Evaluating interfaces with users

Why evaluation is crucial

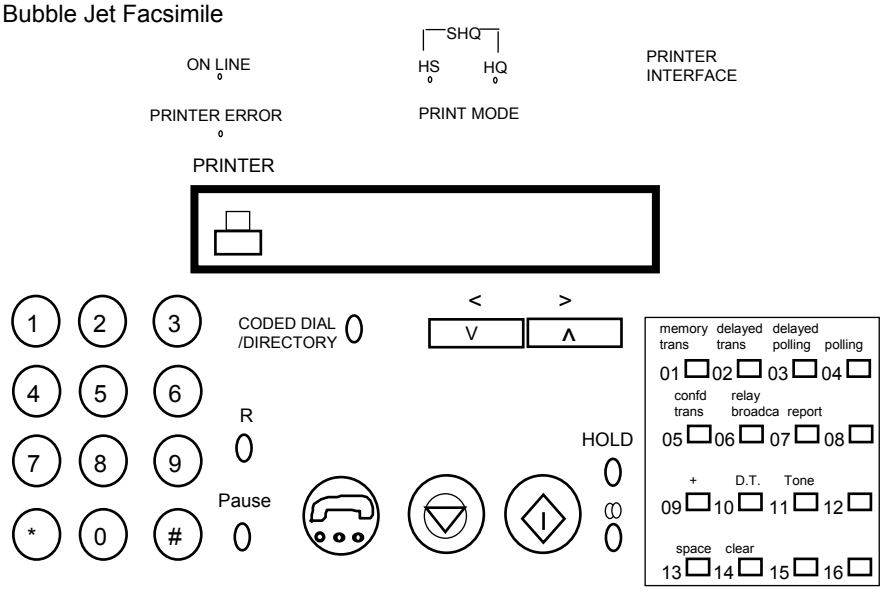
Quickly debug prototypes by observing people use them

Methods reveal what a person is thinking about

Ethics

Slide deck by Saul Greenberg. Permission is granted to use this for non-commercial purposes as long as general credit to Saul Greenberg is clearly maintained.
Warning: some material in this deck is used from other sources without permission. Credit to the original source is given if it is known.

Canon
Fax-B320
Bubble Jet Facsimile

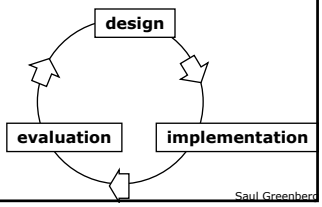


Why bother?

Tied to the usability engineering lifecycle

Pre-design
- investing in new expensive system requires proof of viability

Initial design stages
- develop and evaluate initial design ideas with the user

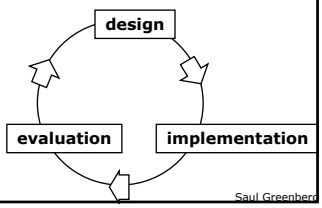


Saul Greenberg

Why bother?

Iterative design
- does system behavior match the user's task requirements?
- are there specific problems with the design?
- what solutions work?

Acceptance testing
- verify that system meets expected user performance criteria
  - 80% of 1st time customers will take 1-3 minutes to withdraw $50 from the automatic teller



Saul Greenberg

Naturalistic approach

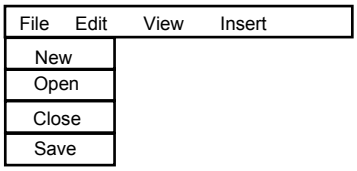
Observation occurs in realistic setting
- real life

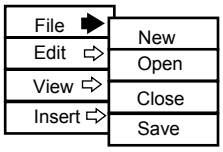
Problems
- hard to arrange and do
- time consuming
- may not generalize

Experimental approach

Experimenter controls all environmental factors
- study relations by manipulating *independent* variables
- observe effect on one or more *dependent* variables
- Nothing else changes

*There is no difference in user performance (**time** and **error rate**) when selecting an item from a **pull down** or a **pull right** menu of 4 items*





Saul Greenberg

Validity

External validity

- confidence that results applies to real situations
- usually good in natural settings

Internal validity

- confidence in our explanation of experimental results
- usually good in experimental settings

Trade-off: Natural *vs* Experimental

- precision and direct control over experimental design *versus*
- desire for maximum generalizability in real life situations

Saul Greenberg

Usability engineering approach

Observe people using systems in simulated settings

- people brought in to artificial setting that simulates aspects of real world setting
- people given specific tasks to do
- observations / measures made as people do their tasks
- look for problem areas / successes
- good for uncovering 'big effects'

Usability engineering approach

Is the test result relevant to the usability of real products in real use outside of lab?

