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UI Learnability and Efficiency

3/3/2016

Adapted from materials of

- MIT CS Course 6.813/6.831
- 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?

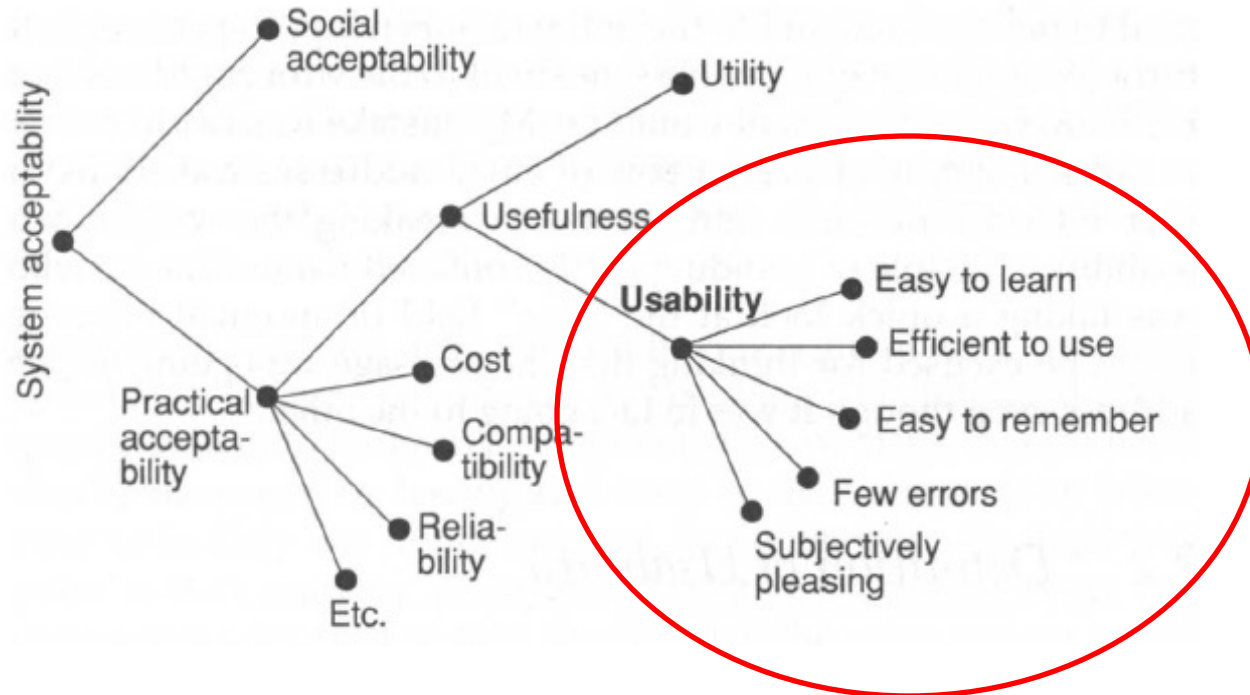
- Errors

- Are the errors committed by users often? Is it easy to recover from errors?

- Satisfaction

- Are users satisfied with the UI?

Usability is only one attribute



(Jakob Nielsen, Usability Engineering, 1994)



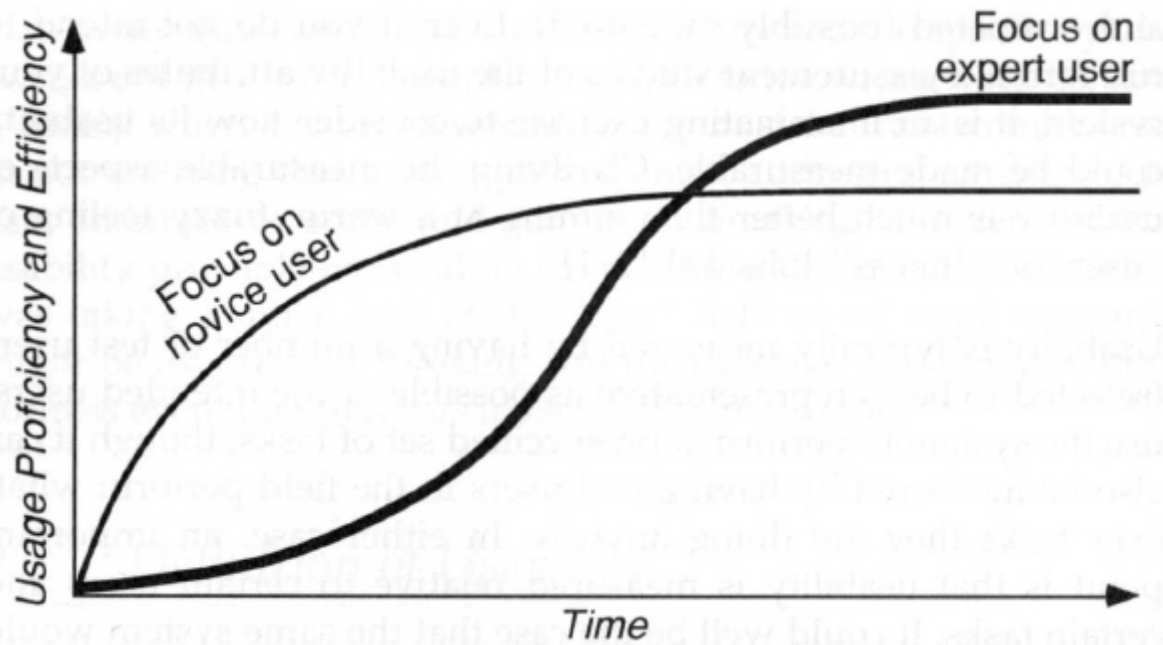
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Learnability

