Usability of Interactive Systems

Bad designs

- Elevator controls and labels on the bottom row all look the same, so it is easy to push a label by mistake instead of a control button

- People do not make same mistake for the labels and buttons on the top row. Why not?

From: www.baddesigns.com

Why is this vending machine so bad?

- Need to push button first to activate reader
- Normally insert bill first before making selection
- Contravenes well known convention

From: www.baddesigns.com
Good and bad design

- What is wrong with the Apex remote?
- Why is the TiVo remote so much better designed?
  - Peanut shaped to fit in hand
  - Logical layout and color-coded, distinctive buttons
  - Easy to locate buttons

Interesting Design Flaws

- Most automatic faucets don’t work if you are wearing black
- Some showers require instructions to be able to operate

Logical or ambiguous design?

- Where do you plug the mouse?
- Where do you plug the keyboard?
- Top or bottom connector?
- Do the color coded icons help?
How to design them more logically

(i) A provides direct adjacent mapping between icon and connector

(ii) B provides color coding to associate the connectors with the labels

From: www.baddesigns.com

Inconsistent Keypad numbers layout

(a) phones, remote controls

(b) calculators, computer keypads

Why was the iPod user experience such a success?
Human Computer Interaction

- 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

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
- Privacy and Security issues: identification theft, medical information, viruses, spam, pornography, national security

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
Human Computer Interaction

- 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

Human Computer Interaction

- The new “look and feel” of computers (Mac)

Human Computer Interaction

- The new “look and feel” of computers (Vista)
Human Computer Interaction

- And smaller devices doing more...

User experience goals

- satisfying
- enjoyable
- engaging
- pleasurable
- exciting
- entertaining
- helpful
- motivating
- emotionally fulfilling

But not:

- boring
- frustrating

Usability requirements

- Synonyms for “user-friendly”:
  - easy to use;
  - accessible;
  - comprehensible;
  - intelligible;
  - idiot proof;
  - available;
  - 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

- 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 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 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
  - 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

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 causes the need for low cost
  - New games and gaming devices!
    - For example, 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
Universal Usability

- **Physical abilities and physical workplaces**
  - Basic data about human dimensions comes from research in *anthropometrics*.
  - 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 touch screen 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 palm rests.
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
  - 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, gender, grammar, spelling
  - Etiquette, policies, tone, formality, metaphors
Are cultural differences important?

- Why is it that certain products, like the iPod, are universally accepted by people from all parts of the world whereas websites are reacted to differently by people from different cultures?

Anna, IKEA online sales agent

- Designed to be different for UK and US customers
- What are the differences and which is which?
- What should Anna’s appearance be like for other countries, like India, South Africa, or China?

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
- 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
Universal Usability (concluded)

- Younger users

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 non-threatening
- **interaction designers** - people involved in the design of all the interactive aspects of a product
- **usability engineers** - people who focus on evaluating products, using usability methods and principles
- **web designers** - people who develop and create the visual design of websites, such as layouts
- **information architects** - people who come up with ideas of how to plan and structure interactive products
- **user experience designers (UX)** - people who do all the above but who may also carry out field studies to inform the design of products