Usability Principles

Concepts, Principles, Guidelines

Rules? Cookbooks?
Agenda

- Usability Principles
  - Why?
  - Systems of categorization
  - Levels of detail
  - Example system of Principles
“Every designer wants to build a high-quality interactive system that is admired by colleagues, celebrated by users, circulated widely, and imitated frequently.” (Shneiderman, 1992, p.7)

…and anything goes!...?...
Why Principles & Guidelines?

- ...Because, well, not everything goes...

- Intended to prevent many bad designs, before they begin, or evaluate existing designs on a scientific basis

- Guidelines based on previous designs, experimental findings

- Rules can all be “broken” (but usually in order to satisfy another principle)
Concepts, Principles, Guidelines

- No “cookbooks”
- No simple, universal checklists
- There are many concepts, principles, and guidelines

Understand the higher level principles that apply across situations, display types, etc.

Implement the standards and guidelines…a few details…
Levels of Consideration

1. Meta-display level
   - Apply to the whole system, across media & across displays
   - Focus on this in Basic Layout Stage

2. Display Layout
   - Apply to groups of elements in a display
   - Focus on this in Prototyping and Redesign

3. Element level
   - Details about specific parts of a display
   - Colors, sound attributes, symbols
UI Design Principles (Dix et al.)

Categories

1. Learnability
   • support for learning for users of all levels

2. Flexibility
   • support for multiple ways of doing tasks

3. Robustness
   • support for recovery

Think about these in terms of meta-display, display, and element levels
1. Learnability Principles

- Ease with which new users can begin effective interaction and achieve maximal performance
  - Predictability
  - Synthesizability
  - Familiarity
  - Generalizability
  - Consistency
Predictability

What will this action do?....

Operation visibility - can see avail actions

- grayed menu items
- menus vs. command shell
Support for user in assessing the effect of past operations on current system state

- Moving a file in UNIX shell vs. GUI
- Is same feedback needed for all users, all apps?

Can the user figure out what caused this error?
Familiarity

> Does UI task leverage existing real-world or domain knowledge?
  - Really relevant to first impressions
  - Use of metaphors
    - Potential pitfalls (see next page)
  - Are there limitations on familiarity?
    - (e.g. parking lot colors and traffic light)
Familiarity?
Generalizability

- Can knowledge of one system/UI be extended to other similar ones?
  - Example: cut & paste in different applications

- Does knowledge of one aspect of a UI apply to rest of the UI?
  - e.g. file browser in OS, file locator in MS-Word

- Aid: UI Developers guidelines
Consistency

- Likeness in behavior between similar tasks/operations/situations
  - In different things
    - interacting
    - output
    - screen layout

- Is this always desirable for all systems, all users?
2. Flexibility Principles

- Multiplicity of ways that users and system exchange information
  - Dialog Initiative
  - Multithreading
  - Task migratability
  - Substitutivity
  - Customizability
Dialog Initiative

- Not hampering the user by placing constraints on how dialog is done
  - User pre-emptive
    - User initiates actions
    - More flexible, generally more desirable
  - System pre-emptive
    - System does all prompts, user responds
    - Sometimes necessary
Multithreading

- Allowing user to perform more than one task at a time
- Two types
  - Concurrent
    - Input to multiple tasks simultaneously
  - Interleaved
    - Many tasks, but input to one at a time
Task migratability

- Ability to move performance of task to entity (user or system) who can do it better
  - Auto-pilot/FMC in planes
  - Spell-checking
  - Safety controls in plant

- For what kinds of tasks should the user be in control?
Substitutivity

- Flexibility in details of operations
  - Allow user to choose interaction methods
  - Allow different ways to
    - perform actions
    - specify data
    - configure
  - Allow different ways of presenting output
    - to suit task, user
Customizability

- Ability of user to modify interface
  - By user - adaptability
    - Is this a good thing?
  - By system - adaptivity
    - Is this a good thing?
3. Robustness Principles

- Supporting user in determining successful achievement and assessment of goals
  - Observability
  - Recoverability
  - Responsiveness
  - Task Conformance
Observability

Can user determine internal state of system from what she perceives?

- **Browsability**
  - Explore current state (without changing it)

- **Reachability**
  - Navigate through observable states

- **Persistence**
  - How long does observable state persist?
Recoverability

- Ability to take corrective action upon recognizing error
  - “UNDO”
  - Difficulty of recovery procedure should relate to difficulty of original task
- Forward recovery
  - Ability to fix when we can’t undo
- Backward recovery
  - Undo previous error(s)
Responsiveness

- Users perception of rate of communication with system
  - Response time
    - Time for system to respond in some way to user action(s)
  - Users perceptions not always right
  - Consistency important
  - Response OK if matches user expectations
Task Conformance

Does system support all tasks user wishes to perform in expected ways?

- Task completeness
  - Can system do all tasks of interest?

