Prototype Evaluation

Human Computer Interaction
CSCI 4620U| SOFE 4850U | CSCI 5540G
Dr. Christopher Collins

Acknowledgement: Parts of this lecture are based on material prepared by Jeremy Bradbury

ANNOUNCEMENTS

Announcements

- Don’t forget to organize to conduct expert reviews for P3b

Today

- By the end of today's lecture, you will be able to:
  - List the three goals of evaluation
  - Describe the principles of learnability, flexibility, and robustness
  - Choose specific evaluation techniques that can be used to:
    - assess the functionality and usability of a system
    - identify possible problems.
  - Distinguish two main classes of evaluation techniques
    - Expert evaluations
    - User-based evaluations (next time)

Practical HCI

EVALUATING PROTOTYPES

Goals of Evaluation

- Evaluation in the context of Human-Computer Interaction has 3 main goals:
  - Test the system functionality (and accessibility of the functionality)
  - Test the user's experience interacting with the system
  - Identify specific system problems

Goal #1: Test the System Functionality

- Testing the system functionality requires us to answer the following questions:
  - Does the functionality cover all of the user requirements? This measures the extent of the functionality
  - Is needed functionality accessible to a user during a given task? Functionality is not useful if it can't be accessed at the appropriate time!
  - Does the functionality meet the user's expectations? This helps us understand if the functionality allows the user to complete tasks as expected

Goal #2: Test the User's Experience

- Testing the user experience is about usability not functionality
- In this context we are interested in the following questions:
  - Is the user satisfied with the system?
  - Is there an emotional reaction to the system?
  - Does the system overload the user?
- Usability can include ensuring that the design meets different principles:
  - Learnability, flexibility, robustness

"Learnability is the ease with which new users can begin effective interaction and achieve maximal performance."

- Dix, Finlay, Abowd, Beale

LEARNABILITY

Learnability

- Predictability
- Synthesizability
- Familiarity
- Generalizability
- Consistency

Learnability -> Predictability

- In general users like to be able to predict the response from the system for a given action
- The response predicted by a user is based on past experience with the system
- Operation Visibility
  - Related to predictability
  - Does the user know what operations can be performed next?

Learnability -> Synthesizability

- The ability of the user to assess the effect of past operations on the current state
- Immediate vs. eventual awareness
  - Immediate: You see the results or receive a notification, e.g. drag and drop a file visually
  - Eventual: You can see changes after explicitly asking for them, e.g. pressing “F5” to refresh a folder view

Learnability -> Synthesizability

- Related to awareness of system status:
  - Examples: providing confirmation of an online purchase, or confirmation of removing an item from an online shopping cart.

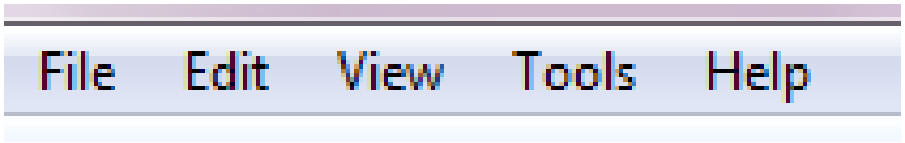
Learnability -> Familiarity

- Make the right first impression
  - Metaphors, “guessability”
- Assesses the benefit from:
  - real-world experience
  - using other interactive systems
  - affordances


SoftBank
13:56
61%
00:00:00
Recorder
Voice Memos
Settings

Learnability -> Generalizability

- Apply knowledge from one situation to a new situation
- For example, cut/copy/paste operation generalizes to many applications
- Consistency



  - Recall the consistency heuristic
  - *Many other principles can be 'reduced' to consistency, e.g. Generalizable = consistent across interfaces, Familiarity = consistent with past experiences*

Consistency Caution

FLEXIBILITY

"Flexibility is the multiplicity of ways in which the user and system exchange information."

