CSE 440: Introduction to HCI

User Interface Design, Prototyping, and Evaluation

Lecture 11:
Inspection

Tuesday / Thursday
12:00 to 1:20

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OF COMPUTER SCIENCE & ENGINEERING

DESIGN
USE
BUILD

Project Status

Looking Forward

- Team Peer Feedback was Due Saturday 11/4
- 3b: Heuristic Evaluation Due Wednesday 11/8
- 3c: Usability Testing Check-In Due Friday 11/10
- 3d: Usability Testing Review Due Monday 11/13
- 3e: Digital Mockup Due Thursday 11/16

Other Assignments

- Reading 4 Due Saturday 11/11, Sooner is Better
- Reading 5 Can Be Done Anytime, Sooner is Better

Reading 4 PDF

You will need a password to access the PDF

uwcse440-2017au

Objectives

Be able to:

Describe why we use inspection-based methods

Given Nielsen's heuristics, be able to:

explain what each of them means

apply them to identify usability failures in an interface

Describe an effective heuristic evaluation process

Explain why the typical recommendation for heuristic evaluation is 3 to 5 independent evaluators

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

- Can become relatively slow and expensive
- Study participants can be scarce
- Can waste participants on obvious problems

Inspection-Based Methods

Simulate study participants

- Instead of actual 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
- Not a method for “coming up with” 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 heuristics explain problems
- 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

The system should always keep people informed about what is going on, through appropriate feedback within reasonable time.

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The system should always keep people informed about what is going on, through appropriate feedback within reasonable time.

Refers to both visibility of system status and providing appropriate feedback

Anytime a person is 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 a person's language, with words, phrases and concepts familiar to the person, 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. Control and Freedom

User control and freedom

People 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.

3. User in Control

User control and freedom

People 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.

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

4. Consistency

Consistency and standards

People should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

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Consistency and standards

People should not have to wonder whether different words, situations, or actions mean the same thing.

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 people with a confirmation option before they commit to the action.

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> 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 people 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 a person's memory load by making objects, actions, and options visible. A person 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.

6. Recognition not Recall

Recognition rather than recall

> Minimize a person's memory load by making objects, actions, and options visible. A person 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.

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, while unseen by novices,
may often speed up the interaction for experts
such that the system can cater to both
inexperienced and experienced use.
Allow people to tailor frequent actions.

7. Flexibility and Efficiency

Flexibility and efficiency of use

> Accelerators, while unseen by novices, may often speed up the interaction for experts such that the system can cater to both inexperienced and experienced use. Allow people 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

Dialogues should not contain information which is irrelevant or rarely needed.
Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

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Aesthetic and minimalist design

> Dialogues should not contain information which is irrelevant or rarely needed.
> Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

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

9. Error Recovery

Help users recognize, diagnose,
and recover from errors

Error messages should be expressed in
plain language (no codes),
precisely indicate the problem,
and constructively suggest a solution.

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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 a person's task, list concrete steps to be carried out, and not be too large.

10. Help

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This does not mean that a person 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

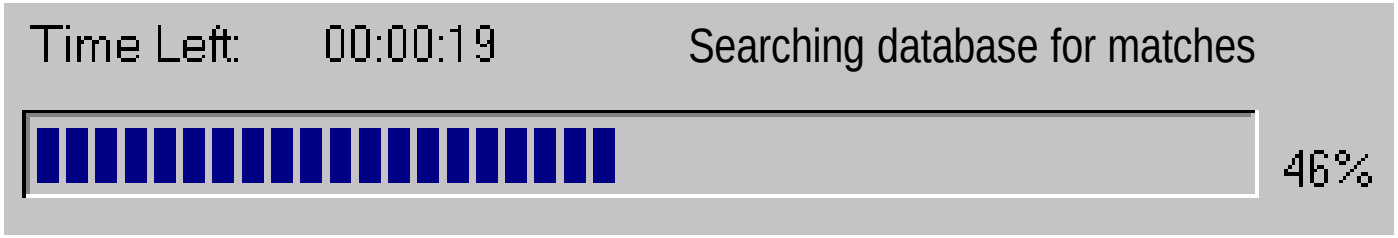
Typography uses different fonts in 3 dialog boxes

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

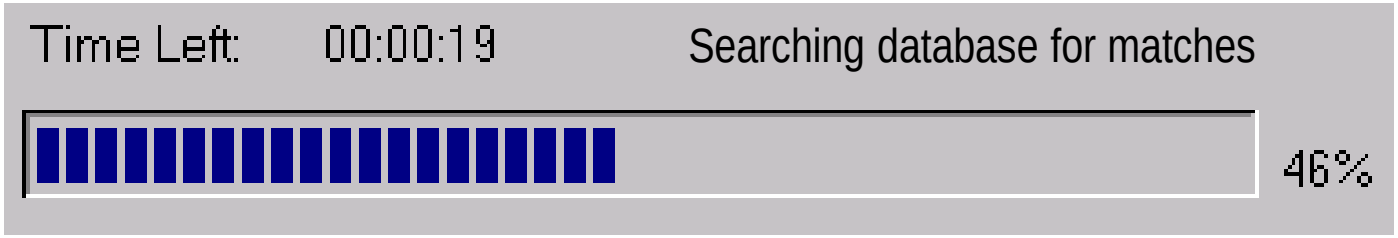
Heuristics

Heuristics

Heuristics



Heuristics



Visibility of system status

pay attention to response time

0.1 sec: no special indicators needed (why?)

