

ISE 570 Human Factors Engineering¹

Fall 2007 (Friday: 5-8pm)

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COURSE DESCRIPTION

Human Factors in Engineering (HF) is a multidisciplinary field concerned with the design and evaluation of users interacting with an engineered system. It focuses on the human performance of tasks, the structure of human-system communication, human capabilities to use system components, and the design, specification, and evaluation of interfaces. The objectives are efficiency, safety, and comfort of users performing their tasks. This course is designed for anybody who is responsible for a product/system realization in a variety of application domains.

COURSE MATERIAL

- **Textbook 1:** Sharp, H., Rogers, Y., and Preece, J. (2nd Edition) (2007). *Interaction Design*. Wiley and Sons. This book emphasizes “interaction” as the basis for human-system design and analysis with a focus on “users” and “tasks” in digital interfaces.
- **Textbook 2:** Stanton, N.A., Salmon, P.M., Walker, G.H., Baber, C., and Jenkins, D.P. (2005, softcover). *Human Factors Methods: A Practical Guide for Engineering and Design*. Ashgate Publishing Limited, Hampshire, England. This book consists of a large collection of tools, methods and techniques used in a variety of different human factors applications.
- **Other material** will be introduced as needed during the class period.

¹ Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one’s own academic work from misuse by others as well as to avoid using another’s work as one’s own. All students are expected to understand and abide by these principles. *Scampus*, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: <http://www.usc.edu/dept/publications/SCAMPUS/gov/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>.

COURSE SCHEDULE

Week	Date	Topic	Reading and Preparation ¹	Assignment/Presentation ²
1	08/31	<ul style="list-style-type: none"> Introduction, Requirements, Expectations Defining the term project Introduction to Human Factors in Engineering 	<ul style="list-style-type: none"> Class Syllabus HFM Chapter 1 	<ul style="list-style-type: none"> Preparation for team formation and project selection
		<ul style="list-style-type: none"> What is Interaction Design? 	<ul style="list-style-type: none"> ID Chapter 1 (part 1) 	
2	09/07	<ul style="list-style-type: none"> Understanding and Conceptualizing Interaction 	<ul style="list-style-type: none"> ID Chapter 1 (part 2) ID Chapter 2 	<ul style="list-style-type: none"> Finalize team and project selection
3	09/14	<ul style="list-style-type: none"> Understanding Users 	<ul style="list-style-type: none"> ID Chapter 3 	<ul style="list-style-type: none"> Assignment 1
		<ul style="list-style-type: none"> Identifying Needs and Establishing Requirements 	<ul style="list-style-type: none"> ID Chapter 10 	
4	09/21	<ul style="list-style-type: none"> Task Analysis <ul style="list-style-type: none"> HTA GOMS 	<ul style="list-style-type: none"> HFM Chapter 3 	<ul style="list-style-type: none"> Assignment 2
		<ul style="list-style-type: none"> Verbal Protocol Analysis Task Decomposition 		
5	09/28	<ul style="list-style-type: none"> Data Gathering Data Analysis 	<ul style="list-style-type: none"> Video: Kid in the Cockpit ID Chapter 7 ID Chapter 8 	<ul style="list-style-type: none"> Assignment 3
		<ul style="list-style-type: none"> Cognitive Walkthrough Critical Incident Technique 	<ul style="list-style-type: none"> HFM Chapter 4 	
6	10/05	<ul style="list-style-type: none"> The Process of Interaction Design Highway sign redesign http://www.nytimes.com/2007/08/12/magazine/12fonts-t.html?ref=magazine 	<ul style="list-style-type: none"> ID Chapter 9 	
		<ul style="list-style-type: none"> Design, Prototyping and Construction 	<ul style="list-style-type: none"> ID Chapter 11 	
7	10/12	<ul style="list-style-type: none"> Situation Awareness <ul style="list-style-type: none"> SA Requirement Analysis SA Global Assessment Technique SA Rating Scales 	<ul style="list-style-type: none"> HFM Chapter 7 	<ul style="list-style-type: none"> Assignment 4
		<ul style="list-style-type: none"> Evaluation 	<ul style="list-style-type: none"> ID Chapter 12 and 13 	
8	10/19	<ul style="list-style-type: none"> Usability Testing 	<ul style="list-style-type: none"> Video: Interview with Jacob Nielsen ID Chapter 14 	
		<ul style="list-style-type: none"> Mid-term project presentation: 5 minutes each team 		<ul style="list-style-type: none"> Letter grade assigned but not counted toward the final grade
9	10/26	<ul style="list-style-type: none"> Analytical Evaluation 	<ul style="list-style-type: none"> ID Chapters 15 	<ul style="list-style-type: none"> Assignment 5

