

## PSYC 768

### NEUROERGONOMICS

Spring 2012

**Time:** 4:30 pm – 7:10 pm Tuesdays  
**Classroom:** David King Hall 2072  
**Instructor:** **Raja Parasuraman**  
2055 David King Hall  
Ph: 703-993-1357  
Email: rparasur@gmu.edu  
**Office Hours:** Wednesdays 11:00 am – 12:00 pm

#### Objectives:

The course is designed to provide students with an introduction to the interdisciplinary field of *neuroergonomics*. This is a newly emerging discipline concerned with the study of brain and behavior at work. Neuroergonomics represents the merging of neuroscience with ergonomics. Neuroscience is the study of brain structure and function. Ergonomics seeks to match technology to the capabilities and limitations of people so that they may work effectively and safely together. Neuroergonomics goes a step beyond its parent disciplines to use emerging knowledge of human brain functioning to inform the design of technologies in the workplace.

This seminar will first examine the conceptual and theoretical bases of neuroergonomics. The course will then go on to an examination of describe the various noninvasive techniques for evaluating human brain function and then discuss various research and application areas in neuroergonomics.

#### Structure of Course

The course will involve lectures, student presentation of papers, and class discussion. I will *sample* some of the major areas of investigation in neuroergonomics. The major goal of the course is to develop an understanding of how knowledge of the neural underpinnings of different perceptual and cognitive processes can influence such ergonomics issues as display and interface design, personnel selection, and training.

**Attendance Policy:** Although I do not grade on attendance, the course involves class participation and discussion and I expect (barring unforeseen circumstances) to see you in class each week.

**GMU Honor Code:** George Mason University has a code of Honor that each of you accepts by enrolling as a student. You should read and become familiar with this code at <http://mason.gmu.edu/%7Emontecin/plagiarism.htm>. The expectation is that all of the work you do for this class will be the work of one individual. However, you are fully encouraged to discuss the readings and topics raised in this class with your fellow students.

**Disabilities:** If you are a student with a disability and you need academic accommodations, please see me and contact the Disability Resource Center (DRC) at 703-993-2474. All academic accommodations must be arranged through that office.

**Evaluation** will be based on a take home test (20%), two class presentations of journal articles (each 15%), a term paper (40%), and class discussion (10%).

Total 100 points, letter grades as follows:

A+: 95-100  
A: 90-94  
A-: 87-89  
B+: 84-86  
B: 80-83  
B-: 77-79  
C: 70-76  
F: 0-69

**Make-up Policy:** You may hand in assignments after the scheduled date only if you (a) receive my permission before the date, or (b) have a valid excuse (note from a doctor, judge, etc.). Papers will not be accepted beyond the due date.

### PRELIMINARY SCHEDULE OF TOPICS

January 24:	INTRODUCTION TO NEUROERGONOMICS (Chapter 1) What is cognitive neuroscience? What is ergonomics? What is neuroergonomics? <b>Discussion of readings: Parasuraman (2011; in press)</b>
January 31:	COGNITIVE NEUROSCIENCE METHODS I (Chapters 2, 3) Electroencephalography (EEG) Event-related potentials (ERPs)
February 7:	COGNITIVE NEUROSCIENCE METHODS II (Chapter 5, 6) Transcranial Doppler Sonography (TCD) Functional Near Infrared Spectroscopy (fNIRS) <b>Take home test (20% towards final grade)</b>
February 14:	No Class
February 21:	MENTAL WORKLOAD <u>Paper presentations: Ayaz et al. (2012); Isreal et al. (1980)</u> <b>Take home test due</b>
February 28:	COGNITIVE NEUROSCIENCE METHODS III (Chapter 7)

Eye movements  
Molecular genetics

- March 6: VIGILANCE (Chapter 10)  
Paper presentations: Hitchcock et al. (2003); Lim et al. (2010).
- March 13: No Class, Spring Break
- March 20: SPATIAL NAVIGATION (Chapter 9)  
Paper presentations: Hartley et al. (2003); Cornwell et al. (2008).
- March 27: ADAPTIVE AUTOMATION (Chapter 16)  
Paper presentations: Bailey et al. (2006); Wilson & Russell (2007)
- April 3: BRAIN STIMULATION TO AUGMENT HUMAN PERFORMANCE  
Paper presentations: Clark et al. (2012); Reis et al. (2009)
- April 10: BRAIN COMPUTER INTERFACES (Chapter 20)  
Paper presentations: Blankertz et al., (2007); Felton et al. (2009) ; Sellers et al. (2006)
- April 17: AFFECTIVE COMPUTING (Chapter 18)  
Paper presentations: Becker-Asano & Wachsmut (2009); Abrilian et al. (2005).
- April 24: DRIVING (Chapter 4)  
Paper presentations: Just et al. (2006); Calhoun et al. (2004); Strayer & Drews (2007).  
**Final date for approval of term paper!**
- May 1: End of class discussion: The future of neuroergonomics
- May 6: **Term paper due (40% towards final grade)**

**IMPORTANT DATES**

- February 21: Take home test due  
April 24: Final date for approval of term paper  
May 1: Last class  
May 6: Term paper due

**Required Textbook**

Parasuraman, R., & Rizzo, M. (2008). *Neuroergonomics: The Brain at Work*. New York: Oxford University Press.

### **Required Readings**

1. Parasuraman, R. (2011). Neuroergonomics: Brain, cognition, and performance at work. *Current Directions in Psychological Science*, 20, 181-186.
2. Parasuraman, R. (in press). Neuroergonomics: Brain-inspired cognitive engineering. In J. D. Lee & A. Kirlik (Eds.) *The Oxford Handbook of Cognitive Engineering. Volume 1: Foundations, Perspectives and Cognitive Issues*. New York: Oxford University Press.

### **Recommended Reading**

Parasuraman, R., Christensen, J., & Grafton, S. (Eds.) (2012). Neuroergonomics: The Human Brain in Action and at Work. Special issue of *NeuroImage*, 59(1).

Additional readings may also be assigned for individual topics.