CSE 440: Introduction to HCI

User Interface Design, Prototyping, and Evaluation

Lecture 12:
Inspection-Based Methods

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Daniel Epstein
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Tuesday/Thursday
10:30 to 11:50
MOR 234

Today

In-Class

- Inspection-Based Methods
- Heuristic Evaluation of Paper Prototypes

Revise Prototypes

Usability Testing Check-In for Friday

- Changes from Inspection
- Changes from First Usability Test

Inspection-Based Methods

We have cut prototyping to its minimum

- Sketches, storyboards, paper prototypes
- Rapid exploration of potential ideas

But we need evaluation to guide improvement

- Evaluation can become relatively slow and expensive
- Study participants can be scarce
- May waste participants on fairly obvious problems

Inspection-Based Methods

Simulate study participants

- Instead of actual study participants, use inspection to quickly and cheaply identify likely problems

Inspection methods are rational, not empirical

Today we cover two complementary methods

- Heuristic Evaluation
- Cognitive Walkthrough

Heuristic Evaluation

Developed by Jakob Nielsen

Helps find usability problems in a design

Small set of evaluators examine interface

- three to five evaluators
- independently check compliance with principles
- different evaluators will find different problems
- evaluators only communicate afterwards

Can perform on working interfaces or sketches

Nielsen's 10 Heuristics

Too few unhelpful, too many overwhelming

- "Be Good" versus thousands of detailed rules

Nielsen seeks to create a small set

- Collects 249 usability problems
- Collects 101 usability heuristics
- Rates how well each heuristics explains each problem
- Factor analysis to identify key heuristics

Nielsen, 1994

Nielsen's 10 Heuristics

Visibility of system status
Match between system and the real world
User control and freedom
Consistency and standards
Error prevention
Recognition rather than recall
Flexibility and efficiency of use
Aesthetic and minimalist design
Help recognize, diagnose, and recover from errors
Help and documentation

Nielsen, 1994

1. Visibility

Visibility of system status

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Refers to both visibility of system status and use of feedback

Anytime wondering what state the system is in, or the result of some action, this is a visibility violation.

2. Real World Match

Match between system and the real world

The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

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Refers to word and language choice, mental model, metaphor, mapping, and sequencing

3. User in Control

User control and freedom

Users often choose system functions by mistake and will need a clearly marked “emergency exit” to leave the unwanted state without having to go through an extended dialogue.
Support undo and redo.

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Support undo and redo.

Not just for navigation exits,
but for getting out of any situation or state.

4. Consistency

Consistency and standards

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> Follow platform conventions.

Internal consistency is consistency throughout the same product. External consistency is consistency with other products in its class.

5. Error Prevention

Error prevention

Even better than good error messages
is a careful design which prevents a problem
from occurring in the first place. Either
eliminate error-prone conditions or check for them
and present users with a confirmation option before
they commit to the action.

5. Error Prevention

Error prevention

> Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

Try to commit errors and see how they are handled. Could they have been prevented?

6. Recognition not Recall

Recognition rather than recall

Minimize the user's memory load by
making objects, actions, and options visible.
The user should not have to remember information
from one part of the dialogue to another.
Instructions for use of the system should be visible or
easily retrievable whenever appropriate.

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Recognition rather than recall

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People should never carry a memory load

6. Recognition not Recall

Addresses visibility of features and information

- where to find things

Visibility addresses system status and feedback

- what is going on

Problems with affordances may go here

- hidden affordance: remember where to act
- false affordance: remember it is a fake

7. Flexibility and Efficiency

Flexibility and efficiency of use

Accelerators -- unseen by the novice user -- may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users.
Allow users to tailor frequent actions.

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Allow users to tailor frequent actions.

Concerns anywhere users have repetitive actions that must be done manually. Also concerns allowing multiple ways to do things.

8. Aesthetic Design

Aesthetic and minimalist design

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Not just about “ugliness”.
About clutter, overload of visual field,
visual noise, distracting animations, and so on.

9. Error Recovery

Help users recognize, diagnose, and recover from errors

Error messages should be expressed in
plain language (no codes),
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Error prevention is about preventing errors before they occur. This is about after they occur.

10. Help

Help and documentation

Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

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This does not mean that the user must be able to ask for help on every single item.

Heuristic Evaluation Process

Evaluators go through interface several times

- inspect various dialogue elements
- compare with list of usability principles

Usability principles

- Nielsen's "heuristics"
- supplementary list of category-specific heuristics (competitive analysis or testing existing products)

Use violations to redesign/fix problems

Examples

Can’t copy info from one window to another

- violates “Minimize memory load” (H6)
- fix: allow copying

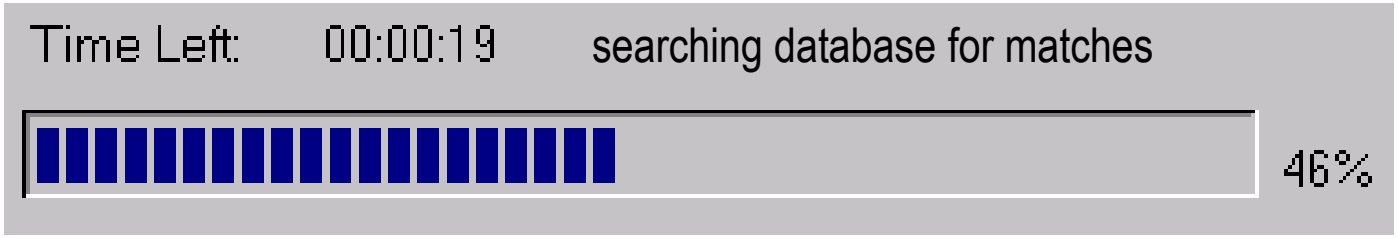
Typography uses different fonts in 3 dialog boxes

- violates “Consistency and standards” (H4)
  - slows users down
  - probably wouldn’t be found by usability testing
- fix: pick a single format for entire interface

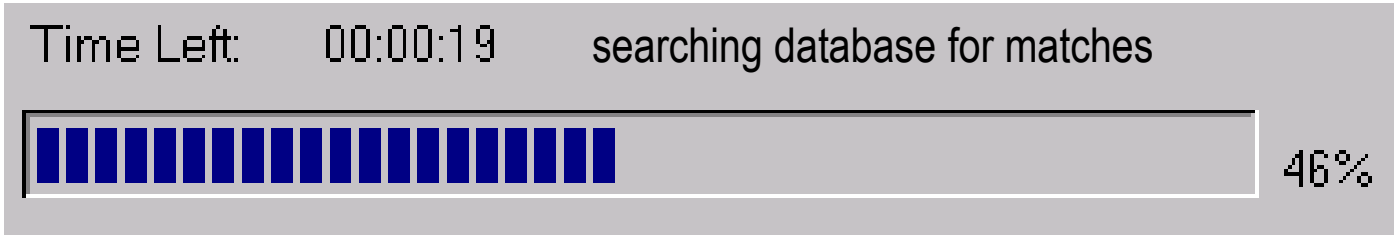
Heuristics

Heuristics

Heuristics



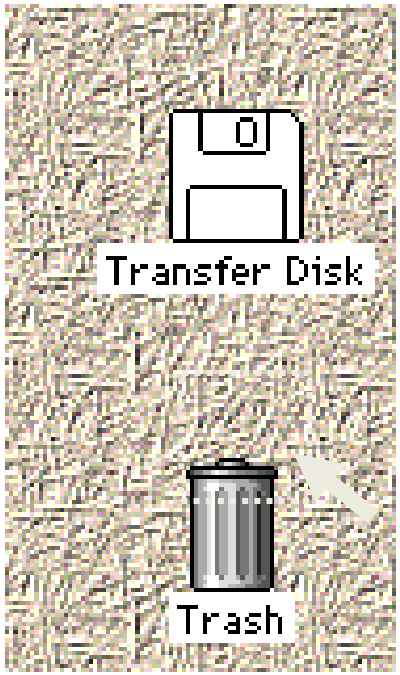
Heuristics



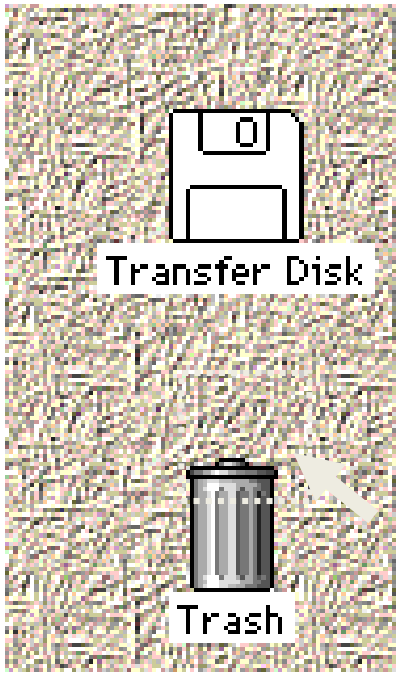
Visibility of system status

- pay attention to response time
  - 0.1 sec: no special indicators needed (why?)
  - 1.0 sec: user tends to lose track of data
  - 10 sec: maximum duration if user to stay focused on action
  - longer delays absolutely require percent-done progress bars

