COMS W4170
Menus

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Menu

- Set of displayed choices from which a user can select
  - Minimizes
    - Training
    - Memorization
    - Syntax errors
  - Good for novices, infrequent users
  - Some overlap with command languages if selection done by keyboard, but no syntax to remember
    - Is it a menu if list of choices is…
      - Post-it'ed on display?
      - Printed on kbd?
      - Displayed on computer, but not complete?

An early example of a menu created by labeling function keys
Types of Matching

- Exact / identity
- Class inclusion / categorical
- Equivalence / fuzzy

Exact Matching

- Alphabetic order > random order
  - Roughly twice as fast on small to medium-size menus
  - Best to be at top of alphabetic list
**Exact Matching**

- **Card 1982**
  - Presented participants with menu of 18 cmds, in three arrangements; needed to mouse select a specific target; average time after 43 trials:
    
    |        | Alpha | Random | Categorical |
    |--------|-------|--------|-------------|
    | Time   | .81 sec | 3.23 secs | 1.28 secs |

  - After > 800 trials, search time is faster, but no significant difference for all conditions; participants have learned exact cmd location

**Exact Matching**

- But, will user really know the target?
  - Months, days, states will work, but,…
    - Postal state abbreviations?
    - Editing commands?
      - Conventional names help!
    - Domain-specific commands?
Choosing a Menu Organization

Exact Targets
- Conventional Order?
  - Short List?
    - Distinctive Categories?
      - Well-Known Categories?
        - Conventional order
          - Alphabetical order
            - Categorical order
              - Conventional order
                - Alphabetical order
                  - Alphabetical order
        - Neither
          - Conventional order
            - Alphabetical order
              - Categorical order
                - Conventional order
                  - Alphabetical order
                    - Alphabetical order

Fuzzy Targets
- Conventional Order?
  - Short List?
    - Equally Likely?
      - Conventional order
        - Alphabetical order
          - Categorical order
            - Conventional order
              - Alphabetical order
                - Categorical order
                  - Frequency order

Menu Graph Structure
- Single menu
- Temporal vs. spatial set of choices
  - Linear sequential (temporal)
    - User given one choice at a time in order,… but designer should
      - Let user navigate forward/backward
      - Display previous choices
      - Let user know how much is left/has been done
  - Simultaneous (spatial)
    - User determines order, can better understand interactions among choices,… but designer should
      - Allocate more space
      - Modify remaining choices based on previous ones (e.g., disable choices that no longer apply)
Menu Graph Structure

- Tree
- Directed Acyclic Graph
  - Often occurs through reuse of “submenus” in different branches
- Directed Graph
  - E.g., WWW
  - Potential for confusion, ∞ loops!
    - Maintain history
    - Provide ability to return (“back” button/menu)
    - Show location

Menu Tree Breadth vs. Depth

T. Landauer & D. Nachbar 85

- Task: Search huge ordered tree of either ints (internal nodes are numerically ordered ranges) or words (internal nodes are alphabetically ordered ranges)
- 4096 leaf items
- Varied depth/breadth: 2–16 items/level arranged 2×12 through 16×3
- Measured selection times: 23.4–12.5 secs: Breadth faster than depth!
- \( T = c + k \log_2 b \), where
  - \( T \) is time for selection within a level
  - \( c \) and \( k \) are constants (\( k \) decreases with practice)
  - \( b \) is breadth at that level
- \( D = \log_b N \), where
  - \( D \) is depth
  - \( N \) is total number of leaf items
- Therefore, total time = \( DT = \log_b N (c + k \log_2 b) = c (\log_b N) + k (\log_2 N) \)
  - Breadth faster than depth!
  - Choices are progressively slower up to penultimate level (harder category match)
  - Choice at last level is relatively fast (exact match)

Hick-Hyman Law: Time to choose among \( b \) equally probable choices is proportional to \( \log_2 b \)

Note: Assuming no need for exhaustive scan!

Sometimes expressed in terms of \( (b + 1) \) to account for additional option of not making a choice

\[ \log_a b \log_b c = \log_a c \]
**Menu Tree Breadth vs. Depth**

- Breadth faster than depth
- Still need to avoid getting lost
  - Cascade
    - Maintains context
    - Quick return to top
    - Relatively easy to back up one level at a time
  - Dexterity issues
    - Can address with delay

**Menu Design**

- Group items meaningfully
  - Logically similar (cohesion)
    - Categorical organization advantages are lost with poor categorization
  - Cover all possibilities (complete)
  - No overlap (partition)
  - Users should be familiar with item meanings
- Phrasing
  - Familiar
  - Consistent
  - Distinctive
  - Concise
  - Keyword to the left
Split Menus

- Menus divided into sections (often two) with more frequent items in the top section
- Can be more efficient than conventional alphabetic menus [Sears & Shneiderman 94]
  - Short first section (e.g., ≤ 4 items)
  - Sections ordered the same way