- Dix, Finlay, Abowd, Beale

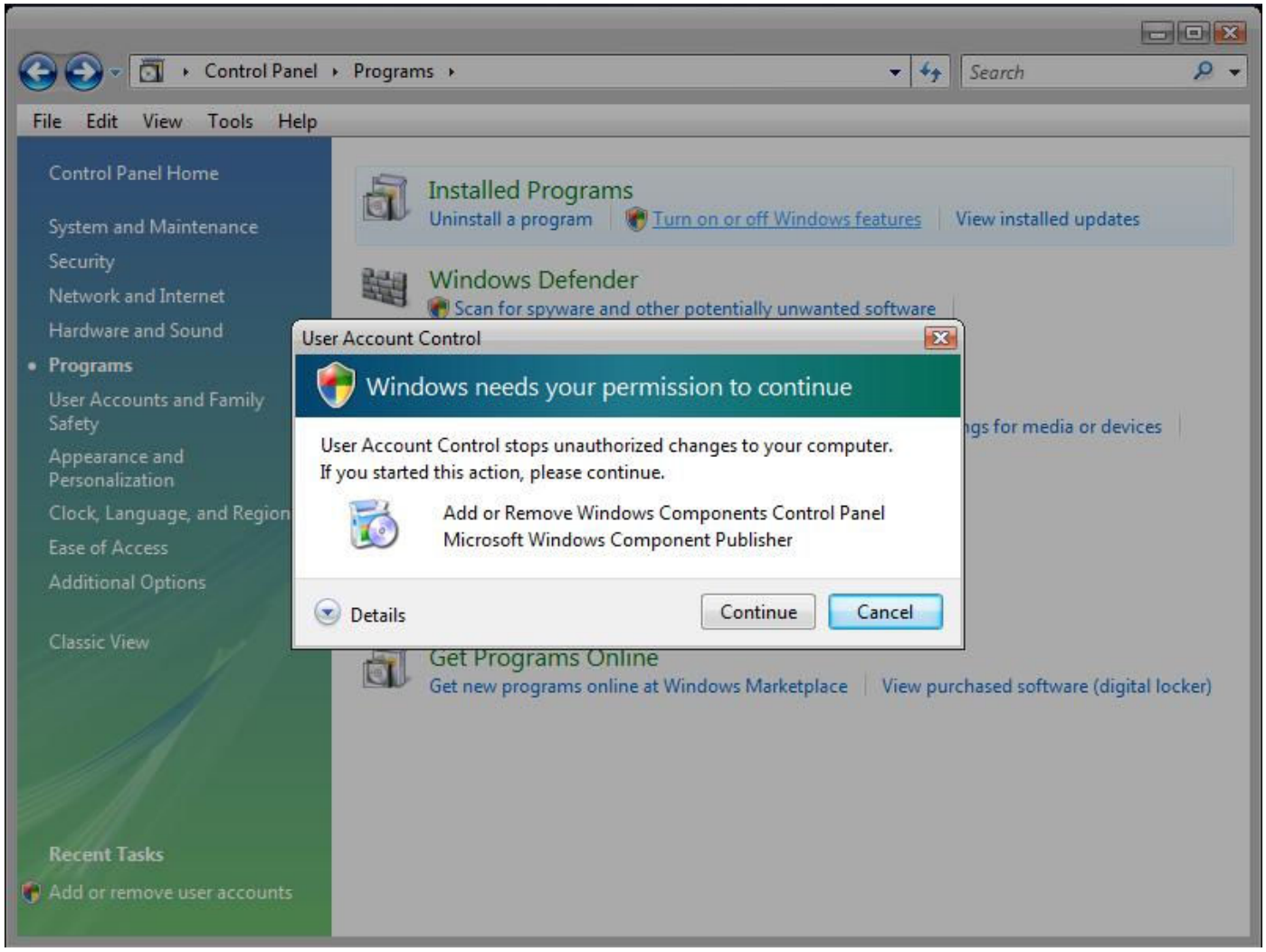
Flexibility

- Dialog initiative
- Multi-threading
- Task Migratability
- Substitutivity
- Customizability

