UI Learnability and Efficiency

Adapted from materials of
- MIT CS Course 6.813/6.831
- Jakob Nielsen, Usability Engineering, 1994

Usability is only one attribute

(Jakob Nielsen, Usability Engineering, 1994)

Outline

- Usability dimensions overview
- Learnability
  - Human memory
  - Models
  - Learnability principles
- Efficiency
  - Human information processing
  - Pointing efficiency
  - Design principles
- UI Hall of Fame or Shame

Usability definition

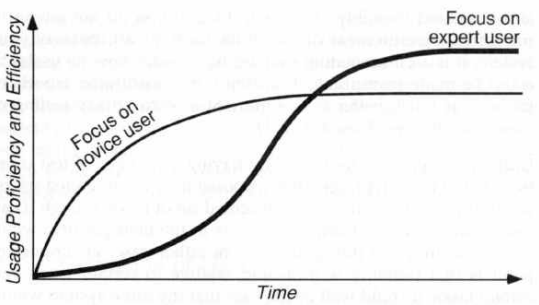
- Usability
  - How well users can use the system's functionality
- Dimensions
  - Learnability
    - How easy it is to learn and use?
  - Efficiency
    - How quickly users perform tasks using the UI?
  - Memorability
    - How easy it is for users to reestablish proficiency?
  - Errors
    - Are the errors committed by users often? Is it easy to recover from errors?
  - Satisfaction
    - Are users satisfied with the UI?

Learnability

Outline

- Learning curve
- Human memory
- Models relevant to UI design
- Learnability principles

Learning curve



(Jakob Nielsen, Usability Engineering, 1994, page 28)

Mini experiment

- Try to remember items below as many as you can

CSC13112
Báo chí
TKGD
Google
Phần mềm
Nóng
Con người
Nhà đất
Xe đạp
USC
Trịnh Công Sơn
Valentine
ebook
Nhân văn
Google
U23
Kỹ sư mù sử

Mini experiment (cont'd)

- How many items do you remember?
- How could you remember them?
  - familiar?
  - funny?
  - attracting your attention?
  - related?
  - repeating them?

Memory

- Short-term memory (working memory)
  - Small: ~ 7 items or "chunks"
  - Short-lived: ~10 seconds
  - Repeating helps retain chunks
    - Distraction does the opposite

Short-term memory ⟷ Long-term memory

- Long-term memory
  - Unlimited size and duration
  - Elaborative rehearshal helps transfer chunks from short-term to long-term memory

Learning

- A process of transferring and putting information from short-term to long-term memory

Short-term memory → Long-term memory

- Implications for user interface design?

Chunking

- Chunk is a unit of memory or perception
  - Depends on how the information is presented

H A PPY V A L E T I N E ← Hard to remember all

HAPPY VALENTINE ← Easy remember all

  - Depends on what you already know
    - Linking with the past experience

0888247247 → 0888.247.247

323-481-1585

How many chunks to a child?

WHAT DO WE LEARN FROM CHUNKING FOR UI DESIGN?

Recognition and Recall

- Recognition
  - Remembering with the help of a visible cue (evidence – bằng chứng)
  - e.g., you recognize your friend easily when seeing his/her face, but you may not remember his/her name.

Một giao diện tốt là giao diện *
- [ ] Dễ học
- [ ] Hiệu quả
- [ ] Dễ nhớ
- [ ] Có nhiều màu sắc
- [ ] Tránh và phục hồi lỗi tốt
- [ ] Mới lạ

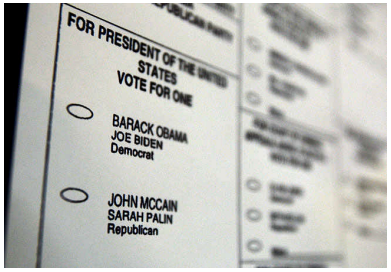
Recognition and Recall (cont'd)

- Recall
  - Remembering with no help
  - e.g., you remember a person when someone refers to him
  - Do you remember her name?

- It is easier to recognize than recall things
  - You don't remember every items in the File menu of Notepad, do you?
  - But you recognize their functions when you look at them

Recognition and Recall (cont'd)

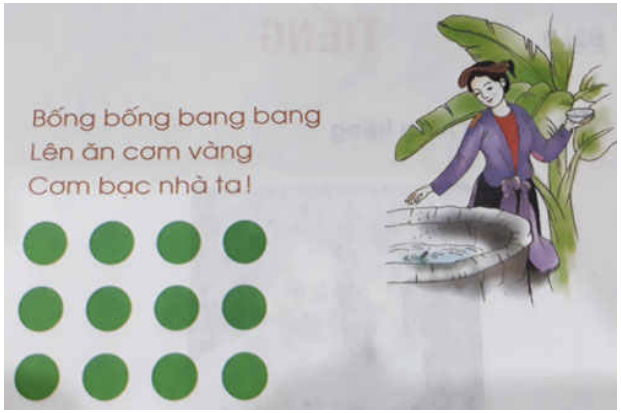
- Which one is recall and recognition?