Heuristics



Heuristics



Mac desktop

- Dragging disk to trash should delete, not eject it

Match system to real world

- Speak the user's language
- Follow conventions

Heuristics

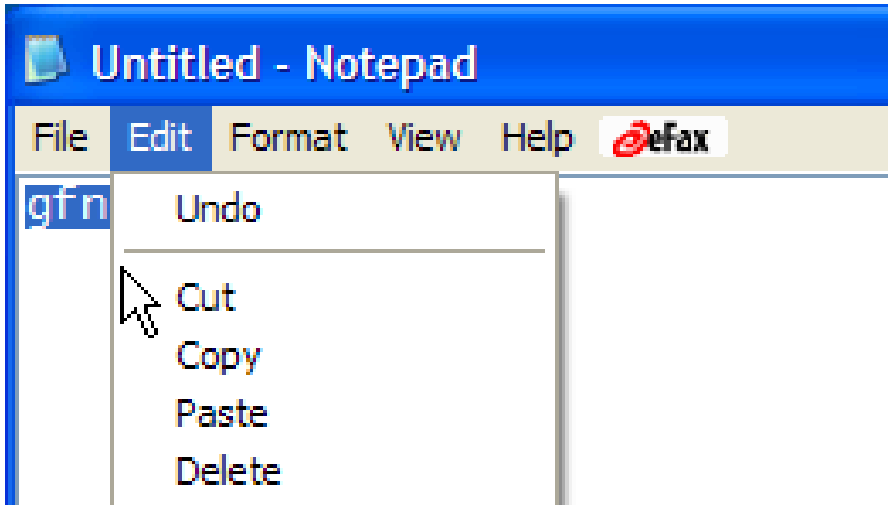
Heuristics

"Mailto", "protocol"?

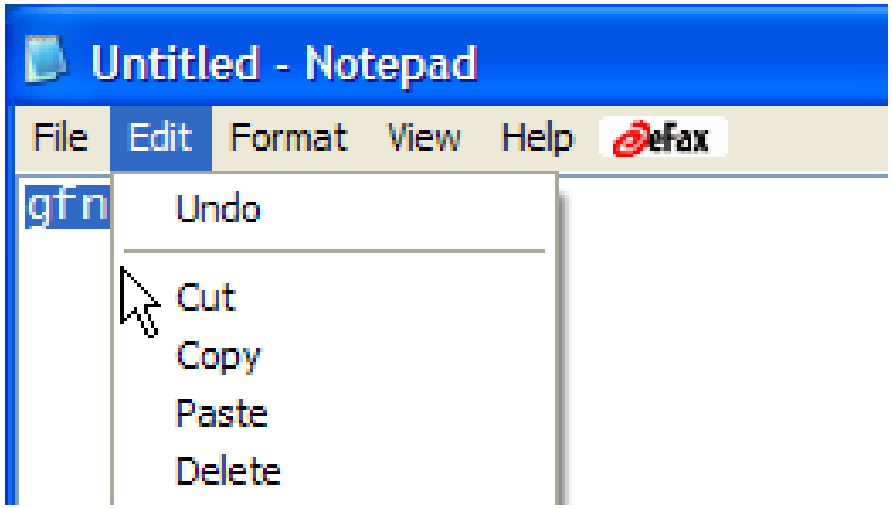
Match system to real world

Speak the user's language

Heuristics


Untitled - Notepad
File
Edit
Format
View
Help
eFax
gfn
Undo
Cut
Copy
Paste
Delete

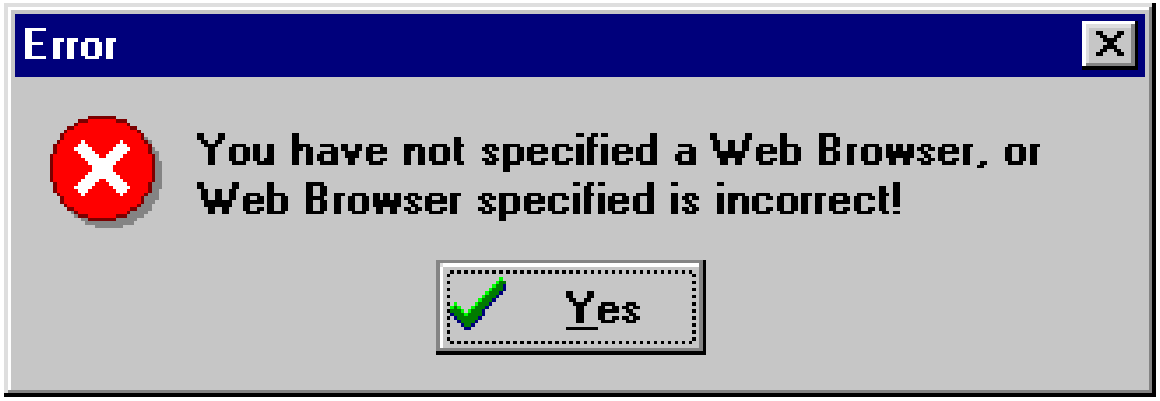
Heuristics



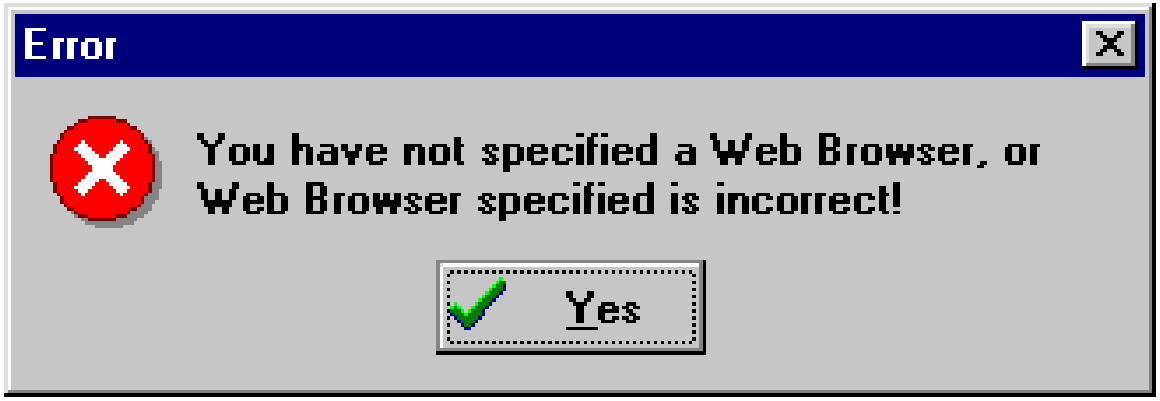
Flexibility and Efficiency of Use

- accelerators for experts (e.g., keyboard shortcuts)
- allow tailoring of frequent actions (e.g., macros)

Heuristics


Error
You have not specified a Web Browser, or
Web Browser specified is incorrect!
Yes

