PSYC 530 Cognitive Engineering: Human Factors in Systems
Fall 2012

Time: 4:30 pm – 7:10 pm Tuesdays
Place: Arch Lab Conference Room, David King Hall

Instructor: Raja Parasuraman
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Office Hours: 11-11:50 Wednesdays or by appointment (email).

Additional readings (journal articles and chapters) will also be distributed.

Prerequisites: An experimental psychology class or consent of instructor.

Objectives: This course is designed to prepare incoming Human Factors and Applied Cognition graduate students (although students in other programs are also welcome to enroll) by providing them with a basic background on the role of human cognitive capabilities and limitations in the design of products, work places, and large systems. The goal is to understand how perceptual and cognitive theories can be applied to diverse systems, from relatively simple devices such as personal computers to complex systems such as air-traffic control, aircraft cockpits, and nuclear power plants. The emphasis is on theories and findings on human performance, rather than the design of systems per se, although implications for design are continually analyzed.

Human factors is both a science and an approach to the design of systems. This course considers the scientific basis for human factors, particularly in relation to modern, semi-automated systems. The science of human factors considers various human characteristics and abilities, both physical and cognitive that are brought into play when people use machines. New approaches to understanding human performance based on neuroscience—the new field of neuroergonomics—are also briefly introduced.

The goal of human factors is to design systems that match technology with human capabilities and limitations. The course has two objectives: (1) to examine several domains of human performance, with an emphasis on the information-processing approach to human perception and cognition; and (2) to investigate the role of human performance capacities and limitations in modern human-machine systems.

Because modern human-machine systems increasingly make use of automation (computer assistance), another focus of the course will be on understanding the cognitive processes involved in human-automation interaction. The aim is to understand how certain perceptual and cognitive characteristics of human operators, for example the limited capacity of working memory or decision-making biases, influence the effectiveness of the performance of real-world systems.

Structure of Course
Each class will consist of a mix of lectures and participatory discussion, with the degree of the latter increasing over time as fundamental issues are further outlined in the lectures. I will lecture on each of several domains of human performance research, with appropriate references to applications to actual systems. Human performance in automated systems will be covered next. The final part of the course will consist of student presentations and discussions of specific topics related to human performance in systems.

**Attendance Policy:** Although I do not grade on attendance, this is a graduate level course 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/~montecin/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.

**Official Communications via GMU E-mail:** Mason uses electronic mail to provide official information to students. Examples include communications from course instructors, notices form the library, notices about academic standing, financial aid information, class materials, assignments, questions, and instructor feedback. Students are responsible for the content of university communication sent to their mason e-mail account, and are required to activate that account and check it regularly.

**Students with 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.

**Exam Make-up Policy:** You may take a test after the scheduled date only if you (a) receive my permission before the day of the test, or (b) have a valid excuse (e.g., a note from a doctor.). Papers will not be accepted beyond the due date. Homework assignments will not be accepted late.

**Add/Drop:** Last day to add: September 4; Last day to drop: September 28

**Grading**

Evaluation will be based on:
2 written tests (each 20%, one in-class, one take-home)
A written research (term) paper (30%)
A presentation (20%)
Classroom discussion (10%).

Total 100 points, letter grades as follows:
A: 90-100
A-: 87-89
B+: 84-86
B: 80-83
B-: 77-79
C: 70-76
Topics

History of human factors and the systems approach
Allocation of function
Signal detection
Vigilance
Attention, perception, and displays
Memory
Decision making
Multi-tasking
Mental workload
Neuroergonomics
Human performance in automated systems

Note that because of time limitations not all aspects of human cognition that are relevant to human-machine systems will be considered, e.g., motor skills, language, stress and human error, spatial vision, etc. However, those of you who are interested in these or related domains of human cognition can nevertheless choose to study these as part of your term paper (described below).

TENTATIVE SCHEDULE

(Relevant chapters from the textbook and assigned readings are indicated)

August 27: History of Human Factors The Systems Approach Ch. 1
September 3: Allocation of Function Information Processing Ch. 1
September 10: Signal detection Ch. 2, Swets et al. (2000)
September 17: Vigilance Test 1 assigned (take home) Ch. 2
September 24: Attention and perception Test 1 due Ch. 3
October 2: Memory Ch. 7
October 9: Decision making Ch. 8, Kahneman & Tversky (1974)
October 16: CLASS PRESENTATIONS 1: Signal Detection, Vigilance, Attention, Memory
October 23: NO CLASS—HUMAN FACTORS & ERGONOMICS CONFERENCE

October 30: Multi-tasking Ch. 10

November 6: Neuroergonomics Ch. 11, Parasuraman (2011)

November 13: Humans and automation Ch. 12, Parasuraman & Manzey (2010)

November 20: CLASS PRESENTATIONS 2: Multi-tasking, Workload, Automation

November 27: Test 2 (in class)
LAST DATE FOR APPROVAL OF TERM PAPER TOPIC!

December 4: Course wrap up: Future trends in Cognitive Engineering

December 9: TERM PAPERS DUE

READINGS

Required Text

Additional Required Readings

For September 10: Signal Detection

For October 14: Decision Making

For November 6: Neuroergonomics

For November 13: Humans and Automation

Optional Readings