Outline

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

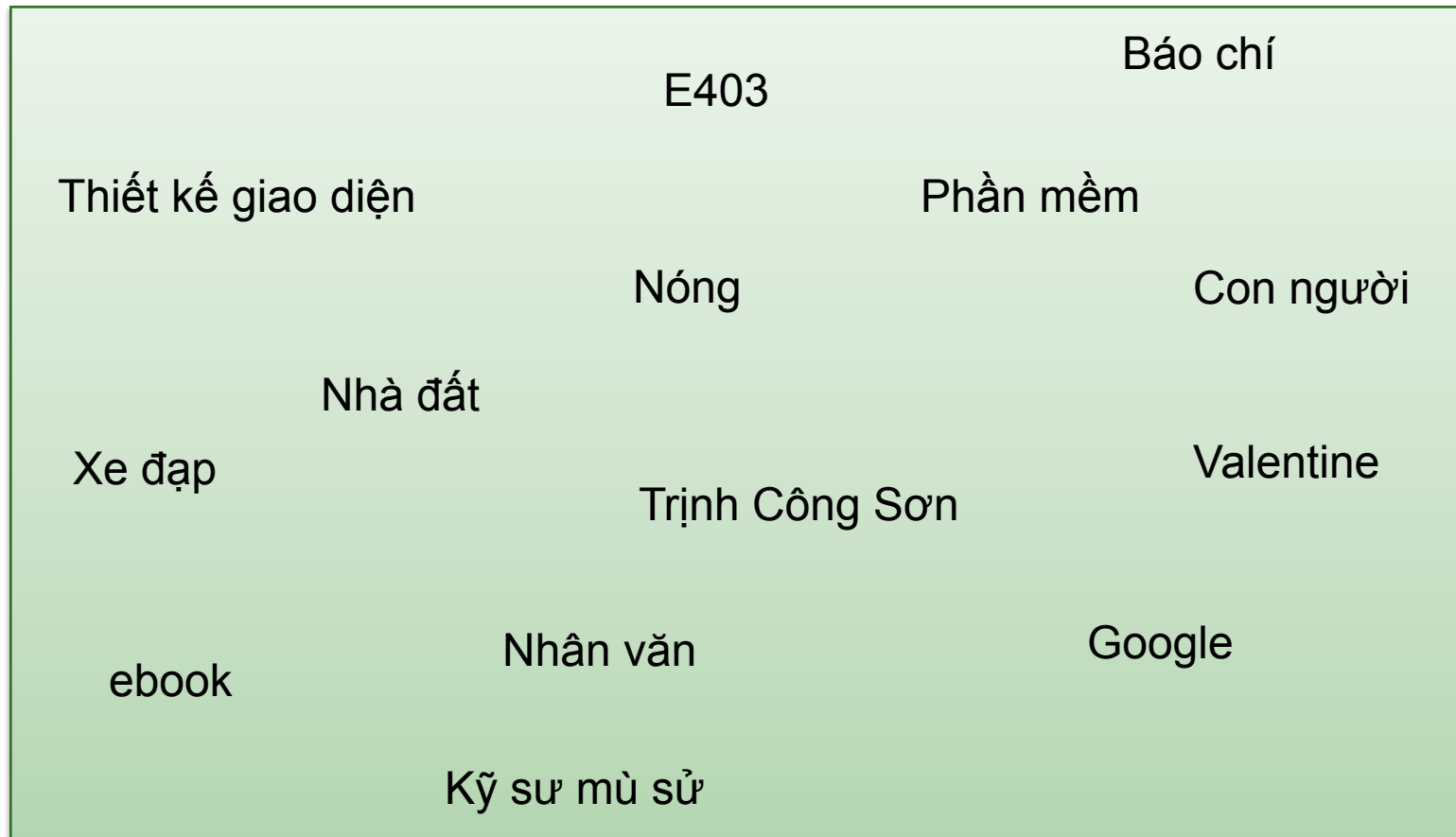
Learning curve



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

Mini experiment

- Try to remember items below as many as you can



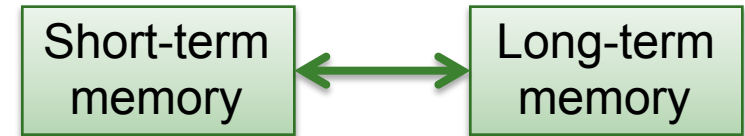
Mini experiment (cont'd)

- 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



- Long-term memory

- ❑ Unlimited size and duration
- ❑ Elaborative rehearsal 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

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

Recognition and Recall

■ Recognition

- ❑ Remembering with the help of a visible cue (evidence – bằng chứng)
- ❑ e.g., you recognize someone when looking at his face or photo

■ Recall

- ❑ Remembering with no help
- ❑ e.g., you remember a person when someone refers to him