1.0 sec: person tends to lose track of data

10 sec: maximum duration if person to stay focused

longer delays require progress bars

Heuristics

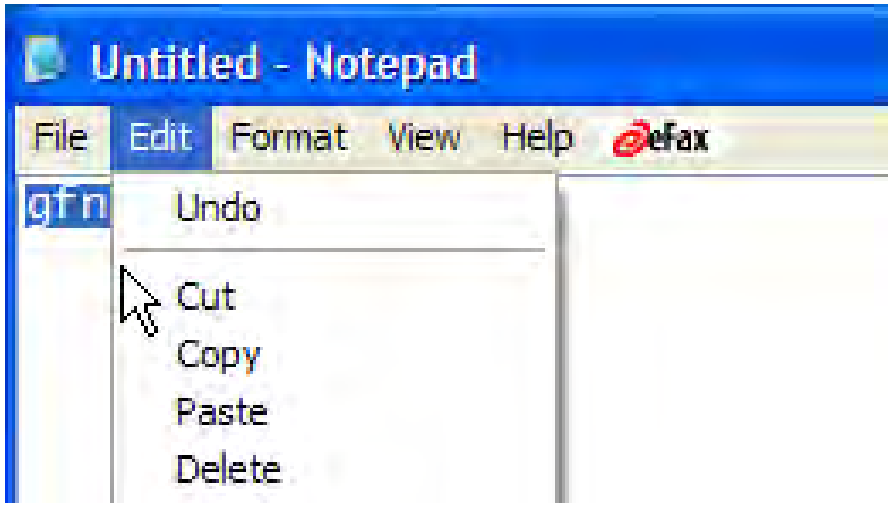
Heuristics

“Mailto”, “protocol”?