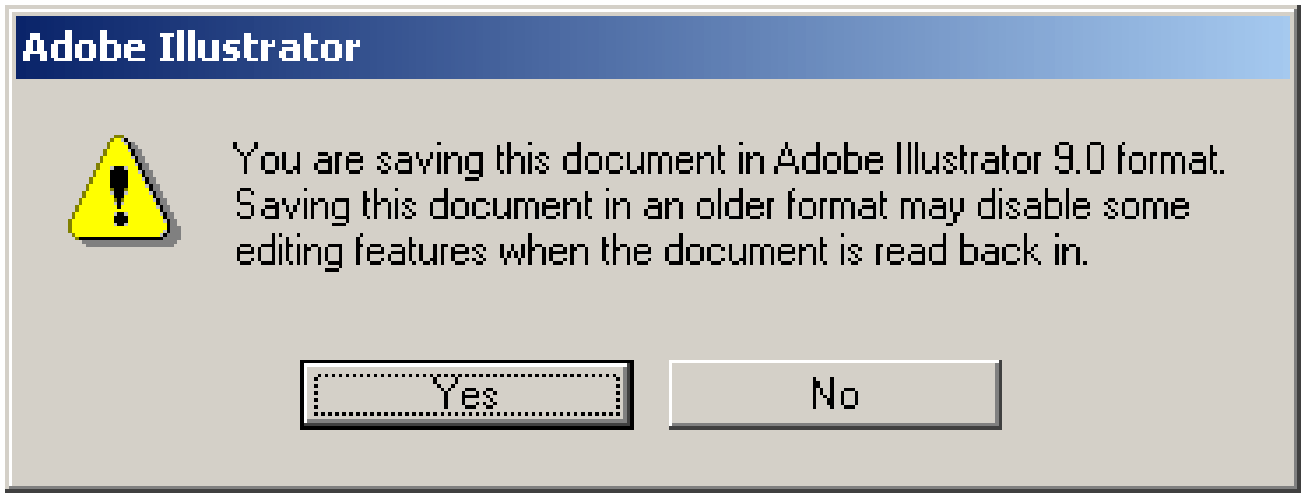
Heuristics



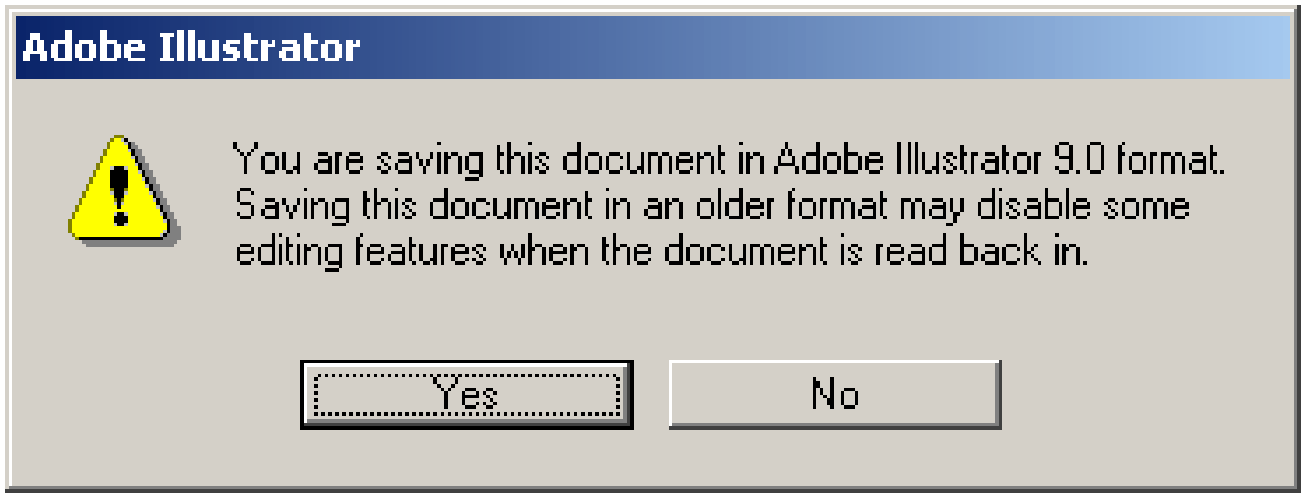
Help recognize, diagnose, & recover from errors

- error messages in plain language
- precisely indicate the problem
- constructively suggest a solution

Heuristics


Adobe Illustrator
You are saving this document in Adobe Illustrator 9.0 format.
Saving this document in an older format may disable some
editing features when the document is read back in.
Yes
No

