Course Summary

CS160: User Interfaces
Maneesh Agrawala

Final Prototype, Report & Poster

Impressive
- Mean: 95.76
- Stdev: 1.92

Consider submitting a CHI work in Progress
http://www.chi2007.org/submit/wip.php
- 6 page paper submission
- Due Jan 12
- If accepted you will get
  - A trip to San Jose
  - Companies recruiting HCI experts (Google, Microsoft, Apple etc.)
  - To meet HCI researchers

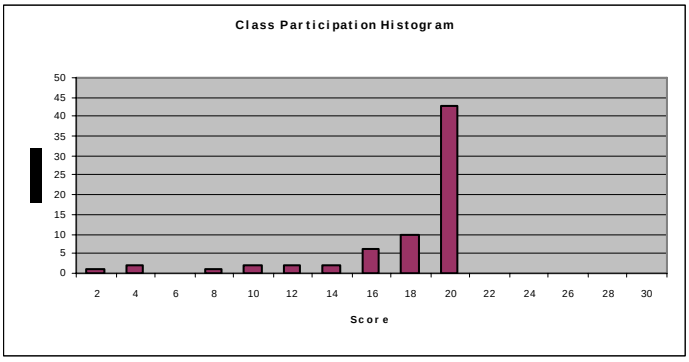
Current Grades

- Individual grade report handed out
- Consider your score vs. mean and stdev.
  - Mean is roughly a B+

- Four main categories so far
  - Class Participation 15%
  - Individual Assignments 15%
  - Group Project 40%
  - Midterm Exam 15%
  - Final Exam 15%

Class Participation

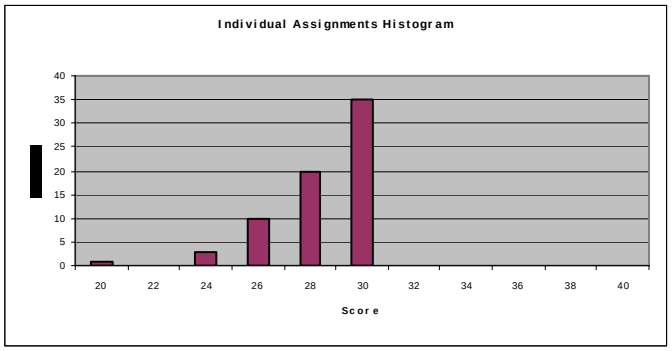
20 possible points – comments on wiki and in class



Mean 17.45, Stdev 4.22

Individual Assignments

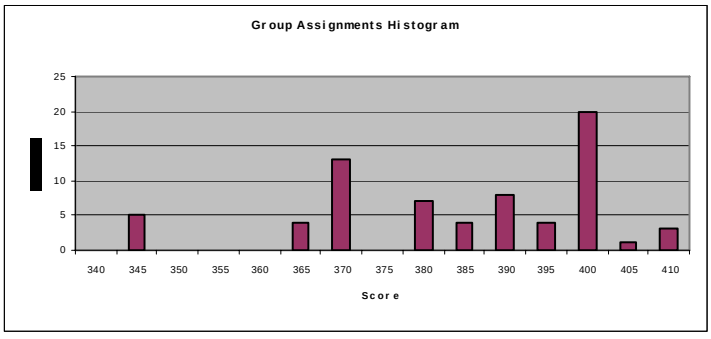
30 points + 10 more for final assessment due today



