Chapter 5 - Attention and Memory Constraints

- Why is the human brain limited in capacity?
- Importance of designing for attentional and memory constraints
- Meaningful and memorable interfaces
- Apply techniques to structuring interfaces that are attention-grabbing and require minimal effort to learn and remember
- How to deal with information and not get overloaded

Focusing Attention

- Focused and divided attention
  - focused attention
    - the ability to attend to one event from a mass of competing stimuli in the environment
    - cocktail party phenomenon
    - relevant to activities and intentions at present time
  - divided attention
    - attempting to attend to more than one thing at a time
- properties of attention
  - involuntary vs. voluntary attention
Relevance to HCI

- Structuring information
  - make it easy to navigate through and find information
    - never too much information, never too little
    - grouped and ordered in a meaningful manner
  - other techniques for guiding attention
    - spatial and temporal cues
    - color
    - alerting techniques (flashing, audio)
    - windows (partitioning)

Guidelines for Designing Interfaces

- Important information displayed in prominent place to catch the user’s eye
- Less important information is relegated to the background
  - specific areas, user should know where to look
- Information not often requested should not be on the screen, but should be accessible
- Attention and perception are intertwined
Multitasking and Interruptions

• Interruptions
  – moment to moment demands of the situation
    • phone calls, doorbells, etc...
• Multitasking
  – carrying out a number of tasks during the same period of time by alternating between them
  – Primary vs. Secondary tasks
    • primary task = most important task at that time

Distraction

• People good at multitasking
  – prone to distraction
    • repetition and automation
• Solution = cognitive aids
  – external representations that are intended to gain our attention at a time relevant to the task that needs to be performed
• Applications to HCI
  – system inform user where he was
  – remind user of common tasks
Automatic Processing

- Automated activities
  - activities done without thinking
    - reading, writing, biking, etc…
  - characteristics of automated activities
    - fast
    - demanding minimal attention
    - unavailable to consciousness
  - Stroop effect
    - conflict between automatic skills

Automatic Processes vs. Controlled Processes

- Automatic processes
  - not affected by limited capacity of brain
  - do not require attention
  - difficult to change once they have been learned
- Controlled Processes
  - non-automatic processes
    - limited capacity
    - require attention and conscious control
Memory Constraints

• Levels of Processing Theory
  – information can be processed at different levels, from shallow analysis to deep semantic analysis
  • meaningfulness affects how well something can be remembered
  • more deeply processed items are better remembered
  • meaningful items are more deeply processed
  • contributions to meaningfulness
    – familiarity - frequency at which word occurs in everyday language
    – imagery - ability to elicit images in one’s mind

Meaningful Interfaces

• Remembered items at interface should be memorable / meaningful
  – what is meaningful?
    • confusion with commonly used words
• Common errors in interfaces
  – arbitrary assignment of commands
  – abbreviations / combination of control keys
• Use contextual, cultural, user characteristics
Meaningful Icons

• Context
  – setting in which icons are used (shoe example)

• Function / Task
  – benefits of icons
    • when recognition plays a major part in tasks
    • when unsure of precise nature of information
    • when there are a diversity of manipulative operations to be performed
  – drawbacks of icons
    • retrieve text in textual form

Meaningful Icons (cont.)

• Representation form
  – 3 forms of representation
    • use of concrete objects
    • use of abstract symbols (arrows, circles, dots)
    • combination
  – Mapping used to represent underlying concept
    • resemblance icons - depict underlying concept through analogous images (falling rock sign)
    • exemplar icons - the typical example (bathroom)
Representation Form (cont.)

- symbolic icons - conveys underlying referent that is at a higher level of abstraction than the image itself (wine glass with crack)
- arbitrary icons - no relation to underlying concept and hence association has to be learned (elephant example)

- Meaningfulness related to underlying concept
  - concrete icons = easy to remember (files)
  - abstract icons = harder to remember (warning signs)

Combinations and Animated Icons

- Combination of icons and commands
  - reduces icon confusion
  - takes up more space on screen

- Animation
  - dynamically conveys meaning of icon
  - must focus on key aspects of a function
  - small size of icons
  - can be distracting
Recognition vs. Recall

- Recognition
  - information from the world
- Recall
  - information stored in the head
- Recognizing material far easier than recalling from memory
- Cognitive mnemonics
  - aid to memory

Knowledge in the World and User Interfaces

- Graphical interfaces reduces mental effort - interface does the remembering
- People use one another as knowledge resources
- Episodic memory
  - information that is retrieved by searching through memory (experts)
- Semantic memory
  - large body of general knowledge we build up throughout our lives