SE 204, IES 506 – Human Computer Interaction

Lecture 2: Usability of Interactive Systems

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Please look at the last four slides for assignments (marked with TODO)
CHAPTER 1: Usability of Interactive Systems

Designing the User Interface: Strategies for Effective Human-Computer Interaction

Fifth Edition

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in collaboration with

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Slightly modified by Gazihan Alankuş
Introduction

- The Interdisciplinary Design Science of Human-Computer Interaction (HCI) combines knowledge and methods associated with professionals including:
  - Psychologists (incl. Experimental, Educational, Social and Industrial Psychologists)
  - Computer Scientists
  - Instructional and Graphic Designers
  - Technical Writers
  - Human Factors and Ergonomics Experts
  - Anthropologists and Sociologists
Introduction (continued)

• What are the Ramifications?
  – Success Stories: Microsoft, Linux, Amazon.com, Google
  – Competition: Firefox vs. Internet Explorer
  – Copyright Infringement Suits - Apple vs. Microsoft (Windows) and Napster vs. The music industry
  – Mergers: AOL and Time Warner
  – Corporate Takeovers: IBM's seizure of Lotus
  – Privacy and Security issues: identification theft, medical information, viruses, spam, pornography, national security
Introduction (continued)

• Individual User Level
  – Routine processes: tax return preparation
  – Decision support: a doctor’s diagnosis and treatment
  – Education and training: encyclopedias, drill-and-practice exercises, simulations
  – Leisure: music and sports information
  – User generated content: social networking web sites, photo and video share sites, user communities
  – Internet-enabled devices and communication
Introduction (continued)

• Communities
  – Business use: financial planning, publishing applications
  – Industries and professions: web resources for journals, and career opportunities
  – Family use: entertainment, games and communication
  – Globalization: language and culture
Introduction (continued)

• The new “look and feel” of computers (Mac)
Introduction (continued)

- The new “look and feel” of computers (Vista)
Introduction (concluded)

• And smaller devices doing more…
Book overview

• Chapter 1:
  – A broad overview of human-computer interaction from practitioner and research perspectives

• Chapter 2:
  – Guidelines, principles, and theories

• Chapters 3-4:
  – Managing design processes and evaluating designs

• Chapters 5-9:
  – Interaction styles

• Chapters 10-14:
  – Critical design decisions

• Afterword:
  – Societal and individual impacts of user interfaces
Usability

- What does that mean?
- What should we do to achieve it?
- How can we know that we achieved it?
- Why do we really want it?
- Who is it for?
Usability requirements

• Synonyms for “user-friendly” in Microsoft Word 2002 are easy to use; accessible; comprehensible; intelligible; idiot proof; available; and ready
• But a “friend” also seeks to help and be valuable. A friend is not only understandable, but understands. A friend is reliable and doesn’t hurt. A friend is pleasant to be with.
• These measures are still subjective and vague, so a systematic process is necessary to develop usable systems for specific users in a specific context
Usability requirements (cont.)

• The *U.S. Human Engineering Design Criteria for Military Systems* (1999) states these purposes:
  – Achieve required performance by operator, control, and maintenance personnel
  – Minimize skill and personnel requirements and training time
  – Achieve required reliability of personnel-equipment/software combinations
  – Foster design standardization within and among systems

• Should improving the user’s quality of life and the community also be objectives?

• Usability requires project management and careful attention to requirements analysis and testing for clearly defined objectives
Goals for requirements analysis

• **Ascertain the user’s needs**
  – Determine what tasks and subtasks must be carried out
  – Include tasks which are only performed occasionally. Common tasks are easy to identify.
  – Functionality must match need or else users will reject or underutilize the product
Goals for requirements analysis

• Ensure reliability
  – Actions must function as specified
  – Database data displayed must reflect the actual database
  – Appease the user's sense of mistrust
  – The system should be available as often as possible
  – The system must not introduce errors
  – Ensure the user's privacy and data security by protecting against unwarranted access, destruction of data, and malicious tampering
Goals for requirements analysis

- **Promote standardization, integration, consistency, and portability**
  - *Standardization*: use pre-existing industry standards where they exist to aid learning and avoid errors (e.g. the W3C and ISO standards)
  - *Integration*: the product should be able to run across different software tools and packages (e.g. Unix)
  - *Consistency*:
    - compatibility across different product versions
    - compatibility with related paper and other non-computer based systems
    - use common action sequences, terms, units, colors, etc. within the program
  - *Portability*: allow for the user to convert data across multiple software and hardware environments
Goals for requirements analysis