Mean 27.96, Stdev 2.18

Group Project

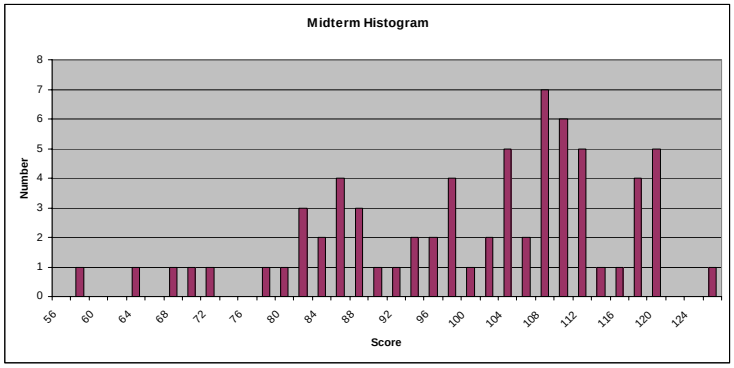
420 points possible



Mean 382.41, Stdev 17.33

Midterm

125 points possible



Mean 99.54, Stdev 15.36

Final Exam

Friday Dec 15 (5-8pm) in 277 Cory

Coverage

- Covers all lectures, section and readings in class
  - 1/3 on material before midterm
  - 2/3 on material after midterm
- Closed book, no cheatsheets, no electronic devices

Optional Final Exam

Current weighting scheme

- Class Participation 15%
- Individual Assignments 15%
- Group Project 40%
- Midterm Exam 15%
- Final Exam 15%

An offer

- You can choose whether or not to take the final
- If you do not take it the weighting scheme will be
- Class Participation 15%
- Individual Assignments 15%
- Group Project 47.5%
- Midterm Exam 22.5%

Optional Final Exam

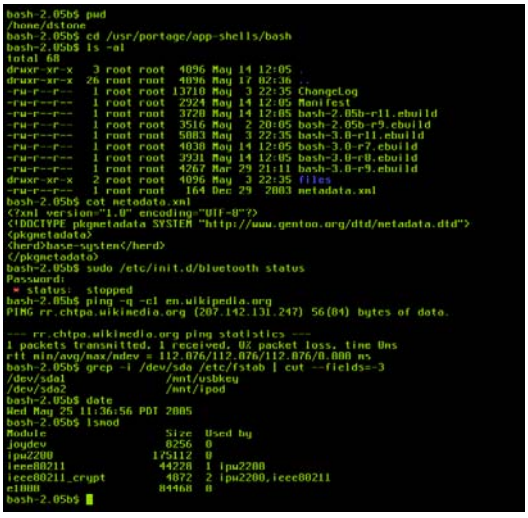
You must tell us by this Friday Dec 8 whether you plan to take the exam or not (email: cs160@imail.eecs.berkeley.edu)

If we do not hear from you we will assume you are taking it. If you say you will take it (or do not send us any email) and do not show up you will get a 0 on the final.

Course Review

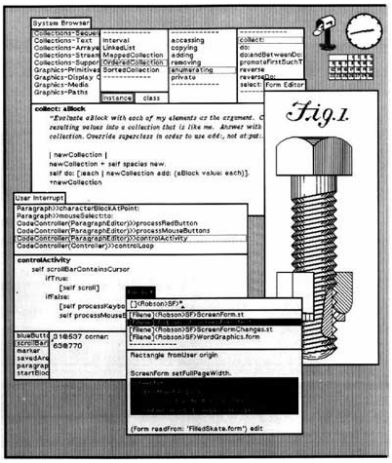
(since Midterm)

In the beginning…



http://www.cryptonomicon.com/beginning.html

The Xerox Alto

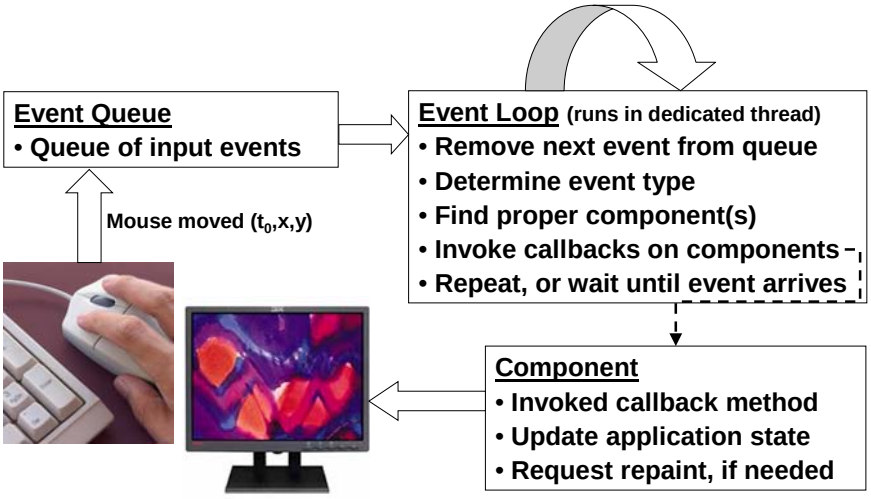


Events

User input is modeled as "events" that must be handled by the system.

