Design guidelines and usability heuristics

Human Computer Interaction

Based on slide deck
Part 5: Principles for Design. Design guidelines and usability heuristics
Human Computer Interaction I: Principles and Design
by
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*The new slides are marked with a **

Usability Heuristics

- Avoid common design pitfalls by following 9 design principles

- Inspect an interface for usability problems with these principles

Evaluating Heuristic evaluation

Style guides

Design principles

broad usability statements that guide a developer's design efforts

- use the users language
- provide feedback ...

derived from common design problems across many systems

Heuristic evaluation

Systematic inspection to see if interface complies to guidelines

Method

- 3-5 inspectors
- usability engineers, end users, double experts ...
- inspect interface in isolation (approx. 1-2 hours for simple interfaces)
- compare notes afterwards
  - single evaluator only catches around 35% of usability problems
  - 5 evaluators catch around 75%

Works for paper, prototypes, and working systems

Heuristic evaluation

Advantages

- "minimalist" approach
  - a few guidelines identify many common usability problems
  - easily remembered
  - easily applied with modest effort

- discount usability engineering
  - end users not required
  - cheap and fast way to inspect a system
  - can be done by usability experts, double experts, and end users

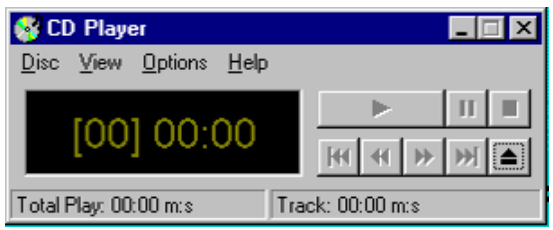
Heuristic evaluation

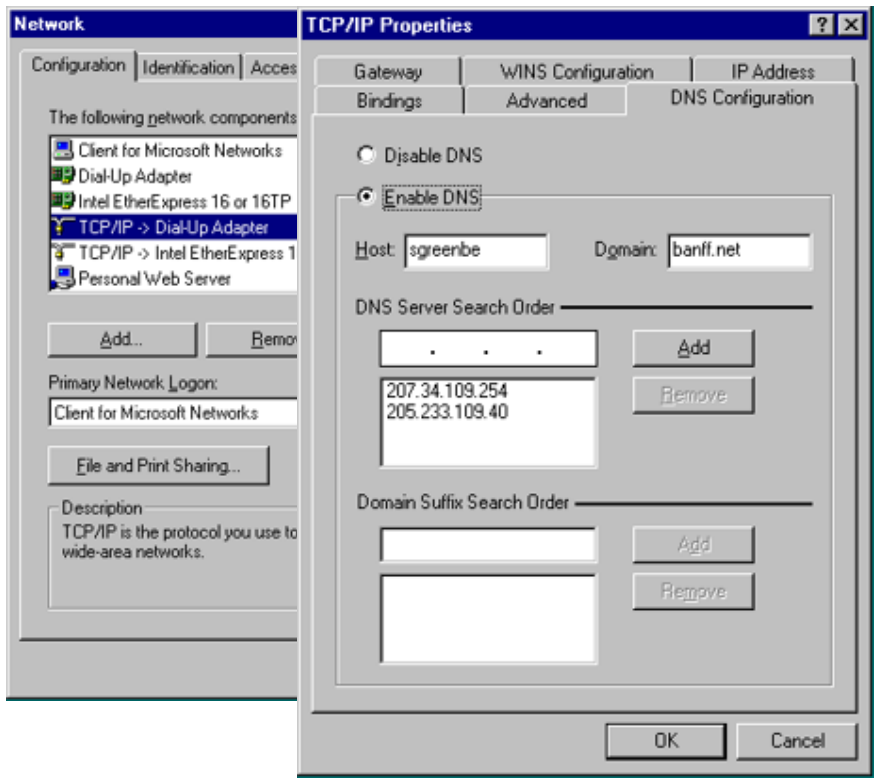
Problems

- principles are more or less at the motherhood level
  - can't be treated as a simple check-list
  - subtleties involved in their use

1. Simple and natural dialogue

- use the user's conceptual model
- match user's task sequence
- minimize mapping between interface and task semantics



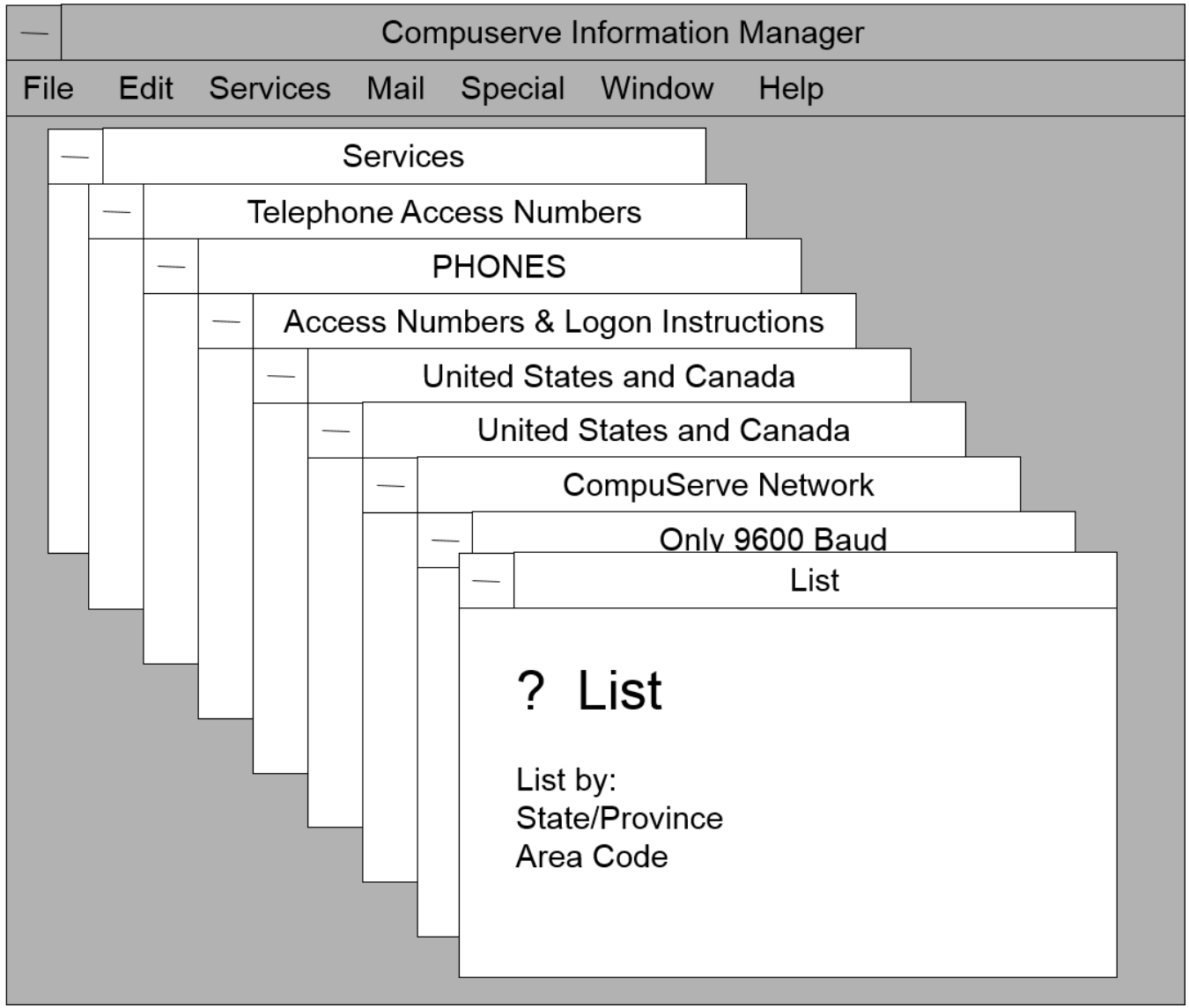


1. Simple and natural dialogue

Present exactly the information the user needs

- less is more
  - less to learn, to get wrong, to distract ...
- information should appear in natural order
  - related information is graphically clustered
  - order of accessing information matches user's expectations
- remove or hide irrelevant or rarely needed information
  - competes with important information on screen
- remove modes
- use windows frugally
  - don't add unneeded navigation and windows management

1. Simple and natural dialogue



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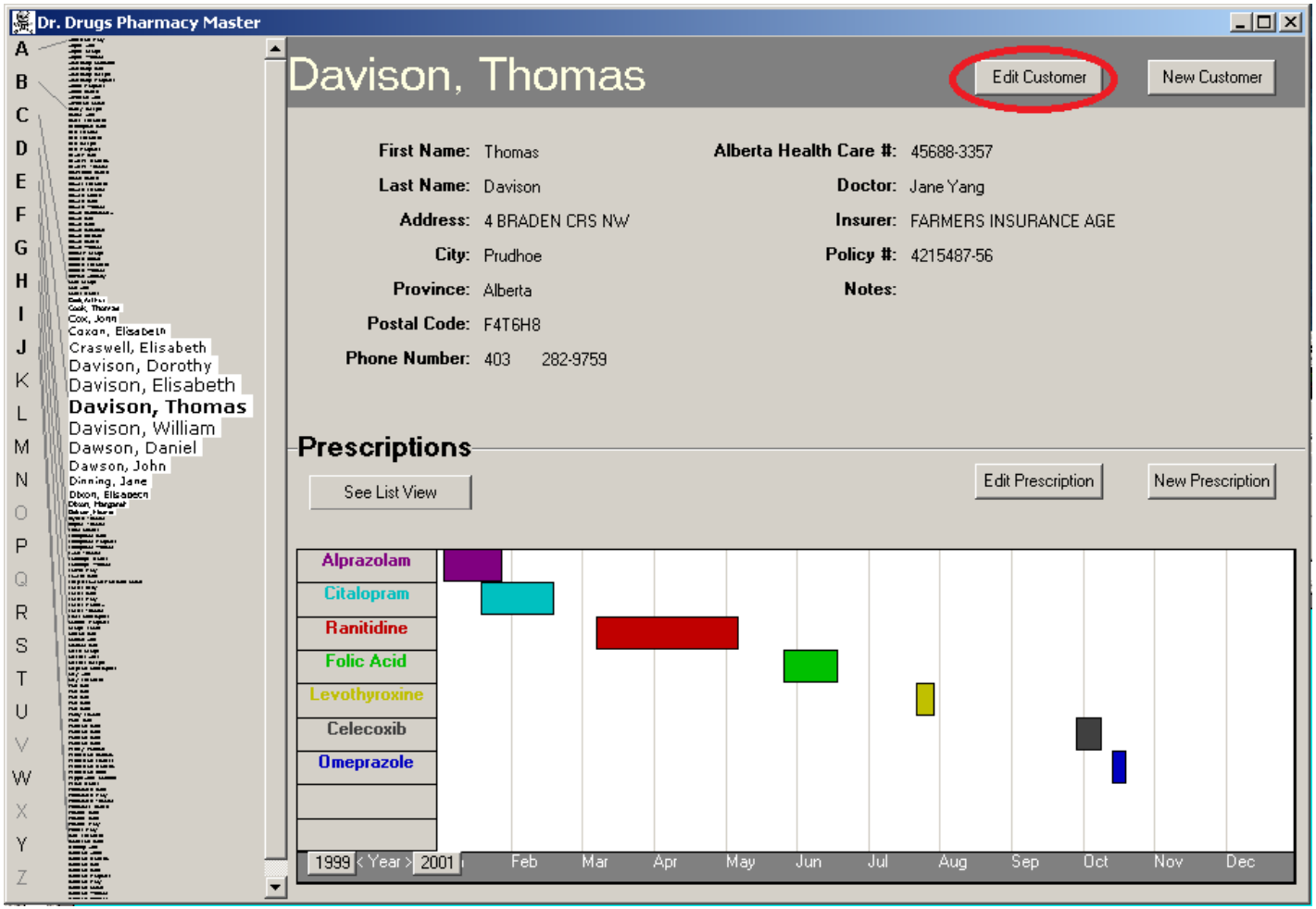

Good: Information all in the same place

By previous 481 students Brant LeClercq, Lloyd Yoon, Amy Yang (with permission)

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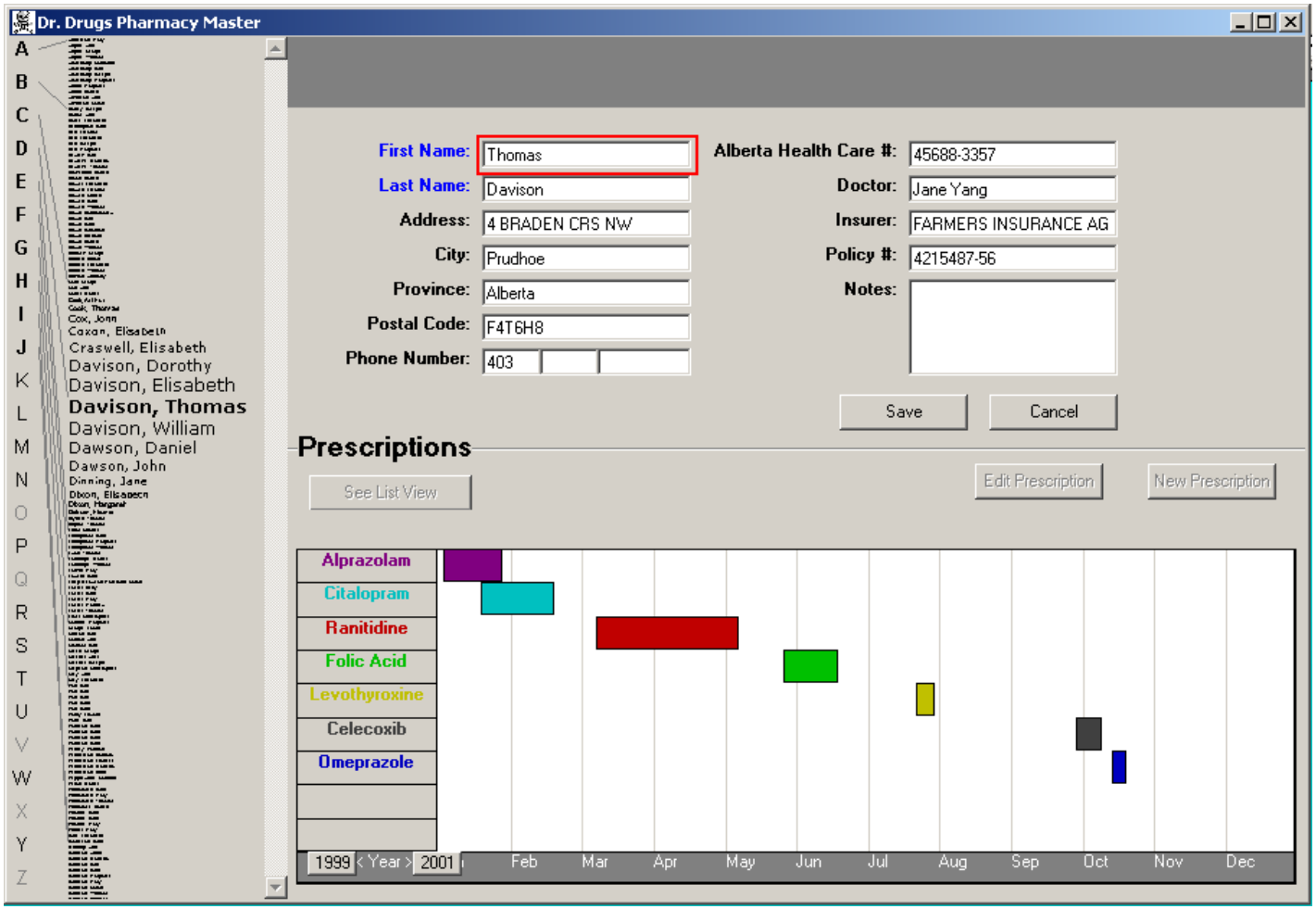

