PRELIMINARY COURSE INFORMATION (subject to change)

Psychology W3255.
Modern Classics in Visual Perception, Visual Science, and Visual Neuroscience. (seminar).
SPRING 2005.

I. Bulletin description

PSYC W3255y. Modern Classics in Visual Perception, Visual Science, and Visual Neuroscience. (seminar)
Spr 2005: 3 pts. L. Matin. T 6:10 - 8 PM. 652 Schermerhorn Hall

Prerequisite: Some background in perceptual or sensory processes or neurophysiology or physical sciences/math/computer science or instructor's permission.
Reading and discussion of classic articles from the past 60 years providing a foundation for the rapidly expanding fields of visual perception, visual science, and visual neuroscience and their connections with computer modeling (with a sprinkling from research on audition); primary source articles will be accompanied by secondary source and brief lecture material to introduce each topic.

II. A full description of the content of the course

The last 60 years have seen an explosion in our understanding of vision, visual perception, and visual neuroscience. The seminar will consist of reading and discussing between 15 and 25 of the important articles that represent some of the work that created the ferment in this explosive growth. Most are from the original literature. Each of these articles will be accompanied by one or more readings from secondary sources that will introduce the topic central to the primary source material. It will broaden perspective to consider some work in audition; two articles will treat audition. The emphasis throughout will be on extracting main principles that make up the main science; a secondary emphasis will be on dealing with bits and pieces regarding the experimental techniques and modes of analysis central to the research in order to develop some understanding of how the empirical research relates to these principles.

III. The rationale for giving the course

The classic work done in the study of vision, visual perception and visual neuroscience during the past 100 years has produced a solid foundation for research being done today; the combination of theoretical and experimental work has resulted in a substantial science with a great deal of simplicity and scope. And it is this that has fostered the mushroom cloud of development in the second half of the 20th century and continues now. Students will read important original work in the context of principles that remain and are abstracted in texts on

Sensation and Perception. A given topic will be introduced with the reason for its importance in the last part of the meeting of a given week and the readings discussed in the subsequent week.

PSYC W3255 is an advanced seminar, designed particularly for undergraduates who are majoring in Psychology or in Neuroscience and Behavior, and for students participating in the Postbac Psychology Program. It fulfills the following degree requirements:

•For the Psychology major or concentration and the psychology postbac program, PSYC W3255 will meet the Group I (perception and cognition) requirement.

•For the Neuroscience & Behavior joint major, W3255 will fulfill the 5th Psychology requirement (one advanced Psychology seminar from a list approved by the department).

•For the Psychology Minor in Engineering, W3255 will count toward the group requirement: "Any four courses from, at a minimum, two of the three groups."

•PSYC W3255 might not satisfy the Senior Seminar requirement of the Barnard Psychology Major. Although it is an advanced seminar, it does not require a major term paper.

•For the science requirements of the College and General Studies, W3255 will qualify as one term of the requirement, provided the student obtains instructor permission and has completed the necessary prerequisites. We anticipate that this course will rarely be used toward fulfillment of this requirement, since recommended preparation includes courses at the 1000- and 2000-levels that will, in turn, meet both terms of the science requirement.

IV. Weekly Topics and Reading Assignments (subject to revision)

TOPICS FOR 13 SESSIONS (* Readings given below)

*1/2. Introduction: Two Visual Systems or One; "representation" in the brain; basics of the visual nervous system.

*3/4. Nature and nurture; (a) the influence of early feedback for the development of normal sensorimotor behavior. (b) The importance of exposure to normal visual stimulation in the development of the visual nervous system. (c) The prewired nervous system and behavior.

5. Early photochemical theory: All of the major psychophysical functions -- flicker, acuity, light and dark adaptation, perception of brightness-- were well predicted by the uncomplicated mathematics of photochemistry; this approach, was mainly promulgated by Selig Hecht, until Rushton's physical measurements of photopigment breakdown and regeneration in the living human and rabbit eyes measured the value of a critical constant in the equations and showed that things were much more complicated.

*6. Visual discrimination: and intensity-time reciprocity: The intensity-time-area relations at both low and levels and high levels of intensity are well-known; these relations are basic to all work on visual discriminations, particularly to visual adaptation.

*7. The Introduction of the physical quantum to visual science: in 1942, Hecht, Shlaer and Pirenne published an article that demonstrated by two independent methods that between 5 and 14 quanta were required at the absolute threshold for seeing under the best possible conditions.

8. The de Lange function and temporal processing: Although there were earlier forays in this direction, deLange's work with flickering visual stimuli in the 1950s brought the use of Fourier analysis to the fore in vision.

