Evaluation 1

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Agenda (for next 3 lectures)

- Evaluation overview
- Designing an experiment
  - Hypotheses
  - Variables
  - Designs & paradigms
- Participants, IRB, & ethics
- Gathering data
  - Objective; Subjective data
- Analyzing & interpreting results
- Using the results in your design

Evaluation, Part 1

- Evaluation overview
- Designing an experiment
  - Hypotheses
  - Variables
  - Designs & paradigms
- Participants, IRB, & ethics

Project Part 4

- All about evaluation
  - Use what you learn in next 3 classes

Why Evaluate?

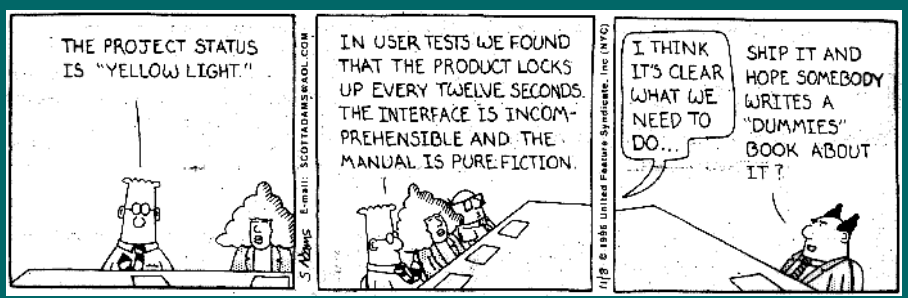
Recall:

- Users and their tasks were identified
- Needs and requirements were specified
- Interface was designed, prototype built

- *But is it any good? Does the system support the users in their tasks? Is it better than what was there before (if anything)?*

One Model

Evaluation can help your design…



Types of Evaluation

- Interpretive and Predictive (a reminder)
  - Heuristic evaluation, cognitive walkthroughs, ethnography, GOMS, …
- Summative vs. Formative
  - What were they, again?

Now With Users Involved

- Interpretive (naturalistic) vs. Empirical:
- Naturalistic
  - In realistic setting, usually includes some detached observation, careful study of users
- Empirical
  - People use system, manipulate independent variables and observe dependent ones

Why Gather Data?

- Design the experiment to collect the data to test the hypotheses to evaluate the interface to refine the design

- Information gathered can be: *objective* or *subjective*
- Information also can be: *qualitative* or *quantitative*

Which are tougher to measure?

Conducting an Experiment

- Determine the TASK
- Determine the performance measures
- Develop the experiment
- IRB approval
- Recruit participants
- Collect the data
- Inspect & analyze the data
- Draw conclusions to resolve design problems
- Redesign and implement the revised interface

The Task

- Benchmark tasks - gather quantitative data
- Representative tasks - add breadth, can help understand process
- Tell them what to do, not how to do it
- Issues:
  - Lab testing vs. field testing
  - Validity - typical users; typical tasks; typical setting?
  - Run pilot versions to shake out the bugs

"Benchmark" Tasks

- Specific, clearly stated task for users to carry out
- Example: Email handler
  - "Find the message from Mary and reply with a response of 'Tuesday morning at 11'."
- Users perform these under a variety of conditions and you measure performance

Defining Performance

- Based on the task
- Specific, objective measures/metrics
- Examples:
  - Speed (reaction time, time to complete)
  - Accuracy (errors, hits/misses)
  - Production (number of files processed)
  - Score (number of points earned)
  - …others…?

Types of Variables

- Independent
  - What you're studying, what you intentionally vary (e.g., interface feature, interaction device, selection technique)
- Dependent
  - Performance measures you record or examine (e.g., time, number of errors)

"Controlling" Variables

- Prevent a variable from affecting the results in any systematic way
- Methods of controlling for a variable:
  - Don't allow it to vary
    - e.g., all males
  - Allow it to vary randomly
    - e.g., randomly assign participants to different groups
  - Counterbalance - systematically vary it
    - e.g., equal number of males, females in each group
  - The appropriate option depends on circumstances

Hypotheses

- What you predict will happen
- More specifically, the way you predict the dependent variable (i.e., accuracy) will depend on the independent variable(s)
- "Null" hypothesis (H_o)
  - Stating that there will be no effect
  - e.g., "There will be no difference in performance between the two groups"
  - Data used to try to disprove this null hypothesis