Good: Information all in the same place

Bad: Special edit mode

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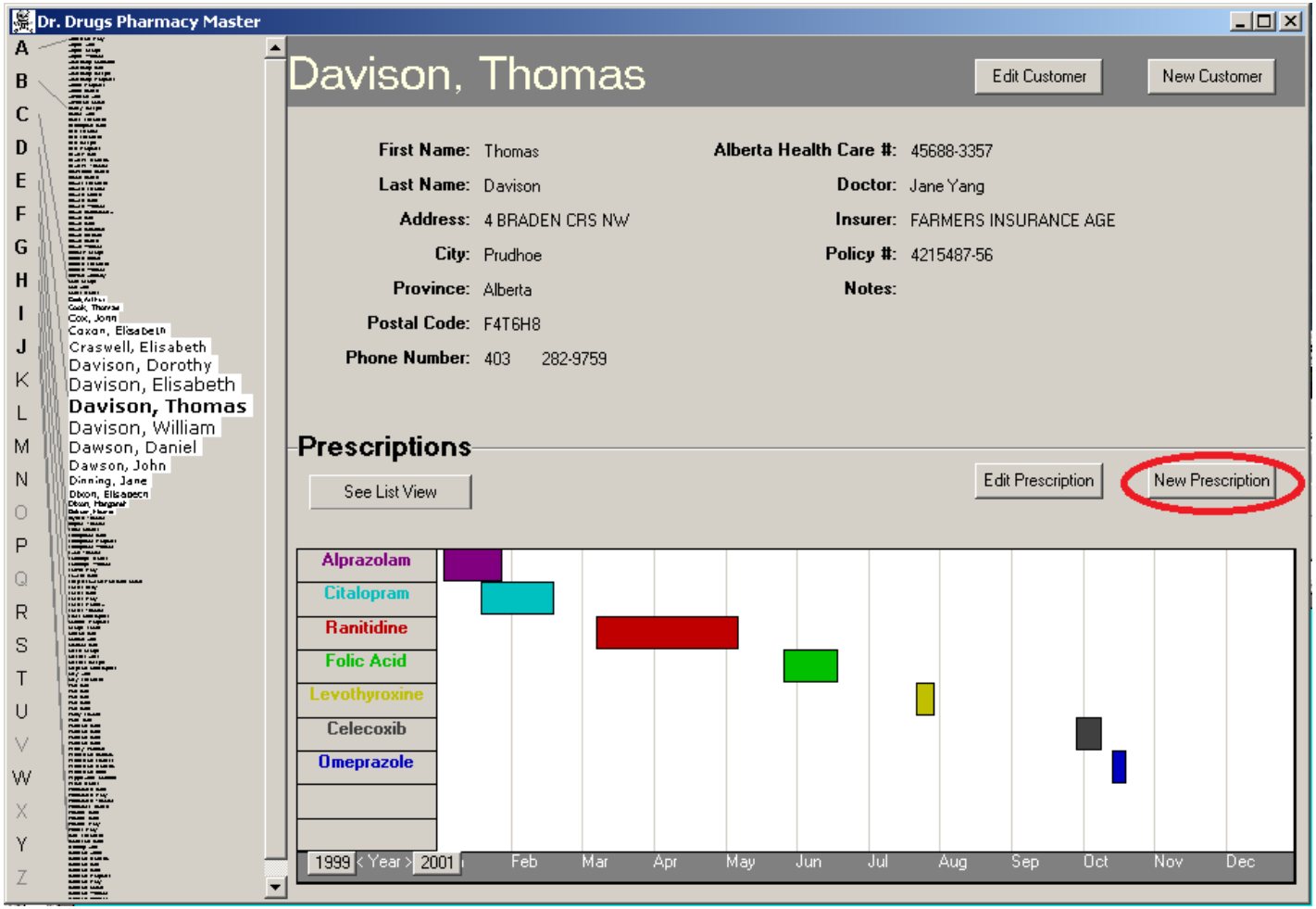

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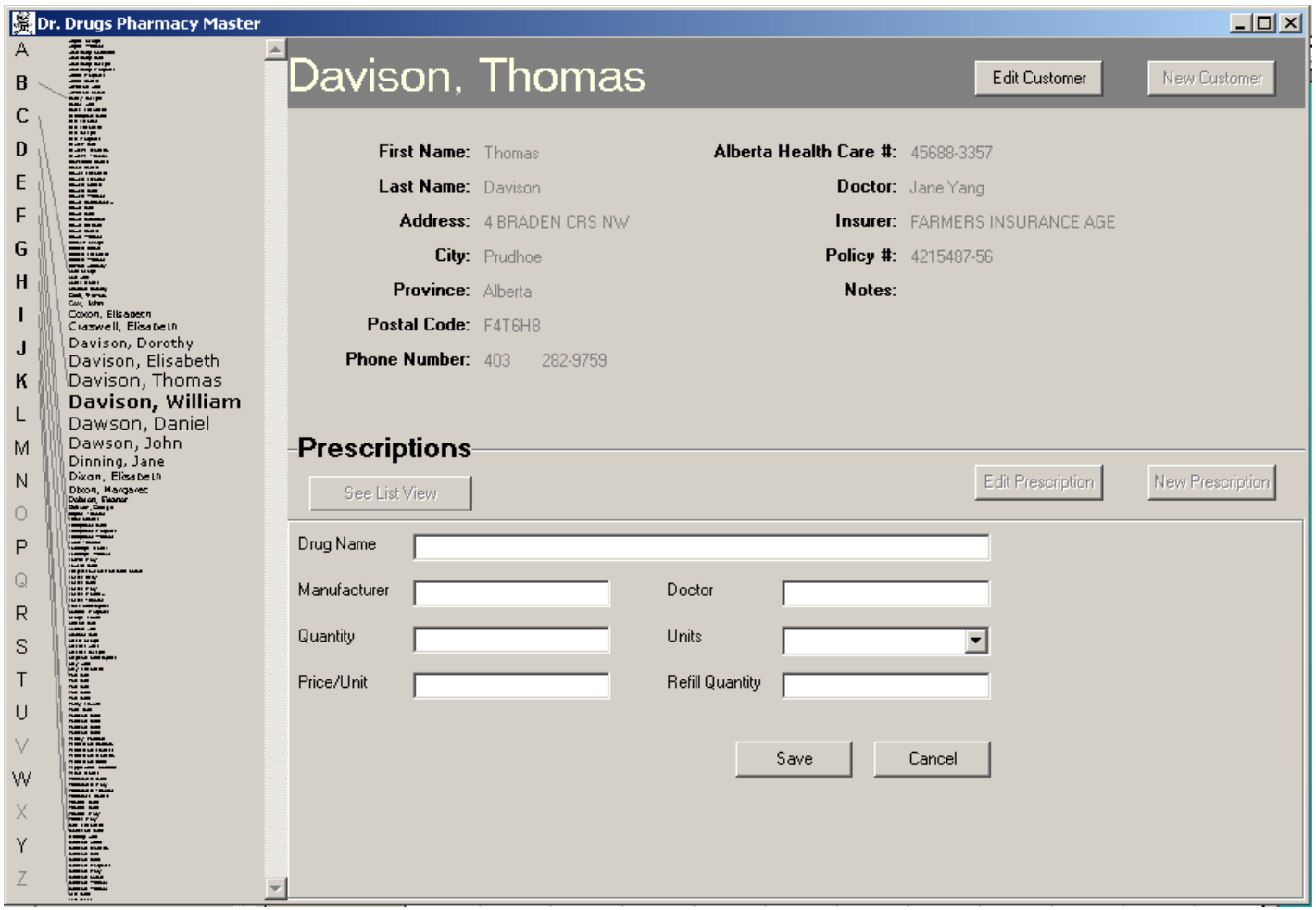

Good: Stable parts of the window

Bad: Prescriptions separate from graphics

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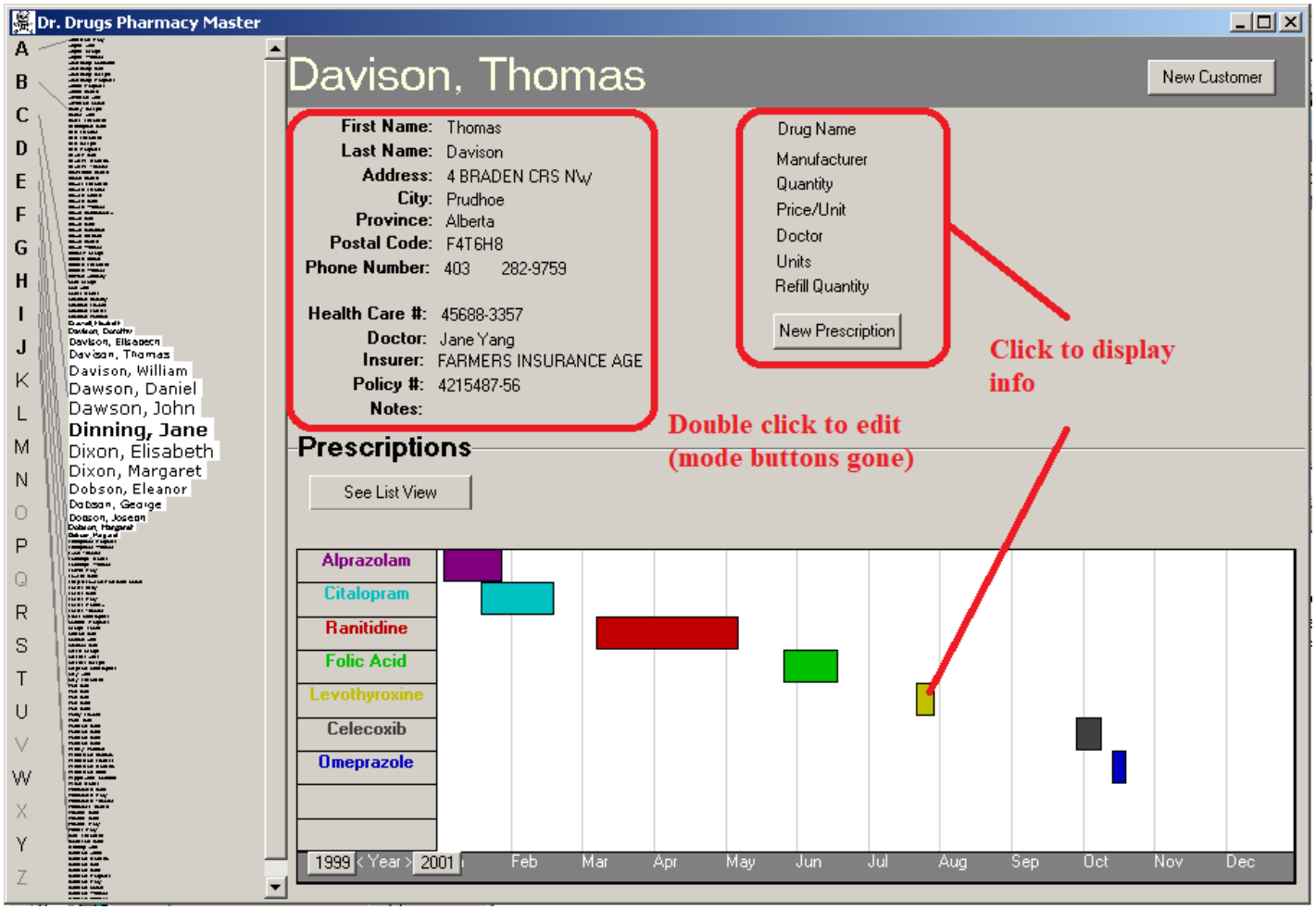

