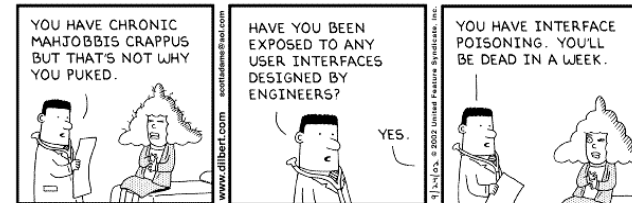


CSC 3461

Evaluation



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2

Reasoning from data

- In the example on the next page:
 - what are the *conditions*
 - what *outcome* is being observed (the dependent variable)
 - what do you think about the reasoning that has been applied?

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Y-file, York in the Media
Monday, February 10, 2003

Aggressive driving declines

York University has observed success after introducing a Road Watch program, reports the *National Post* Feb. 7. Road Watch empowers motorists to report aggressive drivers by filling out a Citizen Report Form, although York's campus is technically private property and thus governed differently than a municipality. It sees 30,000 vehicles per day and has no shortage of headaches. "I read the reports on a daily basis and I see what the trends are," says Richard Pilkington, operations manager of York's Security Services. "We have definitely seen a decline" of aggressive driving incidents, he says.

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Why Evaluate?

- How else to determine whether design goals have been reached?
 - In order to evaluate, criteria are needed
 - These criteria should already be established
 - Derived from the requirement analysis stage of design

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Usability Goals

Preece, Rogers, and Sharp (2002) state the goals of usability are:

- effective to use (effectiveness)
- efficient to use (efficiency)
- safe to use (safety)
- have good utility (utility)
- easy to learn (learnability)
- easy to remember how to use (memorability)

“Thought” question: Are these goals necessarily compatible with one another?

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Types of Evaluation

- Formative
 - done at different stages of development
 - done to provide feedback for design
- Summative
 - done to evaluate the final product

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Why Evaluate?

- Identify problems before application is deployed, not after
 - “deployed” can mean shipped for commercial products or otherwise made available (for other products)
- Characterize problems
 - correct misconceptions by developers (developers’ assessment of the problems may differ from the actual problems that exist)
 - prioritize problems and focus subsequent time and energy

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What is Usability?

Definition #1 <http://whatis.techtarget.com/>

- Usability is the measure of a product's potential to accomplish the goals of the user.
 - term used in relation to software applications and Web sites
 - term can also be used in relation to any product that is employed to accomplish a task (for example, a toaster, a car dashboard, or an alarm clock).
 - Some factors used in determining product usability are ease-of-use, visual consistency, and a clear, defined process for evolution.
- Note the use of the word *potential*
- What is the status of the software application?
 - It doesn't accomplish goals (i.e., it doesn't have *agency*); rather individuals use it to accomplish goals

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What is Usability?

Definition #2

<http://www.affectus.se/artiklar/usabilityinsp/>

- *Usability* basically refers to:
 - how easy it is for users to learn a system,
 - how efficiently they can use it once they have learned it, and
 - how pleasant it is to use.
- Also, the frequency and seriousness of user errors are normally considered to be constituent parts of usability.

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Categorization of Usability Problems

- Types of problems:
 - Relevance / Effectiveness / Usefulness
 - Efficiency
 - Attitudinal
 - Learnability
- Severity
- Frequency

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Categorization of Usability Problems

Nielson's Usability Severity Ratings

- 0 Not a usability problem at all
- 1 Cosmetic problem only - need not be fixed unless extra time is available on project
- 2 Minor usability problem - fixing this should be given low priority
- 3 Major usability problem - important to fix, so should be given high priority
- 4 Usability catastrophe - imperative to fix this before product can be released

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Categorization of Usability Problems

Frequency Ratings

- 0 Problem did not occur
- 1 This problem occurs rarely- only once/under very unusual circumstances
- 2 This problem occurs occasionally - under less commonly occurring conditions
- 3 This problem occurs often during common tasks
- 4 Problem occurs every time under all tested conditions

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Aspects of Usability: REAL

- The acronym REAL summarizes four aspects of usability: <http://www.affectus.se/artiklar/usabilityinsp/>
 - **Relevance:**
 - how well does the system serves the users' needs?
 - **Efficiency:**
 - how efficiently can the users carry out their tasks using the system?
 - **Attitude:**
 - what are the users' subjective feelings towards the system?
 - **Learnability:**
 - how easy is the system is to learn initially?
 - how well do the users remember the skills over time?
- Thought question: how do these aspects relate to the goals described by Preece et al, 2002?