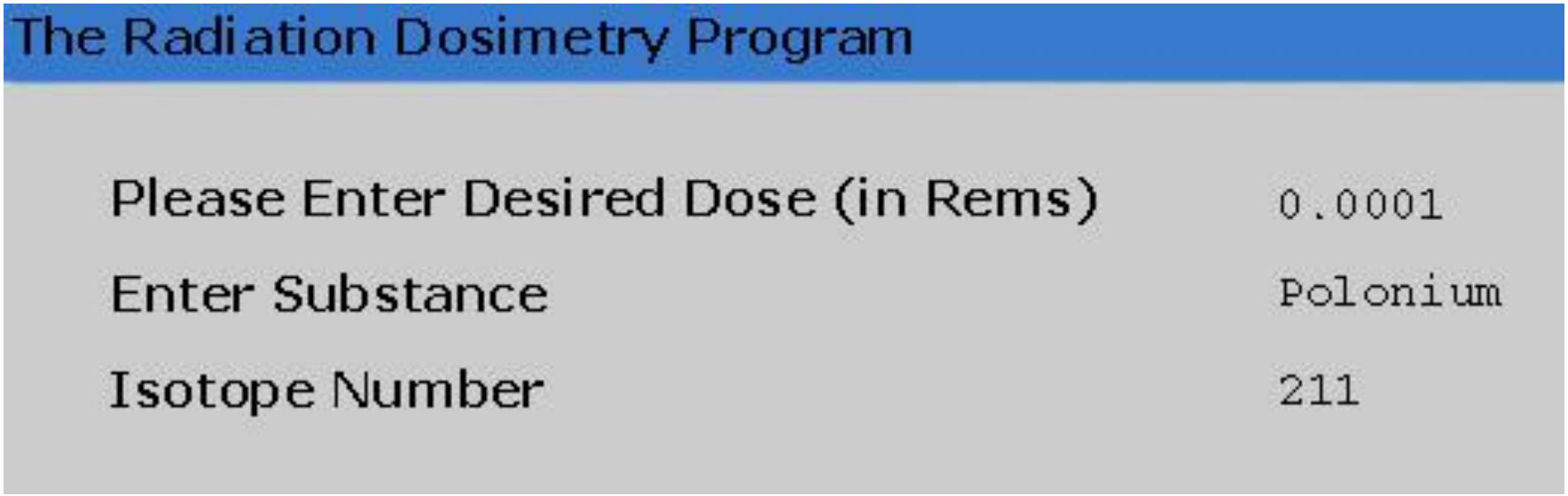
Heuristics



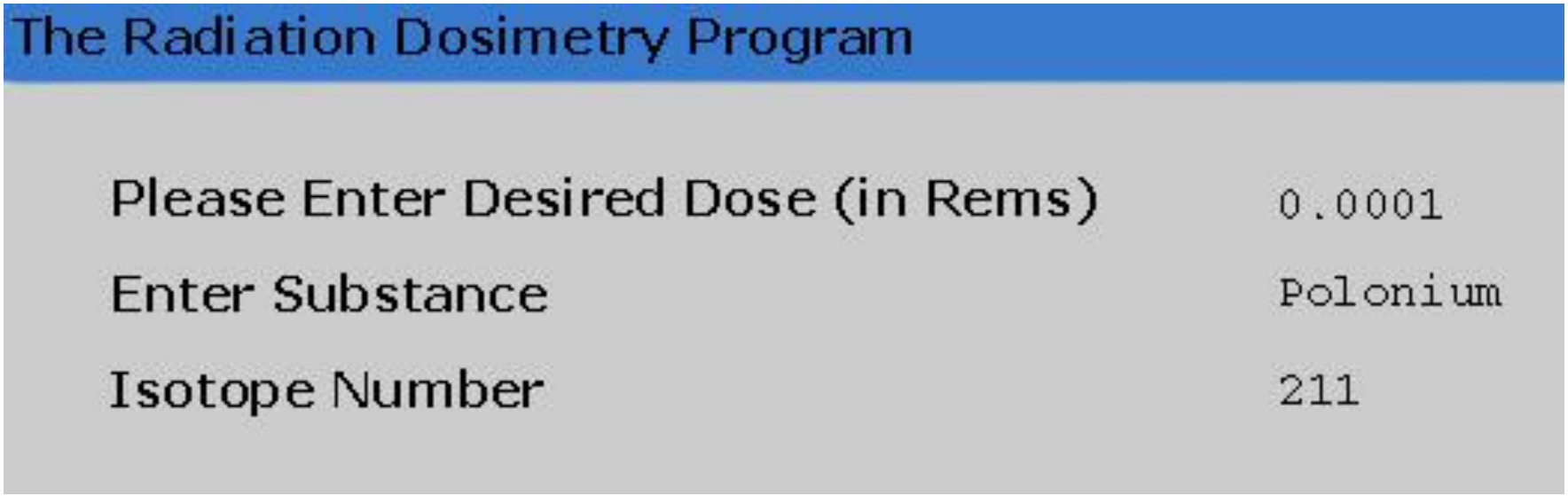
User Control and Freedom

Prevent Errors

Heuristics

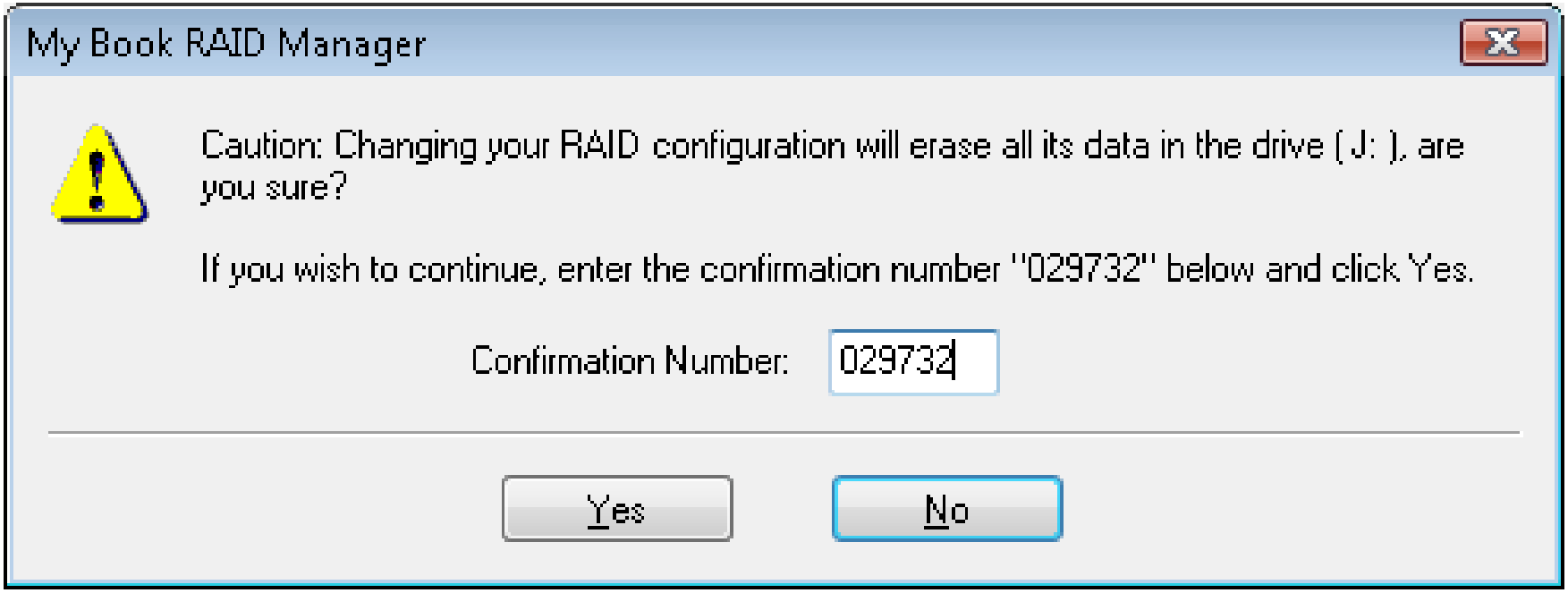

The Radiation Dosimetry Program
Please Enter Desired Dose (in Rems)
0.0001
Enter Substance
Polonium
Isotope Number
211

Heuristics

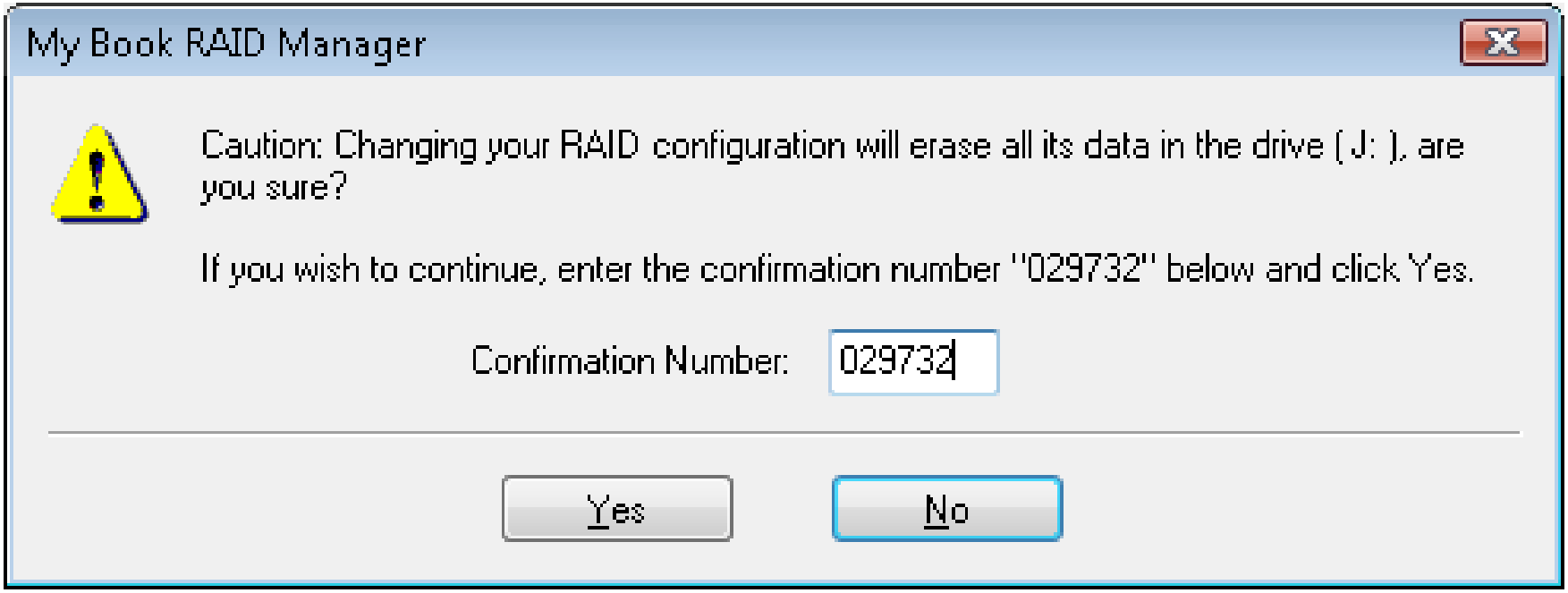


Prevent Errors

Heuristics

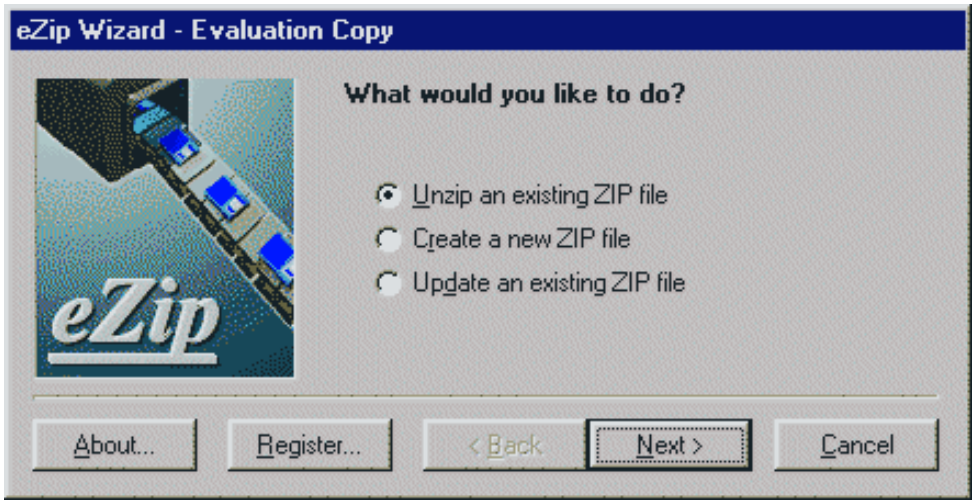

My Book RAID Manager
Caution: Changing your RAID configuration will erase all its data in the drive (J:), are you sure?
If you wish to continue, enter the confirmation number "029732" below and click Yes.
Confirmation Number:
029732
Yes
No

