IE 545
Human Factors Engineering
Motivation and Introduction

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Human Factors Engineering

- considers Human Factors, factors that influence human performance,
  - Individual Factors, e.g.,
    - sensory
    - cognitive
    - physical
  - Group Factors , e.g.,
    - composition
    - organization
    - dynamics
  - Task Factors, e.g.,
    - number
    - nature
    - procedure
  - Equipment Factors, e.g.,
    - display colors
    - control placement and dynamics
    - Tools geometry
  - Environment Factors, e.g.,
    - illumination
    - temperature
    - vibration

in an attempt to understand and improve human performance and safety so as to improve system performance and safety.

Human Factors Engineering

- learns of the effects of human factors on human performance and safety through
  - Experience (often bad)
  - Research

  and develops and applies principles and guidelines to the design of
  - Equipment, e.g.,
    - displays
    - controls
    - tools
    - seating
    - workstations
  - Procedures
  - Job performance aids , e.g.,
    - manuals
    - checklists
    - memory aids
  - Training programs
  - Selection programs

Human Factors Engineering

… the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and other methods to design in order to optimize human well-being and overall system performance.

Definition adopted by the International Ergonomics Association and the Human Factors and Ergonomics Association

Human Factors Engineering

- **Ergonomics** (physical considerations)
  - Anatomy
  - Biomechanics
  - Anthropometry
  - Work Physiology
  - Bioinstrumentation
  - Manual Material Handling
  - Musculoskeletal Disorders
  - Work and Workspace Design
- **Human Factors** (information processing considerations)
  - Attention
  - Sensing & Perception
  - Memory
  - Cognition
  - Action
  - Human Error and Remediation
  - User Interface Design

Ergonomics

Human Factors: Adverse Events Attributable to Human Performance

- *Titanic*
- Tenerife
- Bhopal
- Three-Mile Island
- Chernobyl
- Hawaiian Missile Alert

Other Adverse Events Attributable to Human Performance

- Manufacturing: product defects
- Service Systems: flawed services, delays
- Power Generation and Distribution: blackouts
- Surface Transportation: auto/truck accidents
- Workplace: occupational injuries
- Information Systems: data entry errors
- Design: design flaws
- etc.

IE 545, Human Factors Engineering

Analysis and design of systems considering human characteristics, capabilities and limitations. Analysis and design of displays, controls, tools, and workstations. Human performance analysis. Human factors research methods. 4 credits.

Syllabus

Human Factors Engineering Project

- Project Team: 3 students
- Project Topic: proposed by instructors (with class input), bid on by students, assigned by instructors
- Project Overview
  - background research
  - Statement of Need
  - task analysis
  - requirements development
  - design
  - implementation (→ mockup or part-functional prototype)
  - evaluation
  - documentation
- Progress Reports (6): memo + work product(s)
- User Panel: 3+ representative users
- Trade Study: small experiment to compare design options
- Final Report: comprehensive report + finalized work products

Criteria For a Suitable HFE Project

- User Interface (UI) for a moderately complex system/device
  - not an electric toothbrush or a garage door opener
  - not a professional digital SLR camera or a nuclear power plant control room
  - something in between
  - special-purpose devices preferred over phone/computer apps
- Where the user
  - senses stimuli from system (via displays or directly) and environment (directly or via other systems/devices)
  - assesses situation
  - commits/recalls information to/from memory
  - diagnoses/decides/solves/...
  - sets/revises goals
  - formulates responses
  - responds by acting on system (e.g., via controls) and/or environment
  - repeats the above
  - may need to be accommodated within system, i.e., in a workstation with displays, controls, seating, etc.
- Other possibilities
  - Job performance aid for technical tasks
  - Simple device that requires considerable user manipulation

Some Project Ideas
(several from past IE 545 classes)

- Truck winch User Interface (UI)
- Targeting Device UI
- Thermal weapon sight UI
- Laser rangefinder UI
- Targeting device tripod
- Home HVAC UI ("thermostat")
- Automated Teller Machine (ATM)
- Home entertainment system remote control
- Industrial equipment control panel
- Home blood glucose analyzer UI
- OSU Solar Car cockpit
- Integrated medical instrument (stethoscope, thermometer, etc.)
- Belt Grinder UI
- Automobile Collision Avoidance System UI
- Home kidney dialysis machine UI
- GPS Navigator UI
- Some other UI with which you are familiar that you know could be improved