Problems

- non-typical users tested
- non-typical tasks
- different physical environment
- different social context
  - motivation towards experimenter vs motivation towards boss

Partial Solution

- use real users
- task-centered system design tasks
- environment similar to real situation

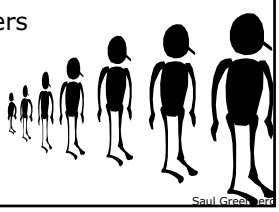
Usability engineering approach

How many users should you observe?

- observing many users is expensive
- *but* individual differences matter
  - best user 10x faster than slowest
  - best 25% of users ~2x faster than slowest 25%

partial solution

- reasonable number of users tested
- reasonable range of users
- big problems usually detected with handful of users
- small problems / fine measures need many users



Discount usability evaluation

Low cost methods to gather usability problems
- approximate: capture most large and many minor problems

How?
- qualitative:
  - observe user interactions
  - gather user explanations and opinions
  - produces a description, usually in non-numeric terms
  - anecdotes, transcripts, problem areas, critical incidents…
- quantitative
  - count, log, measure something of interest in user actions
  - speed, error rate, counts of activities,

Saul Greenberg

Discount usability evaluation

Methods
- inspection
- extracting the conceptual model
- direct observation
  - think-aloud
  - constructive interaction
- query techniques (interviews and questionnaires)
- continuous evaluation (user feedback and field studies)

Saul Greenberg

Inspection

Designer tries the system (or prototype)

- does the system "feel right"?

- benefits
  - can catch some major problems in early versions
- problems
  - not reliable as completely subjective
  - not valid as introspector is a non-typical user
  - intuitions and introspection are often wrong

Inspection methods help

- task centered walkthroughs
- heuristic evaluation

Saul Greenberg

Conceptual model extraction

How?

- show the user static images of
  - the prototype *or* screens during use
- ask the user explain
  - the function of each screen element
  - how they would perform a particular task

What?

- **Initial conceptual model**
  - how person perceives a screen the very first time it is viewed
- **Formative conceptual model**
  - How person perceives a screen after its been used for a while

Value?

- good for eliciting people's understanding before & after use
- poor for examining system exploration and learning

Saul Greenberg

Direct observations

Evaluator observes users interacting with system

- in lab:
  - user asked to complete a set of pre-determined tasks
- in field:
  - user goes through normal duties

Value

- excellent at identifying gross design/interface problems
- validity depends on how controlled/contrived the situation is

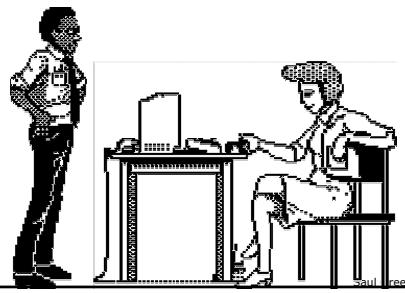
Saul Greenberg

Simple observation method

User is given the task
Evaluator just watches the user

Problem

- does not give insight into the user's decision process or attitude



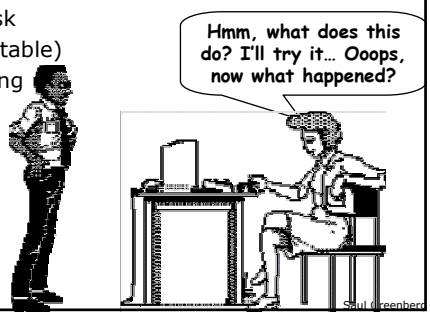
Saul Greenberg

Think aloud method

Users speak their thoughts while doing the task

- what they are trying to do
- why they took an action
- how they interpret what the system did