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Relevance

- Measurement criteria:
 - Number of good and bad features recalled by users
 - Number of available commands not invoked by users
 - Number of available commands invoked by users
 - Number of times users need to work around a problem
 - Percentage of task completed

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Efficiency

- Measurement criteria:
 - Time to complete a task
 - Percentage of task completed
 - Percentage of task completed per unit time (speed metric)
 - Time spent in errors
 - Number of commands used
 - Frequency of help and documentation use
 - Time spent using help or documentation

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Efficiency

- Measurement criteria (con't):
 - Number of repetitions of failed commands
 - Number of runs of successes and of failures
 - Number of times interface misleads user
 - Number of times user needs to work around a problem
 - Number of times the help facilities solve the user's problem

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Attitude

- Measurement criteria:
 - Percentage of favourable/unfavourable user comments
 - Number of good and bad features recalled by users
 - Number of users preferring the system
 - Number of times user loses control over the system
 - Number of times the user is disrupted from a work task
 - Number of times user expresses frustration or satisfaction

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Learnability

- Measurement criteria:
 - Ratio of success to failures (over time)
 - Time spent in errors
 - Percentage or number of errors
 - Number of commands used
 - Frequency of help and documentation use
 - Time spent using help or documentation
 - Number of repetitions of failed commands
 - Number of runs of successes and of failures

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Learnability

- Measurement criteria (con't):
 - Number of available commands not invoked by users
 - Number of features or commands that can be remembered after a test
 - Proportion of users using efficient strategies compared to those using less efficient strategies
 - Number of logical errors made

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Useful vs. Usable

- Useful – the quality of having use
 - the application can be used to accomplish something
- Usable – the quality of having potential to accomplish the goals of the user
 - the user’s goals are the primary focus
 - the application serves (to varying degrees) to help the user accomplish those goals
- How can an application be useful but not usable?
- Does it make sense to say an application is usable but not useful?

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Low Fidelity Prototyping

- Low fidelity prototypes are
 - hand sketches and scenarios
 - e.g., storyboards, “scene by scene”
- They focus on the design, not on the interface mechanics

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Low Fidelity Prototyping

- Advantages of low fidelity prototypes:
 - can be used to conduct usability testing
 - thus, can perform usability testing even before any code has been written
 - can be used early in the development process
 - easy to modify
 - can be used to (re)define requirements
- Disadvantages:
 - _____

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The DECIDE framework

- The DECIDE framework provides the following steps to guide evaluation:
 - **D**etermine the overall goals that the evaluation addresses
 - **E**xplore the specific questions to be answered
 - **C**hoose the evaluation paradigm and techniques
 - **I**dentify practical issues
 - **D**ecide how to deal with the ethical issues
 - **E**valuate, interpret, and present the data

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The DECIDE framework

Determine the overall goals

- What are the high level goals of the evaluation?
- Examples:
 - Check that evaluators have understood the users' needs
 - Ensure that the final interface is consistent
 - Determine how to improve the usability of a user interface

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The DECIDE framework

Explore specific questions

- Break down overall goals into relevant questions
- Overall goal: Why do customers prefer paper tickets to e-tickets?
- Specific questions:
 - What is the customer's attitude?
 - Do they have adequate access to computers?
 - Are they concerned about security?
 - Does the electronic system have a bad reputation?
 - Is its user interface poor?

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The DECIDE framework

Choose paradigm and techniques

- Practical and ethical issues might be considered
- Factors:
 - Cost
 - Timeframe
 - Available equipment or expertise
- Compromises may have to be made

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The DECIDE framework

Identify practical issues

- Important to do this before starting
- Find appropriate users
- Decide on the facilities and equipment to be used
- Schedule and budget constraints
- Prepare testing conditions
- Plan how to run the tests

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The DECIDE framework

Decide on ethical issues

- Studies involving humans must uphold a certain code
- Privacy of subjects must be protected
- Personal records must be kept confidential
- Exact description of the experiment must be submitted for approval

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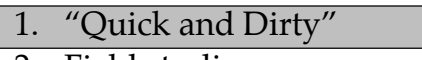
The DECIDE framework

Evaluate the data

- Should quantitative data be treated statistically?
- How to analyze qualitative data?
- Issues to consider:
 - Reliability (consistency)
 - Validity
 - Biases
 - Scope
 - Ecological validity

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Four Paradigms for Evaluation

1. "Quick and Dirty" 
2. Field studies
3. Predictive evaluation
 - Heuristic evaluation
 - Cognitive walkthroughs
4. Usability testing
 - Thinking Aloud Protocol
 - Co-discovery method

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Aside: What is a paradigm anyway?