Flexibility -> Initiative

- System pre-emptive vs. user pre-emptive

System Pre-emptive

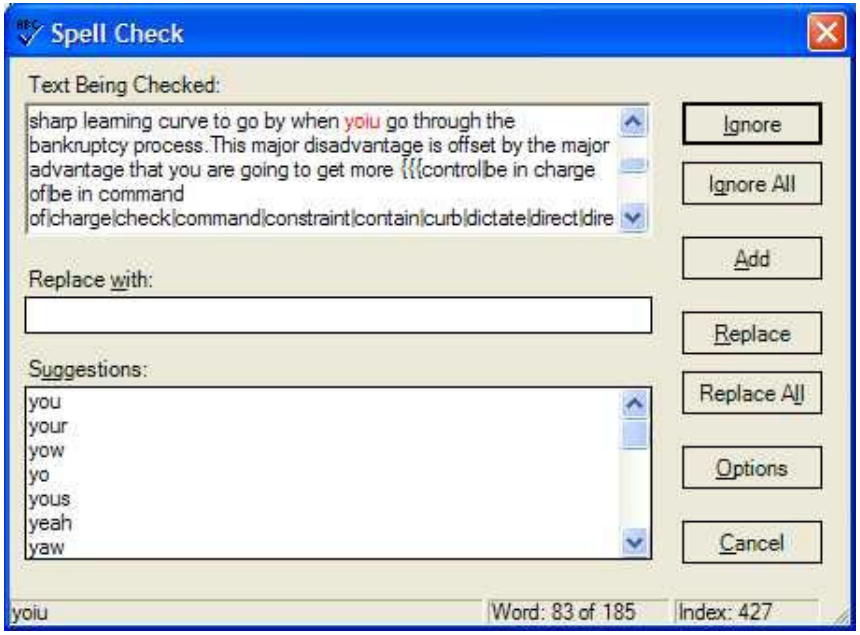


Flexibility -> Multi-threading

- Multi-threading
  - Related to multi-tasking
  - Different kinds of multi-threading: concurrent, interleaved
    - audible bell for new mail while browsing a website
    - multiple touch inputs on a tabletop display

Flexibility -> Task Migratability

- the transfer of control for execution of tasks between system and user
  - Example: Spell check, Auto-pilot



Flexibility -> Substitutivity

- Related to input and output
- Can we substitute equivalent inputs? outputs?
- Input example:
  - in Microsoft Office we can input paragraph spacing in pt, cm, etc.
- Output example:
  - temperature as a thermometer graphic or a line chart (different representation)

Flexibility -> Customizability

- Can the interface by changed to suit the user's preferences?
- Example: hide/show toolbars in Firefox

ROBUSTNESS

Robustness

- Observability
- Recoverability
- Responsiveness
- Task Conformance

"Robustness is the level of support provided to the user in determining successful achievement and assessment of goals."

- Dix, Finlay, Abowd, Beale

Robustness -> Observability

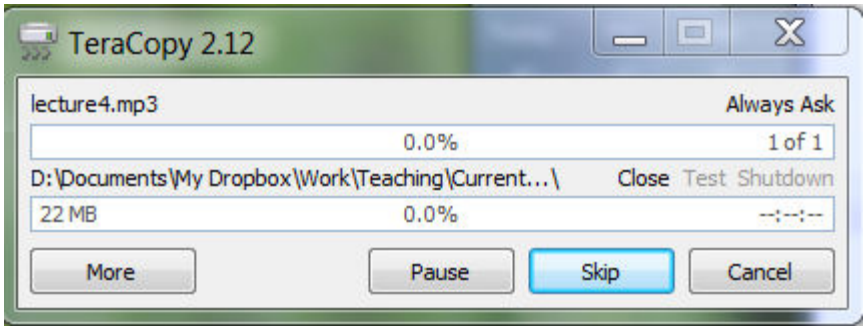
- Ability of the user to evaluate the internal state of the system from its perceivable representation
- Which heuristic does this relate to?

