site.

Library Reserve. All readings will be available at the reserve desk in Wilson Library. Some readings and handouts will also be available on the web.

Background Reading. Three texts that cover many of the topics in the course are listed below. Wandell was the text previously used in this course, and covers much of the material from a fairly technical perspective. Sekuler and Blake give an introductory treatment while Spillmann and Werner provide an advanced review of current research. Students may wish to consult these text for alternative presentation of ideas from the course, or as sources of material for term papers.


# SUMMARY COURSE OUTLINE

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept. 7</td>
<td>Introduction, Unit 1</td>
</tr>
<tr>
<td>Sept. 9</td>
<td>Unit 1</td>
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<tr>
<td>Sept. 14</td>
<td>Unit 2</td>
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<td>Sept. 16</td>
<td>Unit 2</td>
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<tr>
<td>Sept. 21</td>
<td>Unit 2</td>
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<tr>
<td>Sept. 23</td>
<td>Special class Discussion of Dawkins Ch. 2</td>
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<tr>
<td>Sept. 28</td>
<td>Unit 2</td>
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<tr>
<td>Sept. 30</td>
<td>Unit 2</td>
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<tr>
<td>Oct. 5</td>
<td>Unit 3</td>
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<tr>
<td>Oct. 7</td>
<td>Scientific Writing 1, and Problem Set 1 Due</td>
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<tr>
<td>Oct. 12</td>
<td>Unit 3</td>
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<tr>
<td>Oct. 14</td>
<td>Term Paper Title Due, Unit 3</td>
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<tr>
<td>Oct. 19</td>
<td>Unit 4</td>
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<tr>
<td>Oct. 21</td>
<td>Unit 4</td>
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<tr>
<td>Oct. 26</td>
<td>Midterm Exam (Covers Units 1-3)</td>
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<td>Oct. 28</td>
<td>Unit 4</td>
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<td>Nov. 2</td>
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<td>Nov. 4</td>
<td>Unit 5</td>
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<td>Nov. 9</td>
<td>Unit 5</td>
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<tr>
<td>Nov. 11</td>
<td>1st submission of Term Paper Due, Unit 5</td>
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<tr>
<td>Nov. 16</td>
<td>Unit 5</td>
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<tr>
<td>Nov. 18</td>
<td>Unit 6</td>
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<td>Nov. 23</td>
<td>Term Paper Reviews Due, Unit 6</td>
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<td>Nov. 30</td>
<td>Unit 6</td>
</tr>
<tr>
<td>Dec. 2</td>
<td>Scientific Writing 2, Problems Set 2 Due</td>
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<tr>
<td>Dec. 7</td>
<td>Unit 6</td>
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<tr>
<td>Dec. 9</td>
<td>Unit 6</td>
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<tr>
<td>Dec. 14</td>
<td>Final Term Paper Due (11:00 a.m.), Wrap Up</td>
</tr>
<tr>
<td>Dec. 20</td>
<td>Final Exam (10:30a.m.-12:30p.m.) covers Units 4-6.</td>
</tr>
</tbody>
</table>

* indicates the due date for one of the course requirements.
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DETAILED COURSE OUTLINE AND ASSIGNED READINGS

Introduction and Overview (Sept. 7)

Unit 1. Light (Sept. 7, 9)

Legge & Campbell, *Vision of Color and Pattern*.

*Legge, *Low-Vision Perception, Class Notes* (pp. 3-6: Introduction, Incidence & Prevalence)

Palmer, Preface and Ch. 1(pp. 3-15)

Dawkins, Ch. 1


Unit 2. Physiological Optics and Perception (Sept. 14, 16, 21, 28, 30)


*Legge, *Low-Vision Perception, Class Notes* (pp 18-23: Disorders of the Eye's Optics)

Palmer, Ch. 1(pp. 15-28), Ch. 2 (pp. 45-59, skim pp. 59-70)

Dawkins, Ch. 2


Special Class Discussion on Chapter 2 of Dawkins (Sept. 23)

We plan to split the class into two discussion groups in two rooms. Be sure you read the Dawkins chapter and know where your group meets.

1Readings with a * are available on the class web site.
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Unit 3. The Retinal Machine (Oct. 5, 12, 14).

Palmer, Ch. 1 (pp. 28-44), Ch. 2 (pp. 70-93, but treat as optional the subsection on “Hidden Assumptions”), Ch. 4 (Retina and LGN pp. 145-151).

Scientific Writing 1, and Problem Set 1 Due (Oct. 7).

The class session will be split into two parts: discussion of important principles for scientific writing, and review of the solutions to Problem Set 1.

Term Paper Topic Submission (Oct. 14)

Students should submit a working title for their term paper, and a paragraph describing their topic.


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)

Dawkins, Ch. 3

(G) Palmer, Appendix C Color Technology (pp. 689-700)


Video: “Island of the Color Blind,” The Mind Traveler, Oliver Sacks, 1998. We plan to show this video in class, probably on Nov. 2.

Unit 5. Visual Coding of Patterns (Nov. 4, 9, 11, 16)

Palmer, Ch. 4

*Legge, Low-Vision Perception, Class Notes (Three Dimensions of Vision Loss, pp. 6-18), (Some Visual Abnormalities, pp. 23-32)
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Dawkins, Chs. 4 and 5


First Submission of Term Paper (Nov. 11).

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.

Scientific Writing 2, and Problem Set 2 Due (Dec. 2).

The class session will be split into two parts: description of the peer-review system for publishing research articles in scientific journals, and review of the solutions to Problem Set 2.

Unit 6. Objects in Space (Nov. 18, 23, 30, Dec. 7, 9)

Palmer, Chs. 5, 6, 7 and 8

Dawkins, Ch. 11.

*Legge, Low-Vision Perception*, (Perceptual Disorders, pp. 32-end).


(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.


Wrap-Up Lecture (Dec. 14)

Final Version of Term Paper Due Dec. 14, 11:00 am Deadline
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. 5-031 has been 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.

The Dawkins book Unweaving the Rainbow will serve as an example of popular scientific writing by a successful author and scientist. Our readings from Dawkins will illuminate both his subject matter and issues of style. We will devote one full class session to a discussion of one of the chapters from this book.

Additional lecture 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.

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 three people, one member of the teaching staff and two other students in the class. In addition to having your own paper reviewed, you will be asked to review the papers of two other students. The student reviewing will be done “blind,” that is, names of
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Authors and reviewers will be known only to the teaching staff. The reviews should be constructive critiques of about one page in length. We will distribute guidelines to help you structure your reviews. 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. 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, 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.

Late Papers. 5% of the maximum grade value will be deducted for each day late, including weekends.

Electronic Version. You should submit a disk version (or e-mail attachment) of your paper along with the hard copy to Alberto Ortiz. Acceptable formats include Microsoft Word (Mac or PC), RTF or HTML. Provide a disk label or cover note containing your name and the document format. We hope to rely on e-mail for distributing electronic versions for the peer reviewing.