
Perception (Spring 2002)

What, When, & Where

<u>Course #</u>	: Psychology 323b
<u>Distro Group</u>	: III
<u>When</u>	: Spring 2002, Tuesdays and Thursdays, 2:30 - 3:45 pm
<u>Where</u>	: Dunham Labs 220 (10 Hillhouse Ave.) —> <i>Note that this will very likely change!</i>
<u>Webpage</u>	: http://classes.yale.edu/psyc323b/

Instructor Info

<u>Professor</u>	: Brian Scholl (Assistant Professor, Dept. of Psychology)
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<u>Office Hours</u>	: Wednesdays 2:30 - 3:30, just after most classes, or by appointment
<u>Teaching Fellow</u>	: Marissa Greif (marissa.greif@yale.edu ; OHs Thursday 3:45 - 4:45)

Course Description

Welcome! This course will provide you with an introduction to the study of perception, with a heavy emphasis on *visual* perception. In short, we will explore *how we see*. It turns out that there's more to this than you might think. Many people tend to think that there can't be too much going on in visual perception, simply because it's so quick and effortless. ("Can't it work just like a camera?") In reality, there's a tremendous amount of complicated (and interesting!) processing going on in your minds when you open your eyes and *see*. Our minds not only make perception possible, but make it seem like no big deal. Because of this, you will learn some surprising (even shocking) things in this course about how your mind works — and also learn that some of the basic assumptions you've always had about how you see are completely misguided.

We'll have a lot of exciting material to cover. Visual perception is one of the most well-developed and rigorous areas of psychology, and also one of the most fascinating aspects of our minds. (The brain apparently agrees with this assessment, since a significant amount of it is devoted to visual perception — up to 50% of cortex in macaques). After a few classes on introductory ideas, we'll proceed through three main units: (1) low-level visual processing (e.g. of depth, color, and motion); (2) Visual *attention*; and (3) higher-level visual processing (e.g. visual memory, face and object recognition, visual mental imagery). Trying to understand our own minds in this way is one of the most ambitious and exciting projects in all of science, and this course will expose you to some of the major ideas, tools, theories, and results obtained so far.

Expected Work and Grading

1. (25%) Class Participation and Mini-Presentations

This class will consist of both lectures and in-class discussions, and you're encouraged to ask questions and make comments at any time. To get the most out of the course, it is thus essential that you participate regularly. To encourage this, a significant part of your grade will be based on class participation. In addition to regular participation in class discussions, each student will be asked to give two mini-presentations (around 10 - 15 minutes each) during the semester. The first of these (which can be done in pairs if you want) will consist of a brief report on an additional reading for a specific class. This report will typically inform the class about an idea or an experiment related to the day's discussion, but not covered in the main readings done by all students. The sign-up procedure for this first mini-presentation will be discussed in class. The second mini-presentation will occur on either *Thursday April 18th* or *Thursday April 23rd*, and will consist of a brief report on the experiment you are proposing for your final paper (see below).

2. (10%) Questions on Daily Readings

To get the most out of this course, it is essential that you carefully and critically study the readings associated with each class. To encourage this — and to give the instructor a hint as to what you thought of the material — you will be asked to respond to a short question concerning most readings. A sample (if boring) question might be: "Which of the two theories discussed in this article do you think is right, and why?" Your answer to each question — which you must email to your specified TF no later than one hour before the start of the class wherein that reading will be discussed — need be only a single paragraph, and should take no longer than 10-15 minutes to write after you have read the material. The questions due for each class will be assigned at the end of the previous class, and no late submissions will be accepted. They will be graded pass/fail, so as long as you stay caught up in the readings you should get full credit.

3. (25%) Two Short Papers

Twice during the semester you'll be asked to write a short (3-4 page, double-spaced) paper, which responds to a more general question ranging over several of the topics and readings covered in the previous weeks. The first short paper will concern low-level visual processing, and second will concern visual attention. The topic for each paper will be assigned at the beginning of the first class devoted to such issues, and the paper will be due after that section is finished (no earlier than 2 weeks later). Both short papers will be due before Spring Break.

4. (40%) Final Paper

The largest part of your grade will be determined by a final course paper, 10 - 15 pages double-spaced, due on the last day of regular class (*Thursday April 25th*). The nature of this final paper is discussed later in the syllabus.

Readings

The readings for this course have been drawn from many sources — both textbook chapters and research articles — and will be available in a reading packet from *Audobon's*, located at 48 Whitney Ave. You should pick up a copy ASAP, starting the first day of class; *Audobon's* typically has them ready 1 day after you place your order. Since many of the readings come from the primary literature in visual perception, you may often find them challenging, and they will occasionally use terms and refer to ideas with which you are unfamiliar. Don't be discouraged by this! While the readings have been carefully chosen to be accessible, I don't expect you to fully understand every aspect of them. Overall, I think you'll get more out of reading the primary literature in this way than by reading the watered-down and frequently less exciting secondary literature, and we'll discuss any obscure or confusing concepts in class.