- **Complete projects on time and within budget**
  Late or over budget products can create serious pressure within a company and potentially mean dissatisfied customers and loss of business to competitors.
Usability

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Usability measures

- Define the target user community and class of tasks associated with the interface
- Communities evolve and change (e.g. the interface to information services for the U.S. Library of Congress)
- 5 human factors central to community evaluation:
  - Time to learn
    How long does it take for typical members of the community to learn relevant task?
  - Speed of performance
    How long does it take to perform relevant benchmarks?
  - Rate of errors by users
    How many and what kinds of errors are made during benchmark tasks?
  - Retention over time
    Frequency of use and ease of learning help make for better user retention
  - Subjective satisfaction
    Allow for user feedback via interviews, free-form comments and satisfaction scales
Usability measures (cont.)

- Trade-offs in design options frequently occur.
  - Changes to the interface in a new version may create consistency problems with the previous version, but the changes may improve the interface in other ways or introduce new needed functionality.

- Design alternatives can be evaluated by designers and users via mockups or high-fidelity prototypes.
  - The basic tradeoff is getting feedback early and perhaps less expensively in the development process versus having a more authentic interface evaluated.
Usability

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Usability motivations

Many interfaces are poorly designed and this is true across domains:

• Life-critical systems
  – Air traffic control, nuclear reactors, power utilities, police & fire dispatch systems, medical equipment
  – High costs, reliability and effectiveness are expected
  – Length training periods are acceptable despite the financial cost to provide error-free performance and avoid the low frequency but high cost errors
  – Subject satisfaction is less an issue due to well motivated users
Usability motivations (cont.)

- Industrial and commercial uses
  - Banking, insurance, order entry, inventory management, reservation, billing, and point-of-sales systems
  - Ease of learning is important to reduce training costs
  - Speed and error rates are relative to cost
  - Speed of performance is important because of the number of transactions
  - Subjective satisfaction is fairly important to limit operator burnout
Usability motivations (cont.)

- **Office, home, and entertainment applications**
  - Word processing, electronic mail, computer conferencing, and video game systems, educational packages, search engines, mobile device, etc.
  - Ease of learning, low error rates, and subjective satisfaction are paramount due to use is often discretionary and competition fierce
  - Infrequent use of some applications means interfaces must be intuitive and easy to use online help is important
  - Choosing functionality is difficult because the population has a wide range of both novice and expert users
  - Competition cause the need for low cost
  - New games and gaming devices!
    - For example, Nintendo Wii
Usability motivations (cont.)

• Exploratory, creative, and cooperative systems
  – Web browsing, search engines, artist toolkits, architectural design, software development, music composition, and scientific modeling systems
  – Collaborative work
  – Benchmarks are hard to describe for exploratory tasks and device users
  – With these applications, the computer should be transparent so that the user can be absorbed in their task domain
Usability motivations (cont.)

- Social-technical systems
  - Complex systems that involve many people over long time periods
  - Voting, health support, identity verification, crime reporting
  - Trust, privacy, responsibility, and security are issues
  - Verifiable sources and status feedback are important
  - Ease of learning for novices and feedback to build trust
  - Administrators need tools to detect unusual patterns of usage
Usability

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Universal Usability

• It is for everybody!
  – Computer savvy or not
  – Young-old
  – Disabled
  – Different personalities

• It is hard to design things that are for everybody…
  – Challenge
  – Useful things that originate from one person can be useful for others as well
Universal Usability Example: Curb Cuts
Universal Usability

• Physical abilities and physical workplaces
  – Basic data about human dimensions comes from research in *anthropometry*
  – There is no average user, either compromises must be made or multiple versions of a system must be created
  – Physical measurement of human dimensions are not enough, take into account dynamic measures such as reach, strength or speed
Universal Usability (cont.)

- Screen-brightness preferences vary substantially, designers customarily provide a knob to enable user control
- Account for variances of the user population's sense perception
- Vision: depth, contrast, color blindness, and motion sensitivity
- Touch: keyboard and touchscreen sensitivity
- Hearing: audio clues must be distinct
- Workplace design can both help and hinder work performance
Universal Usability (cont.)

• The standard *ANSI/HFES 100-2007 Human Factors Engineering of Computer Workstations* (2007) lists these concerns:
  – Work-surface and display-support height
  – Clearance under work surface for legs
  – Work-surface width and depth
  – Adjustability of heights and angles for chairs and work surfaces
  – Posture - seating depth and angle; back-rest height and lumbar support
  – Availability of armrests, footrests, and palmrests

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Universal Usability (cont.)