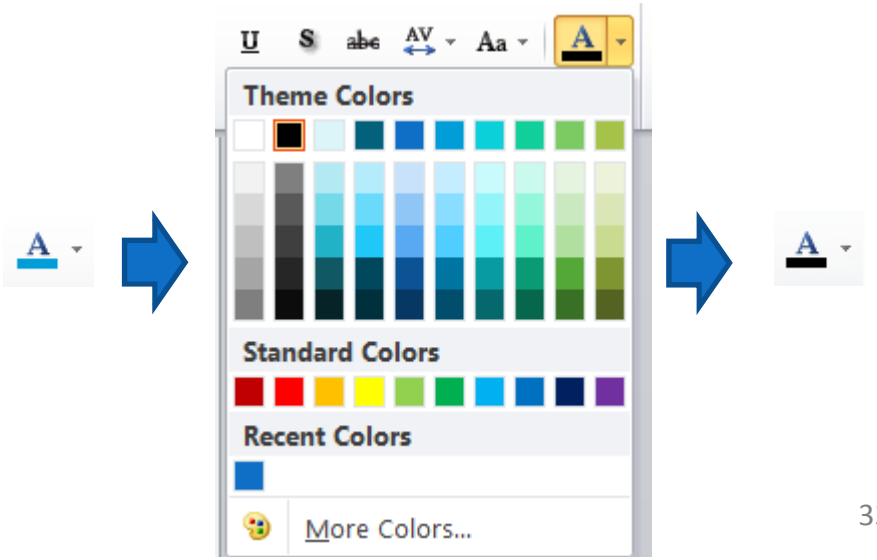
Robustness -> Observability

- Ability of the user to evaluate the internal state of the system from its perceivable representation
- Which heuristic does this relate to?
  - Related to “visibility of system status” heuristic

Robustness -> Observability

- Browsability: change view without altering system state
- Defaults: static defaults and dynamic defaults
  - Static: Yes/No/Skip
  - Dynamic: font colour palette in Word





Robustness -> Observability

- Browsability: change view without altering system state
- Defaults: static defaults and dynamic defaults
- Reachability: possibility of navigation through the observable system states
- Persistence: duration of effect of communication
  - Email beep vs. flag in notification area
  - Tri-state buttons: hover for preview/click for permanent <demo>

Robustness -> Recoverability

- Can the user recover after making an error?
- Forward (start over) vs. backward (undo) error recovery

Robustness -> Responsiveness

- Communication rate of interaction
  - Stability is important
  - Provide awareness of progress for long processes

Robustness -> Task Conformance

- Does the system allow the user to complete the tasks he/she wants to do?