■ It is easier to recognize than recall things

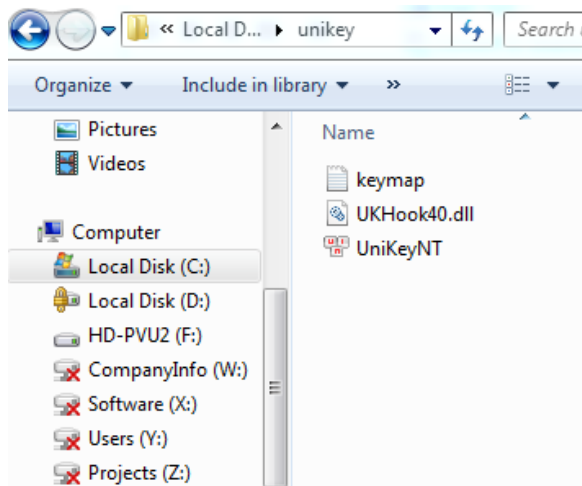
- ❑ You don't remember every items in the File menu of Notepad, do you?
- ❑ But you recognize their functions when you look at them

Recognition and Recall (cont'd)

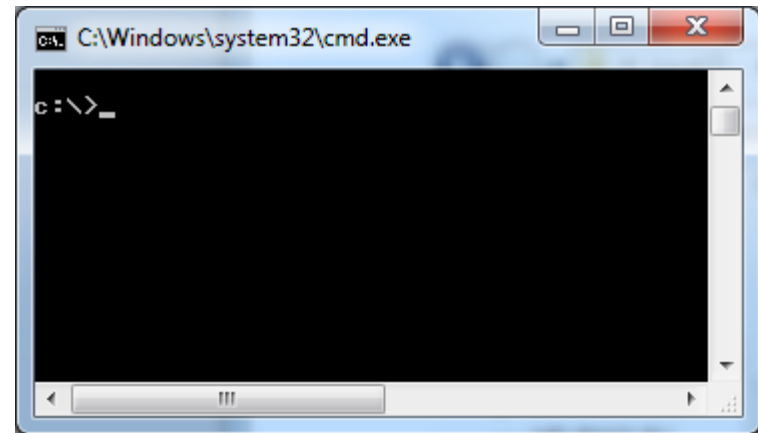
■ Implications

- ❑ Performing operations via visual presentation is more learnable than via command line
- ❑ Direct manipulation is more learnable than other styles of interfaces

Delete a file name keymap.txt



Delete a file name keymap.txt

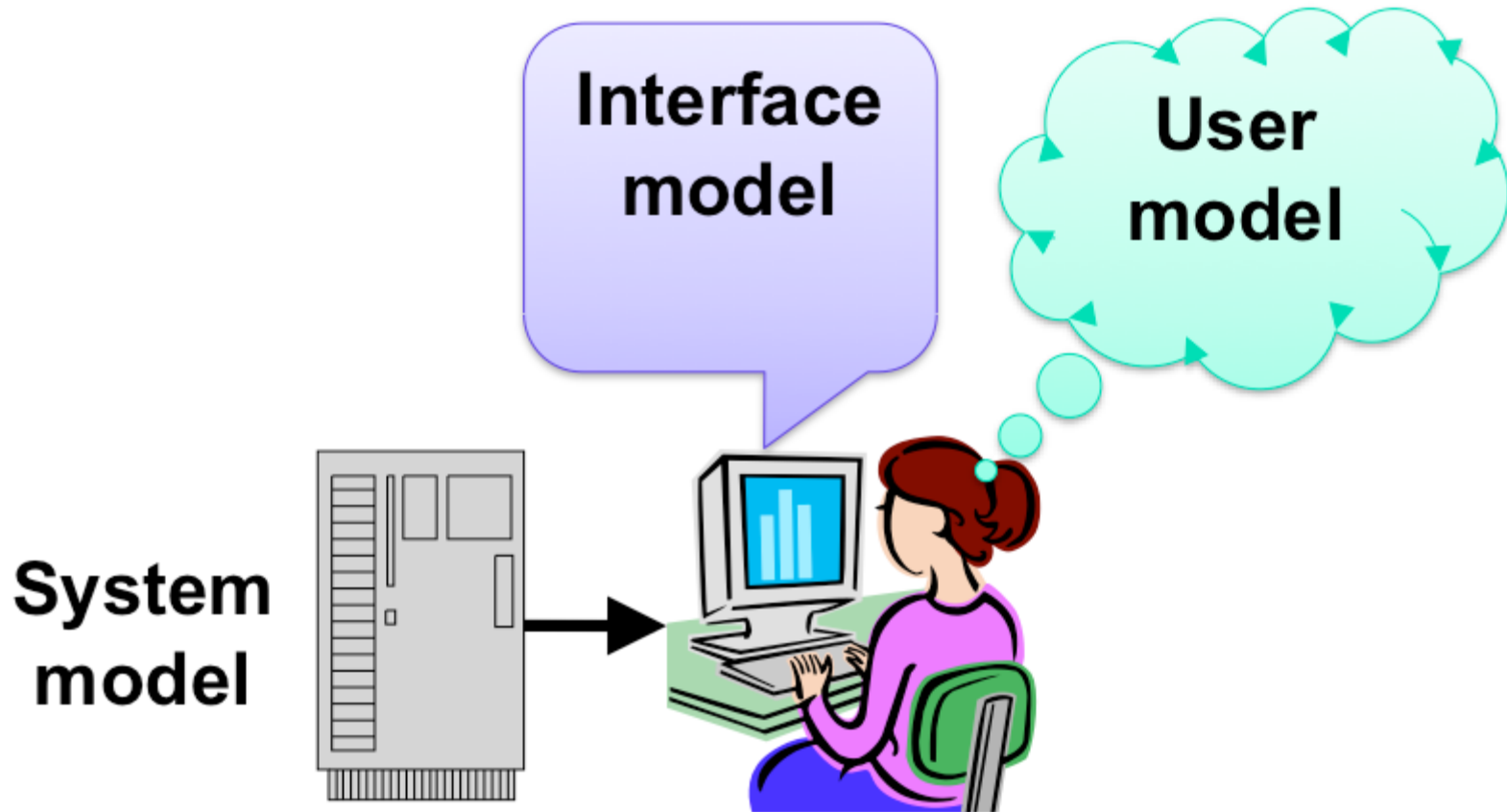


What do you need to remember to do?