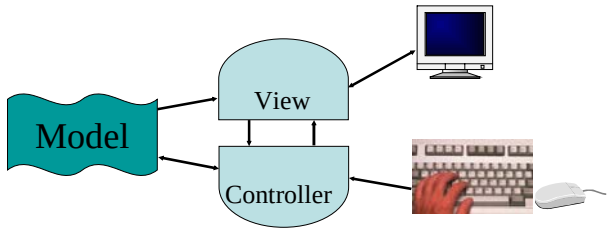
Examples?

- Mouse input
  - Mouse entered, exited, moved, clicked, dragged
  - Inferred events: double-clicks, gestures
- Keyboard (key down, key up)
- Window movement, resizing



Why is an event dispatch loop useful for interactive apps?

Model View Controller



- Model – Information application manipulates
- View – Visual display of the model
- Controller – Receives and handles input from user

Discount Usability Engineering

- Walkthroughs
  - Put yourself in the shoes of a user
  - Like a code walkthrough
- Action analysis
  - GOMS (add times to formal action analysis)
- Heuristic evaluation

Heuristic Evaluation

Developed by Jakob Nielsen (1994)

Can be performed on working UI or sketches

Small set (3-5) of evaluators (experts) examine UI

- Check compliance with usability heuristics
- Different evaluators will find different problems
- Evaluators only communicate afterwards to aggregate findings
- Use violations to redesign/fix problems

Revised Heuristics

H2-1: Visibility of system status

H2-2: Match system and real world

H2-3: User control and freedom

H2-4: Consistency and standards

H2-5: Error prevention

H2-6: Recognition rather than recall

H2-7: Flexibility and efficiency of use

H2-8: Aesthetic and minimalist design

H2-9: Help users recognize, diagnose and recover from errors

H2-10: Help and documentation

Heuristic: Visibility (Feedback)

H2-1: Visibility of system status

- Keep users informed about what is going on
- Example: pay attention to response time
  - 0.1 sec: no special indicators needed
  - 1.0 sec: user tends to lose track of data
  - 10 sec: max. duration if user to stay focused on action
- Short delays: Hourglass
- Long delays: Use percent-done progress bars
  - Overestimate usually better

Severity Ratings Example

0 - don't think that this is a usability problem
1 - cosmetic problem
2 - minor usability problem
3 - major usability problem; important to fix
4 - usability catastrophe; imperative to fix

1. [H2-4 Consistency] [Severity 3][Fix 0]

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

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 across design iterations)

Should be calculated after all evaluations are in

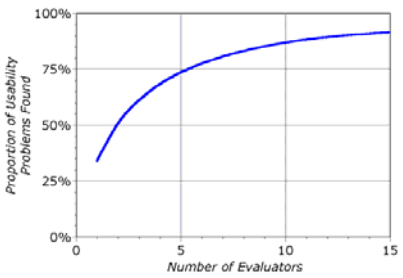
Should be done independently by all judges

Number of Evaluators

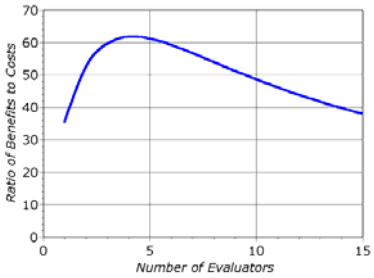
Single evaluator achieves poor results

- Only finds 35% of usability problems
- 5 evaluators find ~ 75% of usability problems
- Why not more evaluators???? 10? 20?
  - Adding evaluators costs more
  - Many evaluators won't find many more problems