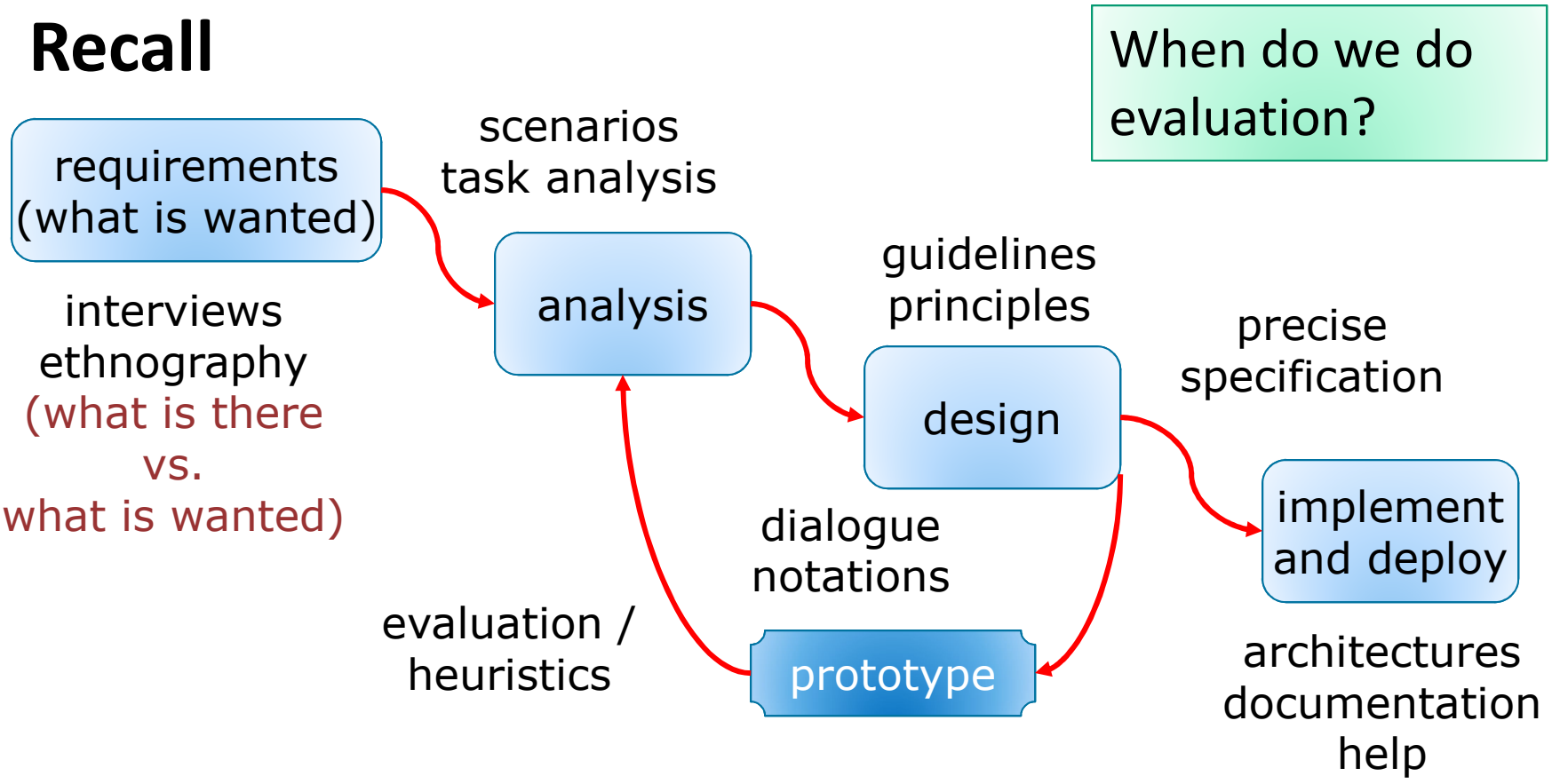
Goals of Evaluation

- Evaluation in the context of Human-Computer Interaction has 3 main goals:
  - Test the system functionality (and accessibility of the functionality)
  - Test the user's experience interacting with the system
  - Identify specific system problems

