UX Design Principles and Guidelines

Achieve Usability Goals
Norman’s Interaction Model
Execution/Evaluation Action Cycle

Goals
What we want to happen

Execution
What we do to the world

Evaluation
Comparing what happened with what we wanted to happen

WORLD

Donald Norman, *The Design of Everyday Things*, 1990
Execution/Evaluation Action Cycle: Stages of Action

Gulf of Execution

Goals
- What we want to happen
- Event (data) driven
- Person initiated

Example – frozen pizza

- Forming intention
- Specifying action
- Executing action

Evaluation
- Evaluating interpretation
- Interpreting perception
- Perceiving world state

New state
Framework to structure UX design principles and guidelines
Planning – Help Users Know *What* to Do

User starting point …
- High-level system understanding
- Goal decomposition
- Workflow task/step structuring and sequencing
- Conceptual model, metaphors, work context
Planning – Design for Understandability

• Match user’s conception (mental model) of high-level task organization
• What system features exist and how to use them
• Possibilities for what users can do at every point
• Help users plan most efficient ways to complete tasks
• Keep users aware of task progress
• Provide cognitive affordances to remind users to complete tasks
Translation: Help Users Know How To Do Something

- Effective cognitive affordances
  - Users know/learn what actions are needed to carry out intentions
  - Users successfully predict action outcomes
  - Users determine how to get started
- Cognitive affordances are visible – legible text, font size, color, background contrast
- Timely, before associated exploit
- Similar cognitive affordances have consistent appearance
Translation (cont.): Content and Meaning of Cognitive Affordance

• Use precise wording and naming for clarity in labels, menu titles, menu choices, icons, data fields
  • E.g., complete labels by adding a noun
  • But balance wordiness with affordance

• Make choices distinguishable but consistent
  • Similar (different) names for similar (different) kinds of things
    • Avoid multiple synonyms for the same thing
  • Similar objects for similar kinds of functions
  • Consistent wording to express similar choices
Translation (cont.): Content and Meaning of Cognitive Affordance

• Control complexity with object proximity and grouping
  • By related tasks and functions
  • (More on this later)

• Recognition over recall
  • Recognition: remembering with the help of a visual clue
  • Recall: remembering with no help
  • Recognition is much easier
Learnability, Memorability and Human Memory

- Don’t assume because the interface tells the user something, they learn and remember it
- Working memory
  - Small 7 ± 2 chunks
  - <10 sec decay
  - Rehearsal can impact decay
- Long term memory
  - Infinite in size and duration
  - Extensive rehearsal transfers chunks
- Chunk is a unit of memory or perception
  - Hard: M W B C R A L O A B I M B F I
  - Easier: MWB CRA LOA BIM BFI
  - Easiest: BMW RCA AOL IBM FBI
- Stacking – task interruptions, limited depth
Translation (cont.): Content and Meaning of Cognitive Affordance

• Avoid inappropriate and erroneous user choices
  • Disable buttons, menu choices to make inappropriate choices unavailable
  • Gray out to make inappropriate choices *appear* unavailable
  • But help users understand why a choice is unavailable

• Cognitive affordances for error recovery
  • Provide a clear way to undo and reverse actions
  • Offer constructive help for error recovery
Translation (cont.): Task Efficiency

- Provide alternative ways to perform tasks
- Provide shortcuts
- Provide keyboard alternatives to avoid physical “switching” actions
- Task thread continuity
  - Anticipate most likely next action, step, or task path
  - If you tell them what they should do, help them get there
- Do not make user redo any work, reenter data
- Retain user state information
  - Example, having to find folder you are working in, over and over
- **Keep the user in control**
  - Good interfaces are explorable, errors are forgiven
Physical Actions: Help Users Do Tasks

- Necessary physical affordances in user interface
- Sensing UI objects for and during manipulation
- Manipulating UI objects, making physical actions
- Avoid physical awkwardness and fatigue; e.g., shifting from mouse to keyboard constantly
- Accommodate disabilities
  - Range of motion, fine motor control, vision, or hearing
  - (More on this later)
- Fitts’ law issues
Understandability: Human Errors

- Failure to correctly execute a learned task
  - Slip – action not carried out as intended or planned
  - Lapse – missed actions and omissions due to short term memory failure
    - Interruptions, loss of intent, omissions due to self satisfied goal (do not complete the task)
  - Typically found in skilled behavior
  - Most common human error – due to inattention