Problems Found



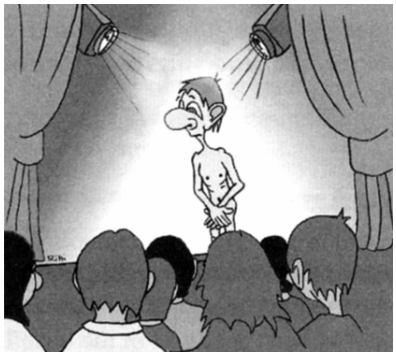
Benefits / Cost



Treat Subjects with Respect

Testing is a distressing experience

- Pressure to perform
- Feeling of inadequacy
- Looking like a fool in front of your peers, your boss,…



(from "Paper Prototyping" by Snyder)

Quantitative Studies

Repeatable, reliable evaluation of interface elements

To control properly, usually limited to low-level issues
- Menu selection method A faster than method B

Pros/Cons
- Objective measurements → scientific method
  - Good internal validity → repeatability
- But, real-world implications may be difficult to foresee
  - External validity?
- Significant results doesn't imply real-world importance
  - 3.05s versus 3.00s for menu selection

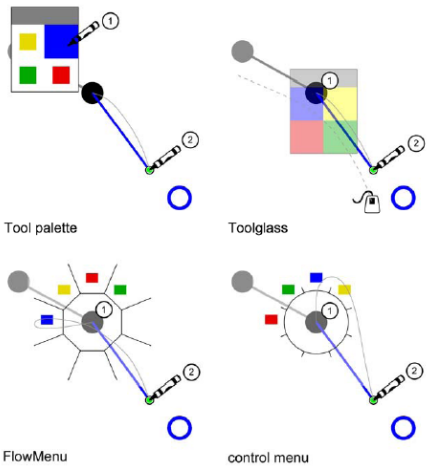
Variables

Independent variables
- Menu type (4 choices)
- Device type (2 choices) ?

Dependent variables
- Time
- Error rate
- User satisfaction

Control variables
- Location/environment …
- Device type ?

Random variables
- Attributes of subjects
  - Age, sex, …



Goals

Internal validity
- Manipulation of IV is cause of change in DV
  - Requires eliminating confounding variables (turn them into IVs, CVs or RVs)
  - Requires that experiment is replicable

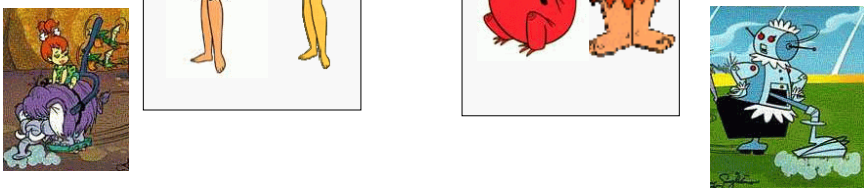
External validity
- Results are generalizable to other experimental settings
- ***Ecological validity*** – results generalizable to real-world settings