A paradigm is:

- a pattern, exemplar, example [OED]
- an example or a model [Webster's]

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“Quick and Dirty” Evaluation

- How it takes place:
 - Individual(s) use the application, either in a lab or in his or her natural environment
 - Evaluator is present, but has minimal control
- What is obtained:
 - Sketches
 - Quotes
 - Descriptive reports
- Feedback is incorporated into design process

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“Quick and Dirty” Evaluation

Issues:

- User might share opinions or impressions of appearance
 - How should these be interpreted?
- A relatively small set of interactions are elicited
 - Are they representative of the future interactions that will take place with that user (or others like him or her?)
 - Factors: evaluator is present; user’s lack of familiarity
 - Are they representative of the future interactions that will take place for other users?
- What is being evaluated?
 - is it the user interface, or the interactions that the user interface affords?
- [Recall: concept of affordance]

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“Quick and Dirty” Evaluation

Advantages:

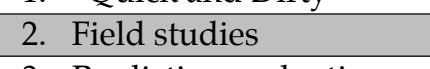
- User-centered
- Practical
- Provides feedback relatively quickly

Disadvantages:

- Users are expected to behave naturally
- Evaluators take minimum control

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Four Paradigms for Evaluation

1. “Quick and Dirty”
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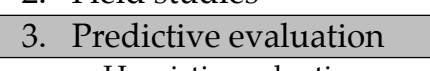
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Field Studies

- How it takes place:
 - analysts visit users in their natural environment.
 - analysts assess how the users' needs are being met and whether there are problems; try to identify design opportunities
- What is obtained:
 - Qualitative descriptions
 - Quotes
 - Sketches
 - Anecdotes
- Often used early in design to check that users' needs are met or to assess problems or design opportunities
- Conducted in the user's natural environment
- Evaluators try to develop relationships with users

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Four Paradigms for Evaluation

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Predictive Evaluations

- How it takes place:
 - Expert evaluators use practical heuristics and practitioner expertise to predict usability problems
 - Usually conducted in a lab
 - Doesn't involve users
- What is obtained:
 - Reviewers provide a list of problems, often with suggested solutions

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Predictive Evaluations

- Two predictive evaluation techniques:
 - Heuristic evaluation
 - Cognitive walkthroughs

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Heuristic Evaluation

- Heuristic evaluation was developed by Jakob Nielsen
 - see: Nielson, Jakob (n.d.) “How to Conduct a Heuristic Evaluation.”
http://www.useit.com/papers/heuristic/heuristic_evaluation.html
- It is a technique in which experts evaluate whether user interface elements conform to a set of usability principles or not.
 - The usability principles are described as *heuristics*
 - Heuristics bear a close resemblance to design principles and guidelines

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Heuristic Evaluation

Ten usability heuristics:

1. Visibility of system status
2. Match between system and the real world
3. User control and freedom
4. Consistency and standards
5. Help users recognize, diagnose, and recover from errors

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Heuristic Evaluation

Ten usability heuristics:

6. Error prevention
7. Recognition rather than recall
8. Flexibility and efficiency of use
9. Aesthetic and minimalist design
10. Help and documentation

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Cognitive walkthroughs

- “Cognitive walkthroughs involve simulating a user’s problem-solving process at each step in the human-computer dialog, checking to see if the user’s goals and memory for actions can be assumed to lead to the next correct action”
(Nielsen and Mack, 1994).
- The focus is on evaluating design for ease of learning

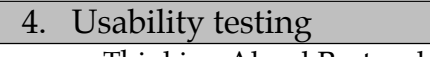
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Cognitive walkthroughs

- Primary Steps:
 - Characteristics of typical users are identified
 - Designers and evaluators meet, walk through the action sequences for each task and try to answer the following questions:
 - Will the correct action be evident to the user?
 - Will the user notice that the correct action is available?
 - Will the user know from the feedback whether they made a correct choice?

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Goals of Usability Testing

- Does the application meet the qualitative usability goals?
- Does the application meet the quantitative usability goals?

Adapted from Mayhew, Deborah J. (1999) The Usability Engineering Lifecycle

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Examples of Qualitative Goals

- E.g. 1: That the design support users working in a high-interrupt environment
 - One way to achieve this goal: that the design provide lots of context information on screen to remind users where they are when they get distracted
- E.g., 2: That the design support very infrequent users of a very complex task
 - One way to achieve this goal: that the design be self-explanatory, easy to learn and to remember.