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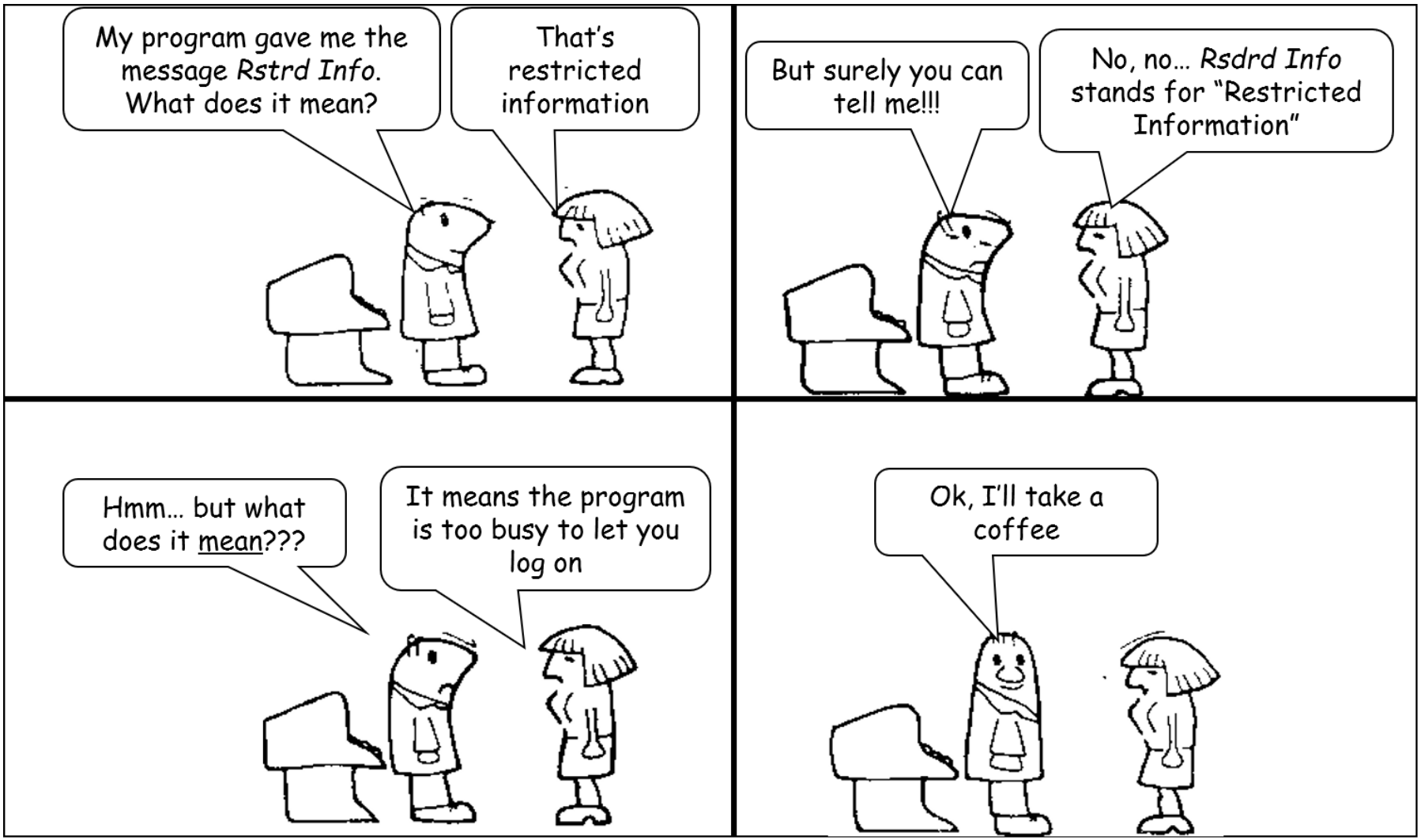
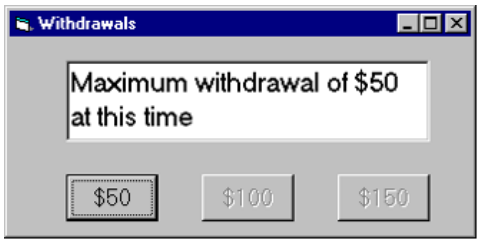
2. Speak the users' language

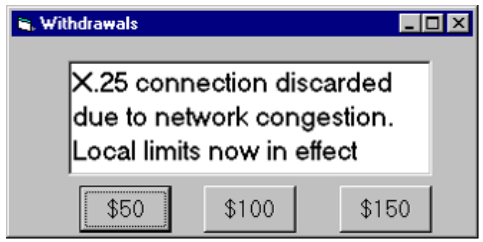


2. Speak the users' language

Terminology based on users' language for task

- e.g. withdrawing money from a bank machine



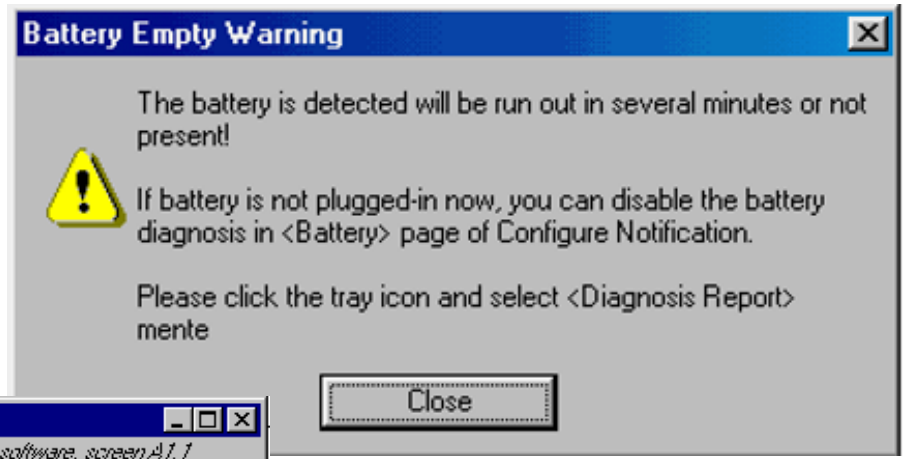


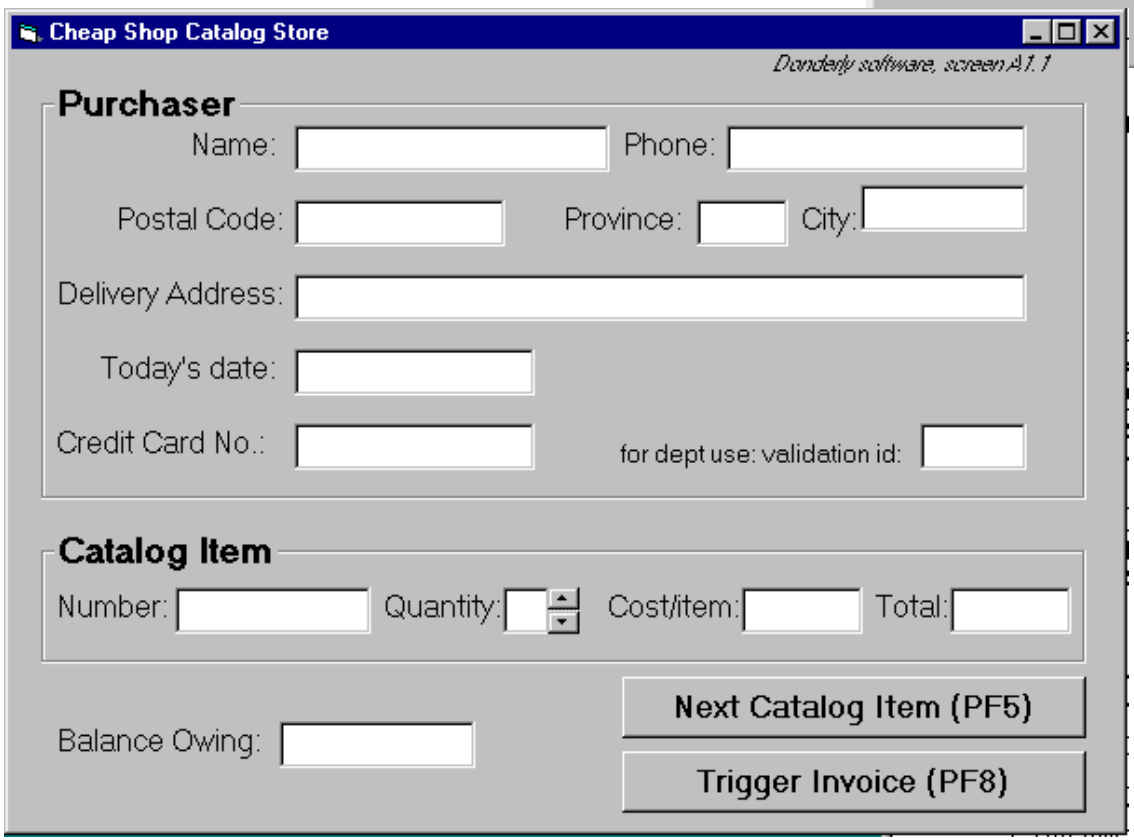
Use meaningful mnemonics, icons & abbreviations

- e.g. File / Save
  - Ctrl + S (abreviation)
  - Alt FS (mnemonic for menu action)
  - 

(tooltip icon)

2. Speak the users' language





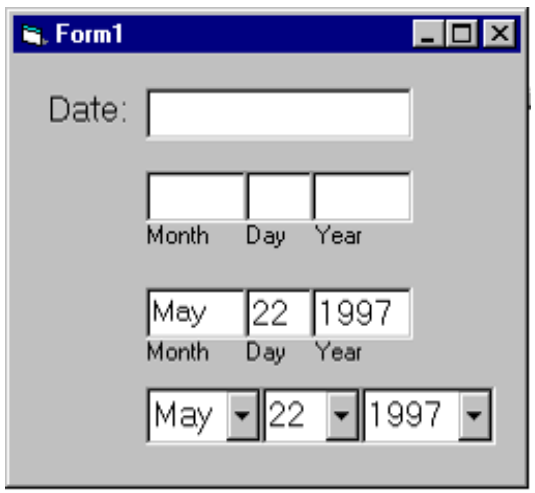
3. Minimize user's memory load

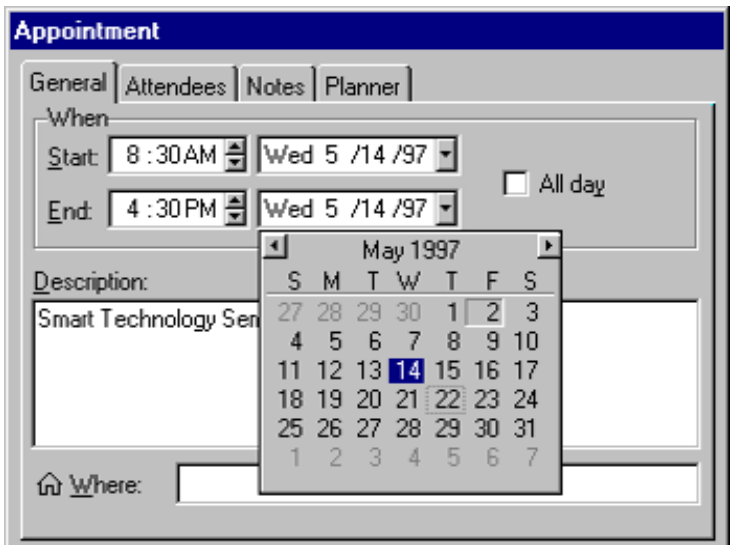
Computers good at remembering, people are not!
Promote recognition over recall

- menus, icons, choice dialog boxes vs commands, field formats
- relies on visibility of objects to the user (but less is more!)

3. Minimize user's memory load

Give input formats, examples and default values



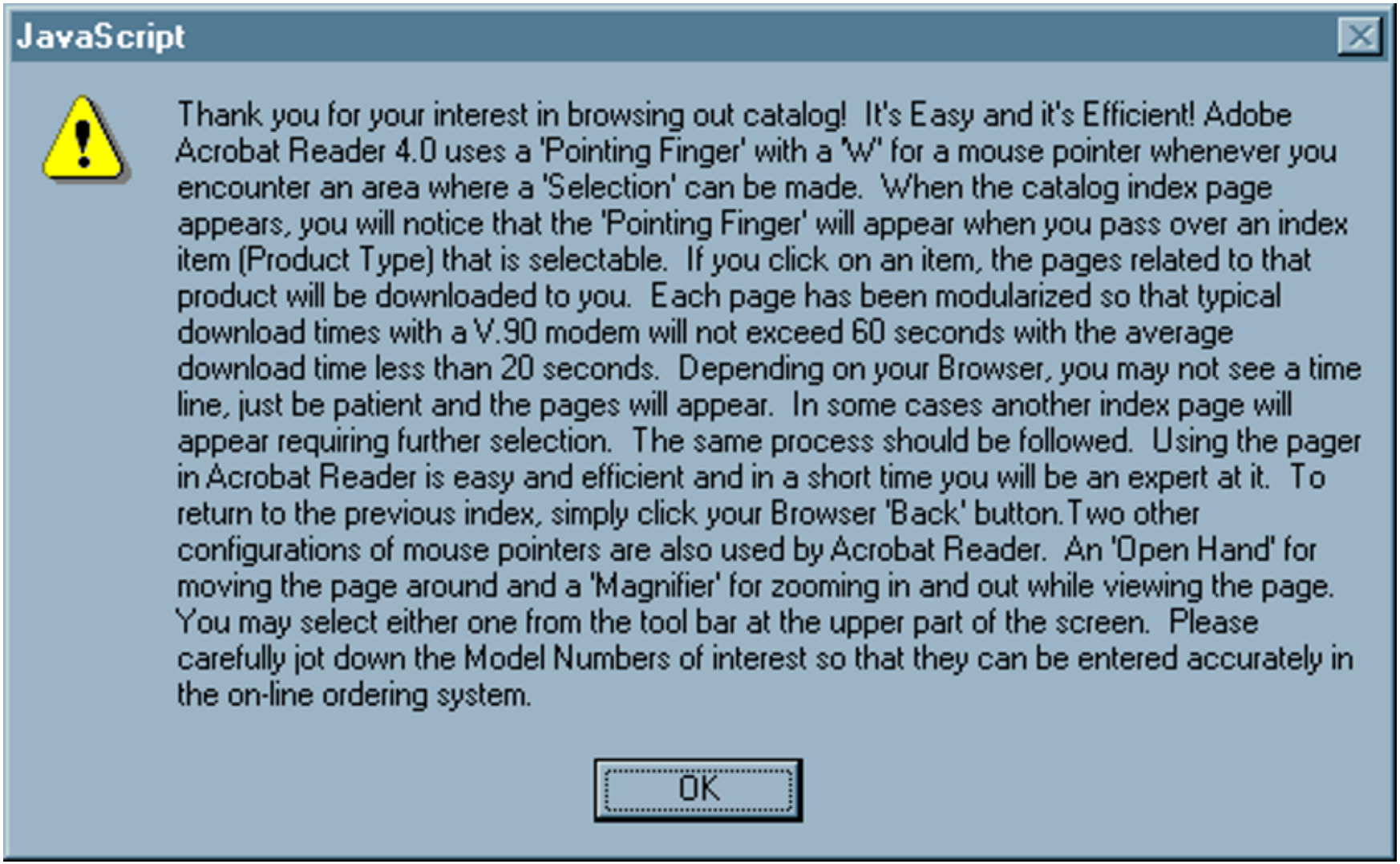


3. Minimize user's memory load

Small number of rules applied universally

- generic commands
  - same command can be applied to all interface objects
    - interpreted in context of interface object
  - copy, cut, paste, drag 'n drop, ... for characters, words, paragraphs, circles, files
  - context menus

3. Minimize user's memory load

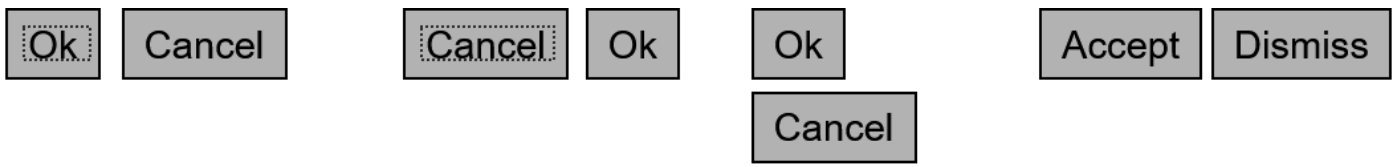


4. Be consistent

Consistent syntax of input

Consistent language and graphics

- same visual appearance across the system (e.g. widgets)
- same information/controls in same location on all windows



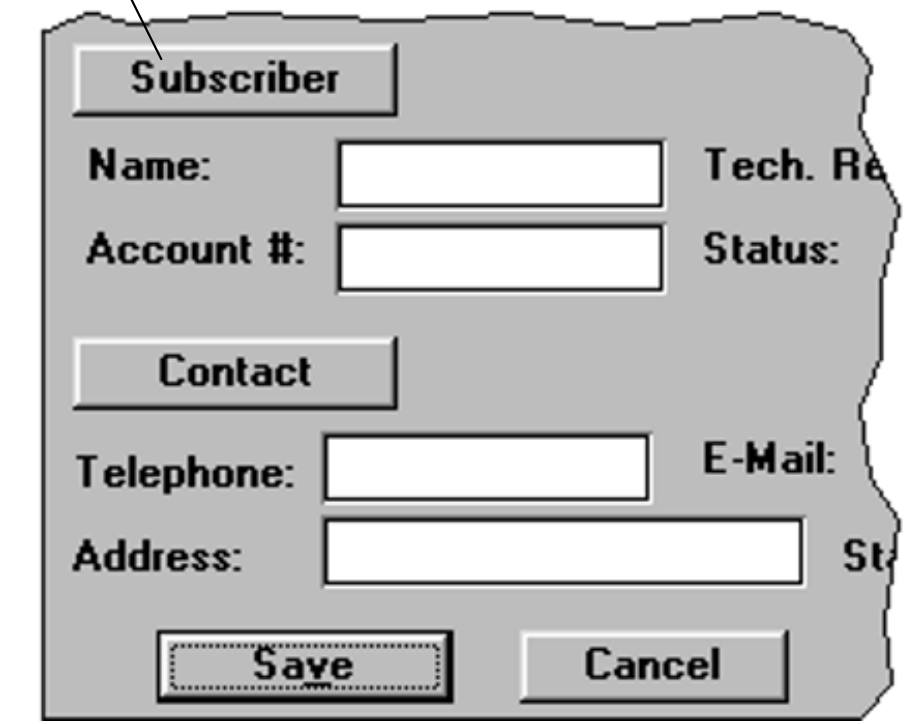
Consistent effects

- commands, actions have same effect in equivalent situations
  - predictability

4. Be consistent

These are labels with a raised appearance.