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
- Three kinds of models relevant to UI design
 - System model or implementation model
 - Internal structure and interactions of the system's 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)



(Source: MIT CS Course 6.813/6.831)

Models (cont'd)

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

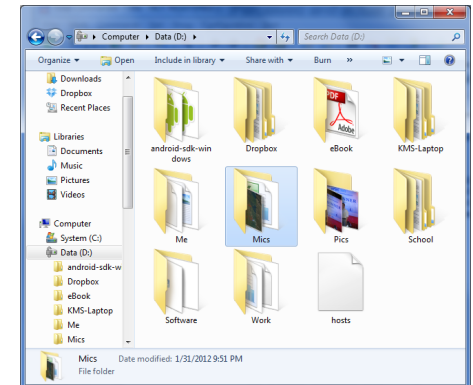


Learnability Principles

- 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"



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

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)

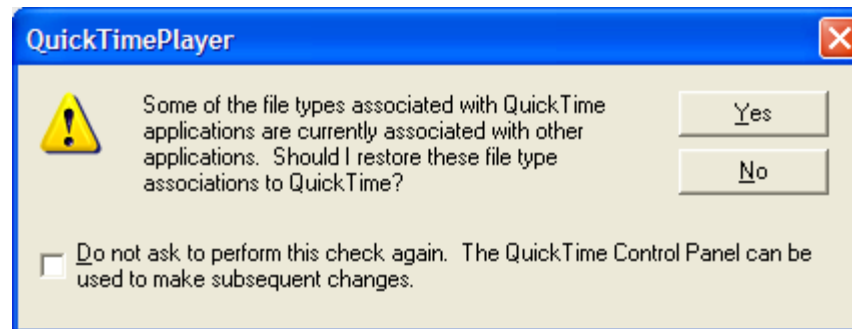
Consistency

- Similar things should work similarly
- 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
- ☐ Culturally 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