Confidence in results
- Statistics

Between Subjects Design

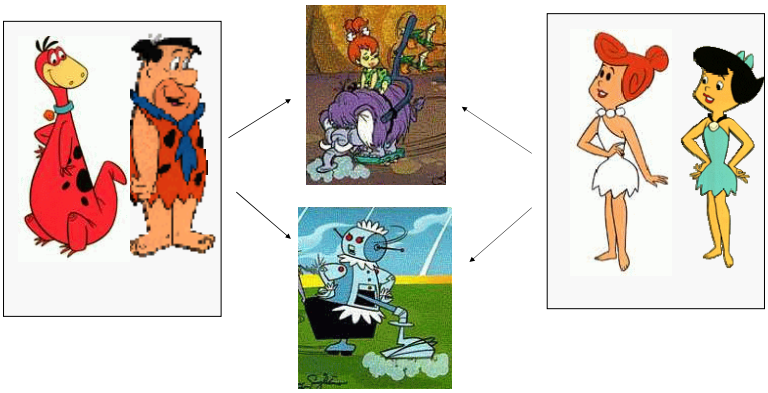
Wilma and Betty use one interface

Dino and Fred use the other



Within Subjects Design

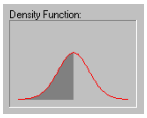
Everyone uses both interfaces

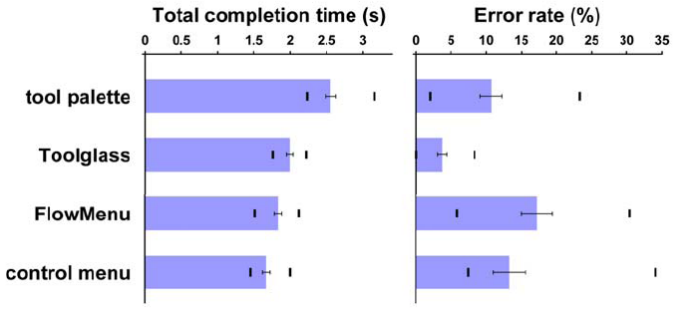


Results: Statistical Analysis

Compute central tendencies (descriptive summary statistics) for each DV across each IV

- Mean
- Standard deviation





Are the Results Meaningful?

Hypothesis testing

- **Hypothesis:** Manipulation of IV effects DV in some way
- **Null hypothesis:** Manipulation of IV has no effect on DV
- Null hypothesis assumed true unless statistics allow us to reject it

Statistical significance (p value)

- Likelihood results due to chance variation (i.e. null hyp. is true)
- $p < 0.05$ usually considered significant (Sometimes $p < 0.01$)
  - Means that < 5% chance that null hypothesis is true

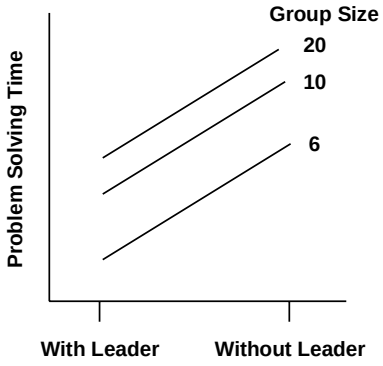
Statistical tests

- T-test (1 factor, 2 levels)
- Correlation
- ANOVA (1 factor, > 2 levels, multiple factors)
- MANOVA (> 1 dependent variable)

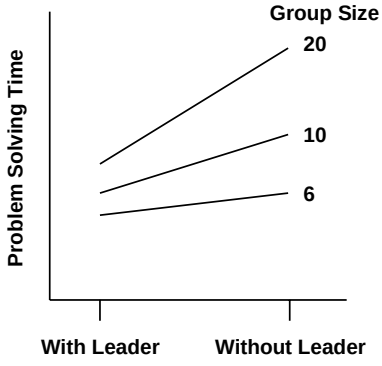
Explaining Psychological Statistics
Barry H. Cohen

Interactions

Multiple IVs effect DV non-additively
Effects of IVs are not independent of one another



Not Interacting



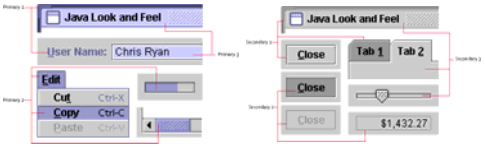
Interacting

Three Principles of Design

- Form follows function
- Economy of form
- Integrity of materials

Color

- Use a small palette (6 color Java look and feel)

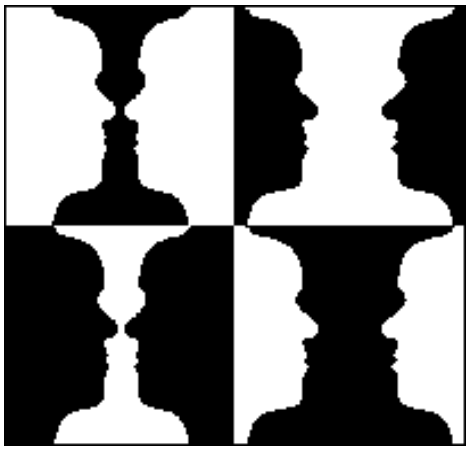


- Don't use all fully saturated colors

- Ensure good color contrast for text

Gestalt Principles

- figure/ground
- proximity
- similarity
- symmetry
- connectedness
- continuity
- closure
- common fate
- transparency



Why Create Visualizations?