Is it any surprise that pople try and click on them?



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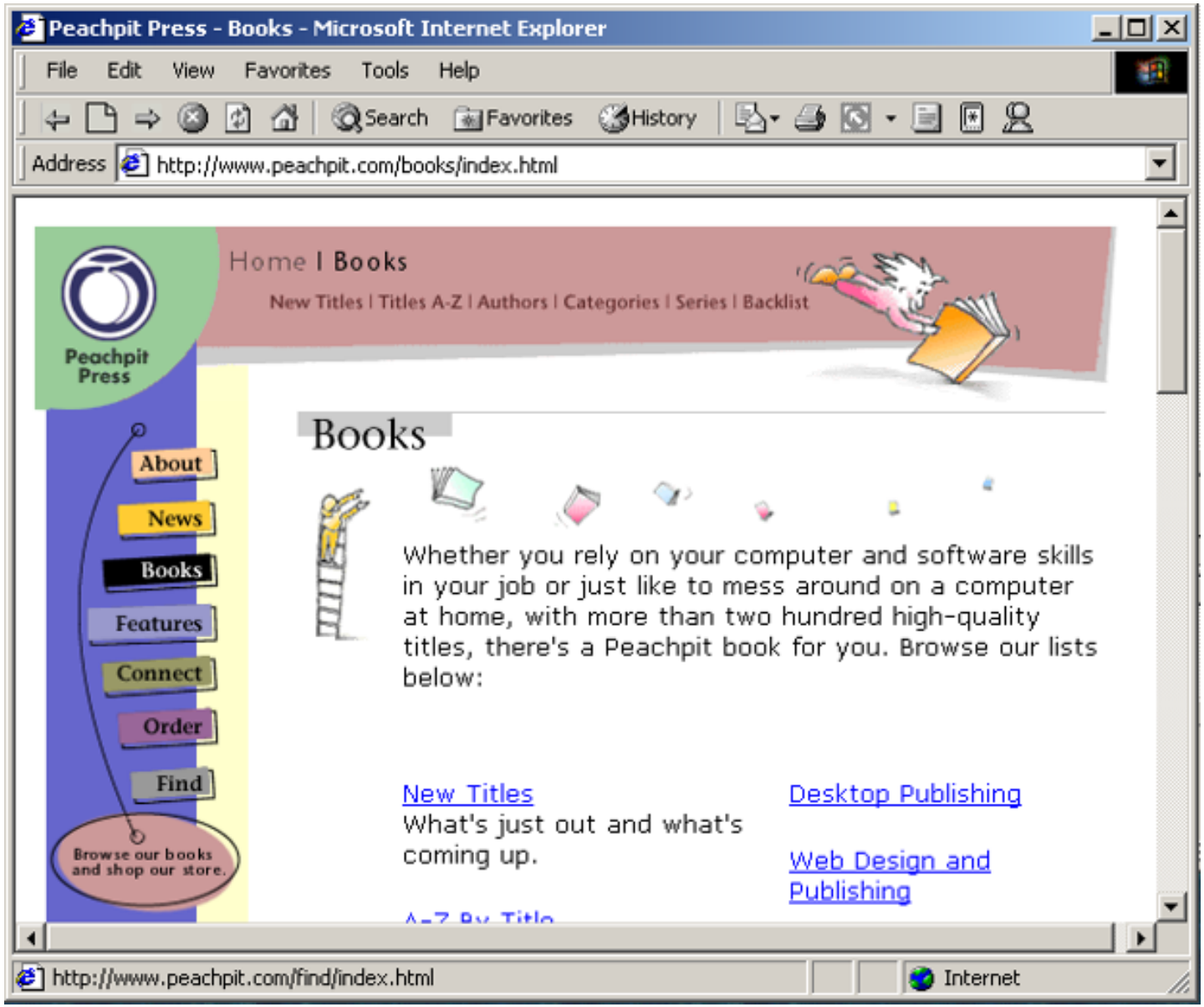

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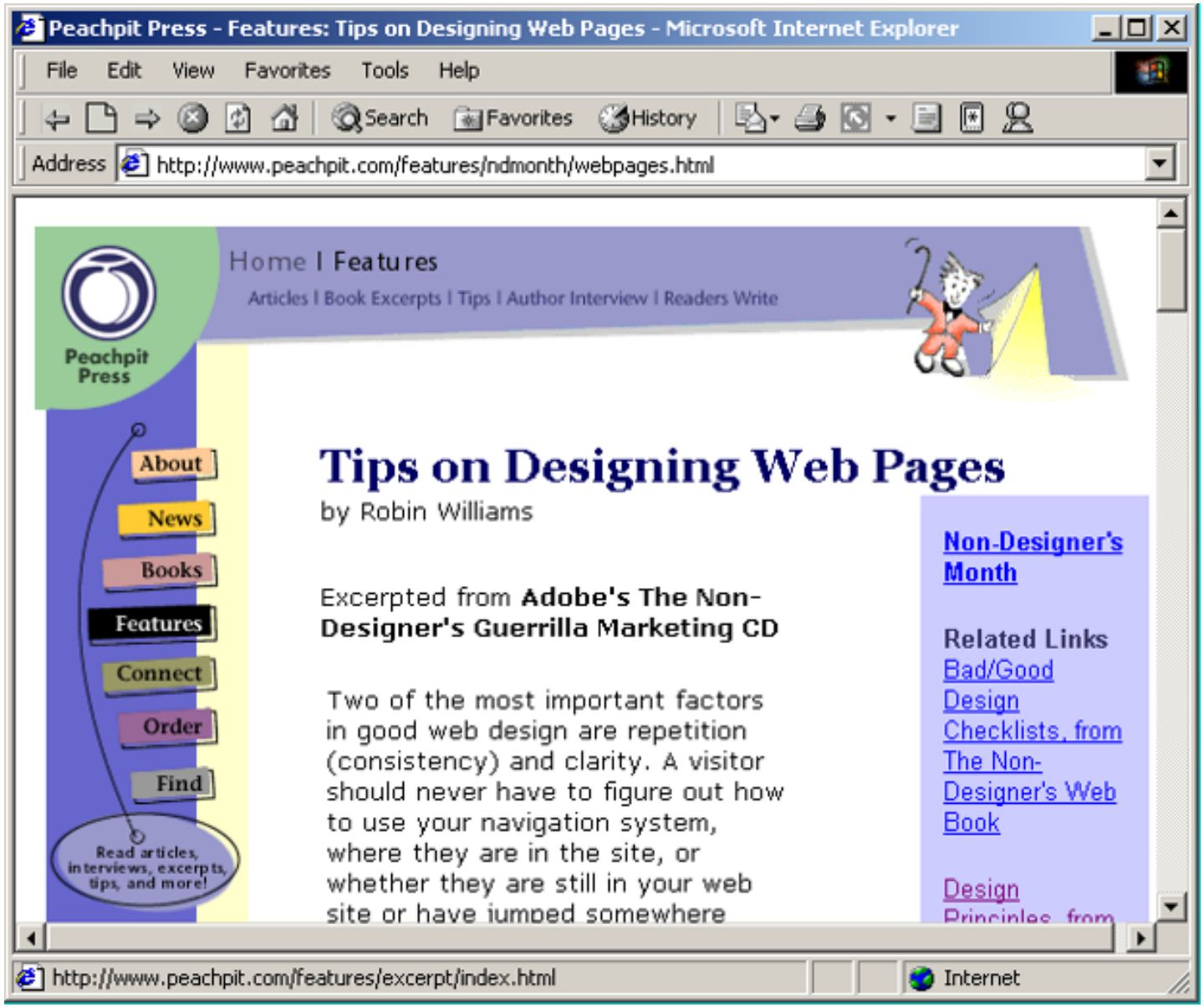
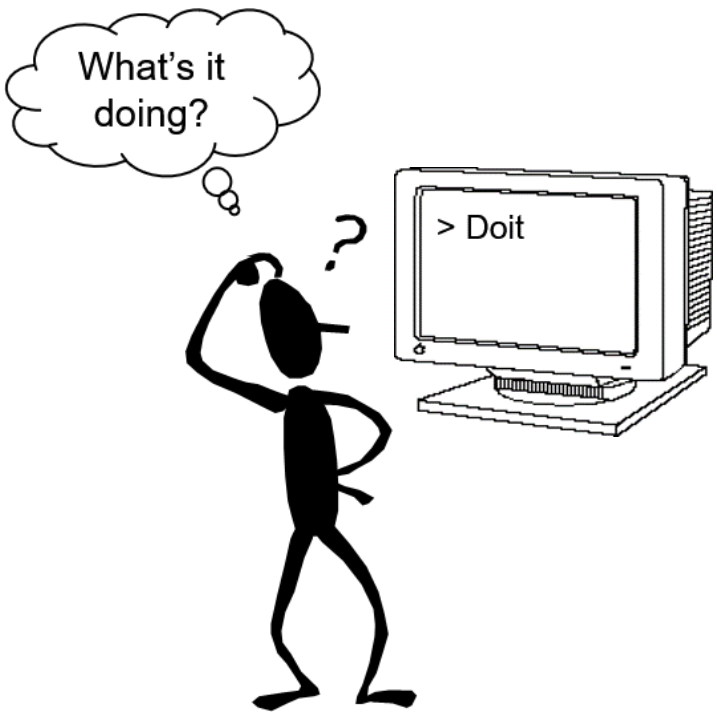


5. Provide feedback

Continuously inform the user about:

- what it is doing
- how it is interpreting the user's input
- user should always be aware of what is going on



5. Provide feedback

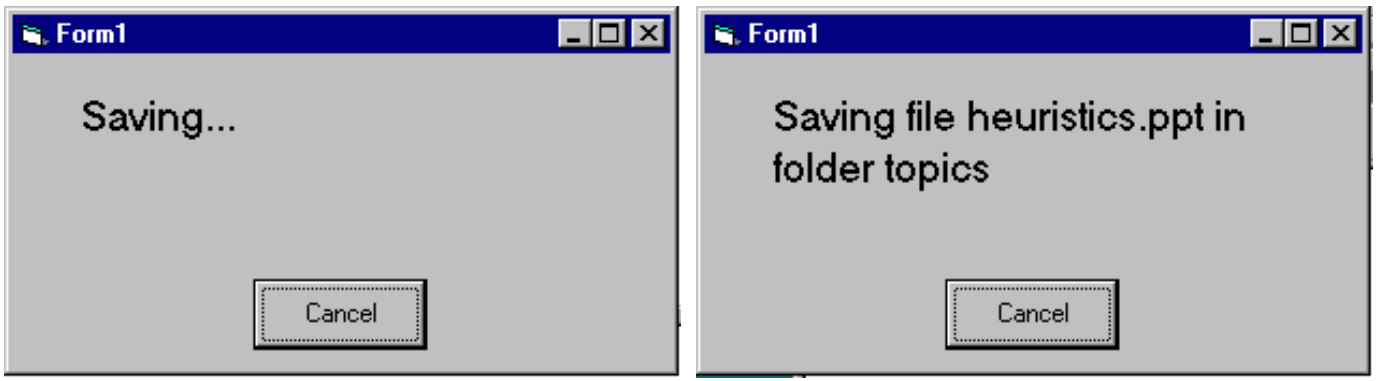
What mode am I in now?

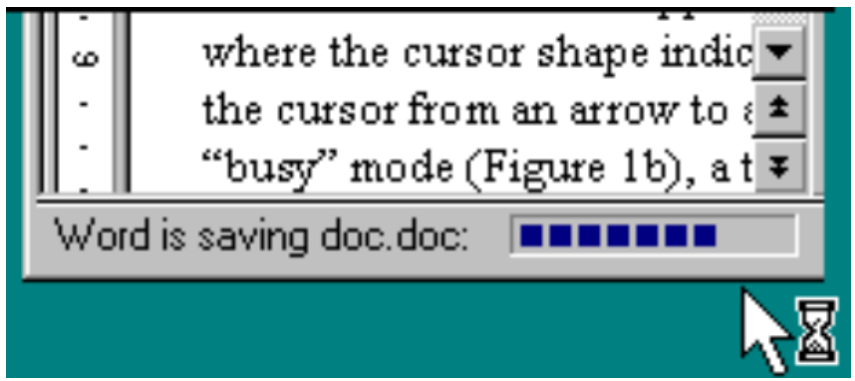
What did I select?

How is the system interpreting my actions?

