COMS W4170
Command Languages & Menus

Steven Feiner
Department of Computer Science
Columbia University
New York, NY 10027

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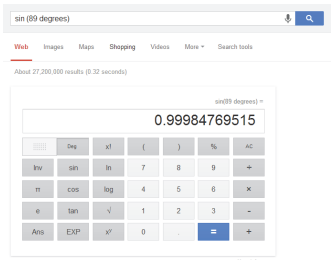
Command Languages

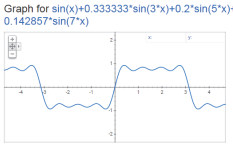
- One of earliest computer IO metaphors after cables/toggle switches/meters
- User must
  - recall notation
  - initiate actions

- Unlike other UI approaches before and after, added functionality doesn't modify UI appearance
- Possibility for excess, baroque complexity
  - !?str?:s/ls/rmdir/:p
  - Does the language have too much functionality? Or does the user have too little training?

Command Languages

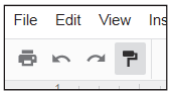
- Still relevant because of
  - Prevalence of textual programming languages
  - "Little languages", "Domain-specific languages"
    - *Awk, HTML, CSS,* but also…
    - Google
      sin 89 degrees
      volume of a cylinder with radius 8 cm and height 2 ft
      2.64 USD per gallon in INR per litre
      0x3a4 + 0xfe3 in roman numerals
      sin x + 1/3 sin 3x + 1/5 sin 5x + 1/7 sin 7x
  - "Need for speed" in interactive systems
    - Text editing, with hands already on kbd (avoid T_H to mouse)
    - Keyboard shortcuts
    - Regular expressions: E.g., "mv a*D*.c ~/proj/src"

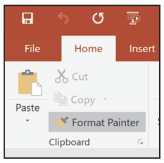




Organization

- Single command
  - ^f ^b ^d del delete …
- Command plus args
  - Prefix, postfix, infix
- Command plus args (with options)
  - Optional trailing args
  - Use of option indicator (e.g., "-")
  - Use of keyword args in arbitrary order (e.g., "<html lang="en-US">")





Structure

Remember: We're trying to minimize the number of rules

- Consistent argument order
  - strcpy, strcat,…
    - dest=arg1, src=arg2
  - bcopy
    - dest=arg2, src=arg1
- Consistent, hierarchical naming

L		RRA
ST		RAR
	vs.	RAA
		RRR

Hierarchy and Congruence

J. Carroll 1982

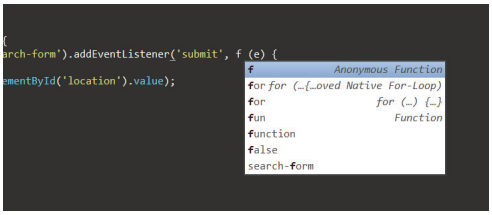
- Hierarchical structure
  - E.g., "Verb object qualifier"
- Congruent (symmetrical) names
  - Meaningful opposites
- Experiment using paper-and-pencil task for small cmd set
  - {congruent, noncongruent} × {hierarchical, nonhierarchical} cmd sets
  - Users
    - liked / performed best with both congruent forms
    - had lowest error rates on hierarchical congruent
- Hierarchical / Congruent
  - Move robot forward
    Move robot backward
- Nonhierarchical / Congruent
  - Advance
    Retreat
- Hierarchical / Noncongruent
  - Move robot forward
    Change robot backward
- Nonhierarchical / Noncongruent
  - Go
    Back

Interactive Documentation/Completion

- Addresses problem of recall

```
skf:ober.cs.columbia.edu 54: l
label                          lkbib
labelit                        ll
lambda                         llc2
lamed                          ln
```

Assorted command line shells



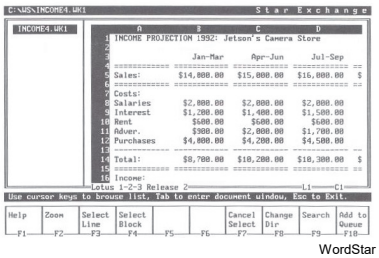
Sublime Text 2

Menu

menu \'men-(ˌ)yü, 'mān-\ *n, pl* **menus** [F, fr. *menu* small, detailed, fr. OF — more at MINUET] (1837) **1 a** : a list of the dishes that may be ordered (as in a restaurant) or that are to be served (as at a banquet) **b** (1) : a comparable list or assortment of offerings ⟨a ~ of television programs⟩ (2) : a list shown on the display of a computer from which a user can select the operation the computer is to perform **2** : the dishes available for or served at a meal; *also* : the meal itself