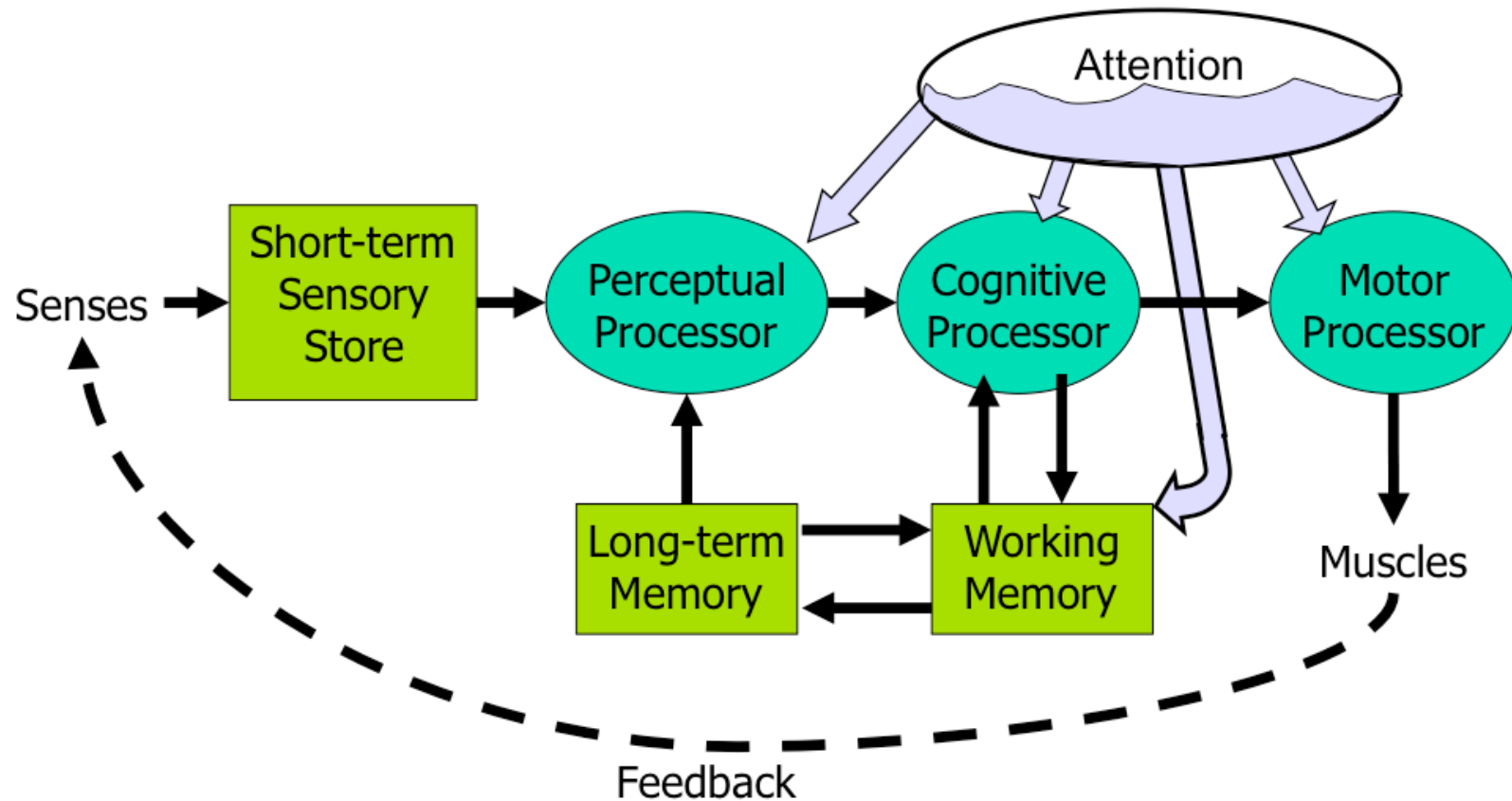


Efficiency

Outline

- Human information processing
- Pointing efficiency
- Design principles

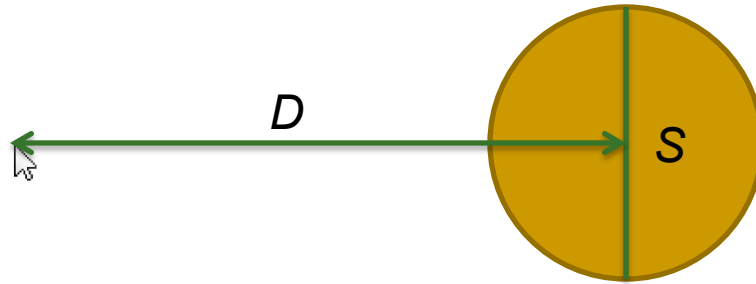
Human information processing



(Source: MIT CS Course 6.813/6.831)

Fitts's law

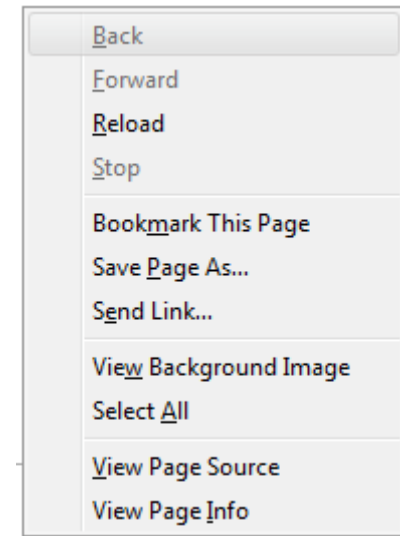
- Time T to move hand to a target of size S at distance D away from the mouse pointer is
$$T = a + b * \log (D/S + 1)$$



- 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

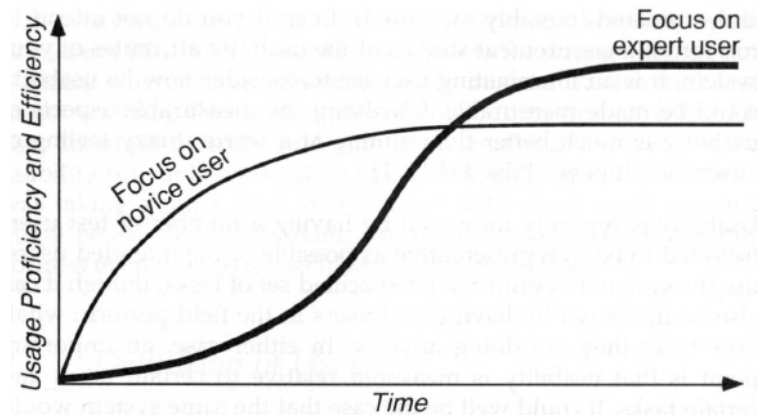
- Time T_n to do a task the n th time is