Goal #3: Identify Specific Problems

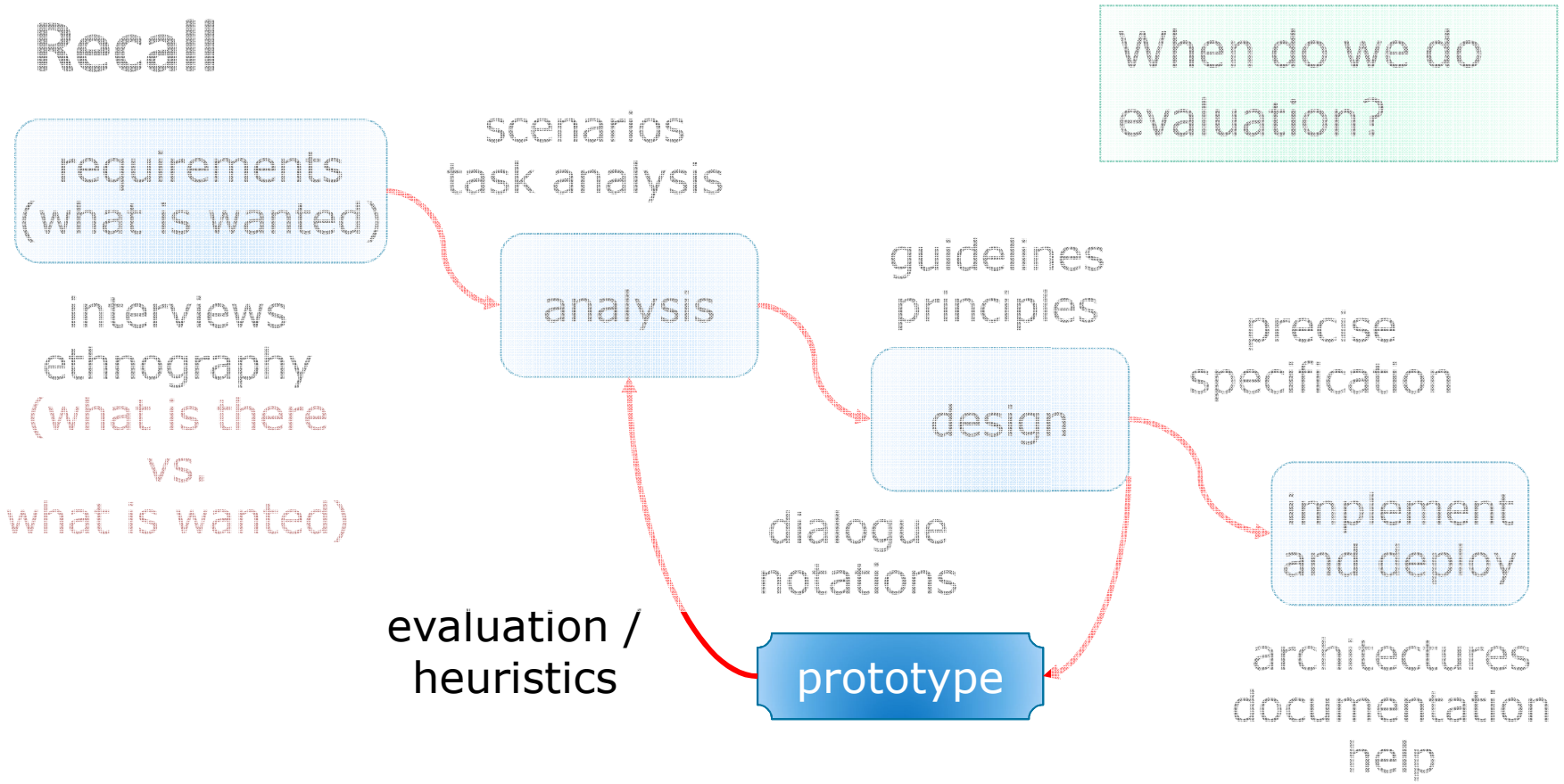
- The distinction between this goal and the other two goals is that:
  - This goal is about identifying specific problems that can be fixed
  - The first two goals test the functionality and user experience – these are often the reason the specific problem actually exists

The Design Process



(Source: Dix, Finley, Abowd, Beale, *"Human-Computer Interaction")*

The Design Process



(Source: Dix, Finley, Abowd, Beale, *"Human-Computer Interaction"*)

Benyon text
Chapter 10

Evaluating HCI

EXPERT ANALYSIS

Discount Usability Engineering

- Expert Analysis techniques
  - Heuristic Evaluation
  - Cognitive Walkthrough
- Find problems, but not complete, nor ecologically valid
- Formative
  - Help inform design at early stage
- Not summative
  - Cannot make claims about usability of a finished product

Expert Analysis

- Expert analysis techniques involve the use of experts to assess a system's user interface instead of using users
- The benefit of expert analysis is that it costs less than evaluations that involve users
  - User participation is typically more expensive
- The drawback of expert analysis is that we are not evaluating actual users interacting with the system

Find 80% of the problems before bringing in real stakeholders.

Cognitive walkthrough

- Walkthroughs are a technique you may have seen previously in software engineering
- In the context of software engineering quality assurance you learned about code reviews and code walkthroughs
- Cognitive walkthroughs apply the same principles but in a different context

"A cognitive walkthrough is [...] learning through exploration."

- Dix, Finlay, Abowd, Beale

Code vs. Cognitive walkthrough

Code Walkthrough

- conducted by expert (e.g., developer)
- reviews program code
- walks through an algorithm or portion of the program
- identifies problems based on style, correctness, etc.