		<ul style="list-style-type: none"> Mental Workload Assessment Methods <ul style="list-style-type: none"> Primary and Secondary Tasks Physiological 	<ul style="list-style-type: none"> HFM Chapter 8 	
10	11/02	<ul style="list-style-type: none"> EXAM 	<ul style="list-style-type: none"> Covers all material prior to this session 	
		<ul style="list-style-type: none"> Mental Workload Assessment Methods (cont.) <ul style="list-style-type: none"> NASA TLX Modified Cooper Harper Scale 	<ul style="list-style-type: none"> HFM Chapter 8 (cont.) 	
11	11/09	<ul style="list-style-type: none"> Guest Lecture: Kathryn Rieger from St. Jude Medical Center on Human Factors in Medical Devices Interface Analysis Methods <ul style="list-style-type: none"> Heuristics Link Analysis Layout Analysis System Usability Scale 	<ul style="list-style-type: none"> HFM Chapter 10 	<ul style="list-style-type: none"> Assignment 6
12	11/16	<ul style="list-style-type: none"> Guest Lecture: Professor Naj Meshkati on Human Error in Complex Systems Design Methods Allocation of Function Analysis Scenario-Based Design 	<ul style="list-style-type: none"> HFM Chapter 11 	<ul style="list-style-type: none"> Assignment 7
13	11/23	<ul style="list-style-type: none"> Thanksgiving holiday 		
14	11/30	<ul style="list-style-type: none"> Guest Lecture: Suzanne Dawes from Aerospace Corporation on Human-Systems Integration Multimodal Critical Path Analysis Keystroke Level Model 	<ul style="list-style-type: none"> HFM Chapter 12 	
15	12/07	<ul style="list-style-type: none"> Final project presentation: 10 minutes each team 		

¹The readings are to be completed *before* the class sessions indicated. Other items may be assigned prior to each session.

²These items are due at the class session indicated. Instructor reserves the right to assign a **zero** to any late item.

Note 1: Any material, presentation and/or task assignments in this class may be revised to accommodate the content and the pace of the class learning process. All revisions will be announced in the class.

COURSE GRADING

Homeworks	Individual	25%
Term Project	Teams	45% (half for Presentation, and half for Final Paper)
Mid-Term Exam	Individual	30% (Closed Book and Note)

STUDENT'S ROLES AND RESPONSIBILITIES

The student's roles are to:

- Participate in class discussions, contribute individual experiences when relevant to the topic so that others can benefit and learn.
- Take individual responsibility for completing assignments on time and to make meeting and audiovisual equipment arrangements themselves at least one week ahead of time. No late work will be accepted.
- Student collaboration is encouraged for team projects; however, each student must do their own work independently throughout the course.
- Complete assignments/papers/presentations in a professional manner, without spelling or grammatical errors and using a professional/technical paper format.
- Follow the USC Guidelines for student integrity/honesty and students with disability.

You are also required to:

- Participate in all team-related activities, homeworks, presentations and report writings
- Check e-mail and Blackboard frequently
- Use MS Office for your reports and presentations with a minimum font size of 12
- If needed, learn and use other software applications to design your interfaces

Policy on Submitting Electronic Files:

To ensure that all student work is handled efficiently and quickly, the following policies must be followed for file uploads and submissions to the TA/Grader.

- All submitted files must begin with the student's *<last name>*, then *<ise570>*, and the *<file name>*, all in lowercase. (e.g. joe_ise570_finalproject.doc). Any electronic submissions not following this convention will be deleted without consideration.
- All assignments must also have the following information on the top right corner or in the header:
 - Student Name (Last, First)
 - ISE 570
 - Name of Work (e.g. Assignment 1)
 - Date of Submission
- Any work not following this convention will not be considered as part of class assignment.

Support Specifically for DEN Students:

- DEN students have specific support structure provided by the DEN staff. Please contact DEN if you need any IT relevant questions.
- In order to tailor the course better to DEN students, we ask that you set up a face-to-face meeting with the instructor within the first two weeks of the semester. This could be for a few minutes of informal discussion at any time during the week days or week nights. Please give me three time slots that you could arrange such a meeting. If this is not doable, or for those students working out of the region, please arrange the same for a telephone

conversation with the instructor. Think about specific needs or arrangements that would make your DEN experience more fruitful.

- The previous instructor designated for this course, Suzanne Dawes, has agreed to act as the expert practitioner for the DEN students. Please use her vast knowledge in the field human systems integration at the Aerospace Corporation as a backup mentor for this course. Her contact information is:
 - Email suzanne.dawes@aero.org (preferred mode of communication)
 - Work Tel: (310) 336-5643

TERM PROJECT AND PAPER

Introduction

The term project is designed to encourage the students in exploring the field of Human Factors Engineering in more depth and expanding their experiences through the design or redesign of a product/system in a systematic and organized fashion.

Team Design for the Project

Teams of 2 to 4 students are formed in the first week of the class. The project may include any device/product/system that you can study at work or any other ones that you can find in your daily life or in the HF literature (see http://www.id-book.com/casestudy_index.htm for a number of design case studies). We have also arranged with Suzanne Dawes to suggest projects for the DEN students who wish to work on DOD related systems (see above for her contact information).