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

a is typically from 0.2 to 0.6

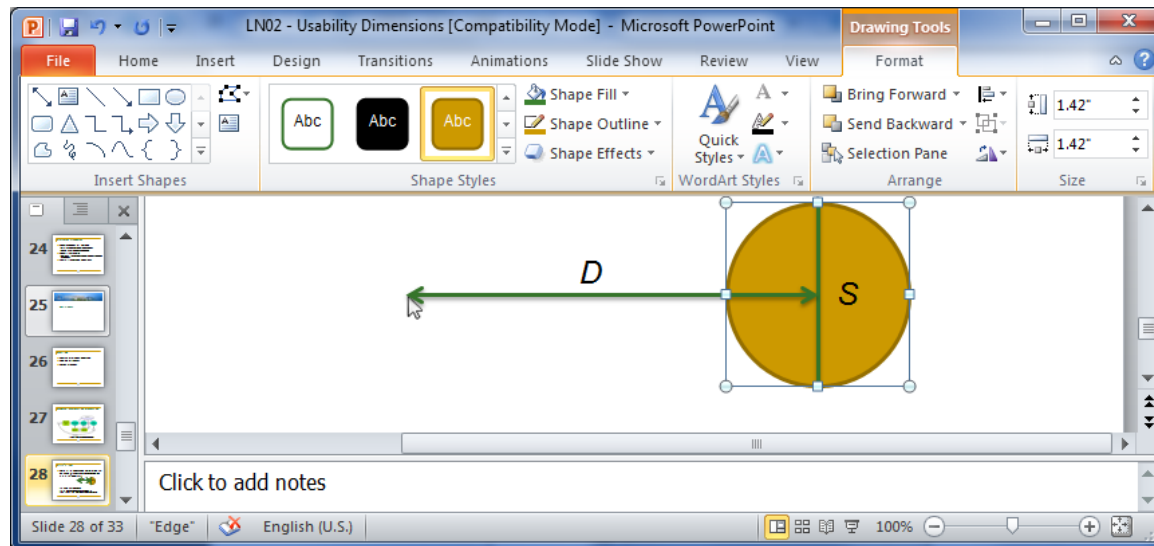
- Implications

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



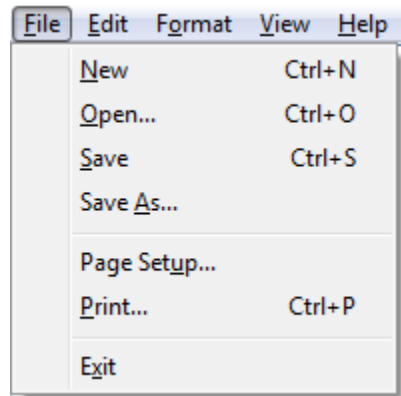
Principles to improve efficiency

- 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

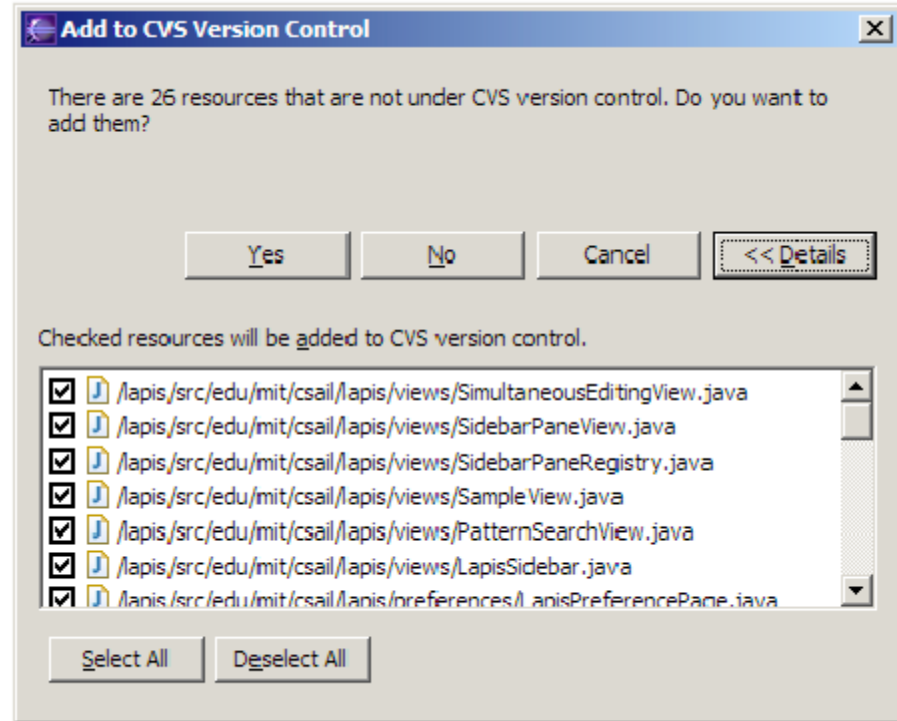


- Predefine a group of styles



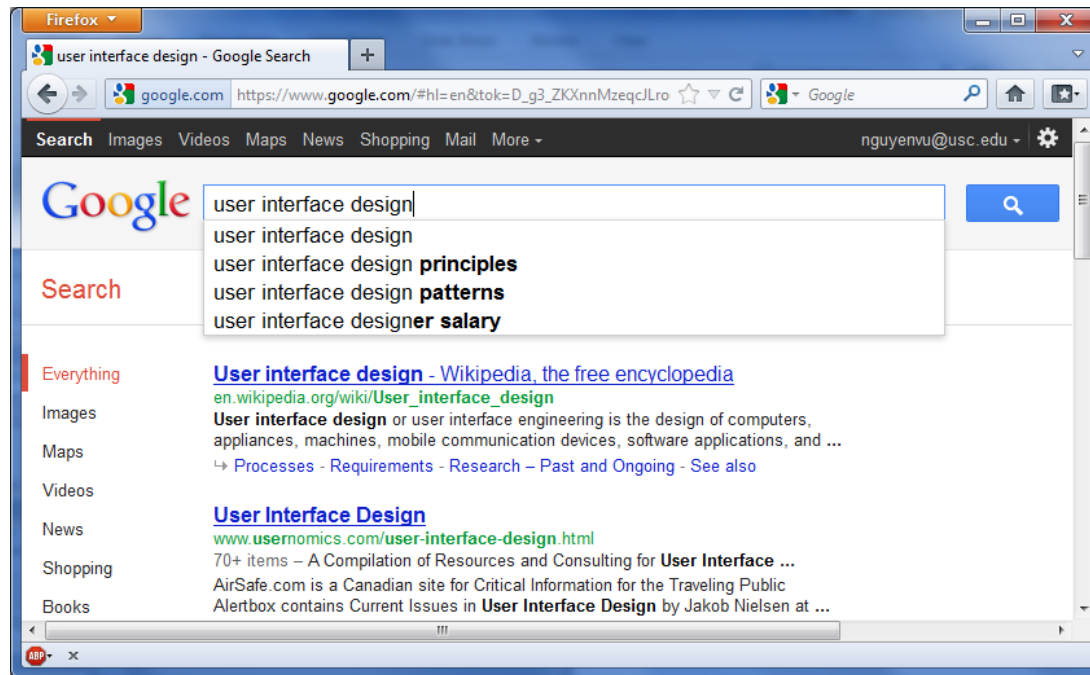
Principles to improve efficiency (cont'd)

