CHAPTER 1:
Usability of Interactive Systems

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

Fifth Edition

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Designing an Interactive System
Many Design Processes…
YOUR USER REQUIREMENTS INCLUDE FOUR HUNDRED FEATURES.

DO YOU REALIZE THAT NO HUMAN WOULD BE ABLE TO USE A PRODUCT WITH THAT LEVEL OF COMPLEXITY?

GOOD POINT. I'D BETTER ADD "EASY TO USE" TO THE LIST.
First step: “Identify and define the problem” → requirements analysis

- **Understand** the type of interactive system and its **social context**
- **Understand** the **user** community (age, experience, culture)
  - frequent users
  - occasional users
- Identify the **tasks** and subtasks that must be carried out by the user
- Distinguish between common/frequent tasks and infrequent tasks
- Identify any **standards** that need to be followed for these tasks (industry standards, legal issues)
Last step: Evaluating and Testing Interactive Systems

Usability measures

- **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.
Design alternatives can be evaluated by designers and users via mockups or prototypes (low or high-fidelity).

- The tradeoff is getting feedback early and perhaps at a lower cost in the development process versus having a more authentic interface evaluated.
Types of Interactive Systems

Life-critical systems

- Air traffic control, nuclear reactors, power utilities, police & fire dispatch systems, medical equipment
- Reliability and effectiveness are expected
- Lengthy 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
• **Industrial and commercial systems**

  – 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
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: need for low cost
- New games and gaming devices!
  - Nintendo Wii
• 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
• 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
The User

- 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, speed
• variances in perception:
  
  • Vision: brightness, contrast, color blindness, and motion sensitivity
  • Touch: keyboard and touchscreen sensitivity
  • Hearing: audio clues must be distinct
• **Ergonomics**: a multidisciplinary field concerning the design of equipment and devices that fit the human body and human cognitive abilities. The two terms "human factors" and "ergonomics" are generally synonymous.

• 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
• 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
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

In any application, background experience and knowledge in the task domain and the interface domain play key roles in learning and performance.
• Personality differences

- There is no set taxonomy for identifying user personality types

- Myers-Briggs Type Indicator (MBTI)
  
  • extroversion versus introversion
  
  • sensing versus intuition
  
  • perceptive versus judging
  
  • feeling versus thinking
• 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
• 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

• Older Adult Users
  – Designers should allow for variability within their applications via settings for sound, color, brightness, font sizes, etc. with less distracting animation
• Younger users
User-Centered Design (UCD) Principles
• early focus on users
• early & continual user testing
• iterative design process
“In-the-field” User Observation

- watch subjects perform their tasks
  what are these tasks?
- record your observations
- as you observe, ask yourselves:
  did your presence affect the subjects?
- after you’ve observed several subjects
  organize your observations – what did you learn?
Design Exercise