Preliminary Course Outline

Here's a preliminary outline of the material we'll cover in this course. The readings are included in the following order in your reading packet, and the full references are listed at the very end of the syllabus. Some of these readings will be optional; these will be noted as the semester progresses. Note that we'll begin with an introduction and overview of some major themes in visual perception, and then move on through three main units: low-level visual processing, visual attention, and higher-level visual processing. The exact timing of these lectures is *very* subject to change: we may end up spending more time than is listed here on topics which strike you as especially interesting or difficult, and/or less time on topics which we don't have time to cover. (Thus, if you prefer or require a precise and unchangeable course schedule, this class is probably not for you.) Overall, I encourage you to interact with me regarding this material: If there are any topics you would like to add, or to cover in more depth, let me know!

T 1/15: Introduction #1: Preliminaries

[No Readings]

Th 1/17: Introduction #2: General Themes in the Study of Perception

Marr (1982), "The Philosophy of the Approach" (from *Vision*)

Palmer (1999), "Visual Perception" (from *Vision Science*)

T 1/22: Introduction #3: Situating Perception in Cognitive Science

Pinker (1997), selection from "Standard Equipment" (from *How the Mind Works*)

Carston (1996), "The Architecture of Mind: Modularity and Modularization"

Th 1/24: The Visual System #1: Optics, the Retina, Early Visual Areas

Sekuler & Blake (2001), "The Eye" and selections from "The Eye and Seeing" (from *Perception*)

T 1/29: The Visual System #2: Visual Cortex

Sekuler & Blake (2001), "Central Visual Pathways" (from *Perception*)

Th 1/31: Visual Features #1: Depth

Short Paper #1 Assigned

Nakayama et al. (1995), selections from "Visual Surface Representation . . ."

Palmer (1999), selection from "Perceiving Surfaces Oriented in Depth" (from *Vision Science*)

T 2/5: Visual Features #2: Lightness

Adelson (2000), "Lightness Perception and Lightness Illusions"

Th 2/7: Visual Features #3: Color

Palmer (1999), "Color Vision: A Microcosm of Vision Science" (from *Vision Science*)

T 2/12: Visual Features #4: Motion

Palmer (1999), selections from "Perceiving Motion and Events" (from *Vision Science*)

Sekuler et al. (1997), "Sound Alters Visual Motion Perception"

Th 2/14: More Motion: Perceiving Causality and Biological Motion

Short Paper #1 Due

Scholl & Tremoulet (2000), "Perceptual Causality and Animacy"

Scholl & Nakayama (2002), "Causal Capture"

Kozlowski & Cutting (1977), "Recognizing the Sex of a Walker . . ." (from *Experimenting . . .*)

T 2/19: Visual Attention #1: Introduction

Short Paper #2 Assigned

Rensink (2000), "The Dynamic Representation of Scenes"
Palmer (1999), selections from "Visual Attention" (from *Vision Science*)

Th 2/21: Visual Attention #2: Attention and Awareness (Inattentive Blindness)

Rensink et al. (1997), "To See or Not to See . . ."
Simons & Levin (1998), "Failure To Detect Changes To People In A Real-World Interaction"
Most, Simons, Scholl, et al. (2001), "How Not to Be Seen . . ."

T 2/26: Visual Attention #3: The Units of Attention

Scholl (2001), "Objects and Attention: The State of the Art"

Th 2/28: Visual Attention #4: The Neuropsychology of Attention

Rafal (1998), "Neglect"
Rafal (1997), "Balint Syndrome"

T 3/5: Perceptual Organization and Grouping

Palmer (1999), "Organizing Objects and Scenes" (from *Vision Science*)
Moore & Egeth (1997), "Perception Without Attention: Evidence of Grouping . . ."

Th 3/7: TBA

Short Paper #2 Due

[Readings TBA]

T 3/12, Th 3/14, T 3/19, Th 3/21: No Class (Spring Break!)

T 3/26: Perceptual Organization in Other Domains: Auditory Scene Analysis

Sekuler & Blake (2001), selections from "Hearing and Listening" (from *Perception*)
Bregman (1990), "The Auditory Scene" (from *Auditory Scene Analysis*)

Th 3/28: Object Recognition and Face Recognition

Biederman (1987), "Recognition-by-Components . . ."
Tong et al. (2000), "Response Properties of the Human Fusiform Face Area"

T 4/2: Visual Memory

Luck & Vogel (1997), "The Capacity of Visual Working Memory . . ."
Chun & Jiang (1999), "Top-Down Attentional Guidance . . ."