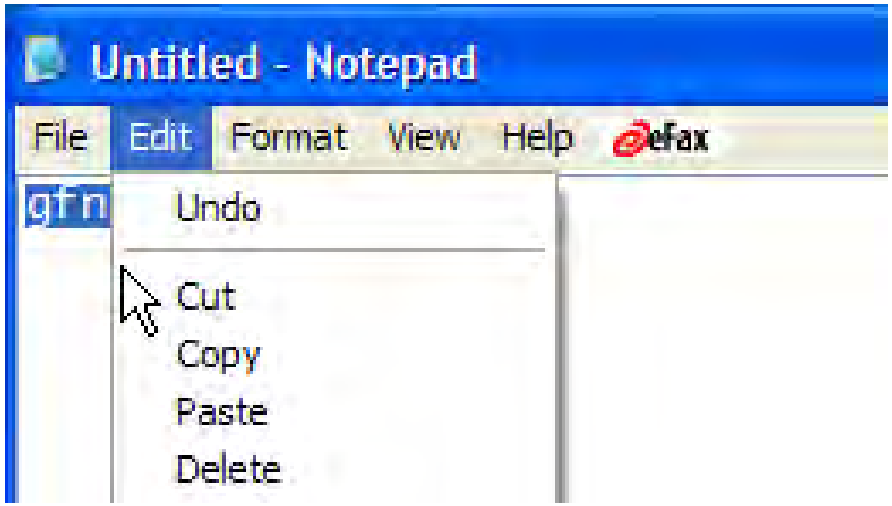
Match system to real world

Speak the person’s language

Heuristics


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

Heuristics

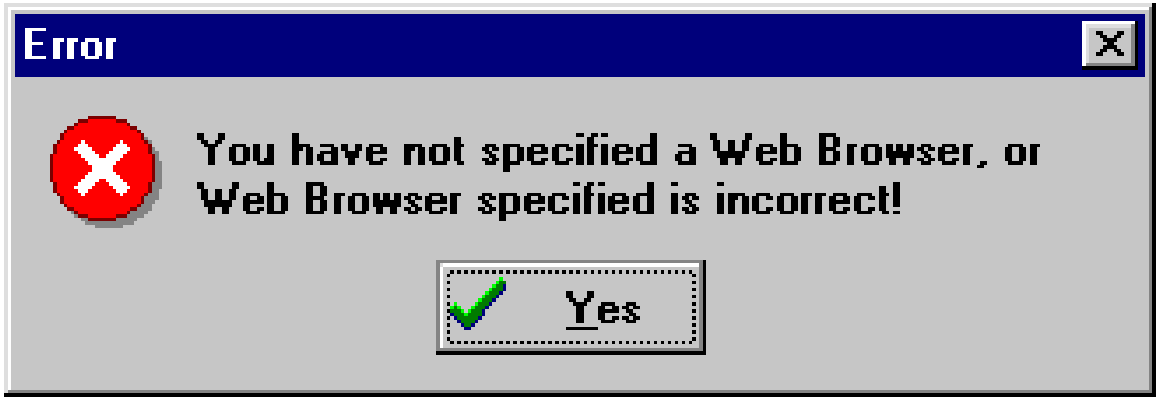


Flexibility and Efficiency of Use

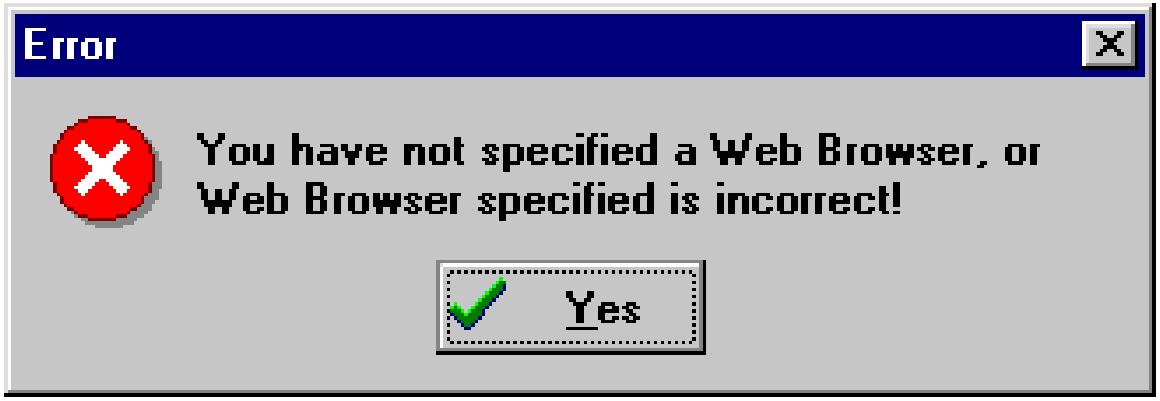
accelerators for experts (e.g., keyboard shortcuts)

allow tailoring of frequent actions (e.g., macros)

Heuristics


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

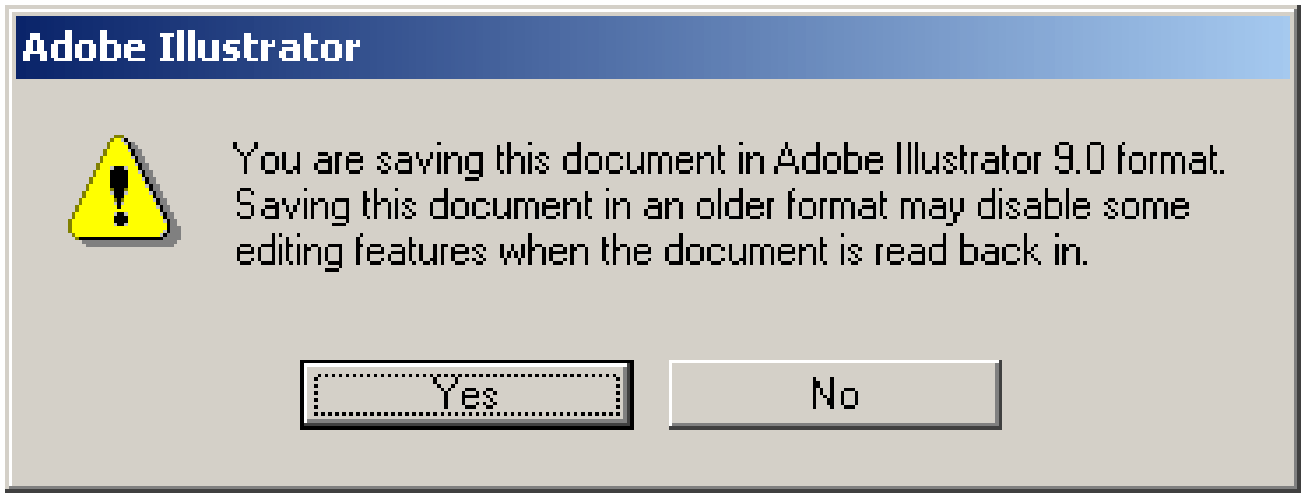
Heuristics



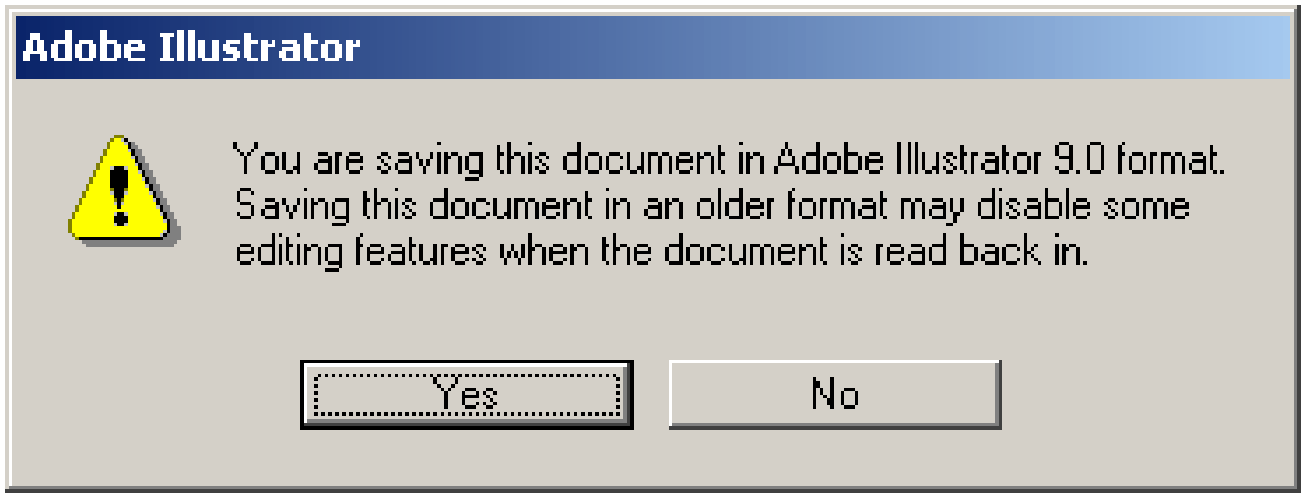
Help recognize, diagnose, & recover from errors