A team leader should be selected by the team members in order to lead the discussions with the instructor. After the instructor's approval of a project, the team will develop a detailed problem statement and generates an outline to accomplish the project objectives. The team will produce a mid-term report and presentation. The final presentation is scheduled at the end of the semester with a paper due at the last day of the semester. We prefer that the mid-term and the final presentations are delivered by different team members. The instructor's evaluation is based on the project presentation effectiveness and technical content of the paper. The instructor's grade will be the same for all team members.

General Guidelines

Each student in the team will define and present his/her own role in developing the specific portions of the report at the two report presentations (see the Schedule):

1. Mid-term project report and presentation: The report should consist of the basic user requirements, task analysis, and a preliminary interface design. Each group will also be asked to make a 10 minute in-class presentation. While neither item will be officially graded, the professor and TA will offer feedback and a letter grade.
2. Final presentation: a complete presentation and final paper at the end of semester with all the figures, tables, references, etc.

Organization of the Paper

In order to organize your writings, we suggest the following style. Please remember that this is a rough “guide” and not designed to place you in a “straight jacket.” Your approach should contain information specifically tailored to your system design and evaluation, which may require a different analysis and presentation format than the one presented below.

<i>Section</i>	<i>Pages</i>	<i>Grade</i>
Cover Page Title Team name & number Team member names Date of delivery 8.5x11 sheets, no plastic cover, stapled at upper left	1	1
Abstract User need that made this problem important Why hasn't this problem been solved before? Interface evaluation methodology you used Data collection and analysis Your design suggestion One sentence on the lessons learned in this project	0.5	3
Introduction The basic components of this “system” The nature of the problem from the user's perspective What did other publications say about this type of problem? Your approach to solving this problem What is the hypothesis that you are testing? Or, “by solving the problem this way, we expect to achieve a better user performance in the following dimensions...” One sentence saying: “The rest of this paper will include the following sections: ...”	1-2	10
User Needs Profiles Behavior requirements End/means objectives (goal hierarchy)	2-3	15
System Analysis Top-level requirements: the new system shall provide x, y, z, ... How do you verify that the new system does what you want it to do? Explain verification approach such as inspection, data analysis, demonstration, testing, etc. Define performance measures for each verification approach Environmental requirements Input/output requirements	3-5	15

System and environmental constraints		
Interactive Task Description Task analysis A detailed user/task/system/data flow diagram (see: http://www.jjg.net/ia/visvocab/ for a visual vocabulary and use Visio's tools for drawing) Link analysis or Operation Sequence Diagram (if needed) Use other relevant tools or techniques (discussed in the class)	<5	15
Interface Design Design rationale: how did you get to this final design choice? Standards/guidelines Prototyping approach (physical or virtual) Tool implementation*	<5	10
Evaluation Decision on which evaluation methodology Testing methodology, analysis, and results Test and evaluate your interface with real people Any alternative designs?	<5	15
Human-System Interaction Show how the system works* Layout/screen design and path to all interface/system states	<5	10
Lessons Learned and Future Developments	0.5-1	3
References At least five books and/or refereed articles (do not include our textbooks) Internet sources should be less than one third of the total references	0.5-1	3

- For example: you may program or simulate the system interface with PowerPoint, HTML, Front Page, IE, Speech Solution, JAVA Script/Swing, SQL, Visual Basic, Visual Studio, 3D Studio, Adobe Photoshop/Framemaker, Macromedia Flash/Dreamweaver/Fireworks, Speech Solutions, Dragon Naturally Speaking.

OTHER SOURCES

There are large amounts of information available in the field of Human Factors. Some are listed below. You should be able to find other sources of information using your own search engines.

Human Factors and Ergonomics Society: <http://hfes.org/>

Human Factors and Ergonomics Resources: http://www.2-sir.com/Human_Factors/

HFES Sites of Interest: <http://users.erols.com/hfespec/sites.htm>

The following sites have emphasis on interfaces:

Our own textbook: <http://www.id-book.com/starters.htm> includes reference sites, materials, video clips, blogs, software, bookmark sharing, organizations and news.

Bad Designs: <http://www.baddesigns.com/>
Human Factors/User-Centered URLs: <http://www.blinn.net/hci-urls.htm#icon>
Human-Computer Interaction Resources on the Net by Mikael Ericsson:
<http://www.ida.liu.se/labs/aslab/groups/um/hci/>
HCI Bibliography (Gary Perlman): <http://www.hcibib.org/>
HCI Index: <http://degraaff.org/hci/>
Usable Web: <http://usableweb.com>
iGeek.com Interface page: <http://www.igeek.com/articles/Interface/>
Jakob Nielsen: <http://www.useit.com/>
ACM/SIGCHI: <http://www.acm.org/sigchi/>
Ben Shneiderman: <http://www.cs.umd.edu/~ben/>
Icon Design: <http://archive.ncsa.uiuc.edu/SDG/IT94/Proceedings/HCI/nielsen/sunweb.html>

Some conference papers can be found from the following organizations:

Annual Meeting of the Human Factors and Ergonomics Society
Association of Computing Machinery, Special Interest Group on CHI (ACM Conference on
Human Factors in Computing Systems)
ACM, SIGGRAPH (ACM Symposium on User Interface Software Technology)