Adapted from Mayhew, Deborah J. (1999) The Usability Engineering Lifecycle

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Examples of Quantitative Goals

- E.g. 1: That experienced users should take no longer than 15 seconds on average to address an email.
 - Experience defined as users who have performed the task five times in a training session
- E.g. 2: That novice users should take no longer than three minutes to complete the registration input form.
 - Novice defined as first-time users

Adapted from Mayhew, Deborah J. (1999) The Usability Engineering Lifecycle 49

Usability Testing

- How it takes place:
 - Users carry out one or more pre-determined tasks in a usability lab
 - Evaluators present but not visible
- What is obtained:
 - Users' opinions (collected by questionnaire or interview)
 - Usability test participants are encouraged to think aloud and voice their every opinion.
 - Reports of performance measures: number and type of errors, time-to-completion and others
 - Qualitative; Quantitative
- Feedback is incorporated into design process
 - Changes are made to the application or site based on the findings of the usability tests.

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Usability Testing

- There should be:
 - specific questions that the usability testing is designed to answer.
 - *Usability testing has specific objectives.*
 - Design issues to be studied need to be determined in advance.
- The tasks are chosen in order to measure specifically chosen attributes of the interaction.

Adopted from <http://searchwebservices.techtarget.com/>

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What to User Test?

The tasks are chosen in order to measure specific attributes:

- The product's ease-of-use
- Ease of system learning
- Retention of learning over time
- Time required to complete task(s); Speed of task completion
- The user's perception of the experience; Subjective user satisfaction
- Conformance with a requirement
- Conformance with guidelines for good design
- Error rates

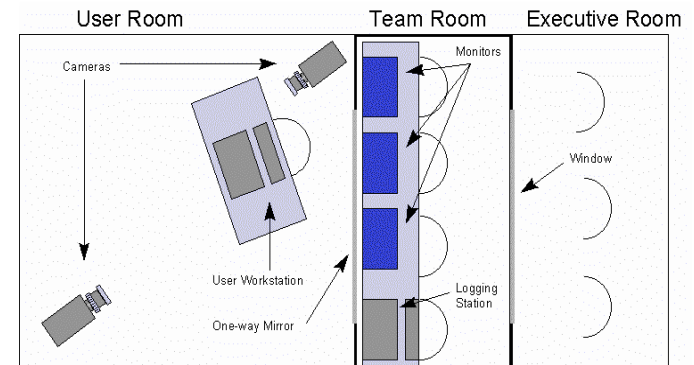
Galitz, W. O., (2002) The Essential Guide to User Interface Design, 2nd Edition, Wiley Computer Publishing, New York, NY. 52

Which Attributes to Evaluate?

- Depends on outcomes of previous evaluations
- Depends on which phase of the development cycle
 - What can be changed?
 - Fundamental design decisions (e.g., the conceptual model of the task)
 - The way the design decisions have been implemented (e.g., Layout, Fonts, etc)

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Usability Lab



<http://www.ulabs.com/images/lab.gif>

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Usability Lab



<http://www.sun.com/usability/>

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Usability Testing

Advantages:

- It is impossible to predict usability from appearance, just like it is impossible to judge a person's personality on appearance.
- Casual "feel good" feedback is inadequate.
- Formal testing is often the only way problems are identified pre-release. Problems found once a product is released are usually not fixed unless they are really severe.

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Usability Testing

Advantages:

- Users, designers, programmers have different models
- The designer's intuition is not always correct
- Design standards and guidelines are not sufficient
- Usability testing leads to competitive advantages and reduced support costs

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Usability Testing

Advantages:

- Applied approach based on experimentation
- Evaluators are strongly in control

Disadvantages:

- Time consuming, expensive
- Used when a prototype or a product is available
- Evaluators are strongly in control

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Usability Testing

What do evaluators say to subjects?

- Give a brief explanation that the participant's involvement is to solicit user feedback.
- Provide *instructions* as to the user's task but not *explanations* of the software.
- Reassurance that any problems are the fault of the software.
- In real-world situations, explain confidentiality agreement, liability legalities, and that participant is free to leave at any time (and still get paid).

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Thinking Aloud Protocol

- During a usability test, instruct participants to verbalize their thoughts.
- The evaluator's goal is:
 - to understand their mental model of the system and the tasks
 - to understand where the subjects have trouble in understanding and using the system
- Prompt participants by asking direct questions about the software

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When to ask questions?

- Need to balance:
 - interruption to the user's task flow
 - interruption may affect the flow of the task
 - short-term memory
 - users may forget
- In general:
 - ask the question after the completion of the task, unless you are more worried about the participant forgetting their current thought process (i.e., interrupt and ask right away).

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Co-discovery Method

- Two participants perform tasks together, but one participant is assigned the mouse and the other the keyboard.
- They are instructed to work together to accomplish a common goal using the product.

- The allocation of input devices increases the amount of communication between the subjects
- Their communication provides information about their thought processes

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Recap

Four Paradigms for Evaluation

1. "Quick and Dirty"
2. Field studies
3. Predictive evaluation
 - Heuristic Evaluation
 - Cognitive Walkthrough
4. Usability testing
 - User Testing

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