SYLLABUS for PSY 710 – Human Factors Psychology
214 Poe Hall
10:15 – 11:30am Tu/Tr

Fall 2010

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All grades, announcements, and handouts will be posted on Moodle
OFFICE Poe 725
OFFICE HOURS Tues/Thurs 1:00-3:00pm or by appointment
Readings Available on Moodle. There is no textbook for this course.

OVERVIEW

This course is an overview of Human Factors (HF) psychology. We will cover a large number of tools, topics and exercises. We will also have discussions with HF industry experts to understand how they use these toc in their work and to expose you to the types of careers available to HF professionals. We will then focus on specific domains within Human Factors such as information technology, healthcare, aging, and transportatio particularly the methods used in the study of these areas.

Readings are assigned for each lecture and should be read before coming to class. The purpose of the readings is to expose you to background literature and the most current information that is critical for human factors psychologists in-training. Remember that these readings and a lively discussion of them are the core why you are in graduate school.

Late assignments will not be graded; no exceptions. Please turn them in at the designated time **IN CLASS**.

LEARNING OUTCOMES

By the end of this course, students will be able to:

- Perform the steps of a usability analysis, including
  - Perform a task analysis
  - Draw decision action diagrams, flow charts, and functional flow diagrams
  - Create user personas
  - Conduct and write up a user needs analysis
  - Write a cognitive walkthrough
  - Write a heuristic evaluation
  - Develop testable prototypes
  - Analyze performance outcomes, such as accuracy and response time
  - Present findings and recommendations for design improvements
- Factual knowledge
  - Talk knowledgably about the field of Human Factors
  - Integrate knowledge gained from primary source readings into discussion papers
  - Write about domains within the field (e.g., aviation, healthcare)
  - Write about research areas within the field (e.g., motor control, attention, individual difference
- Dissemination skill
  - Be able to present research findings to a diverse audience
  - Lead discussion of primary source articles including research methods

EVALUATION

1) Brief discussion paper with questions for each class (25%). For each class you will prepare a 1-page discussion of the readings for that class (not a summary). You should extract the important issues of the readings, critically analyze the readings, and, more importantly, pose discussion questions for class. The questions can be points of confusion, issues for further consideration, follow up research ideas, and so on.

You will be expected to raise some of your discussion points during class (see Class participation). This will due at the end of each class. An example is available on Vista.

2) The major class assignment is the **group project** (36%) that involves the evaluation, redesign, and test of an existing system. More details at the end of the syllabus. There are three parts to the group project, ar each part is worth 12% of your final grade.

3) Class participation (5%). You will be expected to participate in the class discussions by sharing your discussion questions and by participating in the general discussion topic of the week. This is an essential pa of class. Please treat your classmates in a respectful manner by paying attention to the other students durir discussion.

4) Leading class discussions (25%). At the first class, you will pick papers from the syllabus and lead class discussion on those papers. You should present a formal presentation summarizing the paper, posing discussion points, and leading the class in a criticism of the paper. Use of visuals is encouraged. If you are unsure how or what to present, please consult with me well ahead of time.

5) In class activities (3%). Through out the class, there will be in-class activities that you are expected to complete during the class period with your group. If you are absent, you will not get credit for the activity, ar no make-ups will be given.

6) Presentation of group project (6%). In the last few days of class, each group will present their project to th class as though they were presenting final data to a client.

ANTICIPATED COURSE SCHEDULE AND READINGS

(subject to change; updates will be distributed in class or web)