- 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



WordStar

Types of Matching

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

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Exact Matching

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

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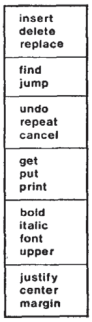
Exact Matching

Categorical menu



- Card 1982
  - Presented participants with menu of 18 cmds, in three arrangements; they needed to mouse-select a specific target; average time after 43 trials:

Alphabetical	Random	Categorical
.81 sec	3.23 secs	1.28 secs

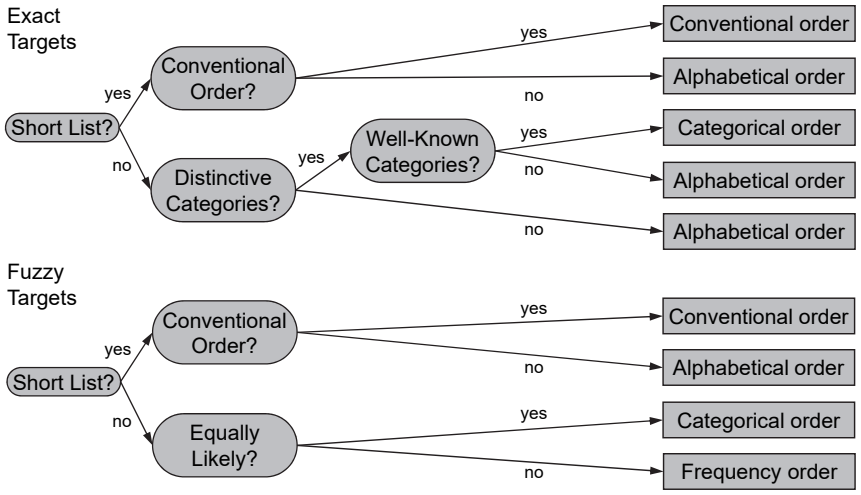
  - After > 800 trials, search time is faster, but no significant difference across *all* conditions; participants have learned exact cmd location

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

K. Paap & R. Roske-Hofstrand, Choosing a Selection Technique in *M. Helander, Handbook of HCI, 1988*



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

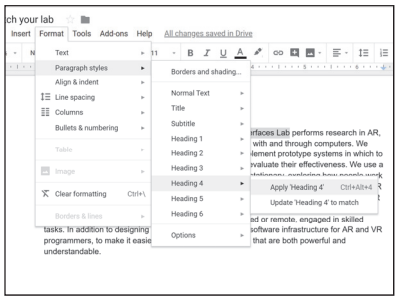
$\log_a b \log_b c = \log_a c$

Menu Tree Breadth vs. Depth

- Fewer levels → faster
  but
- More items in a level →
  more screen space
  or
  need to use scrolling (requiring more time)

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



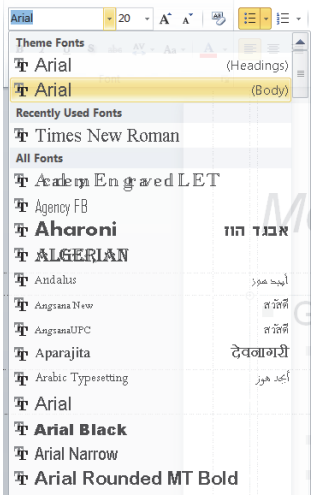
Google docs

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

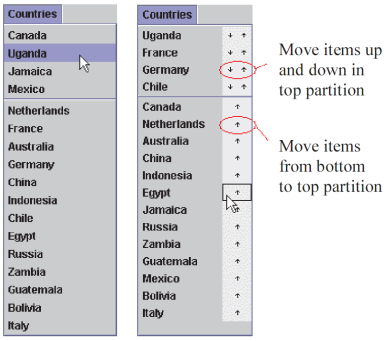
Split Menus

- 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



Static, Adaptive, and Adaptable Menus *L. Findlater & J. McGrenere, CHI 2004*

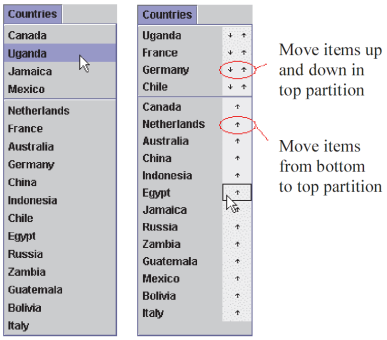
- Compared three types of *split menus* with fixed split sizes (four on top)
  - *Static* (top items are the most frequent prior to study)
  - *Adaptive* (top items *chosen dynamically by algorithms during study* based on frequency/recency)
  - *Adaptable* (top items *chosen by user prior to timed study block*)