5. Provide feedback

Be as specific as possible, based on user's input





Best within the context of the action

5. Provide feedback

Response time

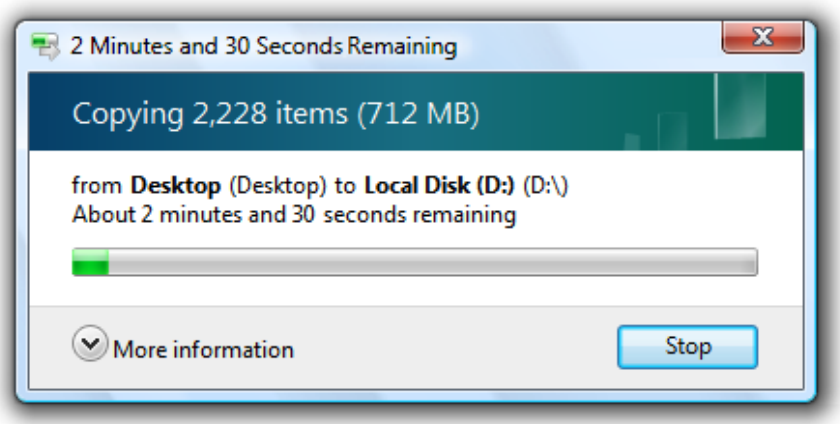
– how users perceive delays

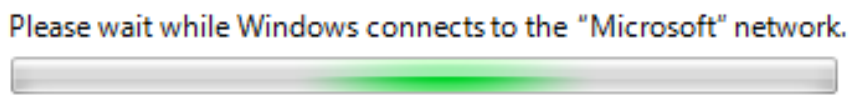
<0.1s	perceived as "instantaneous"
1s	user's flow of thought stays uninterrupted, but delay noticed
10s	limit for keeping user's attention focused on the dialog
>10s	user will want to perform other tasks while waiting

5. Provide feedback

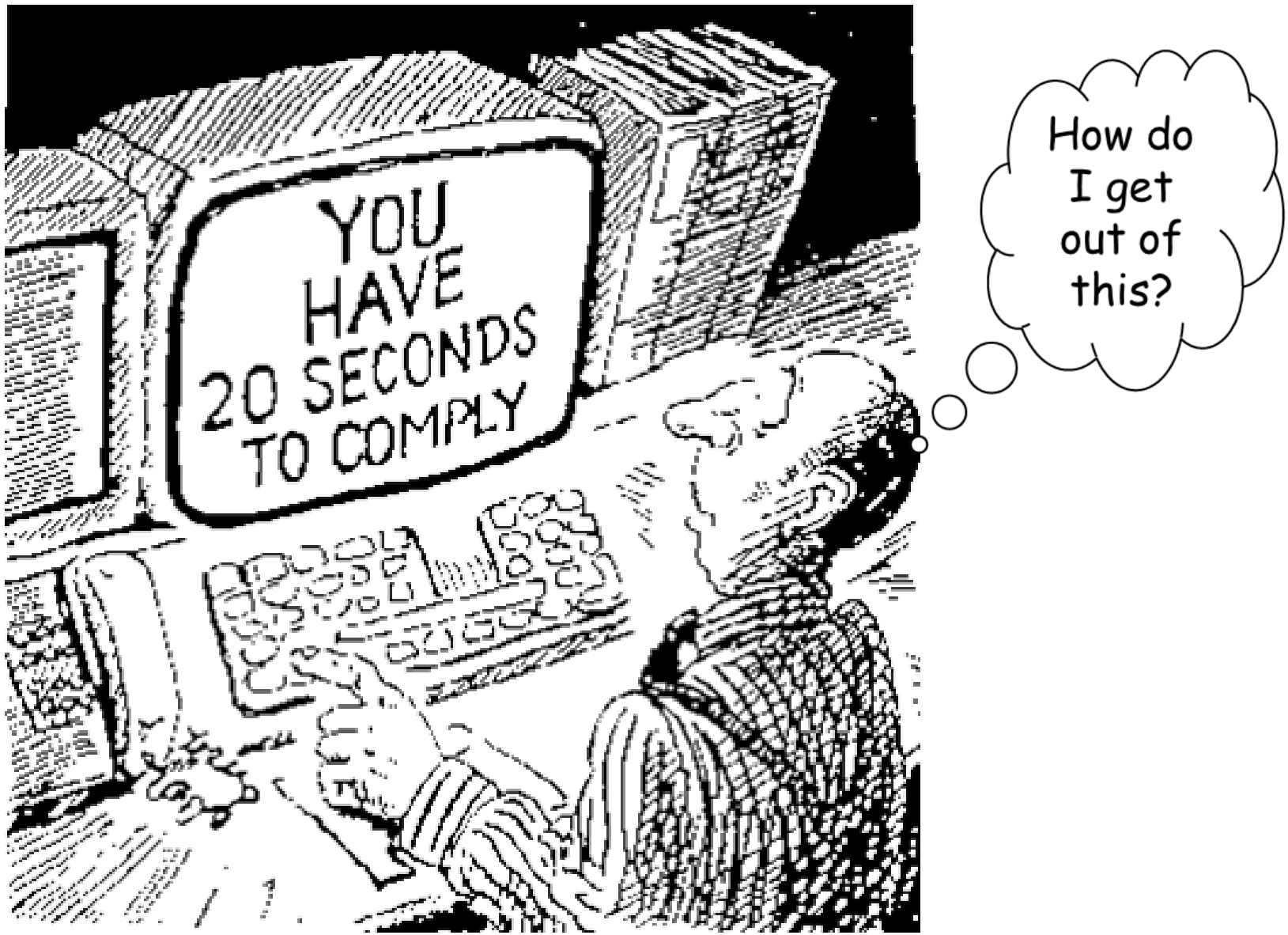
Dealing with long delays

- Cursors
  - for short transactions
- Percentage progress bars
  - time left
  - estimated time
- Random
  - for unknown times





6. Provide clearly marked exits



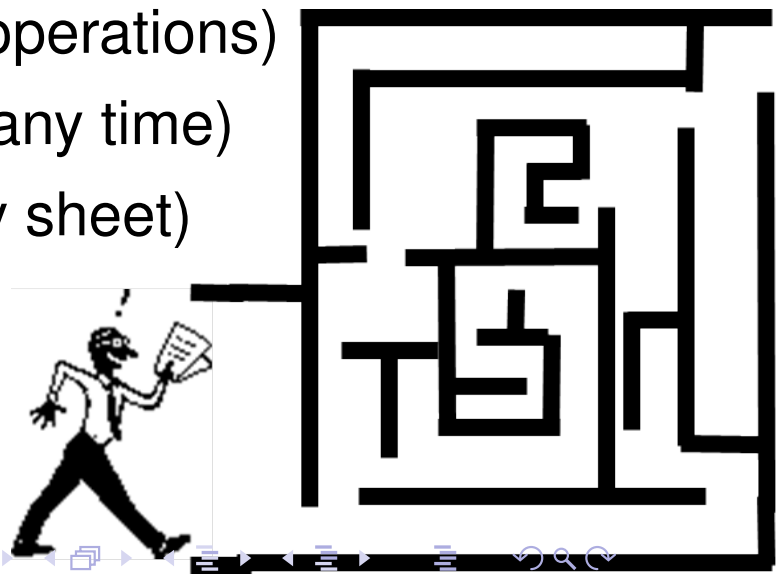
6. Provide clearly marked exits

Users don't like to feel trapped by the computer!

- should offer an easy way out of as many situations as possible

Strategies:

- Cancel button (for dialogues waiting for user input)
- Universal Undo (can get back to previous state)
- Interrupt (especially for lengthy operations)
- Quit (for leaving the program at any time)
- Defaults (for restoring a property sheet)



Core
Dump

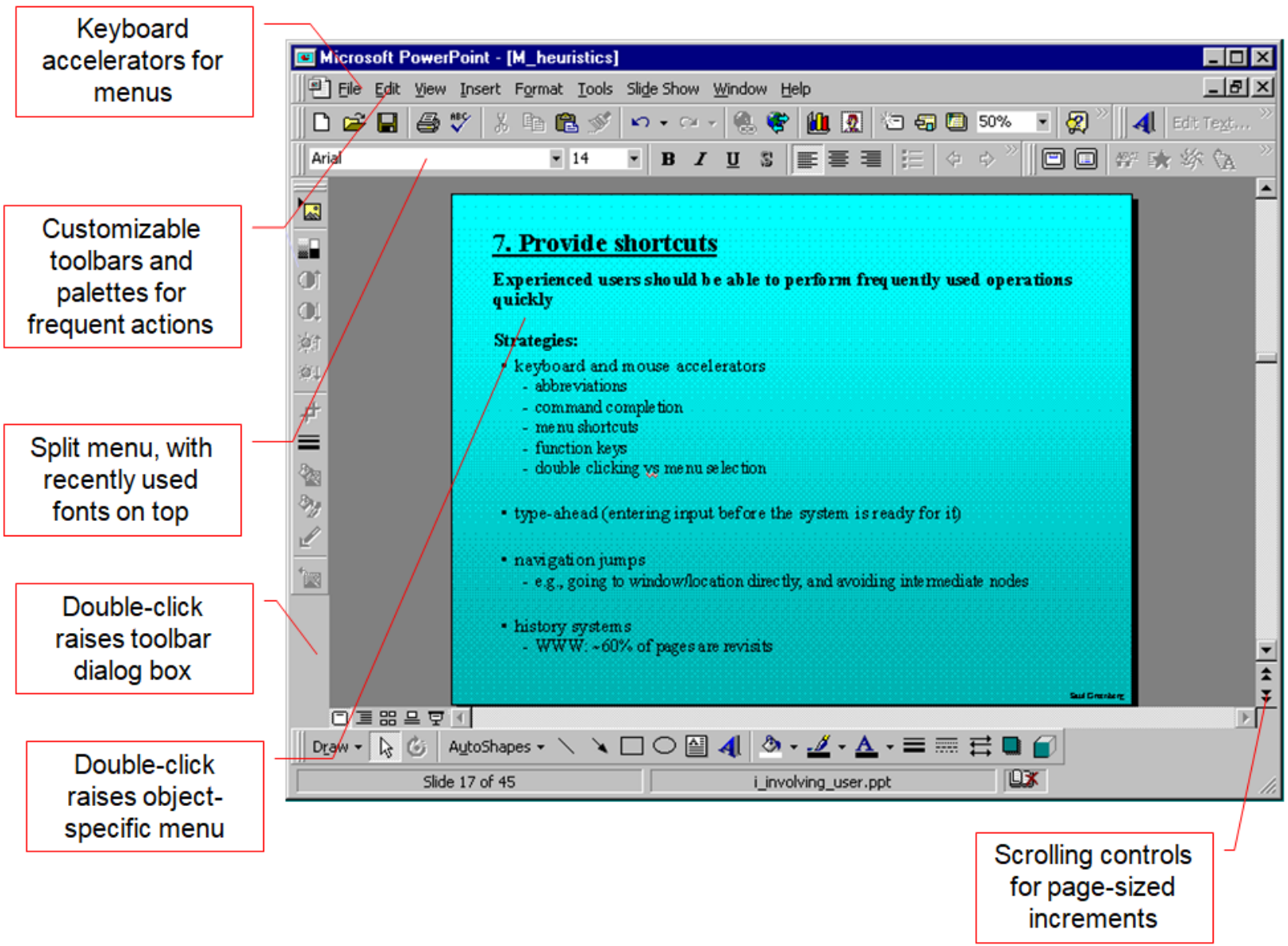
7. Provide shortcuts

Experienced users - perform frequent operations quickly

Strategies

- keyboard and mouse accelerators
  - abbreviations
  - command completion
  - context menus
  - function keys
  - double clicking vs menu selection
- type-ahead (entering input before the system is ready for it)
- navigation jumps
  - e.g., going to window/location directly, and avoiding intermediate nodes
- history systems
  - WWW: $\sim$ 60% of pages are revisits

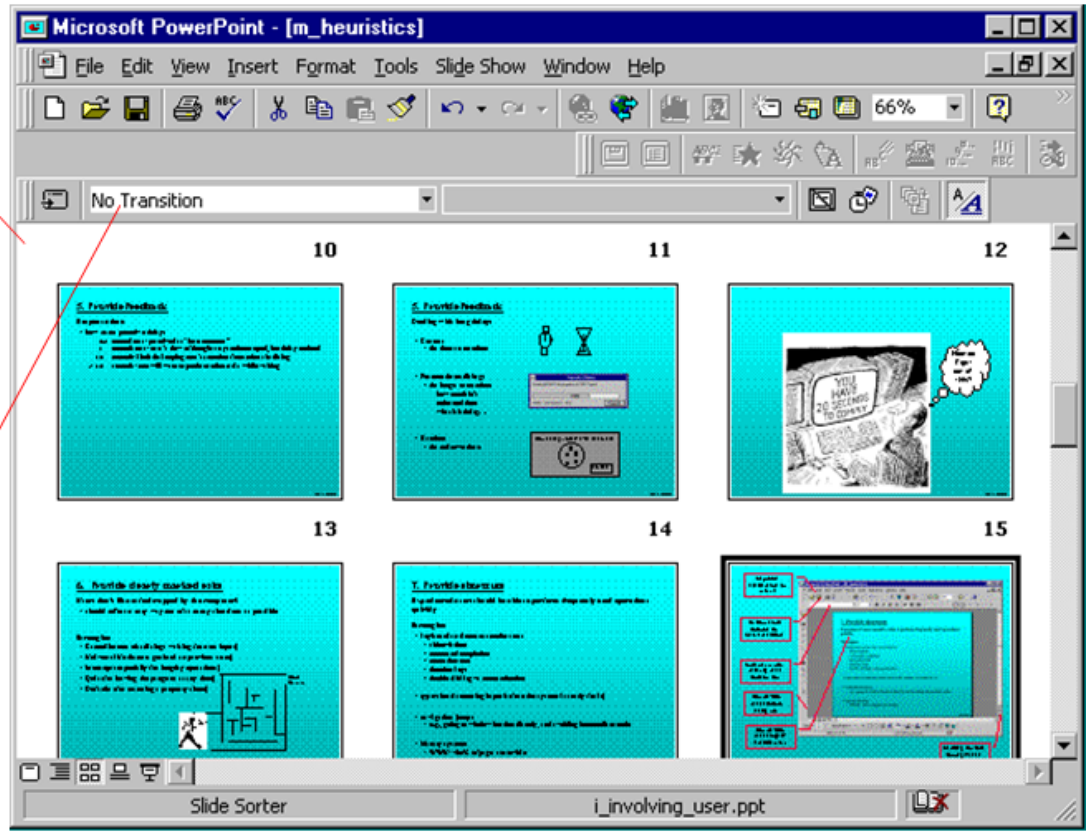
7. Provide shortcuts



7. Provide shortcuts

Alternate representation for quickly doing different set of tasks

Toolset brought in appropriate to this representation



8. Deal with errors in a positive manner

People will make errors!