- 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

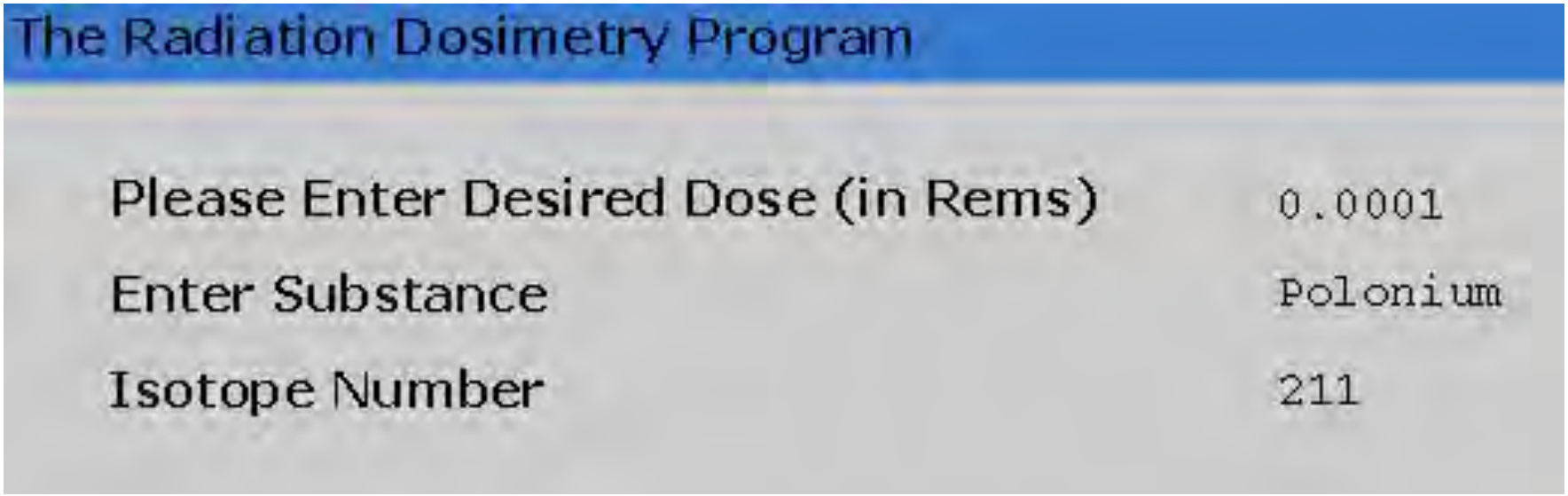
Heuristics



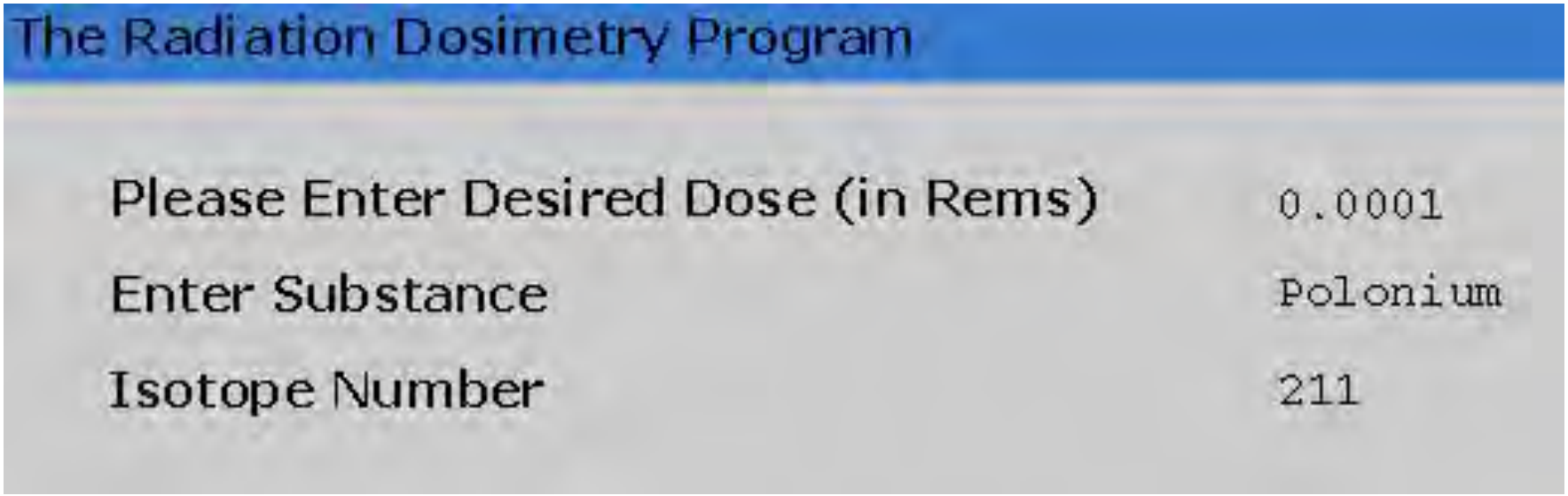
User Control and Freedom

Prevent Errors

Heuristics

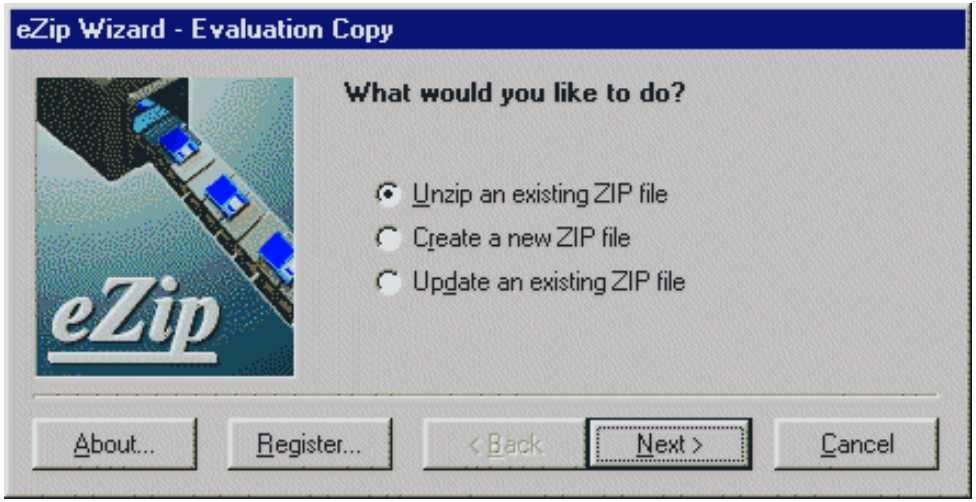

The Radiation Dosimetry Program
Please Enter Desired Dose (in Rems)
0.0001
Enter Substance
Polonium
Isotope Number
211

Heuristics

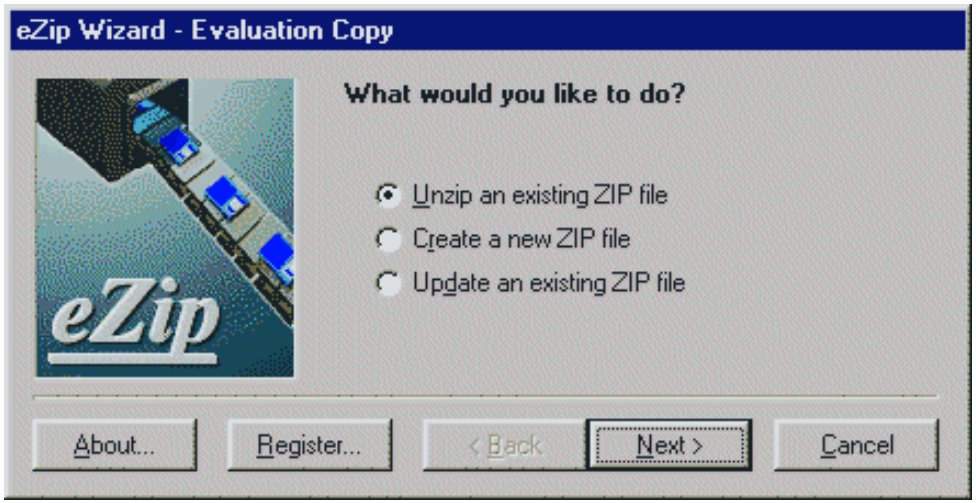


Prevent Errors

Heuristics


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



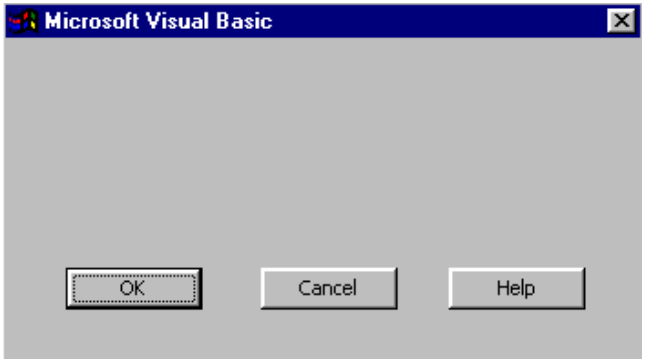
User control & freedom

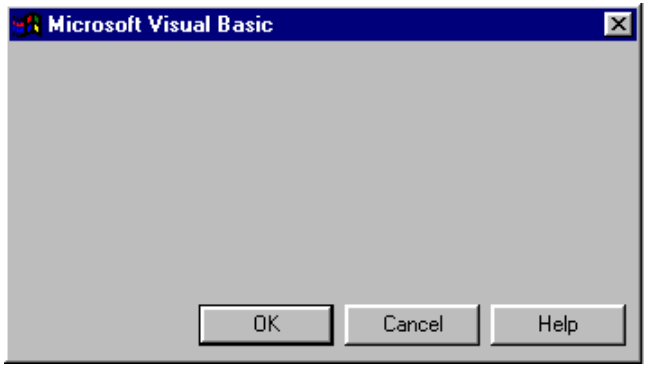
- provide “exits” for mistaken choices, undo, redo
- don’t force down fixed paths