- gives insight into what the user is thinking
- most widely used evaluation method in industry
  - may alter the way users do the task
  - unnatural (awkward and uncomfortable)
  - hard to talk if they are concentrating



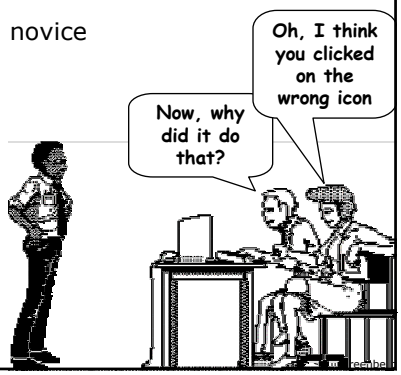
Constructive interaction method

Two people work together on a task

- monitor their normal conversations
- removes awkwardness of think-aloud

Co-discovery learning

- use semi-knowledgeable "coach" and novice
- only novice uses the interface
  - novice ask questions
  - coach responds
- gives insights into two user groups



Recording observations

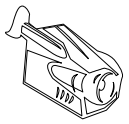
How do we record user actions for later analysis?

- otherwise risk forgetting, missing, or misinterpreting events

- paper and pencil
  - primitive but cheap
  - observer records events, comments, and interpretations
  - hard to get detail (writing is slow)
  - 2nd observer helps…

- audio recording
  - good for recording think aloud talk
  - hard to tie into on-screen user actions

- video recording
  - can see and hear what a user is doing
  - one camera for screen, rear view mirror useful…
  - initially intrusive



Saul Greenberg

Coding sheet example...

tracking a person's use of an editor

	General actions			Graph editing			Errors	
Time	text editing	scrolling	image editing	new node	delete node	modify node	correct error	miss error
09:00	X							
09:02				X				
09:05							X	
09:10					X			
09:13								

Saul Greenberg

Interviews

Good for pursuing specific issues
- vary questions to suit the context
- probe more deeply on interesting issues as they arise
- good for exploratory studies via open-ended questioning
- often leads to specific constructive suggestions

Problems:
- accounts are subjective
- time consuming
- evaluator can easily bias the interview
- prone to rationalization of events/thoughts by user
  - user's reconstruction may be wrong

Saul Greenberg

How to Interview

Plan a set of central questions
- a few good questions gets things started
  - avoid leading questions
- focuses the interview
- could be based on results of user observations

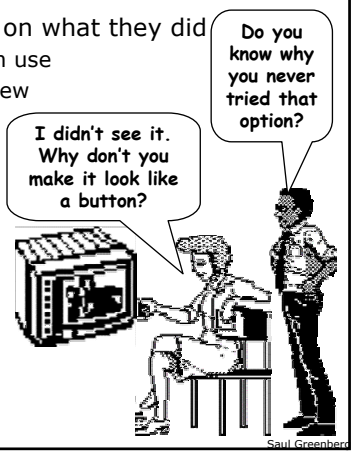
Let user responses lead follow-up questions
- follow interesting leads *vs* bulldozing through question list

Saul Greenberg

Retrospective testing interviews

Post-observation interview to

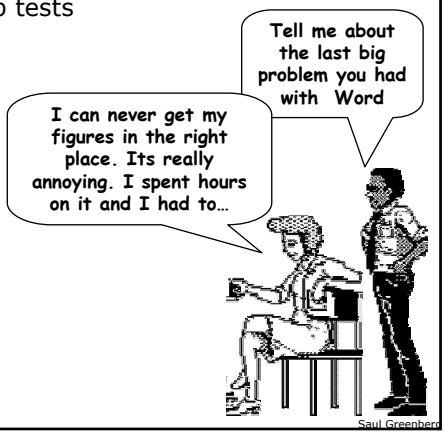
- perform an observational test
- create a video record of it
- have users view the video and comment on what they did
  - clarify events that occurred during system use
  - excellent for grounding a post-test interview
  - avoids erroneous reconstruction
  - users often offer concrete suggestions



Critical incidence interviews

People talk about incidents that stood out

- usually discuss extremely annoying problems with fervor
- not representative, but important to them
- often raises issues not seen in lab tests



Questionnaires and Surveys

Questionnaires / Surveys
- preparation "expensive," but administration cheap
  - can reach a wide subject group (e.g. mail)
- does not require presence of evaluator
- results can be quantified