FOR PRESIDENT OF THE UNITED STATES

WRITE NAMES OF THE CANDIDATES TO VOTE FOR

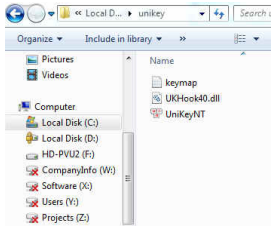
Recognition or Recall?



Recognition and Recall (cont'd)

- Implications
  - Performing operations via visual presentation is more learnable than via command line
  - Direct manipulation is more learnable than other interface styles

Delete a file name keymap.txt



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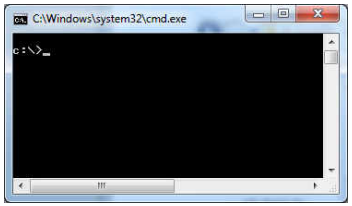
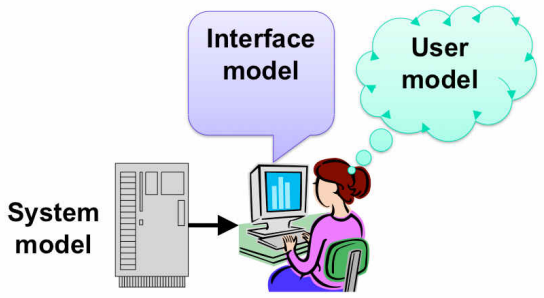


What do you need to remember to do?

Models

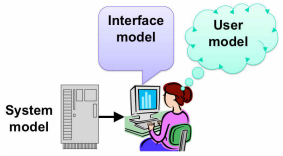
- Model of a system is a presentation of its operations
  - Elements of a system
  - How these elements work together to carry out its operations



(Source: MIT CS Course 6.813/6.831)

Models (cont'd)

- Three kinds of models relevant to UI design
  - System model or implementation model
    - Internal structure and interactions of the system operations
    - How system works internally
    - Visio's objects vs. Photoshop's images
  - Interface model
    - How system works through its interface
    - Command line vs. Menu
    - Editing Visio's objects vs. editing Photoshop's images
  - User model or mental model or conceptual model
    - How the user thinks the system works



Models (cont'd)

- Interface model encapsulates or hides system model
  - It should be simple and appropriated
- Intreface model should closely reflect user model
  - Does this beautiful dog do searching?
- User model may be wrong
  - So, errors happen

Is this a watch?

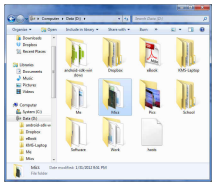
What does the dog icon mean?

Learnability Principles

- Ways to communicate and present the system model
  - Affordances
  - Natural mapping
  - Visibility
  - Feedback
- Consistency
  - Internal, external, and metaphorical
  - Speak the user's language
  - Metaphors
  - Platform standards

Affordances

- "Perceived and actual properties of a thing" – *Don Norman*
- "Perceived" may be different from "actual"



Which one has more affordance?

Natural mapping

- Physical arrangement of controls matches arrangement of their operations
- It's best to map directly, but not always have to be
  - Light switches
  - Car's turn signals

Visibility

- Operations should be visible to users
  - Unix commands are very invisible vs. Windows' menus
  - Right click menus are not very visible
    - A reason why iOS does not support much right-click
  - Drag-drop is not either
    - But it's a direct manipulation style reflecting real world

- Visibility versus Simplicity
  - More visibility may result in reduced simplicity

Feedback

- Actions should have immediate effects
  - e.g., push buttons, scroll bars, mouse icons
- Feedback types
  - Audio
  - Visual
  - Haptic (giving a feeling, e.g., vibration of a mouse click)

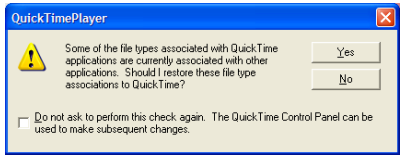
Consistency

- Similar things should work similarly
  - Fonts, colors, icons, layouts, etc.
- Different things should look different