Example

- Do people complete operations faster with a black-and-white display or a color one?
  - Independent - display type (color or b/w)
  - Dependent - time to complete task (minutes)
  - Controlled variables - same number of males and females in each group
  - Hypothesis: Time to complete the task will be shorter for users with color display
  - H_o: $Time_{color} = Time_{b/w}$
  - Note: Within/between design issues, next

Experimental Designs

- Within Subjects Design
  - Every participant provides a score for all levels or conditions

	Color	B/W
P1	12 secs.	17 secs.
P2	19 secs.	15 secs.
P3	13 secs.	21 secs.
...		

Experimental Designs

- Between Subjects
  - Each participant provides results for only one condition

	Color		B/W
P1	12 secs.	P2	17 secs.
P3	19 secs.	P5	15 secs.
P4	13 secs.	P6	21 secs.
...			

Within vs. Between

- What are the advantages and disadvantages of the two techniques?

Within Subjects Designs

- More efficient:
  - Each subject gives you more data - they complete more "blocks" or "sessions"
- More statistical "power":
  - Each person is their own control
- Therefore, can require fewer participants
- May mean more complicated design to avoid "order effects"
  - e.g. seeing color then b/w may be different from seeing b/w then color

Between Subjects Designs

- Fewer order effects
  - Participant may learn from first condition
  - Fatigue may make second performance worse
- Simpler design & analysis
- Easier to recruit participants (only one session)
- Less efficient

Now What…?

- You've got your task, performance measures, experimental design, etc.
- You have hypotheses about what will happen in the experiment
- Now you need to gather the data
- …So you need… PARTICIPANTS

IRB, Participants, & Ethics

- Institutional Review Board (IRB)
  - http://www.osp.gatech.edu/compliance.htm
- Reviews all research involving human (or animal) participants
- Safeguarding the participants, and thereby the researcher and university
- Not a science review (i.e., not to asess your research ideas); only safety & ethics
- Complete Web-based forms, submit research summary, sample consent forms, etc.
- All experimenters must complete NIH online history/ethics course prior to submitting

Recruiting Participants

- Various "subject pools"
  - Volunteers
  - Paid participants
  - Students (e.g., psych undergrads) for course credit
  - Friends, acquaintances, family, lab members
  - "Public space" participants - e.g., observing people walking through a museum
- Must fit user population (validity)
- Motivation is a big factor - not only $$ but also explaining the importance of the research
- Note: Ethics, IRB, Consent apply to *all* participants, including friends & "pilot subjects"

Ethics

- Testing can be arduous
- Each participant should consent to be in experiment (informal or formal)
  - Know what experiment involves, what to expect, what the potential risks are
- Must be able to stop without danger or penalty
- All participants to be treated with respect

Consent

- Why important?
  - People can be sensitive about this process and issues
  - Errors will likely be made, participant may feel inadequate
  - May be mentally or physically strenuous
- What are the potential risks (there are always risks)?
  - Examples?
- "Vulnerable" populations need special care & consideration (& IRB review)
  - Children; disabled; pregnant; students (why?)

Before Study

- Be well prepared so participant's time is not wasted
- Make sure they know you are testing software, not them
  - (Usability testing, not User testing)
- Maintain privacy
- Explain procedures without compromising results
- Can quit anytime
- Administer signed consent form

During Study

- Make sure participant is comfortable
- Session should not be too long
- Maintain relaxed atmosphere
- Never indicate displeasure or anger

After Study

- State how session will help you improve system ("debriefing")
- Show participant how to perform failed tasks
- Don't compromise privacy (never identify people, only show videos with explicit permission)
- Data to be stored anonymously, securely, and/or destroyed

Attribution Theory

- Studies why people believe that they succeeded or failed--themselves or outside factors (gender, age differences)
- Explain how errors or failures are not participant's problem---places where interface needs to be improved

Project

- IRB approval?
- P3 due Thursday after break
  - Prototype description
  - Evaluation plan & usability specs

Midterm Exam

- Grades
- Review

Upcoming

- Thursday – No class
  - Project work day
- More on evaluation (after break)
  - Gathering data
    - Recording, measuring, observing
    - Objective data
    - Subjective data, questionnaires
  - Analyzing Data, Interpreting Results
  - Usability specifications