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



Principles to improve efficiency (cont'd)

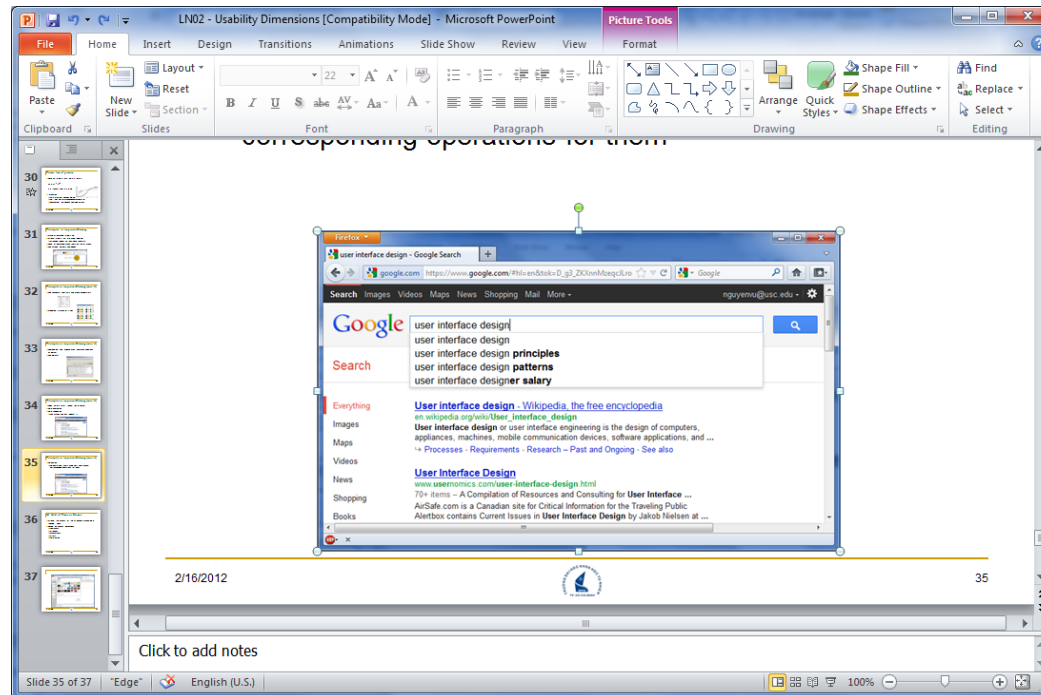
- Keep history (e.g., recent files in Word)
- Auto completion
- Auto suggestion
 - This makes you lazy, doesn't it?



Principles to improve efficiency (cont'd)