- Task adequacy
  - Can user understand how to do tasks?

- Does it allow user to define new tasks?
And Don’t Forget Comfort!
Application of Principles

- In doing design and implementation of your project, revisit this list
- Assess your design against these usability principles

**REMEMBER: There are other principles!** *(see the end of this lecture’s slides)*
Project

- Web space
- Group finalizing
- Help getting general topic area
- Reminder:

  **CITI Online Training Assignment**
Upcoming

- Human Capabilities
  - Physical
  - Cognitive

- Brainstorming
Some Practical Principles

- The following pages contain a number of different, practical guidelines at each of the three levels (meta, display, and element levels)
- Some are the same or similar to ones we have discussed in class
- Some are more specific
- They have proven useful to me, but, of course, your mileage may vary
Meta-display Principles, I

- **Navigation model**
  - Decide on one navigation metaphor (e.g., menu structure vs. home page), and use it consistently.

- **Consistent navigation cues**
  - Families of logos, color schemes, and sounds used to indicate displays are related. Be subtle, consistent, and don’t forget aesthetics!

- **Fail-safe design principle**
  - Allow user to go back to previous items, steps, screens, etc. Allow user to undo as many actions as possible. Provide a true “Quit” or “Cancel” option.
Meta-display Principles, II

- **Open-ended vs. Task completion model**
  - Distinguish between browsing (open-ended) interaction, and task completion behavior.

- **Concert vs. Conversation model**
  - A continuum of interaction types from passive recipient of the information (“concert”) to ask-and-respond dialog between the user and the system (“conversation”).

- **Computer vs. Appliance model**
  - May need to avoid “computerese” and jargon.
Meta-display Principles, III

- **Logo/icon principle**
  - Top level has a logo (or melody). Lower levels have icon version of logo (or “theme” of melody).

- **Family of logos principle**
  - Related applications have icons (and earcons) that form a “family;” in fact, a simple symbolic language to help users navigate.

- **Process preview and progress indicators**
  - Provide a preview or summary of what is to come, and provide an indication of how far along the user is at all times.
Display Level Principles, I

- **Compatibility (cognitive and physical)**
  - Left is left, up is up. Align display dimensions (in all modalities!) with real-world data dimensions.

- **Familiarity principle**
  - Provide users with interface items that relate to their real world.

- **Appropriate medium/modality**
  - Choose the best medium to display a given type of information (like function allocation).

- **Population stereotypes and mappings**
  - Where possible, build on the expectancies of your user population (red = stop; high pitch = hot).
Display Level Principles, II

- Process flow = display flow
  - (Western) readers work left-to-right, top-to-bottom. If there is a most frequent order of actions, design display to correspond (left or up = “back;” right or down = “continue”).

- Conceptual size = hierarchical position
  - Items, objects, groups that are larger (even conceptually) or hierarchy are displayed before smaller items (take note of process flow).

- Group like items
  - Items similar in content or function should be grouped together in space or time. They should share spatial, physical, or temporal attributes.
Display Level Principles, III

- **Continuous vs. Discrete data**
  - Does data “flow” or is it displayed in “chunks”?

- **Object + action vs. Action + object** (action grammar)
  - Is an object selected, then an action indicated, or vice versa?

- **Most important info in “center”**
  - Center the important info in the display space (both visual and auditory). Controls in the periphery.

- **Avoid modes**
  - Each display should have one meaning only, and certainly only one meaning with a screen’s context.
Element Level Guidelines, I

• A few “controls” guidelines...

- Label-Action match
  - Controls say what they do, and do what they say. Consistent both within and across applications. Note: “OK” is not okay!

- Button location / icon /action compatibility
  - (1) Control icon is compatible with action
  - (2) Control location is compatible with the action (and with the icon)

- Consistent menus
  - Menus should be consistent within and across applications. Most frequently used options located to the top and left.
Element Level Guidelines, II

- Several auditory guidelines...

- Duration: 100 ms minimum
- Loudness: 10-15 dB over ambient; max 90 dB
- Onset (“attack”) rate: 1-5 dB per second; 20 ms minimum
- Frequency: 300 - 3000 Hz. Varies with age.
- Levels of data in a dimension:
  - Intensity (pure tones) 4-5
  - Frequency 4-7
  - Duration 2-3
Element Level Guidelines, III

- More auditory guidelines...

- Appropriate spectrum
  - Complex spectral features for warning or detection; transients for localization; simple spectrum for discrimination

- Avoid similar frequencies
  - (Leads to “beating”, poor discrimination)

- Use population expectancies for mappings
  - Louder, brighter, faster, higher pitch = “more” or “up”
  - Rising pitch = “moving up” or “getting full”
  - Major key, bright spectrum = “happy” or “good”

**Note:** Make sure you know which population stereotypes apply (e.g., sighted vs. blind listeners)