• Cognitive and perceptual abilities
  – The human ability to interpret sensory input rapidly and to initiate complex actions makes modern computer systems possible
  – The journal *Ergonomics Abstracts* offers this classification of human cognitive processes:
    • Long-term and semantic memory
    • Short-term and working memory
    • Problem solving and reasoning
    • Decision making and risk assessment
    • Language communication and comprehension
    • Search, imagery, and sensory memory
    • Learning, skill development, knowledge acquisition, and concept attainment
Universal Usability (cont.)

- They also suggest this set of factors affecting perceptual and motor performance:
  - Arousal and vigilance
  - Fatigue and sleep deprivation
  - Perceptual (mental) load
  - Knowledge of results and feedback
  - Monotony and boredom
  - Sensory deprivation
  - Nutrition and diet
  - Fear, anxiety, mood, and emotion
  - Drugs, smoking, and alcohol
  - Physiological rhythms

- But note, in any application, background experience and knowledge in the task domain and the interface domain play key roles in learning and performance
Universal Usability (cont.)

• **Personality differences**
  
  – There is no set taxonomy for identifying user personality types
  
  – Designers must be aware that populations are subdivided and that these subdivisions have various responses to different stimuli
  
  – Myers-Briggs Type Indicator (MBTI)
    
    • extroversion versus introversion
    
    • sensing versus intuition
    
    • perceptive versus judging
    
    • feeling versus thinking
Universal Usability (cont.)

- Cultural and international diversity
  - Characters, numerals, special characters, and diacriticals
  - Left-to-right versus right-to-left versus vertical input and reading
  - Date and time formats
  - Numeric and currency formats
  - Weights and measures
  - Telephone numbers and addresses
  - Names and titles (Mr., Ms., Mme.)
  - Social-security, national identification, and passport numbers
  - Capitalization and punctuation
  - Sorting sequences
  - Icons, buttons, colors
  - Pluralization, grammar, spelling
  - Etiquette, policies, tone, formality, metaphors
Universal Usability (cont.)

• Users with physical challenges
  – Goals
    • Make systems usable by them
    • Rehabilitate them

[Gazihan Alankus, Motion-Based Video Games for Stroke Rehabilitation with Reduced Compensatory Motions, WUSTL Dissertation, 2011]
Universal Usability (cont.)

- **Users with physical challenges**
  - Designers must plan early to accommodate users with disabilities
  - Early planning is more cost efficient than adding on later
  - Businesses must comply with the "Americans With Disabilities" Act for some applications
Universal Usability (cont.)

- Users with physical challenges
  - Example: blind users
    - How can they surf the web?
Universal Usability (cont.)

• **Older Adult Users**
  – Including the elderly is fairly easy
    • Designers should allow for variability within their applications via settings for sound, color, brightness, font sizes, etc. with less distracting animation
  – A growing market with lots of opportunities
Universal Usability (concluded)

• Younger users
What Should We Do?

• Should not ignore the users’ needs
• Create user-centric systems
Goals for our profession

• Potential research topics
  – Reducing anxiety and fear of computer usage
  – Graceful evolution
  – Specification and implementation of interaction
  – Direct manipulation
  – Social media participation
  – Input devices
  – Online assistance
  – Information exploration
Goals for our profession (cont.)

• Providing tools, techniques, and knowledge for system implementers
  – Rapid prototyping is easy when using contemporary tools
  – Use general or self-determined guideline documents written for specific audiences
  – To refine systems, use feedback from individual or groups of users

• Raising the computer consciousness of the general public
  – Many novice users are fearful due to experience with poor product design
  – Good designs help novices through these fears by being clear, competent, and nonthreatening
TODO: Google Group

• Do either one of these if you haven’t already:
  – Find the link to the Google group from class website
  – Or, send an e-mail to gazihan.ieu@gmail.com and I will invite your e-mail to the Google group. You will have to accept the invitation.

• I will use this for class announcements

• You can also send questions, comments, helpful tips, or announcements to it but I will moderate your e-mails.
TODO: Reading Assignment

• Read Chapter 2 from your book:
  – Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, 2009, Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition), Addison Wesley
TODO: Homework

• We are starting slow

• [URL](http://wps.aw.com/aw_shneiderman_dtui_5/110/28381/7265752.cw/index.html)
  – Discussion questions for Chapters 1 and 2
  – Send them as an e-mail with this subject:
    • [SE204] Homework 1
    • Please copy and paste this subject to your e-mails.
    • I will reply with “thank you”. If you don’t get my reply, I did not get your e-mail.
TODO: Project preparation (for IES 506 only)

• Send me an e-mail with three project ideas until Thursday 23:00.
• Let’s discuss via e-mail over the weekend.