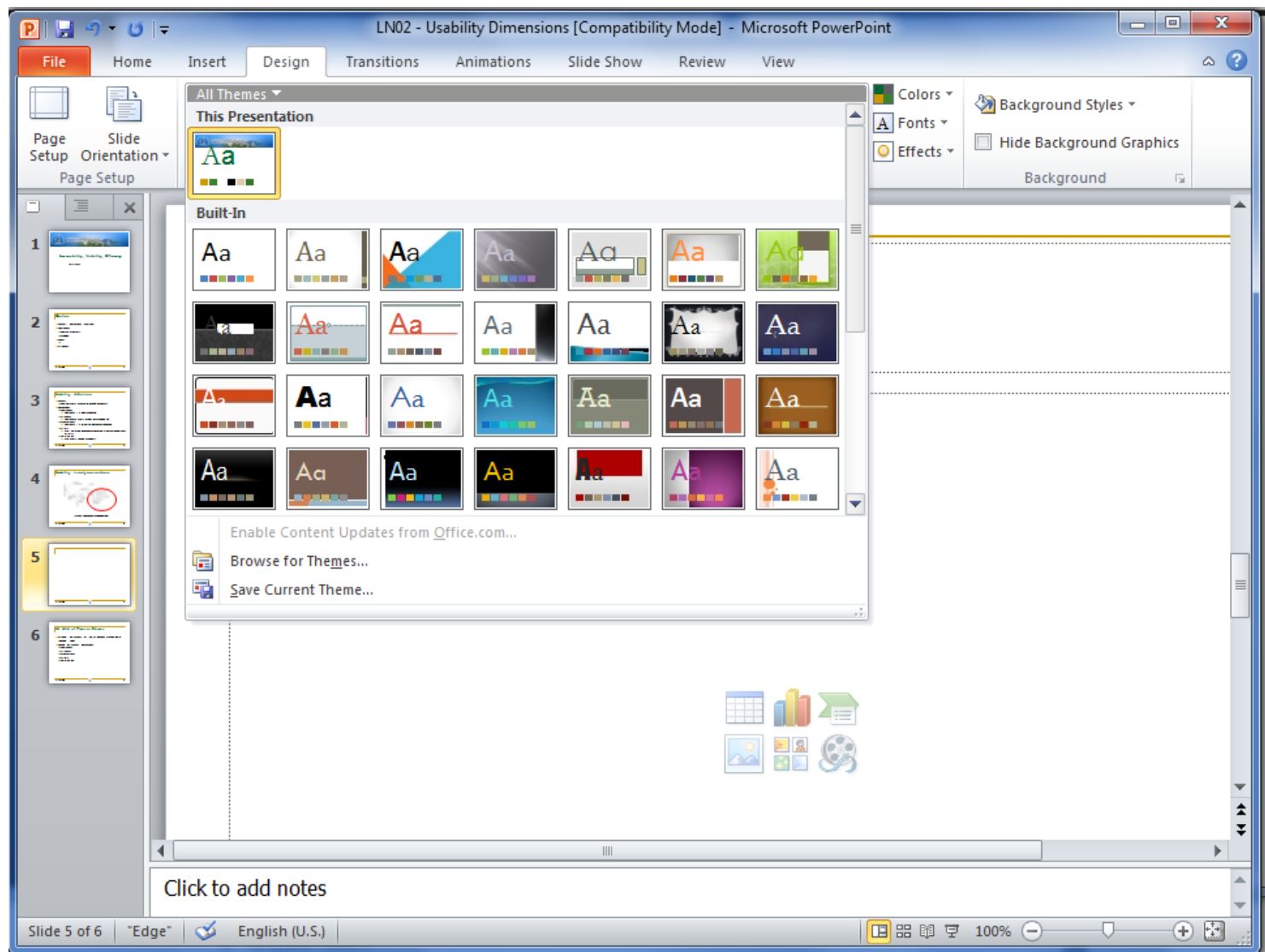
■ Anticipation

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

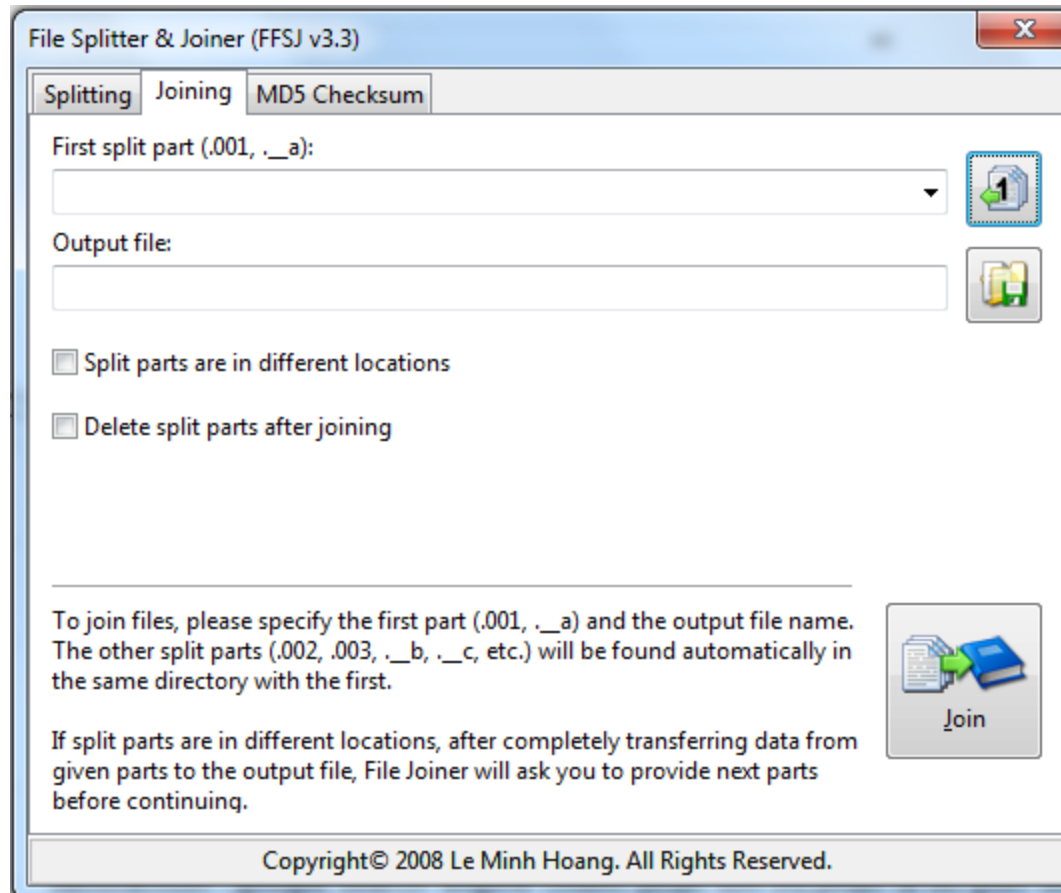


UI Hall of Fame or Shame

- Critique the usability of the UI designs presented in following slides
- Based on usability dimensions
 - ❑ Learnability
 - ❑ Efficiency
 - ❑ Memorability
 - ❑ Errors
 - ❑ Satisfaction



UI Hall of Fame or Shame



Credit: Nguyễn Hữu Đức

UI Hall of Fame or Shame

- HCMC's bus



Credit: Huỳnh Công Toàn