Cognitive Walkthrough

- conducted by expert (e.g., usability expert)
- reviews the interface
- walks through the user interface actions necessary for a user to complete a task
- identifies problems related to the usability of the interface

Cognitive walkthrough

- Goal is to understand usability, including how easy a system is to learn
- People prefer to learn software by doing, rather than through training and manuals
- The checks that are made during the walkthrough ask questions that address exploratory learning
  - Review each step the participant did and provide a ‘story’ about why that step is or is not good for a new user

Terms

- Evaluator: the person leading the evaluation, often a member of the prototype design team
- Expert: the usability expert who is a *participant* in the evaluation (usually use 3-5 experts)

Cognitive walkthrough

Required Artifacts

- A system prototype (or specification)
  - Should be as complete as possible
- Description of the task being used for the walkthrough
- The complete, written list of actions necessary to complete the task
- User profile
  - Details about skill level, background, etc.

Cognitive walkthrough

How does an expert conduct a cognitive walkthrough?

- Once the artifacts are gathered by the evaluator they are given to the expert for review
- As the expert walks through each action and move towards completing a task a set of questions must be answered
- Throughout the process the expert will document the procedure and any problems encountered

Nuance

- The expert does not try to solve the task for him/herself … this would be a ‘think aloud’ study and it is usually conducted with *real stakeholders*
- The expert follows the ideal task completion sequence as outlined by the evaluators and comments directly on problems

Cognitive walkthrough

Questions

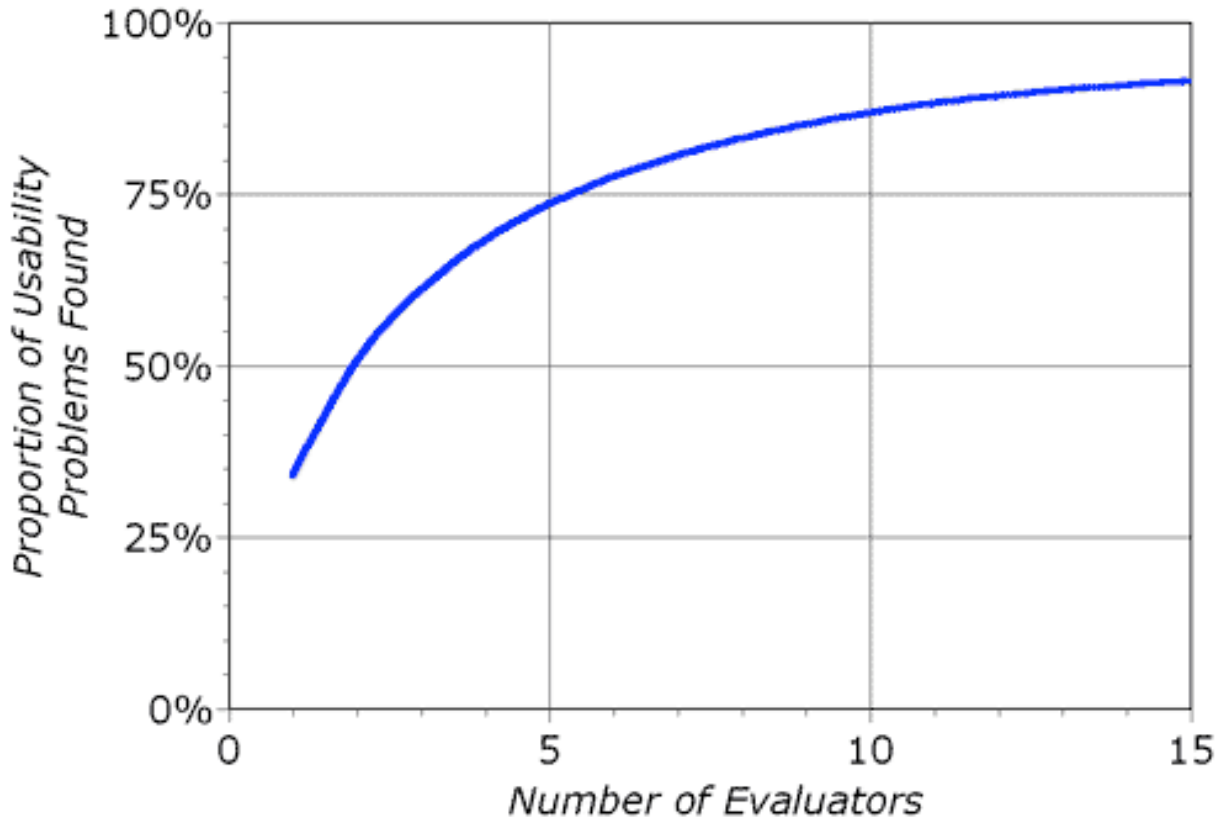
- Upon completing an action the expert asks himself/herself the following questions:
  - *Will the people using the system try to achieve the right effect? (or, "Is the effect of the action the same as the users' goal at that point?")*
  - *"Will users see that the action is available?"*
  - *"Once users have found the correct action, will they know it is the one they need?"*
  - *After the action is taken will users understand the feedback they get?"*