- Use the wrong task
  - Mistakes – a type of error brought about by a faulty plan/intention
  - Somebody did something believing it to be correct when it was, in fact, wrong,
  - Typically found in rule-based or problem-solving behavior
Understandability: Errors

• Capture slip – start executing a task but veer off to another one that starts in a similar way
  • E.g., habituated behavior, walk to school when you intended to go elsewhere
• Description slip – two actions are similar, intend to do one but accidently substitute the other; e.g. juice for milk on cereal
• “Strong but wrong” effect – similar and high frequency pattern of behavior
• Mode errors – states in which same actions have different meanings; e.g., cAP IOCK
Understandability: Error Prevention

- Different things should look and act differently
- Risky (consequential, hard to recover from errors) actions are separated from frequently used ones
- Avoid modes entirely, don’t duplicate actions across modes, or require the user to actively do something to work in a new mode
- Avoid lapses – keep task steps short, include forcing functions that require a sequence of steps (trade off of user freedom)
- Disable illegal commands
Outcomes

• Internal, invisible effect/result within system
• Outcomes must be revealed to user via system feedback
• Where usefulness lives
• Functional affordance of non-user-interface system functionality
• Issues are about computational errors, software bugs
Efficiency: Performance

• Perceptual fusion – two stimuli within perceptual cycle appear fused; $T_p \sim 100$ msec
• Response times:
  • < 100 msec – instantaneous
  • 0.1 – 1.0 sec – user notices the delay
  • 1.5 sec – display busy indicator
  • >1.5 sec – display progress bar
• 2-Second-Rule: users should not have to wait longer than 2 seconds for common UI actions
• 3-Click-Rule – users should not have to wait longer than three clicks to do something useful
Assessment

• Design helping user know if interaction was successful
  • Existence of feedback
  • Presentation of feedback
  • Content, meaning of feedback
Assessment

• Provide some type of feedback for all user actions
  • Helps keep the user grounded in the interactive cycle
  • Understandable error messages when things don’t work
  • Progress feedback on long operations
  • To prevent costly errors, solicit user confirmation before potentially destructive actions
    • Information on alternatives
    • But do not overuse and annoy

• Presentation of feedback – visible, noticeable location; augment with audio
Assessment (cont.)

• Feedback wording
  • Helpful, informative
  • Positive psychological tone; it’s the system’s fault
  • Language of the user and domain context
Assessment (cont.)

Mail Server Query

Results for hartson.cs.vt.edu

send: invalid spawn id (6) while executing "send "1$pid\r"" (file "/genpid_query.pass" line 31)

- Printers Folder

There was an error writing to LPT1: for the printer (HP LaserJet 6P/6MP - PostScript):
The printer is out of paper. Add more paper.
To continue printing, click retry.
Windows will automatically retry after 5 seconds.

- Retry
- Cancel
Assessment (cont.)

• Consistency of feedback
  • Departure and destination screens or objects should be labeled consistently
  • Example, name of arrival dialogue box should match departure button label or menu choice
Presentation

• Provide user control over amount and detail of feedback
  • Only most important information at first; more on demand
• Information display
  • Eliminate unnecessary words
  • Group related information
  • Control density of displays; use white space to set off
  • Columns are easier to read than wide rows
  • The reason that newspapers are printed in columns
  • Responsive design – format information to fit the screen size (more on this later)
Broad Guidelines: Simplicity

• Given two otherwise equivalent designs, the simplest is best (Ochham’s Razor)*
  • Effective and simple is a challenging design objective
• 80/20 rule – 20% of functionality gets used 80% of the time
• Good enough – choose a satisfactory solution rather than the optimal solution
  • Optimization may impose unnecessary complexity

• * “Entities should not be multiplied without necessity.” William of Ockham, 14th century Franciscan friar
Broad Guidelines (cont.)

- **Consistency**
  - Do similar things in different places the same way
  - Label similar things the same
  - A custom design style book can help

- **Use of language**
  - Avoid poor attempts at humor
  - Avoid use of anthropomorphism
  - Avoid using first-person speech
  - Avoid condescending help
    - Examples, Clippy and Bob
  - Use positive psychological tone
  - Avoid violent, negative, demeaning terms
  - Avoid use of psychologically threatening terms, such as “illegal,” “invalid,” and “abort”
  - Avoid use of term “hit”; instead use “press” or “click”
Broad Guidelines (cont.)

- More later on …
  - Grouping
  - Color
  - Text
  - Accessibility
  - Web and small screen
  - Internationalization