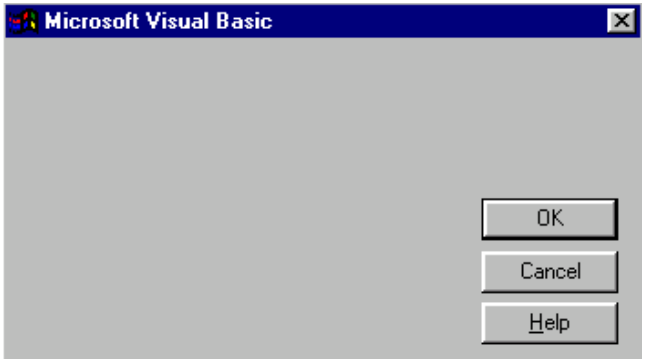
Wizards

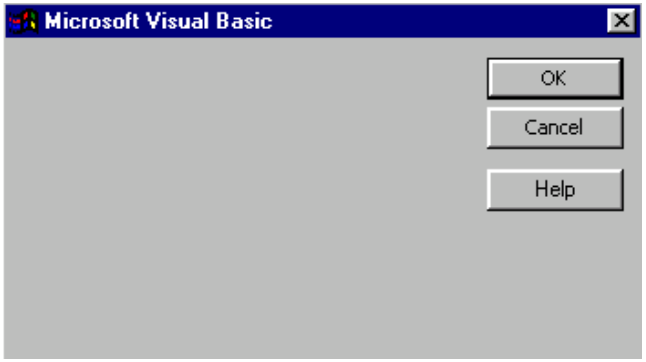
- must respond to question before going to next
- good for beginners, infrequent tasks
- not for common tasks
- consider having 2 versions (WinZip)