Th 4/4: Computer Vision

[Readings TBA]

T 4/9: Modularity of (and in) Vision: Distinguishing Perception & Cognition

Pylshyn (1999), selections from "Is Vision Continuous with Cognition?"
Ramachandran (1998), "Object Recognition can Drive Apparent Motion"
Palmer (1999), selection from "Contextual Effects" (from *Vision Science*)

Th 4/11: Visual Mental Imagery

Stillings et al. (1995), "Mental Images"
Kosslyn et al. (1995), "Topographical Representations of Mental Images . . ."

T 4/16: Catch-up / Student-Inspired Topics

[Readings TBA]

Th 4/18: Student Presentations #1

[Readings TBA]

T 4/23: Student Presentations #2

[Readings TBA]

Th 4/25: Wrap-Up + The Big Picture

[Readings TBA]

*** Final Paper Due! ***

Final Paper Topics

For the final paper in this course (worth 40% of your final grade), you'll design an experiment to test an idea you've had about some aspect of how perception works. The topic you choose can come from any area of perception, but will probably arise from questions and comments that are raised during the class discussions and during your reading. Excellent paper topics can often arise from very general questions you might have — e.g. "I wonder whether this type of visual processing can occur without attention . . ." or "I wonder if this other factor can also affect the perception of grouping/amodal completion/causality/biological motion/etc. . ." However, the final question you address in your paper should be as concrete and focused as possible. You should start thinking of possible paper topics as early as possible: I would suggest keeping a 'brainstorming journal' of possible ideas, and forcing yourself to come up with at least an idea or two (however preliminary or half-baked) for each topic we cover in the course. You should also feel free to bounce possible ideas off each other (both in and outside of class), but you shouldn't (knowingly) write a paper to investigate the same question being explored by a classmate.

Your final paper should have at least 4 main sections (preferably delineated as such via separate section headings): (1) A section motivating the question you're asking, and why it's potentially interesting and important; (2) A review of previous theories and experimental research on such questions from the relevant literature (both that which we have discussed in class, and perhaps also that you have found on your own); (3) A detailed description of the methods you suggest using to test your question (these needn't be as detailed as a journal article, but should clearly describe the materials, the subjects' task, and the type of data which will be collected); and (4) A discussion of each possible pattern of results from the experiment, and what theoretical implications it would have. The final paper should be between 10 and 15 pages (double-spaced).

The paper will be due on the last day of regular classes, *Thursday April 25th*. Note, however, that you will have to have a clear idea of your project at least 1.5 weeks before that, as all students will be delivering short (10-minute) presentations of their ideas during the two classes preceding the due date (*Thursday April 18th* or *Thursday April 23rd*). I highly encourage you to come by office-hours regularly to chat about possible ideas; I can be a useful sounding-board for these, and can also suggest other relevant papers which you might find useful and interesting. At a minimum, I expect you to discuss your idea with me at least once before starting to work on it in earnest.

(A final note: Those psychology majors who are nearing their senior years without a clear idea of what they intend to do for their senior projects are encouraged to propose experiments which are not only interesting but also *tractable*. Then, a possible senior project would be to actually conduct the experiment you've proposed, already having a clear idea of the relevant background, what the implications will be, etc. If you're interested in pursuing such a project, please talk to me as early as possible.)

Full References for Readings

- Adelson, E. H. (2000). Lightness perception and lightness illusions. In M. Gazzaniga (Ed.), *The new cognitive neurosciences, 2nd Ed.* (pp. 339 - 351). Cambridge, MA: MIT Press.
- Biederman, I. (1987). Recognition-by-components: A theory of human image understanding. *Psychological Review*, 94, 115-147.
- Bregman, A. (1990). "The auditory scene". Chapter 1 of *Auditory scene analysis: The perceptual organization of sound* (pp. 1 - 45). Cambridge, MA: MIT Press.
- Carston, R. (1996). The architecture of mind: Modularity and modularization. In D. Green et al. (Eds.), *Cognitive science: An introduction* (pp. 53 - 83). Cambridge, MA: Blackwell.
- Chun, M., & Jiang, Y. (1999). Top-down attentional guidance based on implicit learning of visual covariation. *Psychological Science*, 10, 360 - 365.
- Kosslyn, S., Thompson, W., Kim, I., & Alpert, N. (1995). Topographic representations of mental images in primary visual cortex. *Nature*, 378, 496 - 498.
- Kozlowski, L.T. & Cutting, J.E. (1977). Recognizing the sex of a walker from a dynamic point-light display. *Perception & Psychophysics*, 21, 575 - 580. Reprinted with commentary in L.K. Komatsu (Ed.) (1994). *Experimenting with the mind: Readings in cognitive psychology* (pp. 107 - 117). Pacific Grove, CA: Brooks/Cole.
- Luck, S., & Vogel, E. (1997). The capacity of visual working memory for features and conjunctions. *Nature*, 390, 279 - 281.
- Marr, D. (1982). "The philosophy of the approach". Chapter 1 of *Vision*. New York: W. H. Freeman.
- Moore, C., & Egeth, H. (1997). Perception without attention: Evidence of grouping under conditions of inattention. *Journal of Experimental Psychology: Human Perception & Performance*, 23, 339 - 352.
- Most, S. B., Simons, D. J., Scholl, B. J., Jimenez, R., Clifford, E., & Chabris, C. F. (2001). How not to be seen: The contribution of similarity and selective ignoring to sustained inattention blindness. *Psychological Science*, 12(1), 9 - 17.
- Nakayama, K., He, Z. J., & Shimojo, S. (1995). Visual surface representation: A critical link between lower-level and higher-level vision. In S. Kosslyn (Ed.), *Visual Cognition* (pp. 1 - 70). Volume 2 of *An Invitation to Cognitive Science, 2nd Ed.* Cambridge, MA: MIT Press.