Errors we make

- Mistakes
  - conscious deliberations lead to an error instead of correct solution

- Slips
  - unconscious behaviour gets misdirected en route to satisfying goal
    - e.g. drive to store, end up in the office
  - shows up frequently in skilled behaviour
    - usually due to inattention
  - often arises from similar actions

Designing for slips

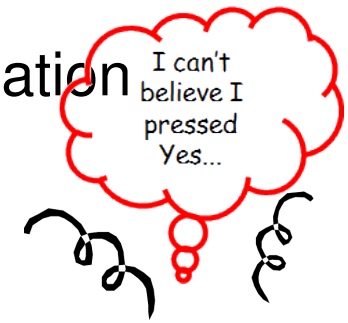
General rules

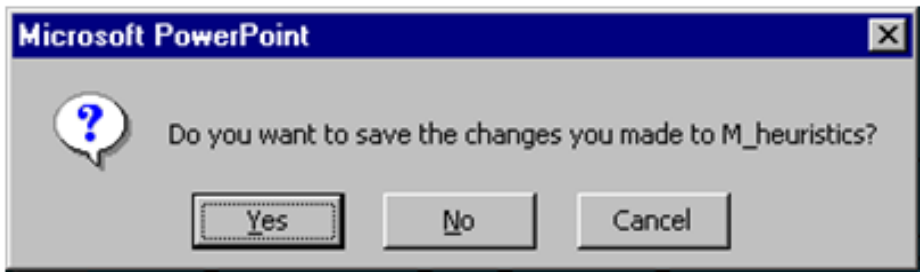
- prevent slips before they occur
- detect and correct slips when they do occur
- user correction through feedback and undo

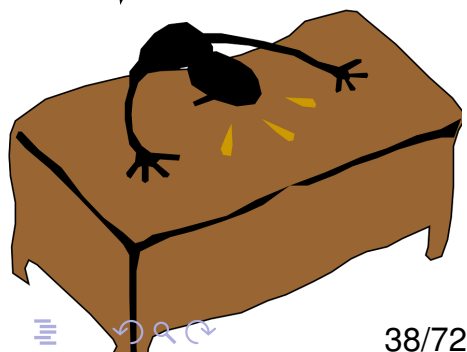
Types of slips

Capture error

- frequently done activity takes charge instead of one intended
- occurs when common & rarer actions have same initial sequence
  - change clothes for dinner and find oneself in bed (William James, 1890)
  - confirm saving of a file when you don't want to delete it
- minimize by
  - make actions undoable instead of confirmation
  - allows reconsideration of action by use
    - e.g. open trash to undelete a file







Types of slips

Description error

- intended action similar to others that are possible
  - usually occurs when right & wrong objects physically near each other
    - pour juice into bowl instead of glass
    - throw sweaty shirt in toilet instead of laundry basket
    - move file to wrong folder with similar name
- minimize by
  - rich feedback
  - check for reasonable input, etc.
  - undo

Types of slips

Loss of activation

- forget what the goal is while undergoing the sequence of actions
  - start going to room and forget why you are going there
  - navigating menus/dialogs & can't remember what you are looking for
  - but continue action to remember (or go back to beginning)!

- minimize by
  - if system knows goal, make it explicit
  - if not, allow person to see path taken

Types of slips

Mode errors

- people do actions in one mode thinking they are in another
  - refer to file that's in a different directory
  - look for commands / menu options that are not relevant

- minimize by
  - have as few modes as possible (preferably none)
  - make modes highly visible

Generic system responses for errors

General idea: Forcing functions

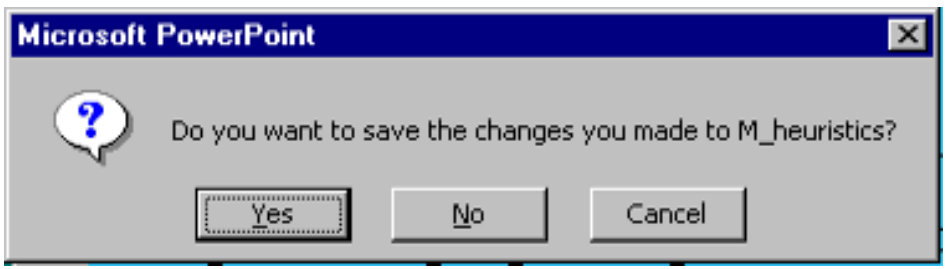
- prevent/mitigate continuation of wrongful action

Gag

- deals with errors by preventing the user from continuing
  - e.g. cannot get past login screen until correct password entered

Warn

- warn people that an unusual situation is occurring
- when overused, becomes an irritant
  - e.g.,
    - audible bell
    - alert box



Generic system responses for errors

Do nothing

- illegal action just doesn't do anything
- user must infer what happened
  - enter letter into a numeric-only field (key clicks ignored)
  - put a file icon on top of another file icon (returns it to original position)

Self-correct

- system guesses legal action and does it instead
- but leads to a problem of trust
  - spelling corrector

Generic system responses for errors

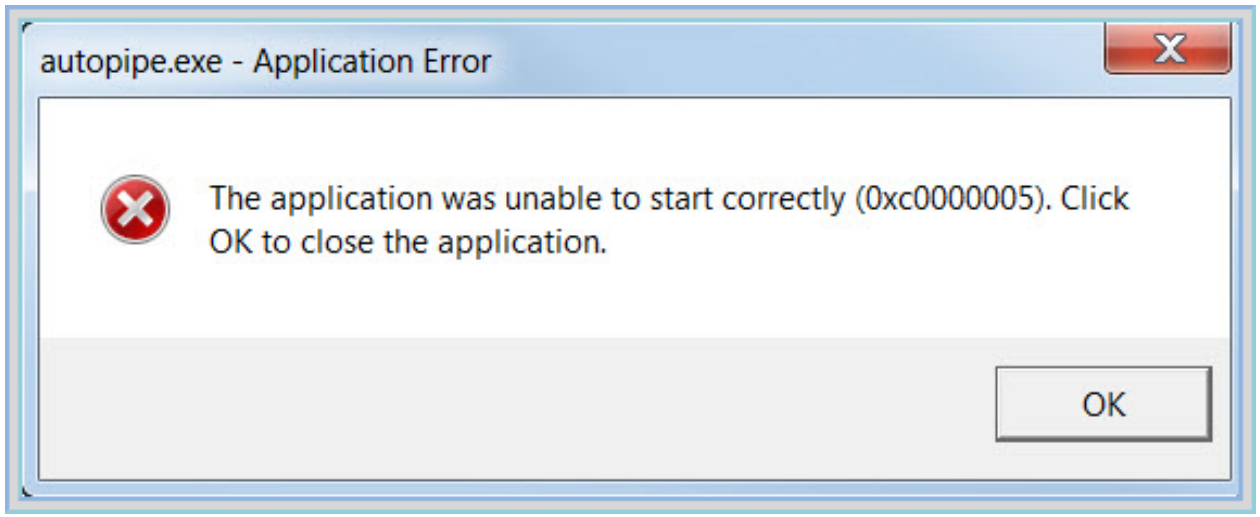
Lets talk about it

- system initiates dialog with user to come up with solution to the problem
  - compile error brings up offending line in source code

Teach me

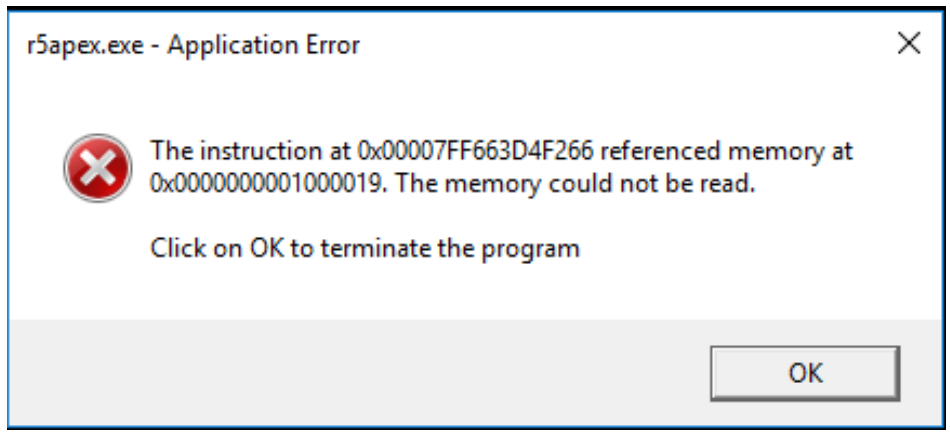
- system asks user what the action was supposed to have meant
- action then becomes a legal one

8. Deal with errors in a positive manner



What does "0xc0000005" mean?

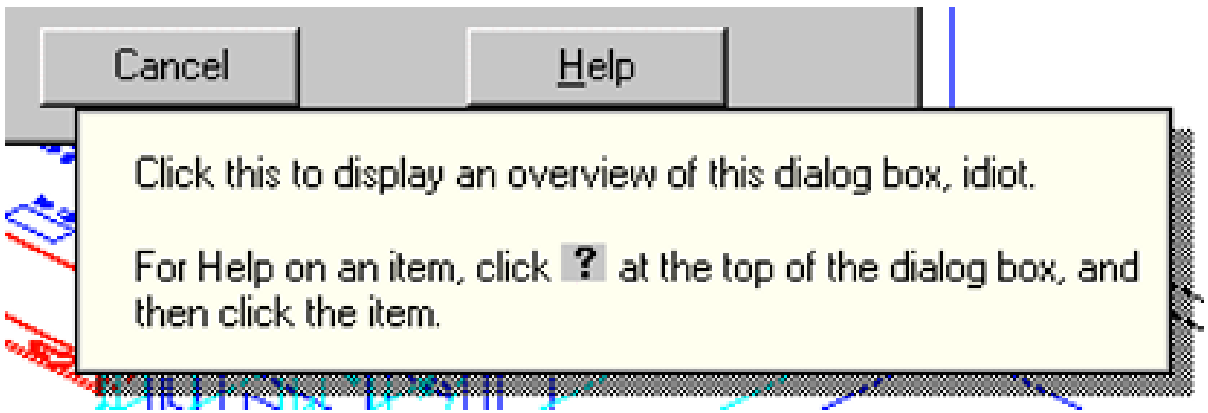
8. Deal with errors in a positive manner



Say what?

8. Deal with errors in a positive manner

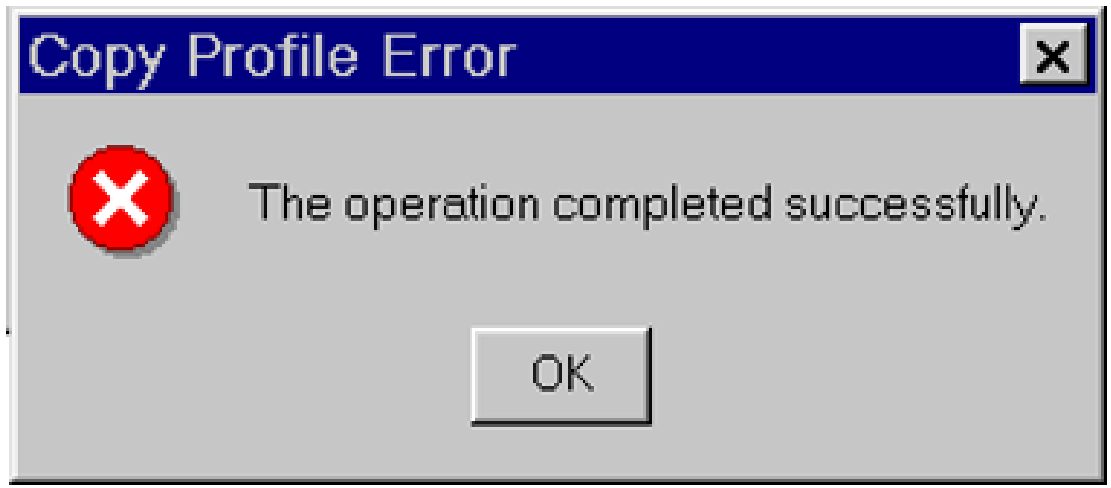
Adobe's *ImageReady*



AutoCAD Mechanical

8. Deal with errors in a positive manner

Microsoft Windows' *Notepad*



Microsoft's *NT Operating System*

8. Deal with errors in a positive manner

Provide meaningful error messages

- error messages should be in the user's task language
- don't make people feel stupid

  Try again, bonehead!

  Error 25

  Cannot open this document

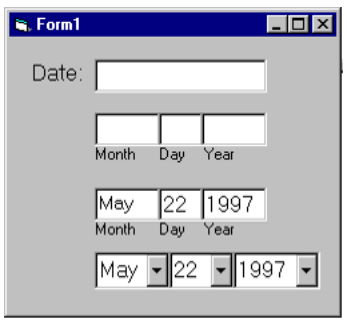
  Cannot open "chapter 5" because the application "Microsoft Word" is not on your system

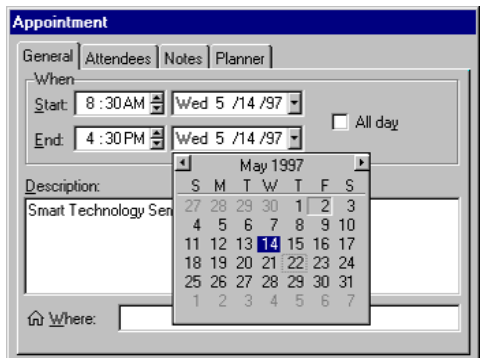
  Cannot open "chapter 5" because the application "Microsoft Word" is not on your system. Open it with "Teachtext" instead?

8. Deal with errors in a positive manner

Prevent errors

- try to make errors impossible
- modern widgets: can only enter legal data





Provide reasonableness checks on input data

- on entering order for office supplies
  - 5000 pencils is an unusually large order. Do you really want to order that many?

9. Provide help

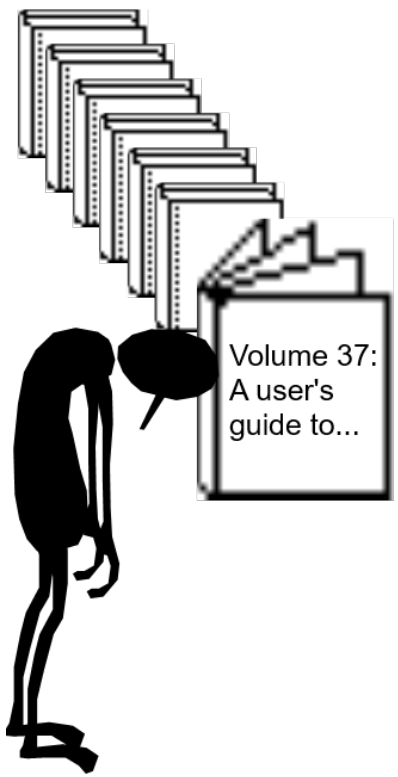
Help is not a replacement for bad design!