Heuristics

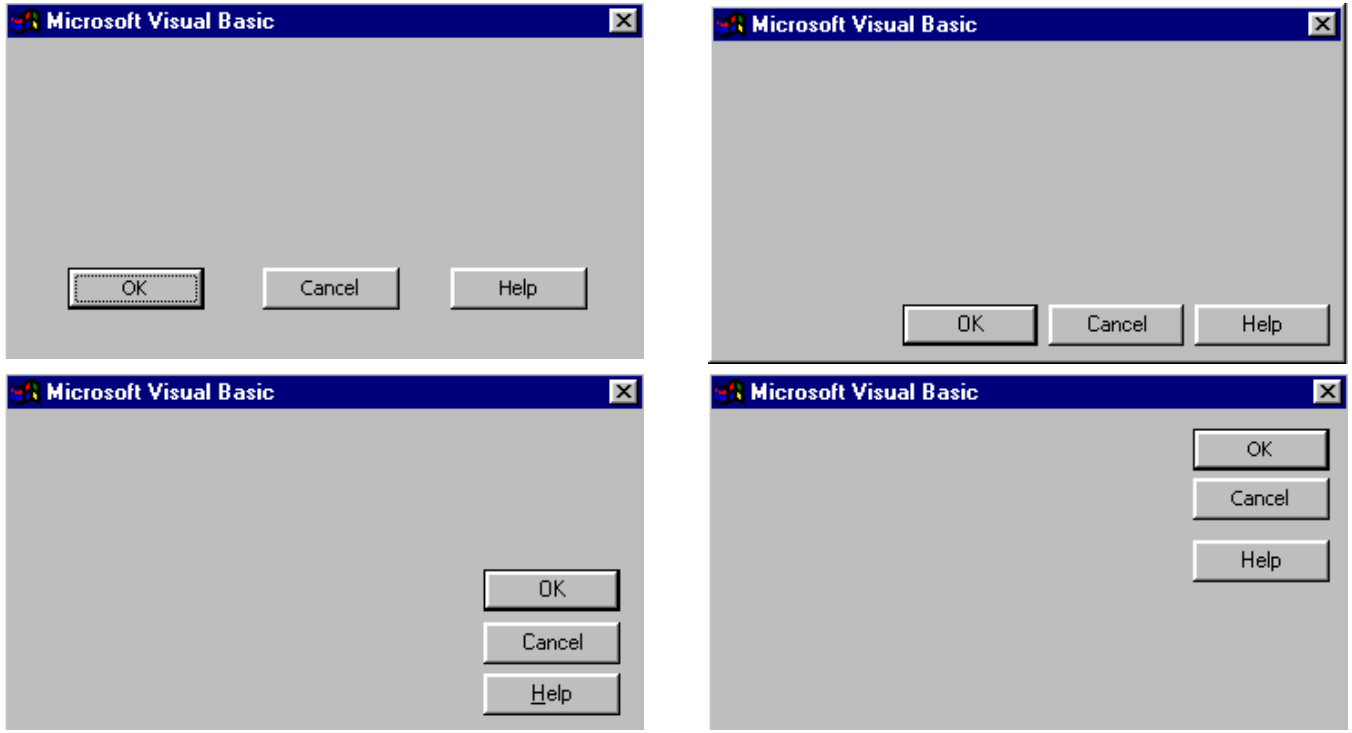

Microsoft Visual Basic
OK
Cancel
Help


Microsoft Visual Basic
OK
Cancel
Help


Microsoft Visual Basic
OK
Cancel
Help


Microsoft Visual Basic
OK
Cancel
Help

Heuristics

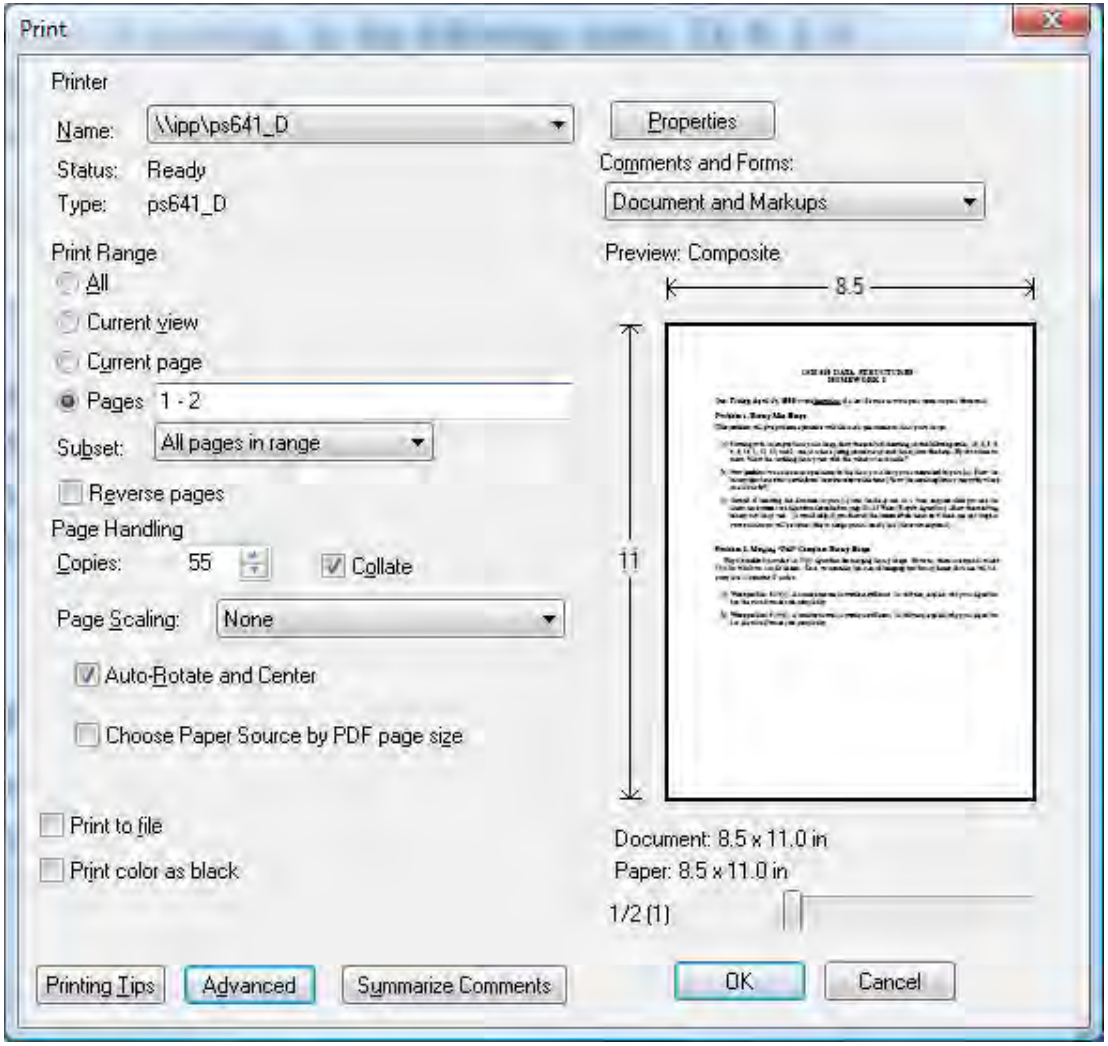


Consistency & Standards

Heuristics


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%2FS
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...

How to Perform Heuristic 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 person’s file, but used the string "Write file" on the second screen.
People may be confused by this different terminology for the same function.

How to Perform Heuristic Evaluation

Why separate listings for each violation?

- risk of a ‘fix’ repeating some 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, but sometimes features are implied and just not yet “implemented”