9. Spatial frequency; Fourier analysis catches on: The selective adaptation paradigm and multiple channels outside of color vision began a trend:

*10. Lateral Inhibition and the perception of contours; image stabilization. A big step forward in connecting neural and perceptual levels

11. A peculiar start on electrical recordings from photoreceptors; but they finally got it right.

12. Recordings from visual cortex are finally successful in getting substantial response out of visual cortex as Hubel and Wiesel discover orientation selectivity

13. Gestalt theory- phenomenology provides an important beginning for some perceptual processes

14. The visual frame and egocentric space perception. Witkin's work on the tilting room and the rod-and-frame made Science out of a set of fascinating demos in Egocentric Space Perception.

15. Auditory Attention (cocktail party effect and auditory localization)

16. The introduction of signal detection theory to psychophysics

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READINGS FOR 6 SESSIONS

*For 1/2. Milner, A. D. and Goodale, M. A. (1995). *The Visual Brain in Action.* Oxford Univ.Press, New York. Chapt. 1, ch, 1, pp. 1-24; Held, R. (1970). Two modes of processing spatially distributed visual stimulation. *The Neurosciences Study Program.* P.O. Schmitt, ed. Rockefeller Univ. Pr., New York. Ingle, D. Two visual systems in the frog. *Science*, 1973, **14**, 1053-55; Marr, D. *Vision*, 1982, ch. 1, pp. 8-38; additions re basics of visual system from: Goldstein, Sensation and Perception, 2002, 6th edition, or other intro book in the area for those whose backgrounds need propping up.

*For 3/4. (a) Held, R. and Hein, A. (1963). Movement-produced stimulation in the development of visually guided behavior. J. *Comp. Physiol. Psych.*, **56**, 872-876. Held, R. Plasticity in sensory-motor systems. *Scient. Amer.*, Nov., 1965; Hein, A., Vital-Durand, Salinger, F., & Diamond, R. (1978) *Science*, **204**, 1321-1322. (b) Wiesel, T.N. (1982). Postnatal development of the visual cortex and the influence of environment (the nobel talk). *Nature*, **299**, 583-591; Hubel, D. (1967). Effects of distortion of sensory input on the visual system of kittens. *The Physiologist* , 10, 17-45 (eleventh bowditch lecture)**.** (c)Sperry, R. (19::) *Scient. Amer.*, Sperry, R. (1950). Mechanisms of Neural Maturation. ch. 7 in *Handbook of Experimental Psychology*, ed. S. Stevens, pp. 236-280.

*For 6: Graham, C. and Kemp, E. (1938). Brightness discrimination as a function of the increment in intensity. *J. Gen. Physiol.*, **21**, 635-650; Graham, C., R. Brown, and Mote, F. (1939). The relative size of stimulus and intensity in the human eye. *J. Exp. Psychol.,* **24**. 555-573; Graham, C. and Margeria, R. (1935). Area and the intensity-time in the peripheral retina. *Amer. J. Physiol.,* **113,** 299-305.

*For 7: Hecht, Shlaer, and Pirenne (1942). Energy, quanta, and vision. *J. Gen. Physiol.* **25**, 819-840; Cornsweet, T. N. (1970). *Visual Perception,* ch. 1-3, pp. 7-67. Academic press, New York,

Possible readings for the remaining sessions:
For 5. Early work of Hecht; Rushton's retinal densitometry work in the living eye; Rushton's equivalent background; Barlow and Sparrock
For 8. de Lange
For 9. Campbell
For 10. Hartline and Ratliff , horseshoe crab; Mach bands -- McCullough; Westheimereffect; Riggs, Ratliff, Cornweet, and Cornsweet
For 11. MacNichol, Svaetichin, Tomita
For 12. Hubel and Wiesel
For 13. Wertheimer, Koffka, Kohler
For 14. Witkin and Asch, Koffka
For 15. Broadbent
For 16. Tanner and Swets

V. Course requirements

Students will lead the seminars, with each article assigned to a student; for some topics a single student will be responsible for more than one article. Subsequent to the presentation the student will write a summary of the material on the material for copies distributed to the class. Grading will be based on the quality of the student's performance in class and the written summaries (3-4 summaries, each 3-4 pages in length, plus references). There will be no exams or term papers. I believe that exams do not belong in a seminar. I don't see a good way of integrating term papers with the objectives of the course at this point.

Grading is allocated as follows:

Class Participation:	30%
Discussion Leading	40%
Written Summaries	30%