Date		Book chapter/Topic	Reading/Assignment		Discussi Leader
Week	**Day**				
Week 1	1	Introductions/Intro to human factors	Groups are formed		
		Tools			
Week 2	1	**Methods** Task Analysis IN CLASS EXERCISES	Norman chapters, Set Phasers on Stun chapters Links on these topics in the Group Project section on Vista		
	2	**Methods** User characteristics Decision-Action Diagrams Questionnaires Structured Interviews IN CLASS EXERCISES	HCI Handbook chapters Links on these topics in the Group Project section on Vista		
Week 3	1	**Methods** Contextual Inquiry Needs Analysis Functional Flow diagrams Heuristic Evaluation Think-Alouds IN CLASS EXERCISES	Byrne, 2003 Links on these topics in the Group Project section on Vista Group project system chosen		
	2	**Methods** Cognitive Walkthroughs Workload Analysis IN CLASS EXERCISES	Stronge, et al., 2005		
		Fundamental Concepts			
Week 4	1	Attention	Norman & Bobrow, 1975 Wickens, 2002		
	2	Attention/Training	Kramer, Larish, Strayer, 1995		
Week 5	1	All groups work together on Part I			
	2	Individual Differences ***Part 1 due***	Underwood, 1974 Rogers, 1997		
Week 6	1	Group Project Discussion - Tools			
	2	Decision Making/Decision Support Systems	Metzger & Parasuraman, 2005 Rankin, 2007		
Week 7	1	All groups work together on Part II			HFES
	2	All groups work together on Part II			HFES
Week 8	1	Motor Control	Schmidt & Lee, 2005 Gillan, et al., 1990		
	2	**Fall Break**			
Week 9	1	Memory	Dismukes, 2007		
	2	Cognition & Memory Architectures	Pirolli, 1999		
Week 10	1	Human Factors & Theory Development	Koltko-Rivera & Hancock, 2005		
		Human Factors Contexts			
	2	HCI/Input devices	McLaughlin, Rogers, & Fisk, 2009		

Week 11	1	Warnings	Wogalter, 2006		
	2	Transportation ***Part 2 due***	Baldwin, 2002		
Week 12	1	Transportation	Strayer, Drews & Crouch, 2006		
	2	Group Project Discussion – Data Collection	In class data collection		
Week 13	1	Neuroergonomics	Parasuraman & Wilson, 2008 Fafrowicz & Marek, 2007		
	2	Aviation	Sarter & Woods, 1994 Colvin,Dodhia,Dismukes, 2005		
Week 14	1	Aviation	Ackerman, 1988		
	2	Wrap-up ***Part 3 due***	Proctor & Vu, 2009		
Week 15	1	Presentations			
	2	Presentations			

ACADEMIC INTEGRITY POLICY

A copy of the NCSU Code of Conduct is available both on the Vista site for this course and at http://www.ncsu.edu/policies/student_services/student_discipline/POL11.35.1.php

You are expected to abide by this code in all aspects of this course.

ABSENCES

Absences must be excused according to NCSU policy:
http://www.ncsu.edu/policies/academic_affairs/courses_undergrad/REG02.20.3.php

STUDENTS WITH DISABILITIES

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage available accommodations, students must register with Disability Services for Students at 1900 Student Hea Center, Campus Box 7509, 515-7653. For more information on NC State's policy on working with students w disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (REG02.20

References for Readings

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Baldwin, C. L. (2002). Designing in-vehicle technologies for older drivers: Application of sensory-cognitive interaction theory. *Theoretical Issues in Ergonomic Science, 3*(4), 307-329.

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Colvin, K., Dodhia, R., & Dismukes, R. K. (2005). Is pilots' visual scanning adequate to avoid mid-air collisions? In *Proceedings of the 13th International Symposium on Aviation Psychology*, (pp. 104-109 Oklahoma City.

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Fafrowicz, M.; Marek, T. (2007). Quo vadis, neuroergonomics? *Ergonomics, 50*, 11, 1941-1949.

Gillan, D. J., Holden, K., Adam, S., Rudisill, M., & Magee, L. (1990). How does Fitts' law fit pointing and dragging? In *Proceedings of the CHI '90 Conference on Human Factors in Computing Systems* (pp. 2 234). New York: ACM.

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Kramer, A.F., Larish, J.F., Strayer, D.L. (1995). Training for attentional control in dual task settings: A comparison of young and old adults. *Journal of Experimental Psychology: Applied,1*,50–76.

McLaughlin, A. C., Rogers, W. A., & Fisk, A. D. (2009). Using direct and indirect input devices: Attention demands and age-related differences. *ACM Transactions on Computer-Human Interaction (TOCHI), 16*(1), 1-15.

Metzger, U., & Parasuraman, R. (2005). Automation in future air traffic management: Effects of reliable and imperfect conflict detection aids on controller performance and mental workload. *Human Factors, 47* 35–49.

Norman, D. A. (1990). The psychopathology of everyday things. *The Design of Everyday Things.* New York: Doubleday.

Norman, D. A. (1990). The psychology of everyday actions. *The Design of Everyday Things.* New York: Doubleday.

Norman, D.A., & Bobrow, D.J. (1975). On data-limited and resource-limited processes. *Cognitive Psycholog 7*, 44-64.

Olson, G. M. & Olson, J.S. (2003). Psychological aspects of the human use of computing, *Annual Reviews c Psychology, 54,* 491–516.