Phases of Heuristic Evaluation

1) Pre-evaluation training

   give expert evaluators needed
   domain knowledge & information on the scenario

2) Evaluation

   individuals evaluate interface
   and make lists of problems

3) Severity rating

   determine how severe each problem is

4) Aggregation

   group meets and aggregates problems (w/ ratings)

5) Debriefing

   discuss the outcome with design team

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 people from completing tasks. Highly confusing or unclear. Difficult to avoid. Likely to occur more than once.

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

Example Heuristic Violation

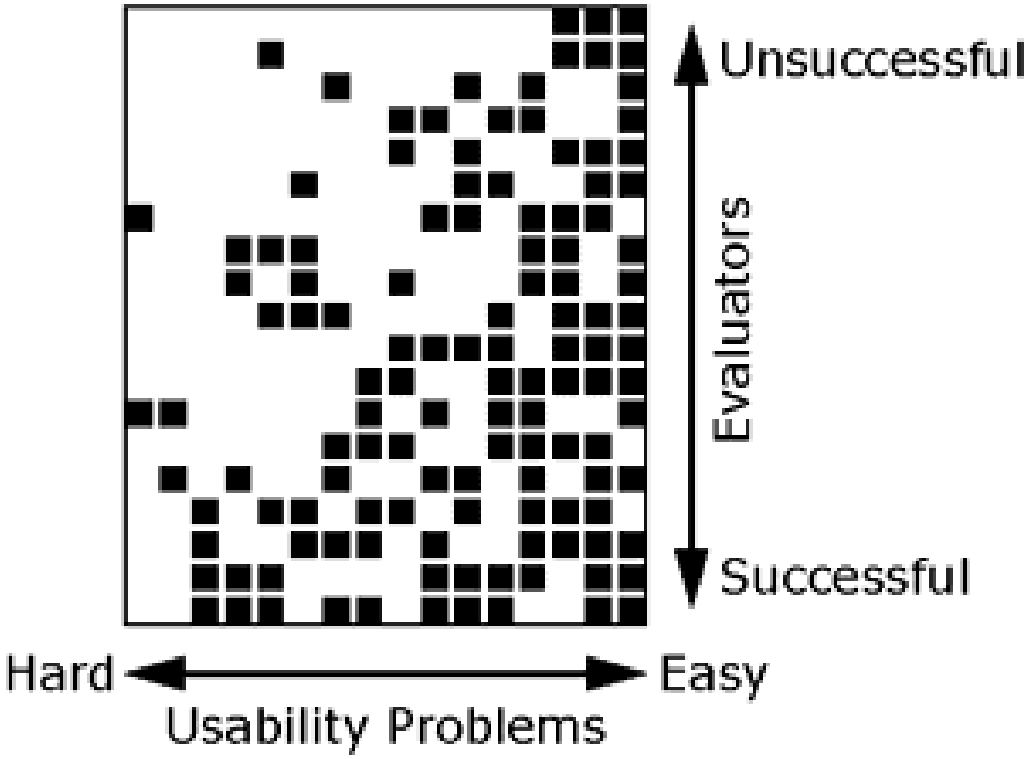
1. [H4 Consistency] [Severity 3]

