Course: Ergonomics for Organisation and Systems Design

Credit: 2–0–0

Lecturer: Professor Kenji Itoh and Associate Professor Hirotaka Aoki

Outline: This course aims at obtaining knowledge and basic skills about the disciplines called ergonomics/human factors, their approaches and their applications to actual design of human-machine systems, work and organisations. Among various contents related to ergonomics with which people are working, this class focuses on applications of ergonomic approaches and methods to actual design and evaluation of human-machine systems and organisational aspects. Contents covered in this class are largely divided into three categories, for which some case studies are included: (1) Introduction to ergonomics, (2) Human-machine interaction and usability, (3) Human errors and risk management.

In this class, in addition to lectures, some group assignments (+ presentation and discussion) will be made concerning some specific topics for better understanding of ergonomic concepts and approaches. Simple questions – just one page answer required – will be also given every week in the end of lecture for the same purpose.

Schedule:

Part I: Introduction to Ergonomics/Human Factors

1. **Basics in Ergonomics** by K. Itoh (10/3)
   - Purposes, definition and approaches of ergonomics
   - History of ergonomics
   - Fields and disciplines related to ergonomics
   - Roles of ergonomics in modern society

2. **Approaches to Human Factors and Ergonomics** by H. Aoki (10/15)
   - Ergonomics thinking
   - General approaches to data acquisition, data representation, data analysis, etc.
   - ⋆ **Group assignment**: What product seems well-designed, but actually is not designed well from ergonomic points of view?

Part II: Human-Machine Interaction and Usability

3. **Human-Machine Systems I** by H. Aoki (10/17)
   - Human-machine systems and interfaces
   - Human processing systems: memory systems, visual systems, etc.
   - Models representing user behaviour: Norman's model

- What is "Gulf of Execution/Evaluation"?

4. **Human-Machine Systems II** by H. Aoki (10/24)
   - Several approaches to systems/products development: User-centred design, Scenario-based design, e.g., Cooper's Persona approach

5. **Research in Human-Machine Systems I:**
   Eye-tracking applications to HMI by H. Aoki (10/31)
   - Physiology/Psychology of Human Eyes
   - History of eye tracking researches
   - Two types of eye tracking applications:
     Diagnostic and Interactive applications
   - Examples of direct manipulation interfaces (WYSWYG, ⋯)

6. **Research in Human-Machine Systems II** by H. Aoki (11/7)
   - Demonstration of Eye tracking: Diagnostic and Interactive applications
   - Preparation for presentation

7. **Presentation of group work** by H. Aoki (11/14)

8. **Usability I** by H. Aoki (11/21)
   - Usability (ISO, Nielsen)
   - Usability Engineering by Nielsen

9. **Usability II** by H. Aoki (11/28)
   - Usability testing
   - New concepts/tools in usability design (User experience)

Part III: Organisational Design for Safety

10. **Human Error Theory** by K. Itoh (12/5)
    - Accident causes in high risk systems
    - Types of human erroneous actions: what is human error?
    - Mechanisms of accident
      (example in railway setting)
    - Classification of errors & contexts
    - Approaches for accident prevention
    - Foolproof and Fail-safe
    - Approaches for accident analysis
    - Strengths and weaknesses of each approach

11. **Risk management** by K. Itoh (12/12)
    - Definition of risk
    - Risk comparisons between systems
    - Accident causes in high risk systems
    - Traditional risk management approach
    - Trade-off between efficiency and thoroughness
    - New approach: Resilience Engineering
    - ⋆ **Group assignment**: What approach do you take to analyse latent factors

of traffic accidents and its intervention?

12. Safety Culture by K. Itoh (12/19)
- Definition of "safety culture"
- Differences between culture and climate
- Dimensions of safety culture
- Purposes of safety culture assessment
- Methods for safety culture assessment
- Safety culture factors (Management commitment, leadership, communication, reporting attitudes to errors, ⋯)
- Components of "safe" culture
(Non-punitive culture, just culture, reporting culture, learning culture, ⋯)
- Overlapped cultures
(National culture, domain culture, professional culture, organisational culture)
- Safety culture in healthcare
- ⋆ **Question**: When do you blame a person making error or no blame?

13. Safety performance measurement and incident reporting by K. Itoh (1/9)
- Methods for measuring safety outcomes
- Incident Reporting System
- Error Taxonomy
- Safety/Quality performance indicators
- Global Trigger Tool
- Contributions of safety culture to safety outcomes

14. Case study: Applications to Railway Safety by K. Itoh (1/23)
- Risk management for track maintenance train operations
- Safety culture in railway organisations

15. Presentation of group work by K. Itoh (1/30)
- Approach to analysis of latent factors of traffic accidents
- Discussion

Evaluation: Individual assignments, group assignments and ordinary attitudes in the class, e.g., participation in discussions and questions (+ attending status in the class)