Heuristics

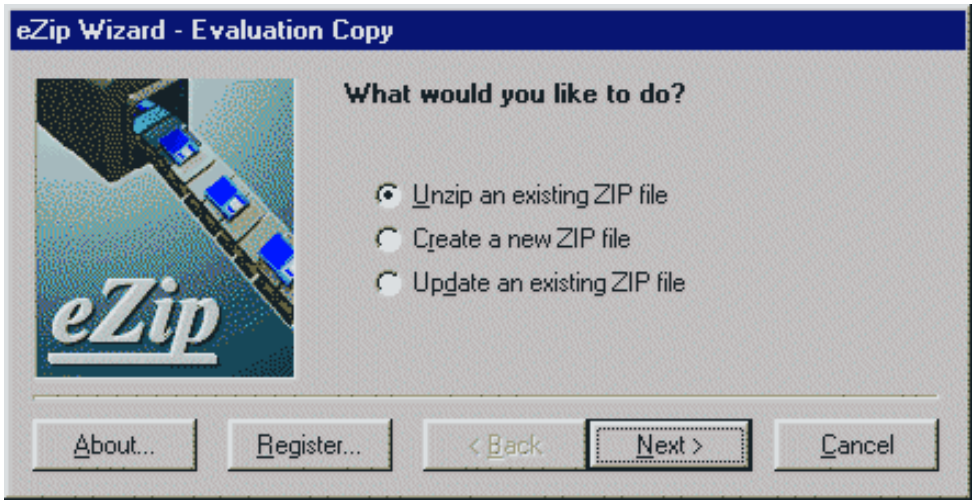


Prevent Errors

Heuristics


eZip Wizard - Evaluation Copy
What would you like to do?
Unzip an existing ZIP file
Create a new ZIP file
Update an existing ZIP file
eZip
About...
Register...
< Back
Next >
Cancel

Heuristics



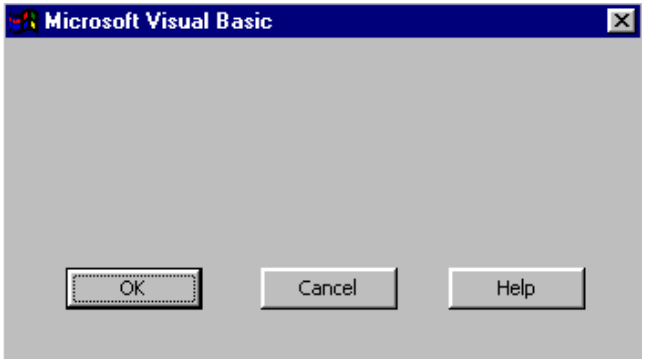
User control & freedom

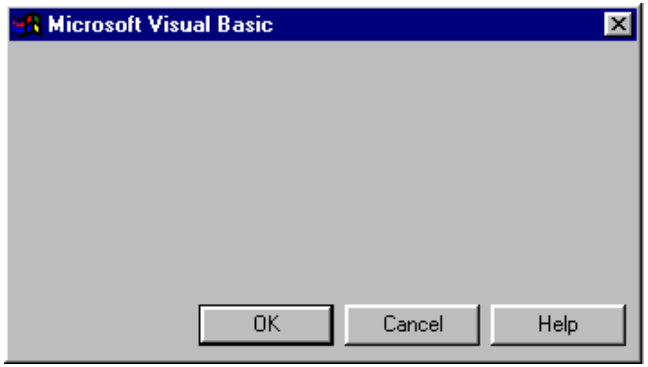
- provide “exits” for mistaken choices, undo, redo
- don’t force down fixed paths

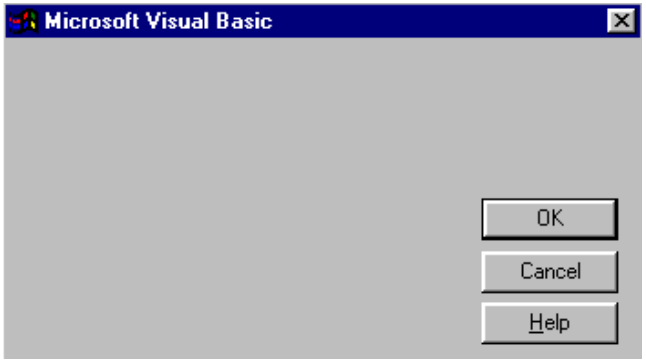
Wizards

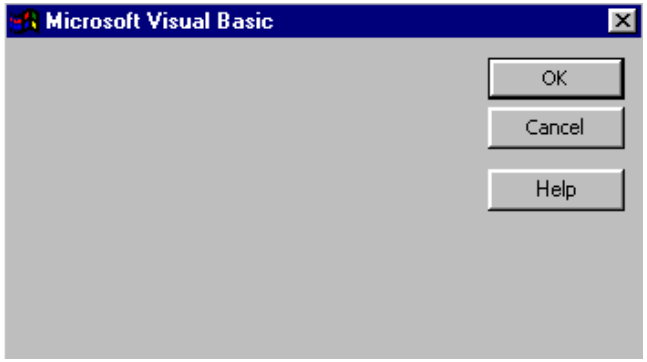
- must respond to question before going to next
- good for beginners, infrequent tasks
- not for common tasks
- consider having 2 versions (WinZip)