But
- only as good as the questions asked

Saul Greenberg

Questionnaires and Surveys

How
- establish the purpose of the questionnaire
  - what information is sought?
  - how would you analyze the results?
  - what would you do with your analysis?
- do not ask questions whose answers you will not use!
- determine the audience you want to reach
- determine how would you will deliver / collect the questionnaire
  - on-line for computer users
  - web site with forms
  - surface mail
    - pre-addressed reply envelope gives far better response

Saul Greenberg

Styles of Questions

Open-ended questions
- asks for unprompted opinions
- good for general subjective information
  - but difficult to analyze rigorously

Can you suggest any improvements to the interfaces?

Saul Greenberg

Styles of Questions

Closed questions
- restrict respondent's responses by supplying alternative answers
- makes questionnaires a chore for respondent to fill in
- can be easily analyzed
- watch out for hard to interpret responses!
  - alternative answers should be very specific

Do you use computers at work:

✓ O often O sometimes O rarely

vs

In your typical work day, do you use computers:

O over 4 hrs a day
O between 2 and 4 hrs daily
✓ O between 1and 2 hrs daily
O less than 1 hr a day

Saul Greenberg

Styles of Questions

Scalar

- ask user to judge a specific statement on a numeric scale
- scale usually corresponds with agreement or disagreement with a statement

Characters on the computer screen are:

- hard to read easy to read
- 1 2 3 4 5

Saul Greenberg

Styles of Questions

Multi-choice

- respondent offered a choice of explicit responses

How do you most often get help with the system? (tick one)

O ✓ on-line manual
O paper manual
O ask a colleague

Which types of software have you used? (tick all that apply)

✓ word processor
O data base
✓ spreadsheet
O compiler

Saul Greenberg

Styles of Questions

Ranked

- respondent places an ordering on items in a list
- useful to indicate a user's preferences
- forced choice

Rank the usefulness of these methods of issuing a command
(1 most useful, 2 next most useful..., 0 if not used
__2__ command line
__1__ menu selection
__3__ control key accelerator

Saul Greenberg

Styles of Questions

Combining open-ended and closed questions

- gets specific response, but allows room for user's opinion

It is easy to recover from mistakes:

disagree agree comment: *the undo facility is really helpful*

1 (2) 3 4 5

Saul Greenberg

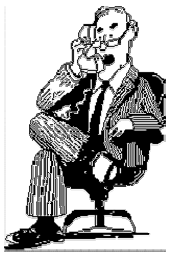
Continuous Evaluation

Monitor systems in actual use

- usually late stages of development
  - ie beta releases, delivered system
- fix problems in next release

User feedback via gripe lines

- users can provide feedback to designers while using the system
  - help desks
  - bulletin boards
  - email
  - built-in gripe facility
- best combined with trouble-shooting facility
  - users always get a response (solution?) to their gripes

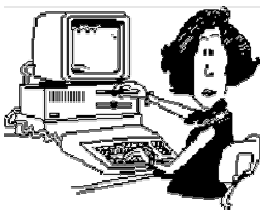


Saul Greenberg

Continuous evaluation

Case/field studies

- careful study of "system usage" at the site
- good for seeing "real life" use
- external observer monitors behavior
- site visits

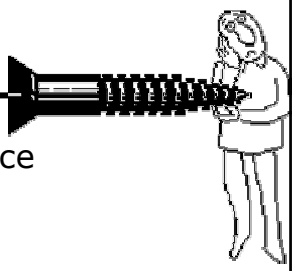


Saul Greenberg

Ethics

Saul Greenberg

Ethics



Testing can be a distressing experience

- pressure to perform, errors inevitable
- feelings of inadequacy
- competition with other subjects

Golden rule

- subjects should always be treated with respect

Saul Greenberg

Ethics – before the test

Don't waste the user's time
- use pilot tests to debug experiments, questionnaires etc
- have everything ready before the user shows up

Make users feel comfortable
- emphasize that it is the system that is being tested, not the user
- acknowledge that the software may have problems
- let users know they can stop at any time

Maintain privacy
- tell user that individual test results will be completely confidential