Simple systems:

- walk up and use
- minimal instructions

Most other systems

- feature rich
- simple things should be simple
- learning path for advanced features



Documentation and how it is used

Many users do not read manuals

- prefer to spend their time pursuing their task

Usually used when users are in some kind of panic

- paper manuals unavailable in many businesses!

  e.g. single copy locked away in system administrator's office
- online documentation better
- good search/lookup tools
- online help specific to current context

Sometimes used for quick reference

- syntax of actions, possibilities ...
- list of shortcuts ...

Types of help

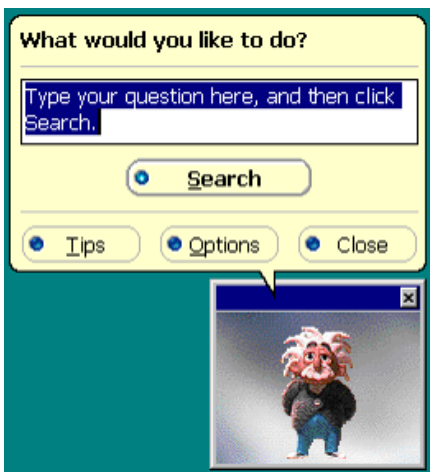
Tutorials and/or getting started manuals

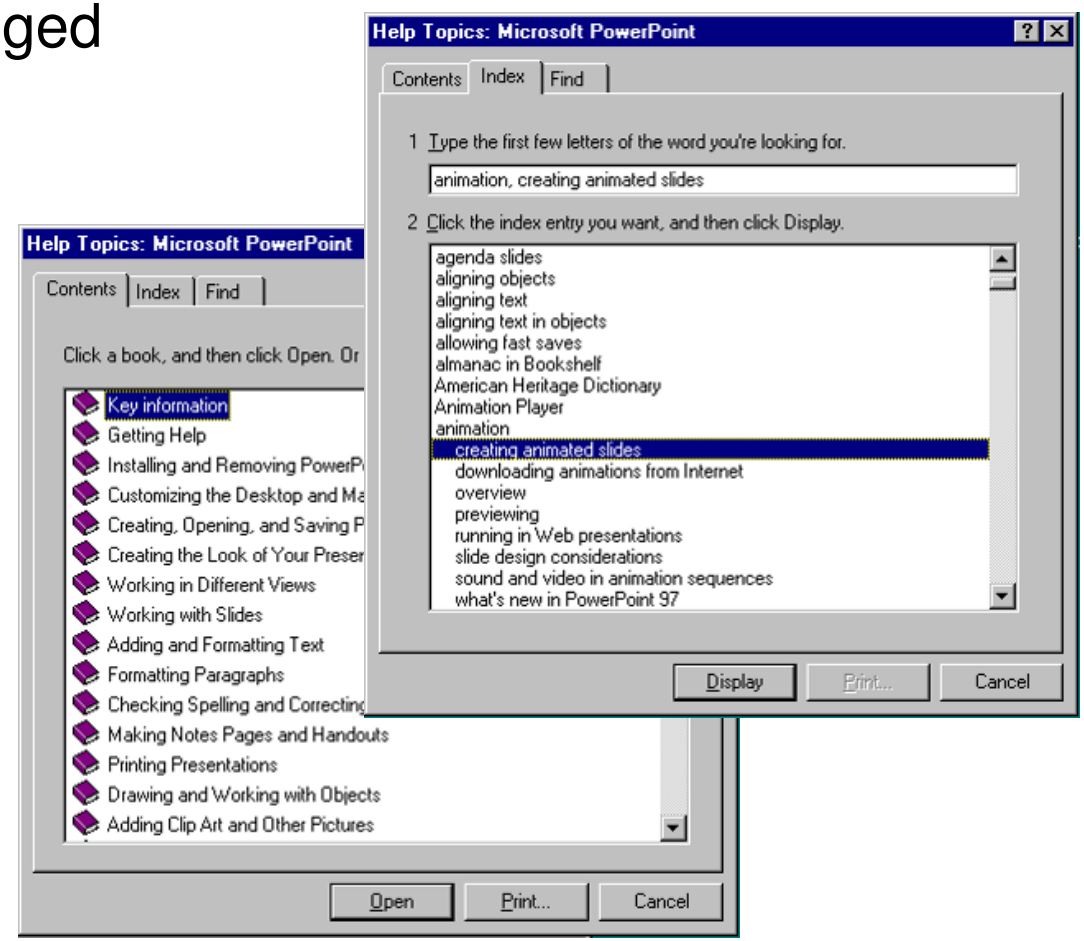
- short guides that people are likely to read when first obtaining their systems
  - encourages exploration and getting to know the system
  - tries to get conceptual material across and essential syntax
- on-line "tours", exercises, and demos
  - demonstrates very basic principles through working examples

Types of help

Reference manuals

- used mostly for detailed lookup by experts
  - rarely introduces concepts
  - thematically arranged
- on-line hypertext
  - search / find
  - table of contents
  - index
  - cross-index





Types of help

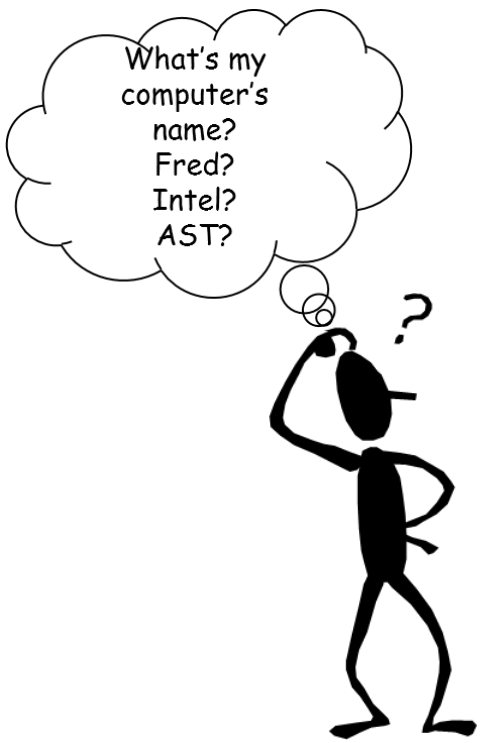
Reminders

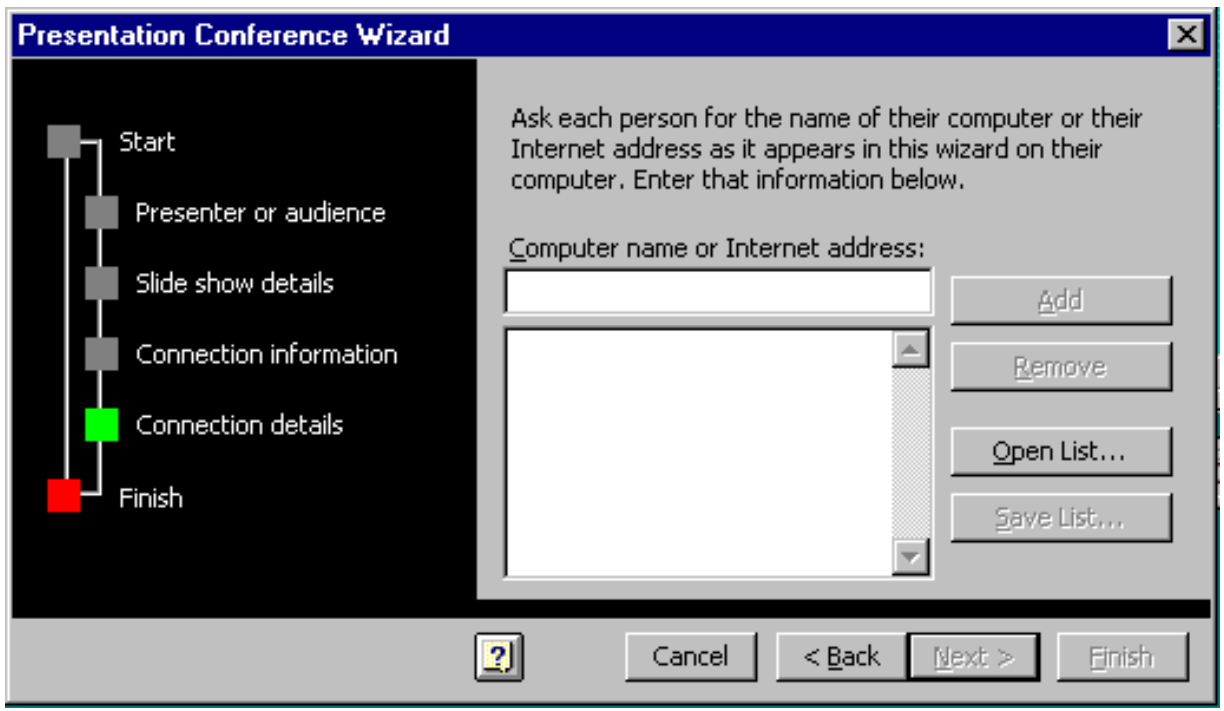
- short reference cards
  - expert user who just wants to check facts
  - novice who wants to get overview of system's capabilities
- keyboard templates
  - shortcuts/syntactic meanings of keys
  - recognition vs. recall
  - capabilities
- tooltips and other context-sensitive help
  - text over graphical items indicates their meaning or purpose

Types of help

Wizards

- walks user through typical tasks
- *but* dangerous if user gets stuck

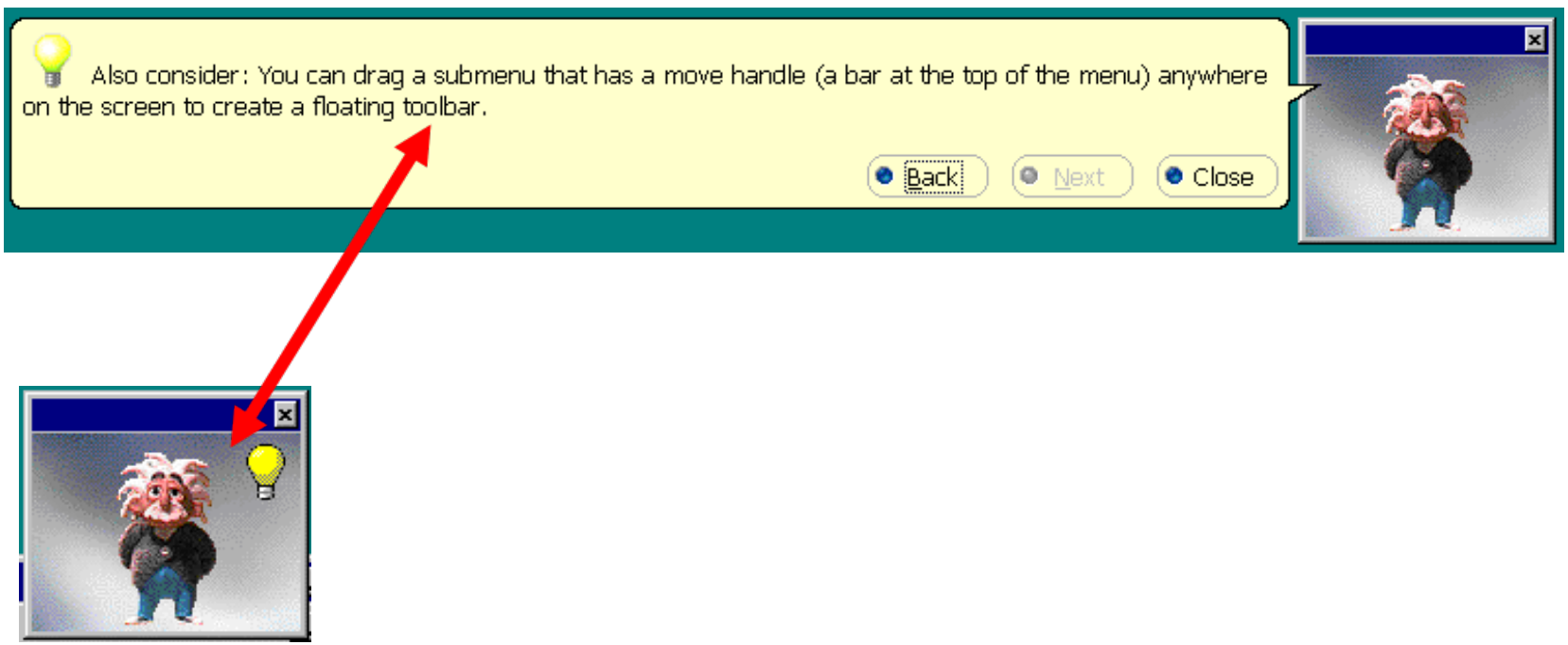




Types of help

Tips

- migration path to learning system features
- also context-specific tips on being more efficient
- must be "smart", otherwise boring and tedious



Evaluating Heuristic evaluation

Problems found by a single inspector

Problems found by multiple inspectors

Individuals vs. teams

Self guided or scenarios?

Problems found by a single inspector

Average over six case studies

- 35% of all usability problems
- 42% of the major problems
- 32% of the minor problems

Not great, but

- finding some problems with one evaluator is *much* better than finding no problems with no evaluators!