Heuristics

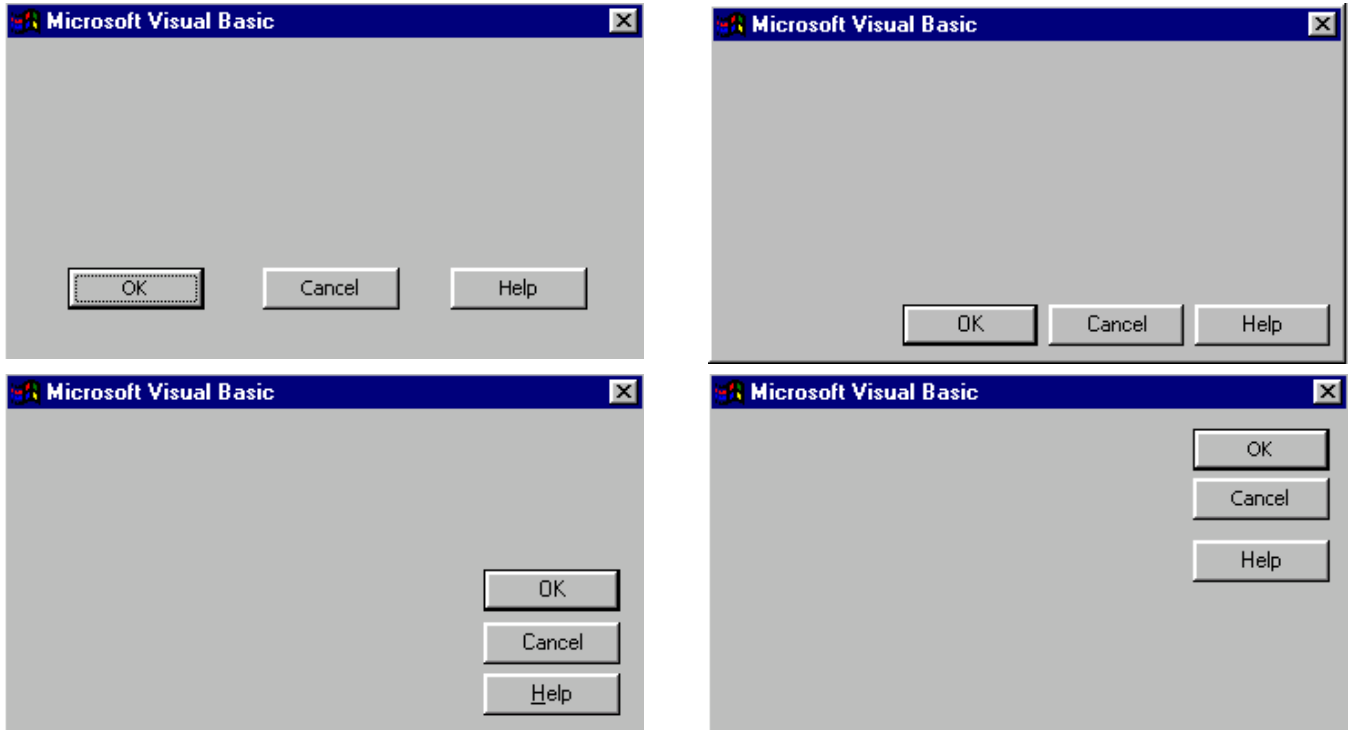

Microsoft Visual Basic
OK
Cancel
Help


Microsoft Visual Basic
OK
Cancel
Help


Microsoft Visual Basic
OK
Cancel
Help


Microsoft Visual Basic
OK
Cancel
Help

Heuristics

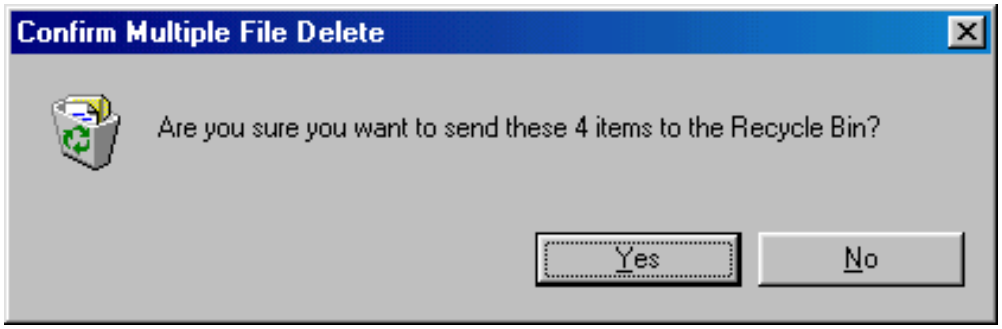


Consistency & Standards

Heuristics

% rm cse440*

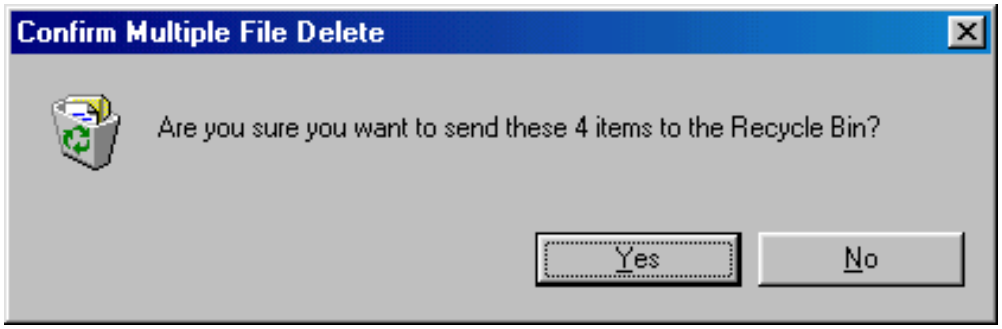
%



Heuristics

% rm cse440*

%

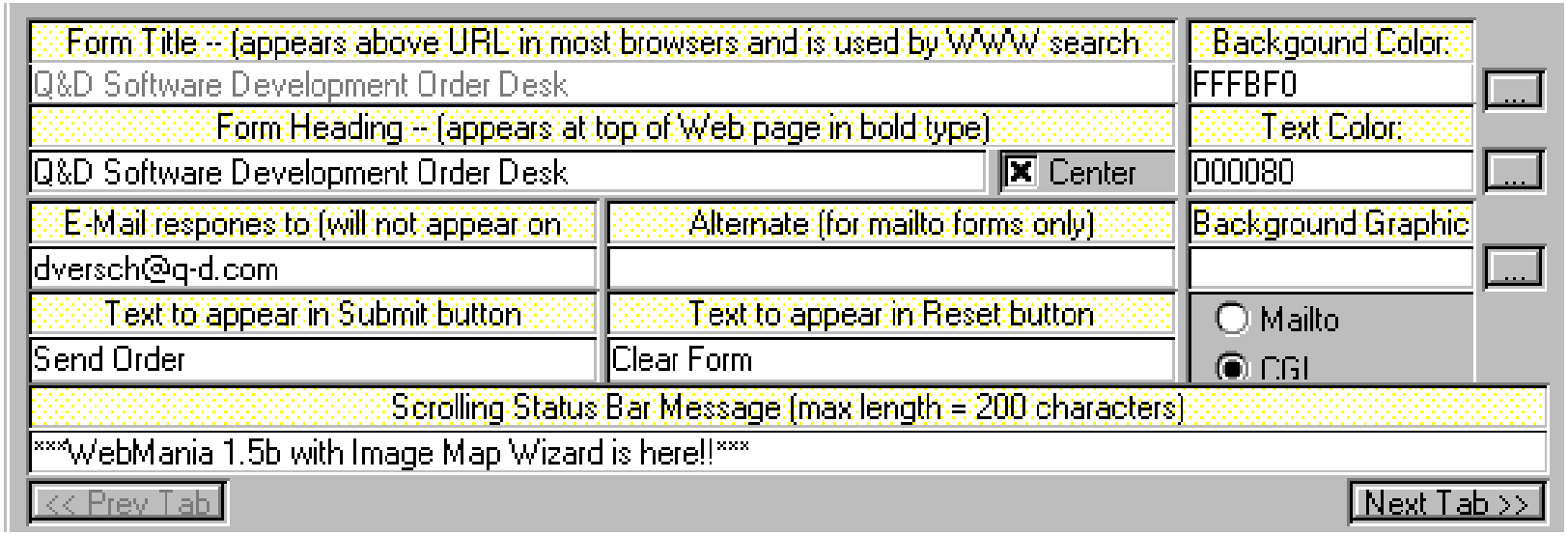


Error prevention

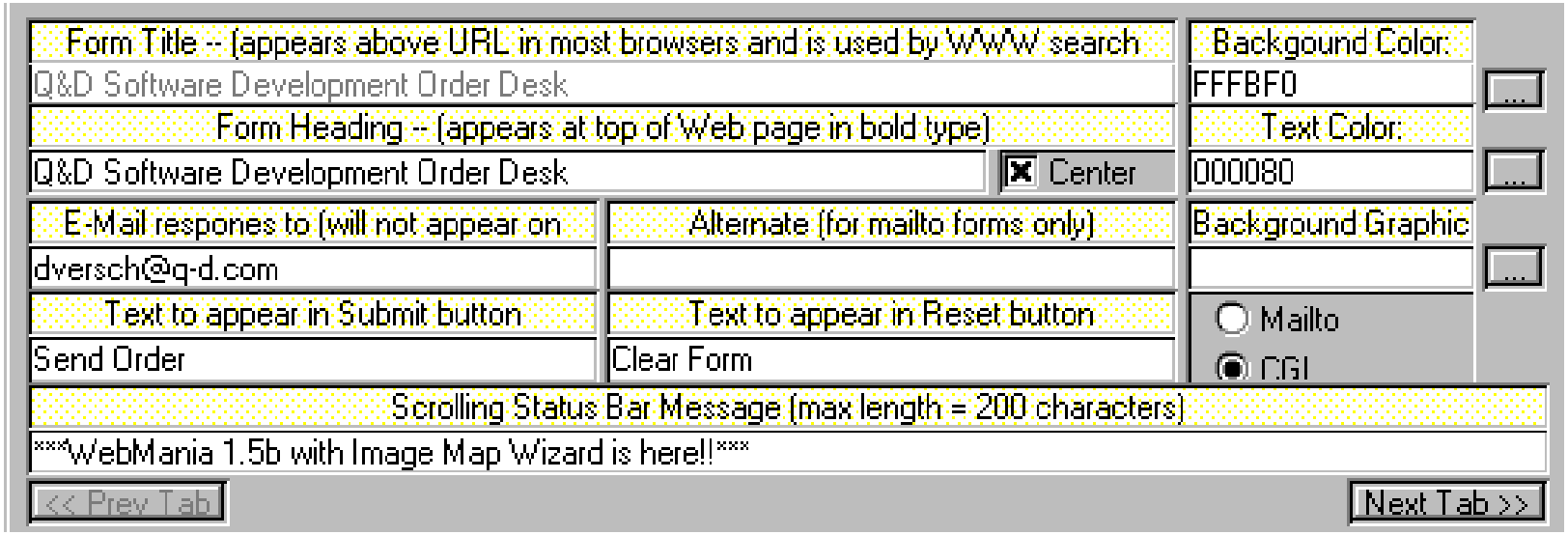
Recognition rather than recall

Visibility

Heuristics


Form Title -- (appears above URL in most browsers and is used by WWW search
Q&D Software Development Order Desk
Form Heading -- (appears at top of Web page in bold type)
Q&D Software Development Order Desk
Center
E-Mail respones to (will not appear on
dversch@q-d.com
Alternate (for mailto forms only)
Text to appear in Submit button
Send Order
Text to appear in Reset button
Clear Form
Backgound Color:
FFFBF0
Text Color:
000080
Background Graphic
Mailto
CGI
Scrolling Status Bar Message (max length = 200 characters)
WebMania 1.5b with Image Map Wizard is here!!
<< Prev Tab
Next Tab >>