- Consistency types
  - Internal: within the system
  - External: across different systems
  - Metaphorical: reflecting real-world objects
    - A print icon is a metaphor of the printer

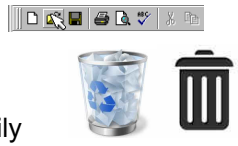
Concistency (cont'd)

- Speak the user's language
  - Use common words, avoid slangs and jargon
  - But avoid wordy and overly verbose



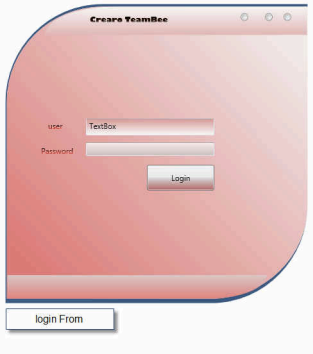
Metaphors

- Metaphor is a presentation of real-world in user interface
- Advantages
  - Highly learnable
  - Connect with user's existing model easily
- Problems
  - Hard to design metaphors that are appropriate
  - Potentially deceptive and misleading
  - May not be used consistently everywhere
  - Cuturally dependent (localization issue)



Platform standards

- Follow guidelines of platforms
  - MS Windows user interface guidelines
  - Apple user experience guidelines
- Follow frameworks
  - Various frameworks have their own looks and feels guidelines
- Learn from existing applications



Group activity

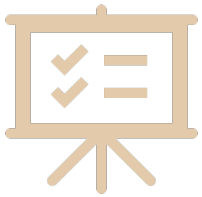
- Form groups of 5 each
- Discuss and make the following design more learnable
- You have 20 minutes to do
- Report results: 2 groups, 5 minutes each
- Use your plain paper to sketch

Misfit Shine 2

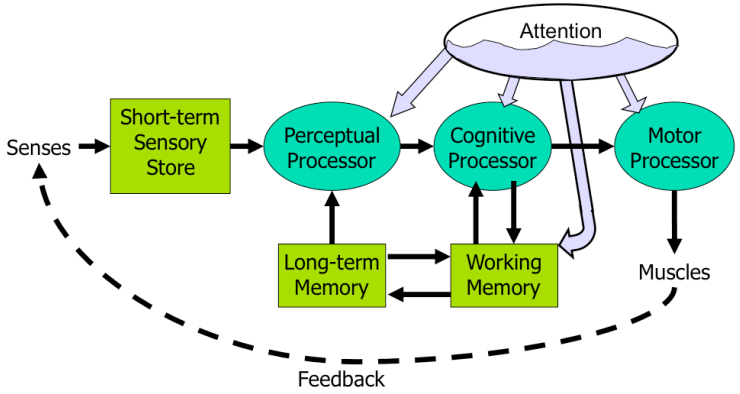
Efficiency

Outline

- Human information processing
- Pointing efficiency
- Design principles



Human information processing

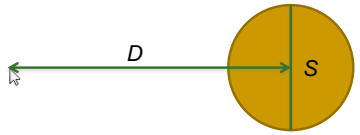


(Source: MIT CS Course 6.813/6.831)

Fitts's law

- Time *T* to move hand to a target of size *S* at distance *D* away from the mouse pointer is

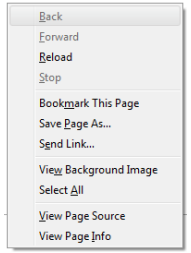
  $T = a + b * \log (D/S + 1)$



  - *a* and *b* are constants
  - *T* is dependent only on *log (D/S + 1)*
  - *log (D/S + 1)* is defined as *index of difficulty*

Implications of Fitts's law

- Similar targets should be grouped
- Targets at screen edge are easy to hit
- Pie menu is faster to use than linear menu
  - It's faster 15-20% according to a study by Callahan, 1994
- Lengthy menus should be avoided



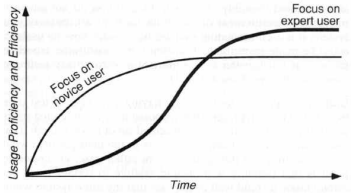
(Callahan et al. 1994, "An empirical comparison of pie vs. linear menus," CHI 1991)

Power law of practice

- Time T_n to do a task the *n*th time is

  $T_n = T_1 * n^{-a}$

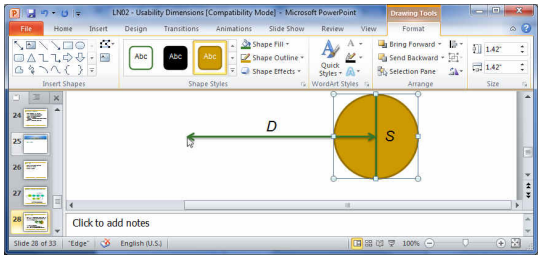
  a is typically from 0.2 to 0.6



- Implications
  - With practice, novices get better
  - But their performance becomes nearly flat
  - Remember the Nielsen's Learning curve?