Inform the user
- explain any monitoring that is being used
- answer all user's questions (but avoid bias)

Only use volunteers
- user must sign an informed consent form

Saul Greenberg

Ethics – during the test

Don't waste the user's time
- never have the user perform unnecessary tasks

Make users comfortable
- try to give user an early success experience
- keep a relaxed atmosphere in the room
- coffee, breaks, etc
- hand out test tasks one at a time
- never indicate displeasure with the user's performance
- avoid disruptions
- stop the test if it becomes too unpleasant

Maintain privacy
- do not allow the user's management to observe the test

Saul Greenberg

Ethics – after the test

Make the users feel comfortable
- state that the user has helped you find areas of improvement

Inform the user
- answer particular questions about the experiment that could have biased the results before

Maintain privacy
- never report results in a way that individual users can be identified
- only show videotapes outside the research group with the user's permission

Saul Greenberg

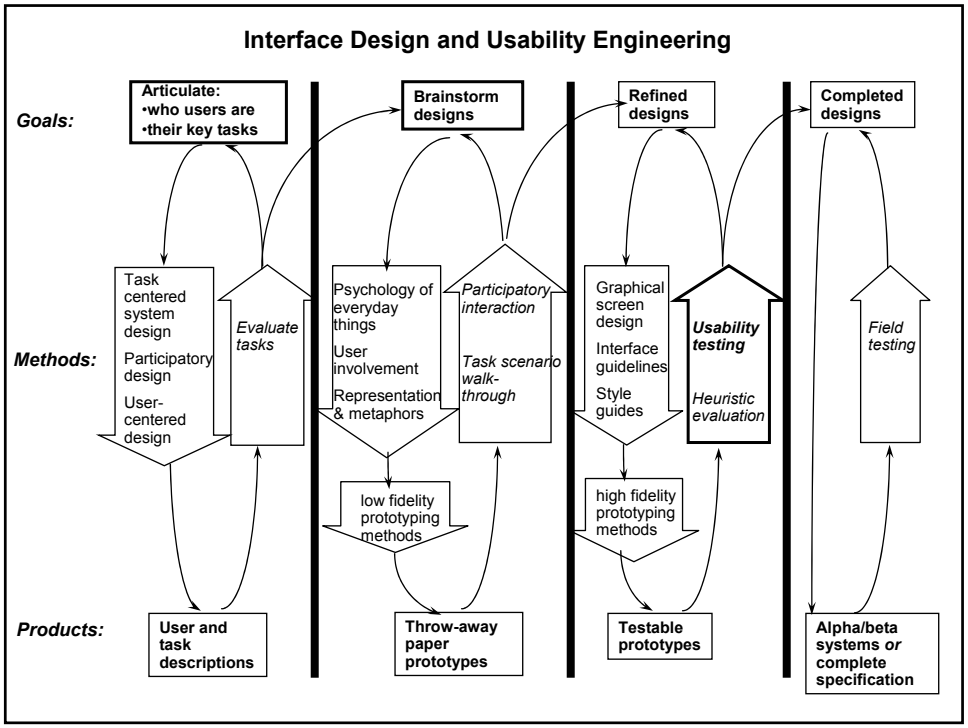
What you now know

Debug designs by observing how people use them
- quickly exposes successes and problems
- specific methods reveal what a person is thinking
- but naturalistic *vs* laboratory evaluations is a tradeoff

Methods include
- conceptual model extraction
- direct observation
  - think-aloud
  - constructive interaction
- query via interviews, retrospective testing and questionnaires
- continuous evaluation via user feedback and field studies

Ethics are important

Saul Greenberg


Interface Design and Usability Engineering
Goals:
Articulate:
•who users are
•their key tasks
Brainstorm designs
Refined designs
Completed designs
Methods:
Task centered system design
Participatory design
User-centered design
Evaluate tasks
Psychology of everyday things
User involvement
Representation & metaphors
Participatory interaction
Task scenario walk-through
Graphical screen design
Interface guidelines
Style guides
Usability testing
Heuristic evaluation
Field testing
low fidelity prototyping methods
high fidelity prototyping methods
Products:
User and task descriptions
Throw-away paper prototypes
Testable prototypes
Alpha/beta systems or complete specification