Heuristics



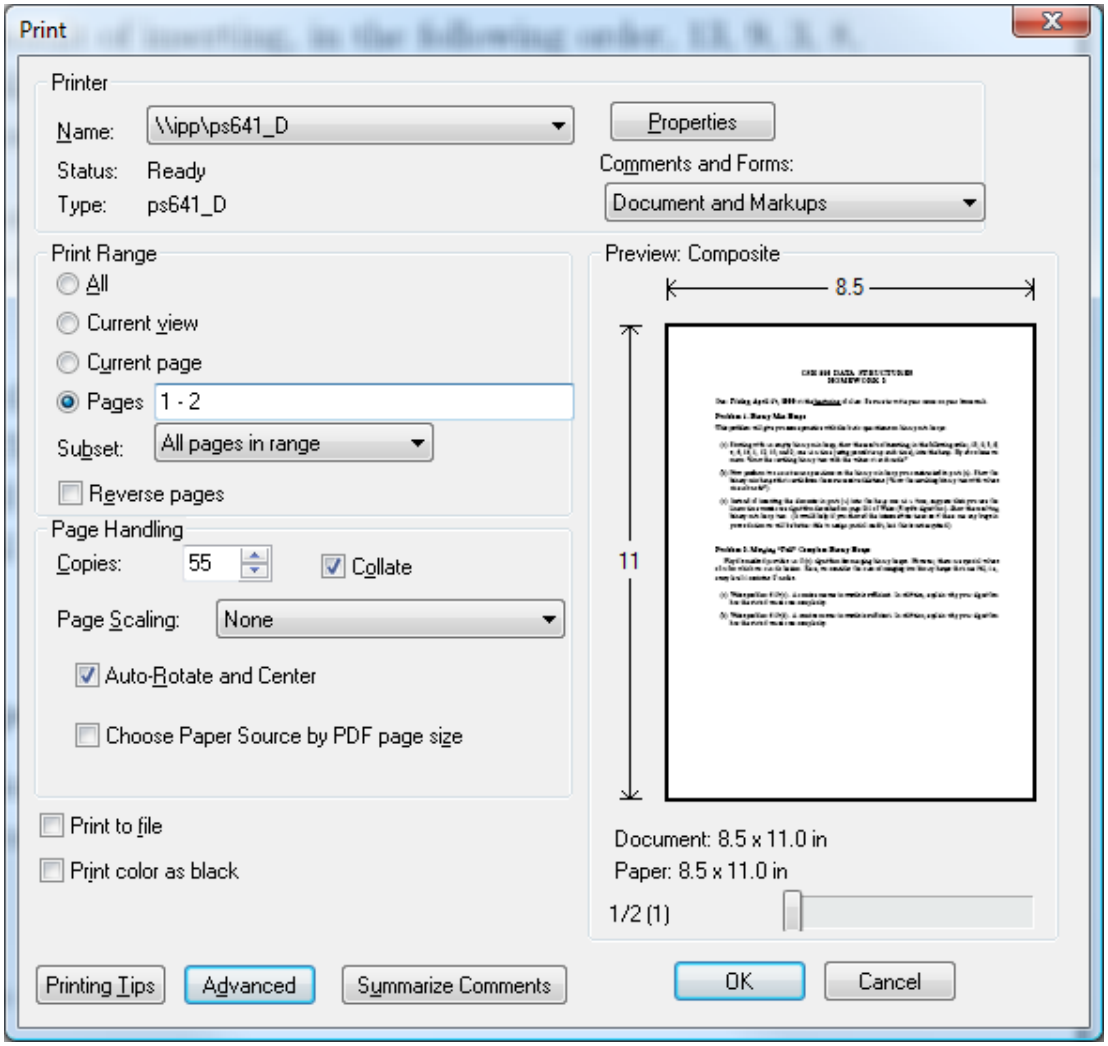
Aesthetic & Minimalist design

- no irrelevant information in dialogues

Heuristics


Select an award style...
Select an award style using the scroll bar. When you've found a style that suits you, press OKAY to create that award and open the editor.
Certificate of
ACHIEVEMENT
CERTIFICATE OF ACHIEVEMENT
Cancel
OK

Heuristics


Print
Printer
Name:
\\ipp\ps641_D
Properties
Status:
Ready
Type:
ps641_D
Comments and Forms:
Document and Markups
Print Range
All
Current view
Current page
Pages
1 - 2
Subset:
All pages in range
Reverse pages
Page Handling
Copies:
55
Collate
Page Scaling:
None
Auto-Rotate and Center
Choose Paper Source by PDF page size
Print to file
Print color as black
Preview: Composite
8.5
11
Document: 8.5 x 11.0 in
Paper: 8.5 x 11.0 in
1/2 (1)
Printing Tips
Advanced
Summarize Comments
OK
Cancel

Heuristics


UR Rewarding Experiences - Mozilla Firefox
File Edit View History Bookmarks Tools Help
https://ultimaterewardslt.chase.com/edealinv/servlet/ExecMacro?ctl_nbr=10630&nurl=control%2F5
Most Visited Getting Started Latest Headlines
UR Rewarding Experiences
My Chase Accounts Manage Ultimate Rewards Help Log Off
CHASE
ultimate rewards
Rewards Home Travel Experiences Merchandise Gift Cards Cash Back Earn Faster Spotlight
Your rewards balance is 25,601 Points
All Rewards Search GO
Rewarding Experiences
Your Chase card with Ultimate Rewards gives you access to great entertainment including concerts, sporting events, chef dinners and more.
Use your points or your Chase card to redeem for most items, or just your points to bid on the auctions.
Featured Experiences & Auctions
Five-Night Vacation to Rome for Two
Auction
Rome, Italy
Opening Bid: 128,575 points
View Details | View More Like This
Quick Search
City
All Cities
Category:
All Categories
From To
Search
Culinary & Wine
Culinary Experiences (29)
Wine Experiences (2)
Restaurants (1)
See All Culinary & Wine
Sports & Leisure
Car Racing (38)
Adventure (27)
Outdoor Activities (24)
See All Sports & Leisure
Art & Entertainment
More Art & Entertainment (4)
Museums (1)
Music (1)
See All Art & Entertainment
Gift Ideas
Cook up Sweet Chocolate Creations
43,400 points or $434 on your Chase Card
Private Photography Lesson
Current Bid: 12,519 points
DJ Delights
14,400 points or
Featured Experiences
These new Experiences offer excitement on land, on sea and in the air!
Ride shotgun in a dragster at Brainerd International Raceway. $184 or 18400 points.
Dance and dine on a Washington, D.C. dinner cruise for two. $249 or 24900 points.
How It Works
There are two types of rewards:
Auctions
For auctions, you can bid on rewards using your points. If you are the top bidder when the auction expires, you win.
Redeem Now
For everything else, you can redeem now using your points or your Chase card with Ultimate Rewards.
» FAQs
Transferring data from ultimaterewardslt.chase.com...

Phases of Heuristic Evaluation

1) Pre-evaluation training

   give expert evaluators needed
   domain knowledge & information on the scenario

2) Evaluation

   individuals evaluate interface & make lists of problems

3) Severity rating

   determine how severe each problem is

4) Aggregation

   group meets & aggregates problems (w/ ratings)

5) Debriefing

   discuss the outcome with design team

How to Perform Evaluation

At least two passes for each evaluator

- first to get feel for flow and scope of system
- second to focus on specific elements

If system is walk-up-and-use or evaluators are domain experts, no assistance needed

- otherwise might supply evaluators with scenarios

Each evaluator produces list of problems

- explain why with reference to heuristic
- be specific & list each problem separately

Example Heuristic Violation

1. [H4 Consistency]

The interface used the string "Save" on the first screen for saving the user's file, but used the string "Write file" on the second screen. Users may be confused by this different terminology for the same function.

How to Perform Heuristic Evaluation

Why separate listings for each violation?

- risk of repeating problematic aspect
- may not be possible to fix all problems

Where problems may be found

- single location in interface
- two or more locations that need to be compared
- problem with overall structure of interface
- something that is missing
  - common problem with paper prototypes
  - (sometimes features are implied by design documents and just haven't been "implemented" – relax on those)

Severity Rating

Used to allocate resources to fix problems

Estimates of need for more usability efforts

Combination of

- frequency
- impact
- persistence (one time or repeating)

Should be calculated after all evaluations are in

Should be done independently by all judges

Severity Rating

0 - Do not agree this is a problem.

1 - Usability blemish. Mild annoyance or cosmetic problem. Easily avoidable.

2 - Minor usability problem. Annoying, misleading, unclear, confusing. Can be avoided or easily learned. May occur only once.

3 - Major usability problem. Prevents users from completing tasks. Highly confusing or unclear. Difficult to avoid. Likely to occur more than once.

4 - Critical usability problem. Users will not be able to accomplish their goals. Users may quit using system all together.