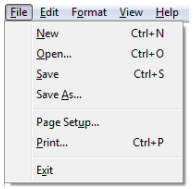
Principles to improve efficiency

- Make often-used targets big
- Group targets that are used together
  - Grouped toolbar buttons, menu items, etc.
- Place oftenly-used menu items on top of menu
- Use screen corners and edges



Principles to improve efficiency (cont'd)

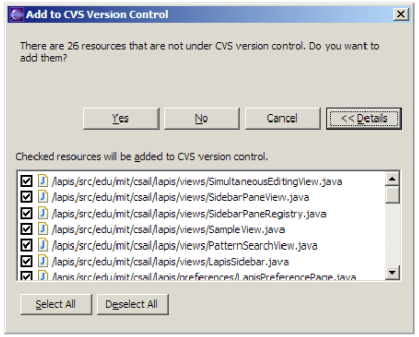
- Use keyboard shortcuts and menu accelerators



- Predefine a group of styles

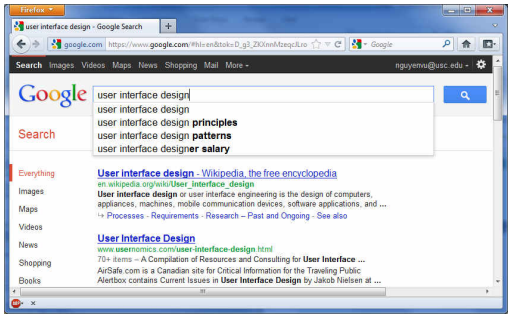
Principles to improve efficiency (cont'd)

- Aggregating and choose most common selections by default
- Use defaults



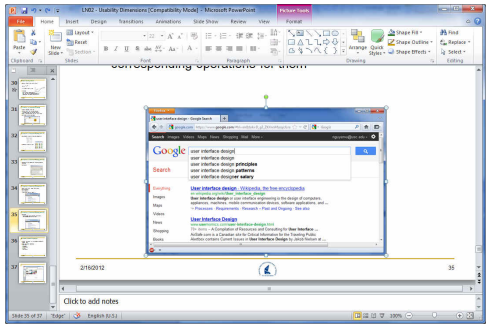
Principles to improve efficiency (cont'd)

- Keep history (e.g., recent files in Word)
- Auto completion
- Auto suggestion
  - This makes you lazy, doesn't it?



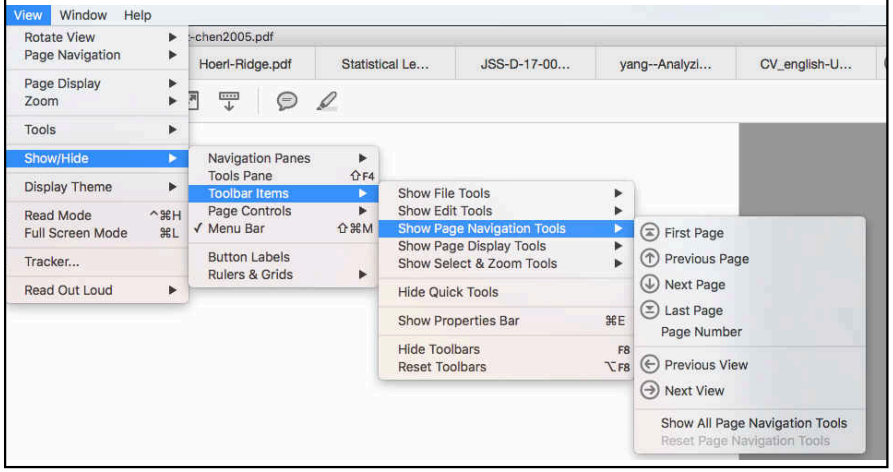
Principles to improve efficiency (cont'd)

- Anticipation
  - Anticipate what users will do next and present corresponding operations for them



Bad menu for efficiency

- Acrobat Reader for Mac



Let Your Ideas Flow

- Chindogu, Japan

Exercise 2

- Propose a design for withdrawing money from ATM as fast as possible.