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

Why Multiple Evaluators?

Every evaluator does not find every problem

Good evaluators find both easy & hard ones



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

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.

Example Heuristic Violation

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

The interface used the string "Save" on the first screen for saving the person's file, but used the string "Write file" on the second screen. People 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

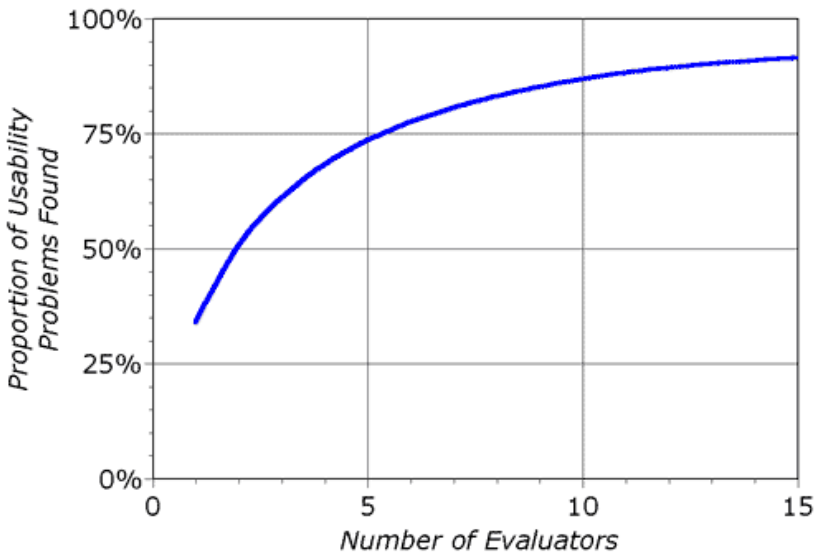
Single evaluator achieves poor results

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

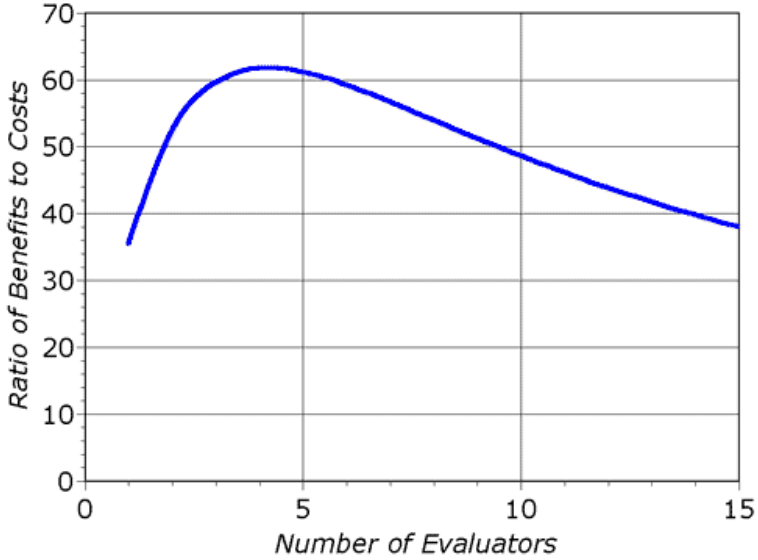
Nielsen, 1994

Decreasing Returns

problems found



benefits / cost



Nielsen, 1994

Alternative Inspection-Based Methods

Cognitive Walkthrough

- Surfaces different types of usability problems
- Consider as a complement to heuristic evaluation

Action Analysis

- Low-level modeling of expert performance
- Be aware of GOMS, but 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) Person description, including level of experience and 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 person's point of view
4) Action sequence describing the system display and the actions needed to complete the task. One system display and one 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,
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 person be trying to produce whatever effect the action has?
2) Will the person be able to notice that the correct action is available?
3) Once the person 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 person 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 much faster
- Does not require interpreting participant actions
- May miss problems or find false positives

Usability testing

- More accurate, by definition
- Account for actual people 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 11:
Inspection

Tuesday / Thursday
12:00 to 1:20

James Fogarty
Kailey Chan
Dhruv Jain
Nigini Oliveira
Chris Seeds
Jihoon Suh

PAUL G. ALLEN SCHOOL
OF COMPUTER SCIENCE & ENGINEERING

DESIGN
USE
BUILD

Phases of Heuristic Evaluation

1) Pre-evaluation training

   give expert evaluators needed
   domain knowledge & information on the scenario

2) Evaluation

   individuals evaluate interface
   and make lists of problems

3) Severity rating

   determine how severe each problem is

4) Aggregation

   group meets and aggregates problems (w/ ratings)

5) Debriefing

   discuss the outcome with design team