Parasuraman, R., & Wilson, G. F. (2008). Putting the brain to work: Neuroergonomics past, present, and futu *Human Factors, 50*, 468–474.

Pirolli, P. L. (1999). Cognitive architectures and cognitive engineering models in human-computer interactio *The Handbook of Applied Cognition.* Sussex, England: Wiley.

Proctor, R.W. & Vu, K.P. (2009). Cumulative knowledge and progress in human factors. *Annual Reviews of Psychology, 61.*

Rankin, W. L. 2000, The maintenance error decision aid (MEDA) process. Proceedings of the IEA 2000/HFE 2000 Congress, 3-795 – 3-798.

Rogers, W. A. (1997). Individual differences, aging, and human factors: An overview. In A. D. Fisk and W. A Rogers (Eds.), *Handbook of Human Factors and the older adult* (pp. 151-170). San Diego, CA: Academic Press.

*Sanders, M.M. & McCormick, E.J. (1993). Applied anthropometry, work-space design and seating. *Human Factors in Engineering & Design 7th ed.* (pp. 421-423). McGraw-Hill, NY.

Sarter, N.B. and Woods, D.D. (1994). Pilot Interaction with Cockpit Automation II: An Experimental Study c Pilots' Model and Awareness of the Flight Management System (FMS*). International Journal of Aviation Psychology, 4*(1), 1-28.

Schmidt, R. A. & Lee, T. D. (2005). Methodology for studying motor performance. *Motor control and learning: a behavioral emphasis* (pp. 19-51). Champaign, Il: Human Kinetics.

*Shapiro, D. C., Zernicke, R. F., Gregor, R. J., & Diestel, J. D. (1981). Evidence for generalized motor programs using gait-pattern analysis. *Journal of Motor Behavior, 13*, 33-47.

Strayer, D.L., Drews, F.A., & Crouch, D.J. (2006). Comparing the cellphone driver and the drunk driver. *Human Factors, 48*, 381–391.

Stronge, A.J., Nichols, T., Rogers, W. A., & Fisk, A.D. (2008). Systematic Human Factors Evaluation of a Teledermatology System within the U.S. Military. *Telemedicine and e-Health, 14*(1), 25-34.

Wickens, C. D. (2002). Multiple resources and performance prediction. *Theoretical Issues in Ergonomic Science, 3*(2), 159-177.

Wogalter, M.S. (2006). Purposes and Scope of Warnings. In M. S. Wogalter, ed., Handbook of Warnings. Lawrence Erlbaum Associates, Mahwah, NJ, 3-9.

Underwood, Benton J. (1974). *Individual Differences as a Crucible in Theory Construction.* A Distinguished Scientific Contribution Award address presented at the annual meeting of the American Psychologica Association (New Orleans, Louisiana, August 1974).

*indicates non-required but interesting additional readings.

Human Factors: Group Project

Group Selection

Groups should consist of about 3 members. Choose your group members carefully – you will work w these people all semester*. In addition to choosing group members you can count on, it would be a good idea choose members that have a variety of skills and knowledge – remember the interdisciplinary aspects of engineering psychology.

Project Overview

The purpose of this project is to give you the experience of performing a complete evaluation and des recommendation, as if you were a practicing Engineering Psychologist. You will apply the knowledge you le in class and become familiar with HF methods, including evaluation by experimentation. For the design recommendation, you will gain experience implementing a systems approach to design, user-centered design, and the iterative design process. As part of the design recommendation, you will also build a mockup and/or prototype, and present the recommendations to an audience (your classmates).

Part I: Understand the problem

The goal of Part I is to deeply understand that problem that you are addressing, pertinent users, and the issues and constraints that are involved in the problem. If the task has an existing system/interface, you should perfc an interpretive evaluation of that system to help you learn more about it. Most important is identify important characteristics of the problem that will influence your subsequent design.

In class we will discuss different techniques for acquiring this kind of information. Feel free to utilize the techniques that you feel are most appropriate to the particular task you are examining. Your text and online sources can also provide tools: use them. Your report and deliverable for this part should deeply examine the problem of study. Who are the potential users? What tasks do they seek to perform? What functionality shoul the system provide? Basically, you are setting up a set of constraints for your subsequent design. What criteri should be used to judge if your design is a success or not?