Record information
- Photographs, blueprints, …

Support reasoning about information (analyze)
- Process and calculate
- Reason about data
- Feedback and interaction

Convey information to others (present)
- Share and persuade
- Collaborate and revise
- Emphasize important aspects of data

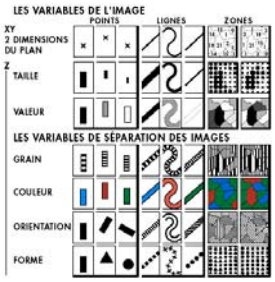
Data and Image

N - Nominal (labels)
- Fruits: Apples, oranges, …

O - Ordered
- Quality of meat: Grade A, AA, AAA

Q - Quantitative
- Ordered, with measurable distances, or amounts
- Physical measurement: Length, Mass, Temp, …

Visual Variables
- Position
- Size
- Value
- Texture
- Color
- Orientation
- Shape



Magnitude Estimation

Most accurate


Position (common) scale

Position (non-aligned) scale


Length


Slope

Angle


Area

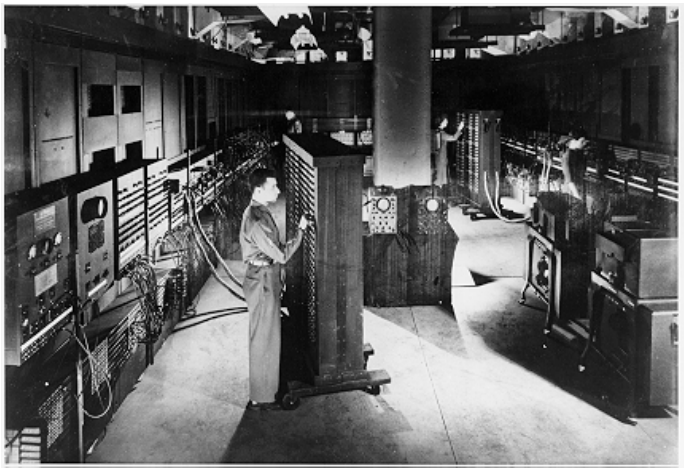

Volume

Least accurate


Color hue-saturation-density

ENIAC (1943)

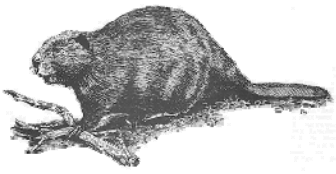
World's first numerical integrator and computer

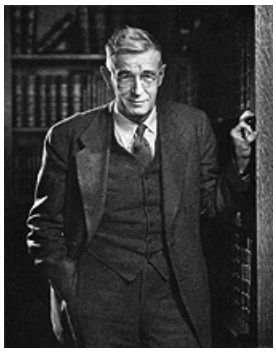


From IBM Archives.

Vannevar Bush

- Name rhymes with "Beaver"
- Faculty member MIT
- Coordinated WWII effort with 6000 US scientists
- Social contract for science
  - Federal government funds universities
  - Universities do basic research
  - Research helps economy & national defense

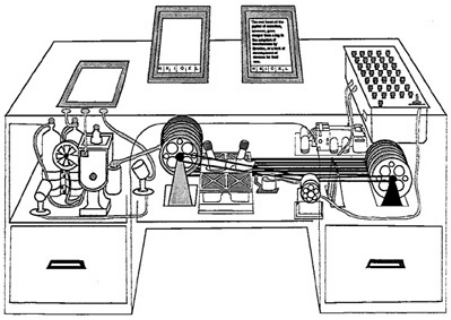




1890 - 1974

As We May Think: Memex

- Store all personal books, records, communications
- Items retrieved through indexing, keywords, cross references,...
- Can annotate text with margin notes, comments...
- Can construct a trail through the material and save it
- Acts as an external memory