- Benyon, p. 106

Recall: Heuristic evaluation

- A technique that can be applied to specifications, prototypes, user interface implementation – relatively low cost
- Heuristic evaluation involves a set of evaluators analyzing a user interface design
- Each evaluator works independently to identify problems with the user interface
- How many evaluators is enough?

Recall: Heuristic evaluation



Source: http://www.useit.com/papers/heuristic/heuristic_evaluation.html

Heuristic evaluation

- If the interface of a system does not conform to one of the heuristics it may indicate a usability problem
- Jakob Nielsen has identified 4 ways usability problems can be located:
  1. At a single interface location
  2. By comparing two interface locations
  3. In the interface structure
  4. As a missing part of the interface

Source: http://www.useit.com/papers/heuristic/usability_problems.html

Neilson's Usability Heuristics

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

Severity Ratings

- Combination of three factors:
  - The frequency of problem occurrence
  - The impact of the problem if it occurs
  - The persistence of the problem
- Rating scale:

  0 = There is no usability problem at all
  1 = Cosmetic problem only
  2 = Minor usability problem
  3 = Major usability problem
  4 = Usability catastrophe: imperative to fix

http://www.useit.com/papers/heuristic/severityrating.html

CW Documentation

CW Report

- Action forms for each step
  - Answers to each of the questions asked

CW & Heuristic Reports

- Cover form
  - The name of the expert
  - Date and time
  - The artifacts used in the walkthrough
- Usability problem report sheets
  - The name of expert
  - Date and time
  - Include problem description and severity rating

NOTE: Each problem report sheet corresponds to a negative answer to a question on an action form

Previous studies as evidence

- One way to reduce the cost of evaluation is to use existing studies to support design choices
- Previous studies in the area of HCI may be relevant to the user interface being designed
- **Example:** A study regarding the interaction styles for a particular group of users may indicate that a command-line interface is the most appropriate choice

Previous studies as evidence

- It is important to realize that not all previous studies are relevant!
  - Do the results of the study apply to the domain we are designing an interface for?
  - Are the participant in the study similar to the users of the interface under design?
  - etc.
- It is best if an expert is used to assess the relevance and applicability

HCI Theory

DESIGN REVIEWS AND CRITIQUES

Unclear System Status

http://www.pandora.com

Summary

- Today we introduced:
  - Three goals of evaluation
  - Design principles to look for
  - Expert Evaluation
    - Cognitive Walkthrough

Your Action Items

- Read “VCR” example online
- Consider how you will conduct your expert evaluation
  - How will you describe your system concept in an unbiased way?
  - Heuristic evaluation
    - List of heuristics available under lecture folder
  - Cognitive walkthrough
    - Consider an ideal task sequence to have the expert conduct
    - List of questions to ask available under lecture folder

Ongoing Course Evaluation

- Please complete lecture 17 feedback form online.