More specifically, you should develop the following items and communicate them in your report as appropri

1. Mission statement
   An overview of what they system will do and why it's needed.
2. User Definition/Analysis
3. Context/Environmental Analysis
4. Task Analysis
5. Function Allocation
6. System Requirements
7. Functional Flow Charts / Decision-Action Diagrams
8. Workload Analysis
9. Collect preliminary data
   - Use people in your group as your participants
   - Use these data to stimulate ideas about design recommendations

10. An Introduction and Conclusion section should be included in Part I. The Introduction should summarize your approach to evaluating the system. The Conclusion should suggest what design changes should be made This includes a description and justification of how the above information was gathered. Feel free to be creati (yet professional). Use of pictures, video, illustrations, and diagrams is welcome.

Part II: Redesign

The key goal of part 2 of the project is to use the knowledge gained in part 1, as well as that from class, to develop a few interface design alternatives for your problem. Further, you must provide a set of initial usabili specifications for your system and a plan for usability testing of it.

In this part of the project you will provide mock-ups, storyboards, and sketches of your interface designs. Tha is, you should provide pencil-and-paper or electronic images of the interface at various stages. You do not ne to build a working prototype. Your design sketches should be sufficiently detailed for a potential user to prov useful feedback about the design. Along with your design mock-ups, you should provide a brief narrative wal through of how the system will work. Perhaps most importantly, you should also include your justifications f why design decisions were made, and what you consider to be the relative strengths and weaknesses of your different designs.

Accompanying your designs should be a set of usability specifications for the system. What are your objectives? For example, if you are working on a remote key entry system, you might specify time limits in which you expect a user to be able to unlock a door, or a maximum number of errors that you expect to occur Basically, you should list a set of criteria by which your interface can be evaluated.

Finally, this part of the project should include an evaluation **plan** for the system. What kinds of tasks will you have users perform to evaluate the interface? What kind of subjective questionnaire would you deploy to hav user critique the interface? You will need to actually carry out some of this evaluation in part 3, so plan something practical and do-able.

Your project report should include all the explanatory material mentioned above as well as all the design sketches, drafts, storyboards, etc., that you generated. If some of your sketches are on paper, please scan in these images. Make sure that your report reflects the design process of your group.

Part III: Testing

In the final part of the project, your group will implement a mockup of your interface and conduct an initial usability evaluation. You can create a working mockup using PowerPoint, Visual Basic, HTML, etc, howeve this is NOT required. The Wizard-of-Oz method is perfectly acceptable. If you are designing something more physical (a new glucometer, for example) you may have to mock it up using super-sculpy, tape, or other physical materials. The important criterion is to have something where you can conduct an initial usability evaluation with the tasks you proposed in the previous part.

After your prototype is (somewhat) working, you will run usability studies of the system on prospective users These users will be students outside your group from this class. Your studies should simply be a carrying-out the usability plan from Part II. Give the users tasks and have them interact with your interface. Collect performance data. Collect subjective feedback and document your way of doing so.

Your write-up for this part should include a description of your system prototype. You can include media to help explain it. Also include the results of your usability studies. What conclusions can you draw from the studies? What aspects of your design "worked" and what failed to meet your specifications? If you had more time to work on the design, what would you now change and improve? Remember, no designer ever gets a system perfect. I will reward teams who honestly and carefully assess their design and who clearly provide a plan for its improvement.

In your report, include:

1. Evaluations/recommendations for improvement of the following (and anything else particular to your design):
    - Displays

- Controls
- Workspace layout
- Anthropometry

2. The mockup
3. Data on redesigned system
   - Use people outside of your group but within this class as your participants.
   - Use these data to assess the effectiveness of your redesign.
4. Among some of the questions you should answer:
   1) Is there a need for additional functions?
   2) Is there a need to reduce functions?
   3) Does the design meet ADA requirements?
      a. Displays/controls/workspace/anthropometry

5. An Introduction and Conclusion should also be included in Part III. The Introduction should summarize the reasoning for design recommendations suggested from Part I, II and their implementation. The Conclusion should summarize all the design changes and procedures that you completed in Parts I & II, as well what the data collected in Part III say about your new design.

Part IV: In-class presentation

- Approximately 60 minute talk/discussion, presented at the end of semester. This talk should explain your progress through the semester from A to Z. Walk your audience through your ideas, most difficult issues, and the methods you used to identify and solve these issues. Demonstrate the final product as though you were "selling" it to your company as a reason to revise their current product. Be ready for questions from the audience!

*I will give you a chance to rate the amount of work your other team members did at the end of the semester (and this will figure that into your individual grades.)