Example Heuristic Violation

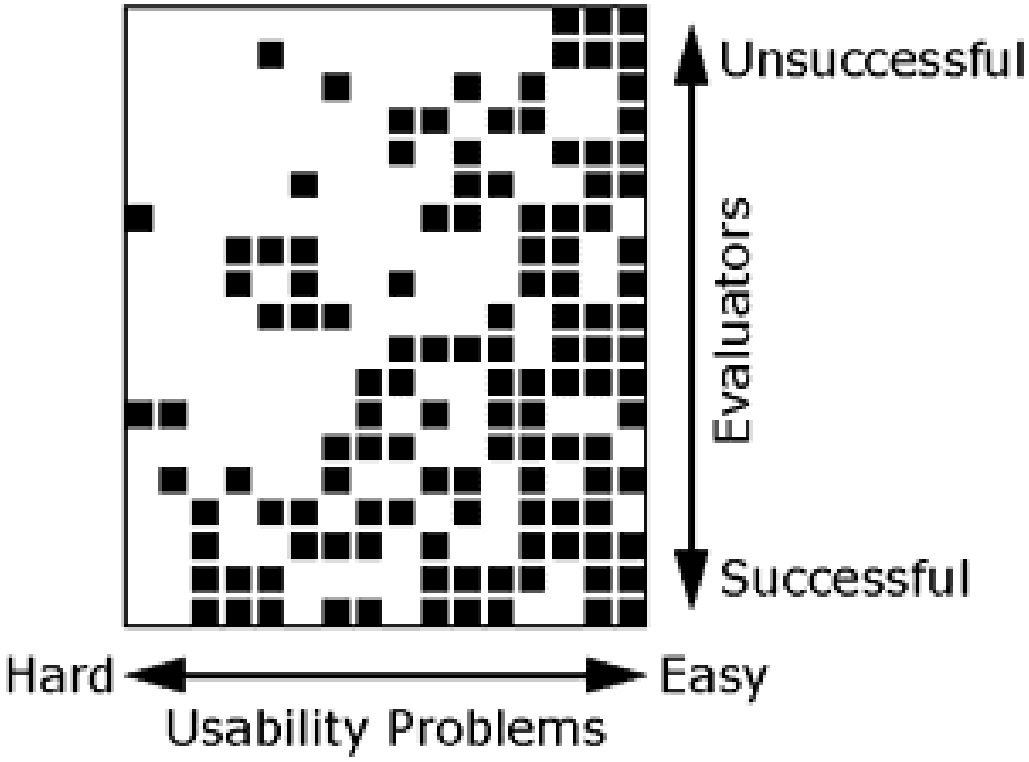
1. [H4 Consistency] [Severity 3]

The interface used the string "Save" on the first screen for saving the user's file, but used the string "Write file" on the second screen. Users may be confused by this different terminology for the same function.

Why Multiple Evaluators?

Every evaluator doesn't find every problem

Good evaluators find both easy & hard ones



Fixability Scores

1 - Nearly impossible to fix. Requires massive re-engineering or use of new technology. Solution not known or understood at all.

2 - Difficult to fix. Redesign and re-engineering required. Significant code changes. Solution identifiable but details not fully understood.

3 - Easy to fix. Minimal redesign and straightforward code changes. Solution known and understood.

4 - Trivial to fix. Textual changes and cosmetic changes. Minor code tweaking.

Debriefing

Conduct with evaluators, observers, and development team members

Discuss general characteristics of interface

Suggest potential improvements to address major usability problems

Development team rates how hard to fix

Make it a brainstorming session

Example Heuristic Violation

1. [H4 Consistency] [Severity 3] [Fix 4]

The interface used the string "Save" on the first screen for saving the user's file, but used the string "Write file" on the second screen. Users may be confused by this different terminology for the same function.

Fix: Change second screen to "Save".

Results of Using HE

Discount: benefit-cost ratio of 48

- cost was $10,500 for benefit of $500,000
- how might we calculate this value?
  - in-house → productivity; open market → sales

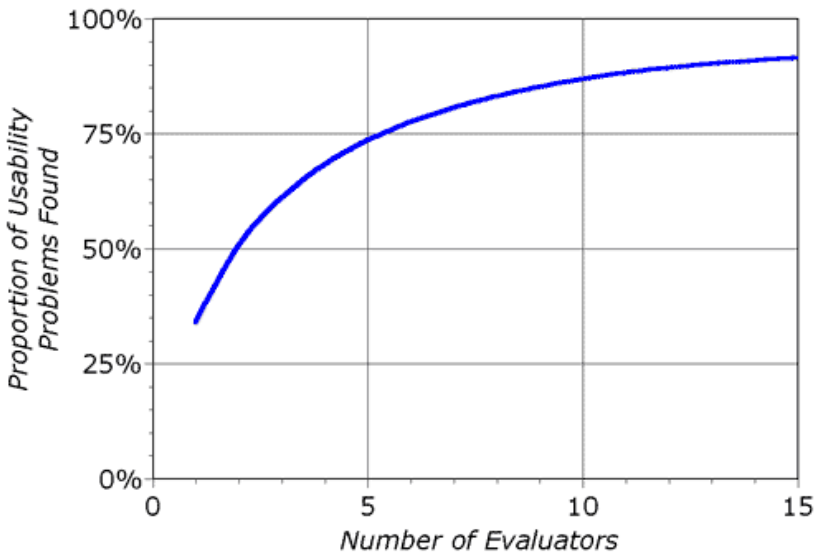
Single evaluator achieves poor results

- only finds 35% of usability problems
- 5 evaluators find ~ 75% of usability problems
- why not more evaluators?

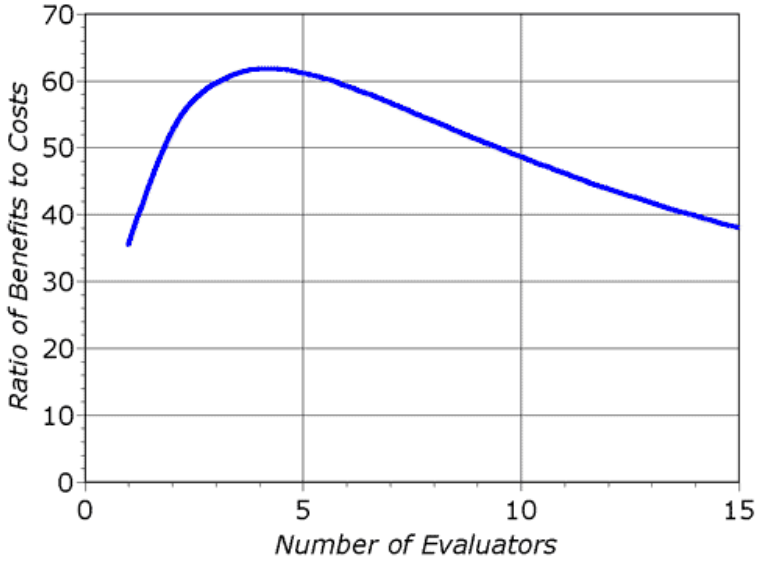
Nielsen, 1994

Decreasing Returns

problems found



benefits / cost



Nielsen, 1994

Alternative Inspection-Based Methods

Cognitive Walkthrough

- Helps surface different types of usability problems
- Consider this as a complement to heuristic evaluation

Action Analysis

- Low-level modeling of expert performance
- Be aware of GOMS, but you may never encounter it

Cognitive Walkthrough

Evaluation method based on:

- A person works through an interface in an exploratory manner
- A person has goals
- The person is applying means-ends reasoning to work out how to accomplish these goals

Evaluation by an expert, who goes through a task while simulating this cognitive process

Preparation: Need Four Things

1) User description, including level of experience any assumptions made by the designer
2) System description (e.g., paper prototype)
3) Task description, specifying the task the expert has to carry out, from a user's point of view
4) Action sequence describing the system display and the user actions needed to complete the given task. One system display and one user action together are one step.

Cognitive Walkthrough Process

Designer/Developer prepares the required documents described on previous slide

Gives these documents to the usability expert

Expert reads the descriptions, and carries out the task by following the action list

At each step in action list, asks four questions

Record problems similar to heuristic evaluation

Believability

1) Will the user be trying to produce whatever effect the action has?
2) Will the user be able to notice that the correct action is available?
3) Once the user finds the correct action at the interface, will they know that it is the right one for the effect they are trying to produce?
4) After the action is taken, will the user understand the feedback given?

Action Analysis / Cognitive Modeling

GOMS: Goals, Operators, Methods, Selection

Developed by Card, Moran and Newell

Walk through sequence of steps

Assign each an approximate time duration

Sum to estimate overall performance time

1. Select sentence		
Reach for mouse	H	0.40
Point to first word	P	1.10
Click button down	K	0.60
Drag to last word	P	1.20
Release	K	0.60
		3.90 secs

Inspection vs. Usability Testing

Inspection is

- Is much faster
- Does not require interpreting user actions
- May miss problems or find false positives

Usability testing is

- More accurate, by definition
- Account for actual users and tasks

One approach is to alternate between them

- Find different problems, conserve participants

CSE 440: Introduction to HCI

User Interface Design, Prototyping, and Evaluation

Lecture 12:
Inspection-Based Methods

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234