Problems found by a single inspector

Varies according to

- difficulty of the interface being evaluated
- the expertise of the inspectors

Average problems found by:

- novice evaluators - 22%
  - no usability expertise
- regular specialists - 41%
  - expertise in usability
- double specialists - 60%
  - experience in both usability and the particular kind of interface being evaluate
  - also find domain-related problems

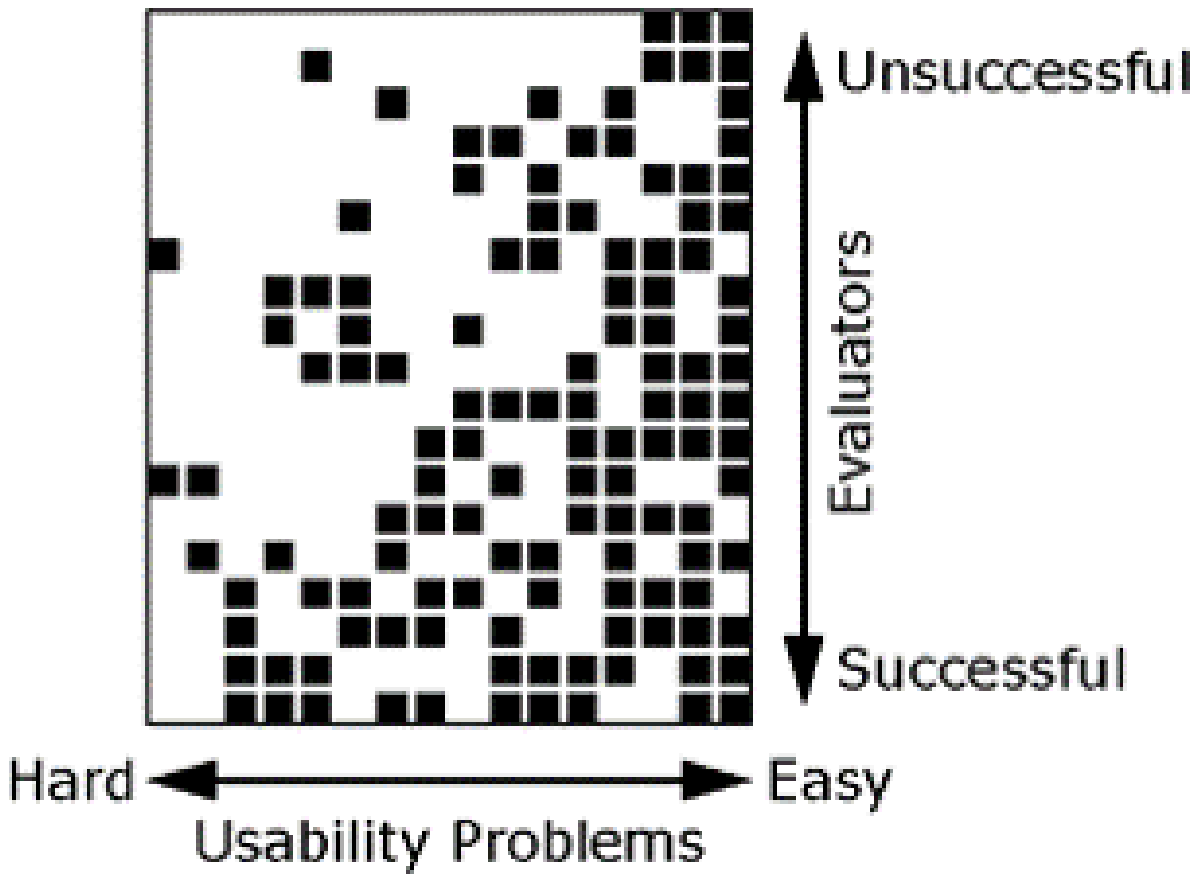
Tradeoff

- novices poorer, but cheaper!

Problems found by a single inspector

Evaluators miss both easy and hard problems

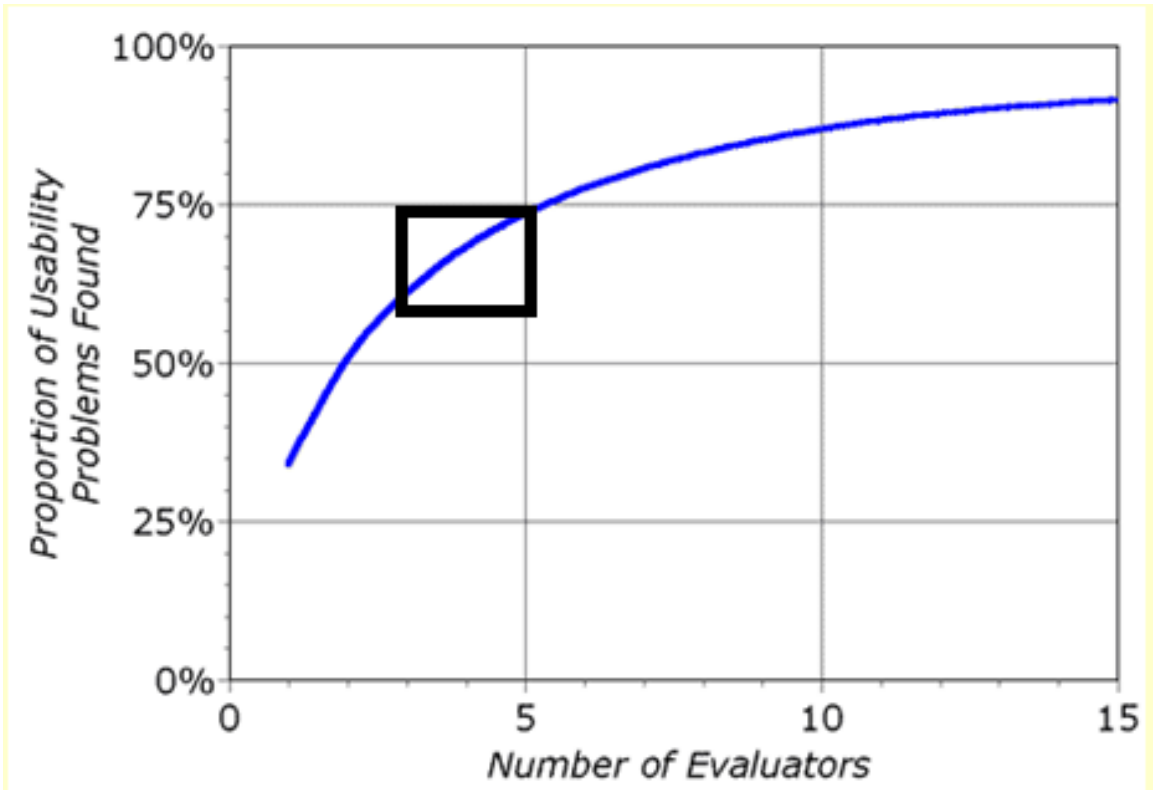
- "best" evaluators can miss easy problems
- "worse" evaluators can discover hard problems



Problems found by multiple inspectors

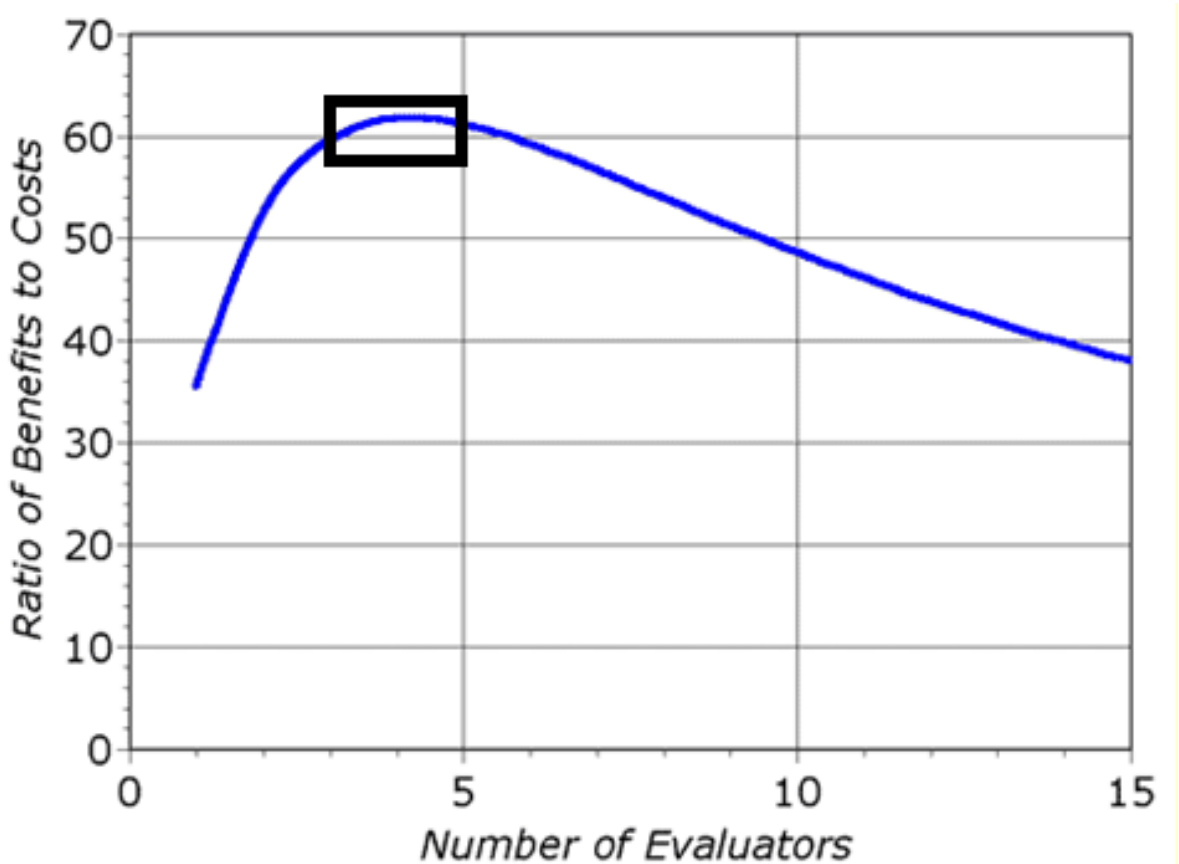
3-5 evaluators find 66-75% of usability problems

- different people find different usability problems
- only modest overlap between the sets of problems found



Problems found by multiple inspectors

Where is the best cost/benefit?



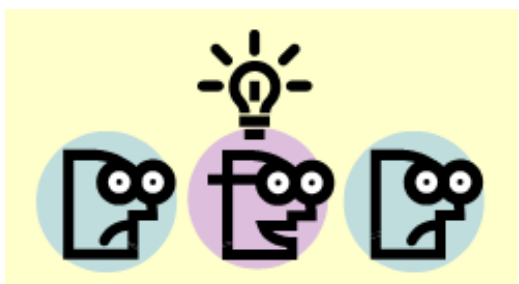
Individuals *vs* teams

Nielsen

- recommends individual evaluators inspect the interface alone

Why?

- evaluation is not influenced by others
- independent and unbiased
- greater variability in the kinds of errors found
- no overhead required to organize group meetings



Self Guided *vs* Scenario Exploration

Self-guided

- open-ended exploration
- not necessarily task-directed
- good for exploring diverse aspects of the interface, and to follow potential pitfalls

Scenarios

- step through the interface using representative end user tasks
- ensures problems identified in relevant portions of the interface
- ensures that specific features of interest are evaluated
- but limits the scope of the evaluation - problems can be missed

Other guidelines

Style guides

Style guides

Guidelines published by producers of graphical user interfaces (GUIs)

- example
  - Microsoft Windows
  - Apple
  - all major software platforms have published guidelines for user interface design

Describes the "look and feel" of the GUI
Good, but hard too follow

- GUI and widget specific
- vast number of guidelines
- may miss fundamental design principles

Style guides

Microsoft Windows

- User experience guidelines for Windows-based desktop applications
  `https://docs.microsoft.com/en-us/windows/desktop/uxguide/guidelines`
- User Interface Principles
  `https://docs.microsoft.com/en-us/windows/desktop/appuistart/-user-interface-principles`

Style guides

Apple

- Human Interface Guidelines
  `https://developer.apple.com/design/human-interface-guidelines/`

Android

- Android Design Guidelines
  `https://developer.android.com/design`

You know now

Nine principles of design

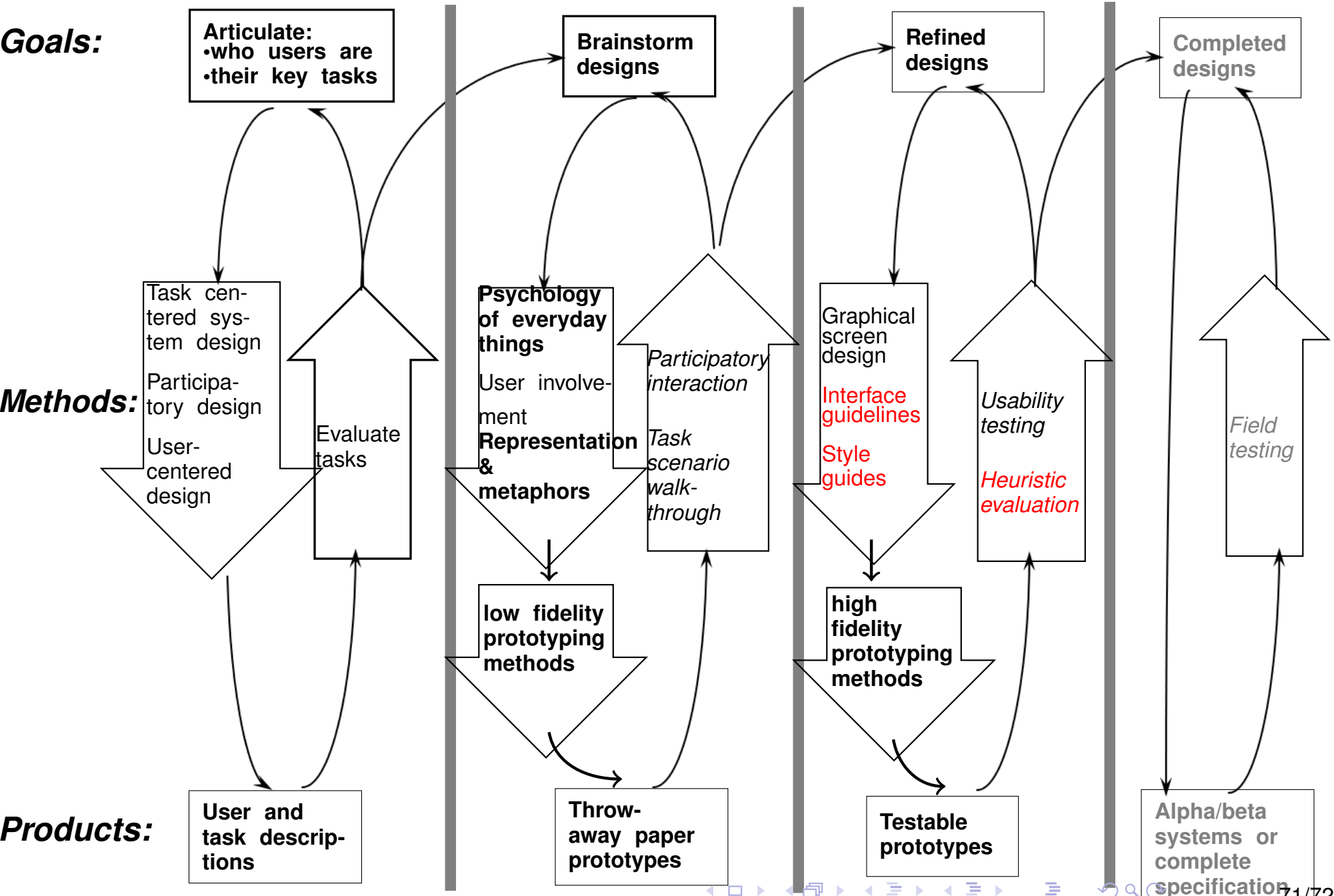
- Simple and natural dialogue
- Speak the user's language
- Minimize user's memory load
- Be consistent
- Provide feedback
- Provide clearly marked exits
- Provide shortcuts
- Deal with errors in a positive manner
- Provide help

Heuristic evaluation

- Principles can be used to systematically inspect the interface for usability problems

Style guides

Interface Design and Usability Engineering



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