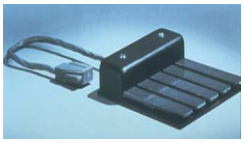
Sketchpad (1963)

- Ivan E Sutherland's PhD thesis
- Modern pen-based system supporting
  - CAD design
  - 3D modeling
- Key: Interactivity (real-time computing was non-existent)

Video: 4:30

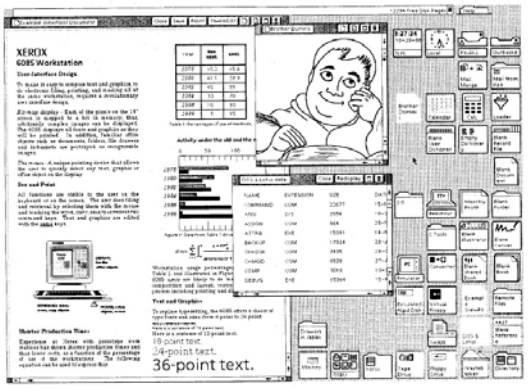
NLS: oNLine System (1968)

- 1968 Fall Joint Computer Conference (SF)
- Demonstrated NLS to1000 computer scientists
  - Video screen, chording keyboard, mouse, videoconferencing, hyperlinking, word processing, email,
  - User testing
  - Extremely influential



Video: 10:54

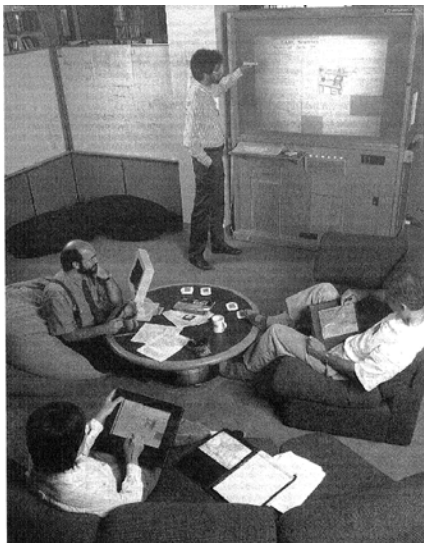
Xerox Star (1982)



Bitmapped display, windows, icons, menus, pointer, desktop, direct manipulation, WYSIWYG …

Video: 1:11

Ubiquitous Computing (1991)



Marc Weiser's vision

- 100s of computers work together
- Will disappear (invisible)

Liveboard
(Yard scale)

PARC tab
(Inch scale)

PARC pad
(Foot scale)

Current Research in HCI

Scott Klemmer: dTools and mashups

Ryan Aipperspach: Activity Monitoring in the Home

Jingtao Wang: Mobile Interfaces

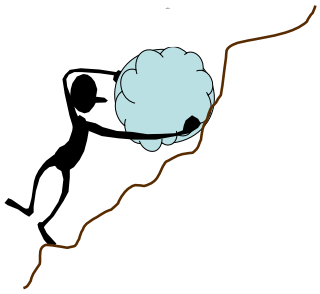
Takeaways: Why UI is Important

Major part of work for "real" programs
- Approximately 50%

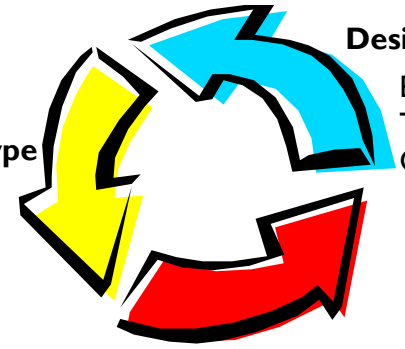
You will work on "real" software
- Intended for people other than yourself

Bad user interfaces cost
- Money (5%↑ satisfaction → up to 85%↑ profits)
- Lives

User interfaces hard to get right
- People are unpredictable



Takeaways: Iterative Design



Design
Brainstorming
Task analysis
Contextual inquiry

Prototype
Low-fi, paper

Evaluate
Low-fi testing,
Qualitative eval
Quantitative eval