Static, Adaptive, and Adaptable Menus *L. Findlater & J. McGrenere, CHI 2004*

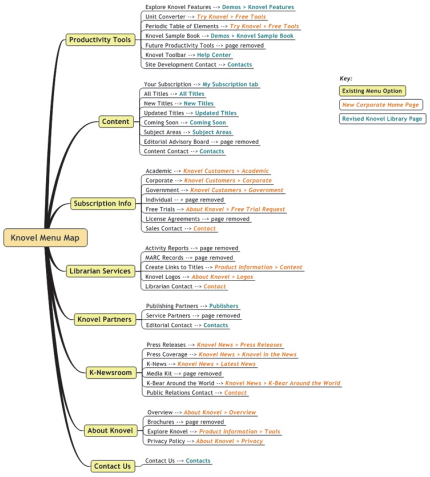
- Within-subject, counterbalanced for order
- Static faster than adaptive
- Adaptable faster than adaptive, *except when adaptable used first* (was slower then)
- Adaptable not slower than static *except when adaptable used first* (was slower then)
  - Why? Top item list initially empty in adaptable menus and participants who used adaptable menu first were less likely to customize. (Were asked to customize without seeing the advantages of customization.)

Subjective: Majority of participants preferred adaptable and thought they were most efficient with adaptable menus.



Menu Map

- Visual representation of graph structure of a system's menus
- D. Parton et al. 1985 experiment
  - Use of menu maps for 12 mins better than practicing for 12 mins, when followed by 10 mins working with 3×3 menu
  - "Big picture" of a menu map has advantages for learning over "peephole" experience of real navigation with a menu



http://www.info.knovel.com/newsite_menumap.htm

Site Map

- Representation of web site structure
  - Often hand curated, showing only the top level

I cannot find the CBS.com show or the CBS Interactive website that I am looking for. Where should I look?

For a complete list of CBS Shows and websites, please visit the CBS "Site Map."

See http://www.nngroup.com/articles/site-map-usability

http://www.cbs.com/site-map

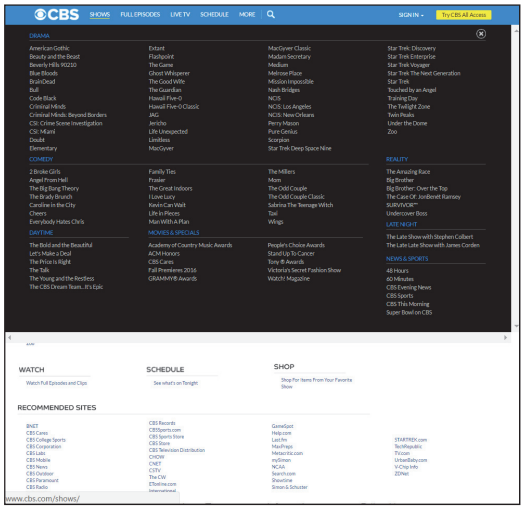
Site Map

- Representation of web site structure
  - Often hand curated, showing only the top level

Mostly superfluous in this case, courtesy of this "mega menu"

See http://www.nngroup.com/articles/site-map-usability

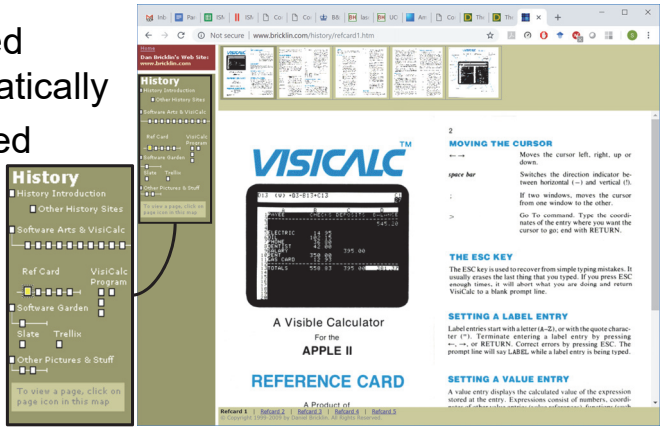
"Mega menu" displayed by hovering over "SHOWS" (Note different categorization of items)



http://www.cbs.com/site-map

Site Map Variation: Showing Link Structure and User Location

- Can be
  - Created automatically
  - Included on all pages



http://www.bricklin.com/history/intro.htm