Palmer, S. (1999). *Vision science: Photons to phenomenology*. Cambridge, MA: MIT Press.

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| - "Color vision: A microcosm of vision science", | Chapter 3, | pp. 94 - 142 |
| - "Contextual effects", | Chapter 9 (selection), | pp. 428 - 431 |
| - "Organizing objects and scenes", | Chapter 6, | pp. 254 - 310 |
| - "Perceiving motion and events", | Chapter 10 (selections), | pp. 465 - 487, 493 - 504 |
| - "Perceiving surfaces oriented in depth", | Chapter 5 (selection), | pp. 199 - 249 |
| - "Visual attention", | Chapter 11 (selections), | pp. 531 - 544, 554 - 563 |
| - "Visual perception", | Chapter 1 (selection), | pp. 4 - 15 |

- Pinker, S. (1997). Selection from "Standard equipment." Chapter 1 of *How the Mind Works* (pp. 3 - 36). W. W. Norton.
- Polyshyn, Z. W. (1999). Is vision continuous with cognition? The case for cognitive impenetrability of visual perception. *Behavioral and Brain Sciences*, 22, 341 - 423 (selections).
- Rafal, R. D. (1997). Balint syndrome. In T. Feinberg & M. Farah (Eds.), *Behavioral neurology and neuropsychology* (pp. 337 - 356). New York: McGraw-Hill.
- Rafal, R. (1998). Neglect. In R. Parasuraman (Ed.), *The attentive brain* (pp. 489 - 525). Cambridge, MA: MIT Press.
- Ramachandran, V. (1998). Object recognition can drive apparent motion. *Nature*, 395, 852 - 853.
- Rensink, R. (2000). The dynamic representation of scenes. *Visual Cognition*, 7, 17 - 42.
- Rensink, R. A., O'Regan, J. K., & Clark, J. J. (1997). To see or not to see: The need for attention to perceive changes in scenes. *Psychological Science*, 8(5), 368 - 373.
- Scholl, B. J. (2001). Objects and attention: The state of the art. *Cognition*, 80(1/2), 1 - 46.
- Scholl, B. J., & Nakayama, K. (2002). Causal capture: Contextual effects on the perception of collision events. *Psychological Science*, in press.
- Scholl, B. J., & Tremoulet, P. D. (2000). Perceptual causality and animacy. *Trends in Cognitive Sciences*, 4(8), 299 - 309.

Sekuler, R., & Blake, R. (2001). *Perception, 4th Edition*. New York: McGraw-Hill.

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| - "Central visual pathways", | Chapter 4, | pp. 123 - 169 |
| - "Hearing and listening", | Chapter 11 (selections), | pp. 441 - 444, 454 - 484 |
| - "The eye and seeing", | Chapter 3 (selections), | pp. 77 - 91, 103 - 121 |
| - "The human eye", | Chapter 2, | pp. 33 - 76 |

- Sekuler, R., Sekuler, A., & Lau, R. (1997). Sound alters visual motion perception. *Nature*, 385, 308.
- Simons, D. J., & Levin, D. T. (1998). Failure to detect changes to people in a real-world interaction. *Psychonomic Bulletin and Review*, 5, 644 - 649.
- Stillings, N. et al. (1995). "Mental images". From *Cognitive science: An introduction* (pp. 42 - 54). Cambridge, MA: MIT Press.
- Tong, F., Nakayama, K., Moscovitch, M., Weinrib, O., & Kanwisher, N. (2000). Response properties of the human fusiform face area. *Cognitive Neuropsychology*, 17, 257 - 279.