HCI Research Methods

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Scientific Approach (~~beyond user friendly~~)

- Specify users and tasks
- Predict and measure
  - time to learn
  - speed of performance
  - rate of human errors
  - human retention over time
- Assess subjective satisfaction

  (Questionnaire for User Interface Satisfaction)
- Accommodate individual differences
- Consider social, organizational & cultural context

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Scientific Method - Controlled Experiment

- Practical Problem & Existing Theory
- Write a Lucid & testable Hypothesis
- Alter a small number of independent variables (treatment)
- Select & assign subjects
- Control other variables
- Measure small number dependent variables
- Apply statistical test
- Guidance for practitioners, refine theory, advice for experimenters

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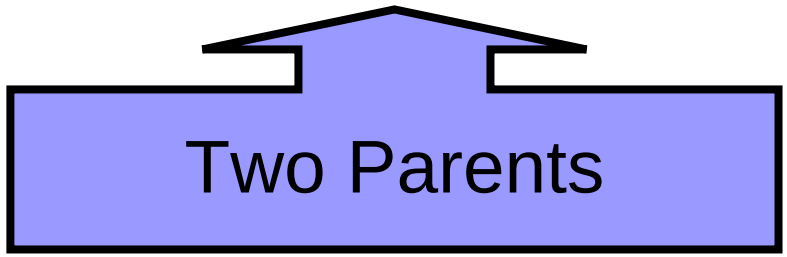
Scientific Method - Controlled Experiment

- **Practical Problem & Existing Theory**



- **Guidance for practitioners, refine theory, advice for experimenters**

Research Methods

- Controlled Experiments
  - Theory-driven, hypothesis testing
  - Modify Independent Variables → Measure Dependent Variables
- Ethnographic Methods
- Surveys & Questionnaires
- Logging & Automated Metrics

http://www.otal.umd.edu/charm/

Usability Engineering

- User-Centered Design Processes
- Guidelines Documents and Processes
  - Research-based (NCI, 2003)

    www.usability.gov/pdfs/guidelines.html
- User Interface Building Tools
- Expert Reviews and Usability Testing

Design Process – Data Gathering

- Ethnographic Observation
- Participatory Design
- Scenario-based Design
- Social Impact Statements

Design Process - LUCID

Management strategy to highlight usability engineering

Processes, Deliverables, and Reviews

Stages for LUCID

1: **Envision:** Develop product concept
2: **Discovery:** Perform research and needs analysis
3: **Design Foundation:** Design concepts & key screens
4: **Design Detail:** Do iterative design and refinement
5: **Build:** Implement software
6: **Release:** Provide rollout support

(Cognetics Corp www.cognetics.com)

Design Process - Contextual Design

(Karen Holtzblatt & Hugh Beyer www.incent.com)

Guidelines Document and Processes

- Social process for developers
- Records decisions for all parties to see
- Promotes consistency and completeness
- Facilitates automation of design
- Should contain philosophy and examples of:
  title screens, menus, forms, buttons, graphics, icons, fonts, colors, instructions, help, tutorials, error messages, …
- Multiple levels are desirable:
  standards, practices, guidelines
- **E**ducation, **E**nforcement, **E**xemption & **E**nhancement

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Expert Reviews and Usability Testing

- Improved product quality
- Shorter development time
- More predictable development lifecycle
- Reduced costs
  - Speed development
  - Simplify documentation
  - Facilitate training
  - Lower support
  - Fewer updates
- Improved organizational reputation
- Higher morale: staff and management

Expert Reviews

- **Experienced reviewers**
  - Review every screen, menu, dialog box
  - Spot inconsistencies and anomalies
  - Suggest additions
- **Disciplined approaches**
  - Heuristic evaluation: check if goals are being met
  - Guidelines review: verify adherence
  - Consistency inspection: terms, layout, color, sequencing
  - Cognitive walkthrough: pretend to be a user following scenario
  - Formal inspection: public presentation and discussion

Usability Testing

- Physical place and permanent staff vs. discount usability testing
- Focuses attention on user interface design
- Encourages iterative testing
  - Pilot test of paper design
  - Online prototype evaluation
  - Refinement of versions
  - Testing of manuals, online help, etc.
  - Rigorous acceptance test
- Must participate from early stages
- Must be partners, not "the enemy”

(Dumas & Redish, 1999; Nielsen, 1993)

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Usability Testing

- Usability testing not only speeds up projects but it produces dramatic cost savings.

- Participants should represent the intended user communities
  - background in computing, experience with the task, motivation, education, & ability with the natural language used in the interface

Usability Testing

- Videotaping
  - valuable for later review & for showing designers or managers the problems that users encounter.

- Many variant forms of usability testing have been tried:
  - Paper mockups
  - Discount usability testing
  - Competitive usability testing
  - Universal usability testing
  - Field test and portable labs
  - Remote usability testing
  - Can-you-break-this tests

Evaluation Methods

Ethnographic Observational Situated

- Multi-Dimensional
- In-depth
- Long-term
- Case studies

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Domain Experts
Doing Their Own Work
for Weeks & Months

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MILCs

Shneiderman & Plaisant, *BeLIV workshop*, 2006

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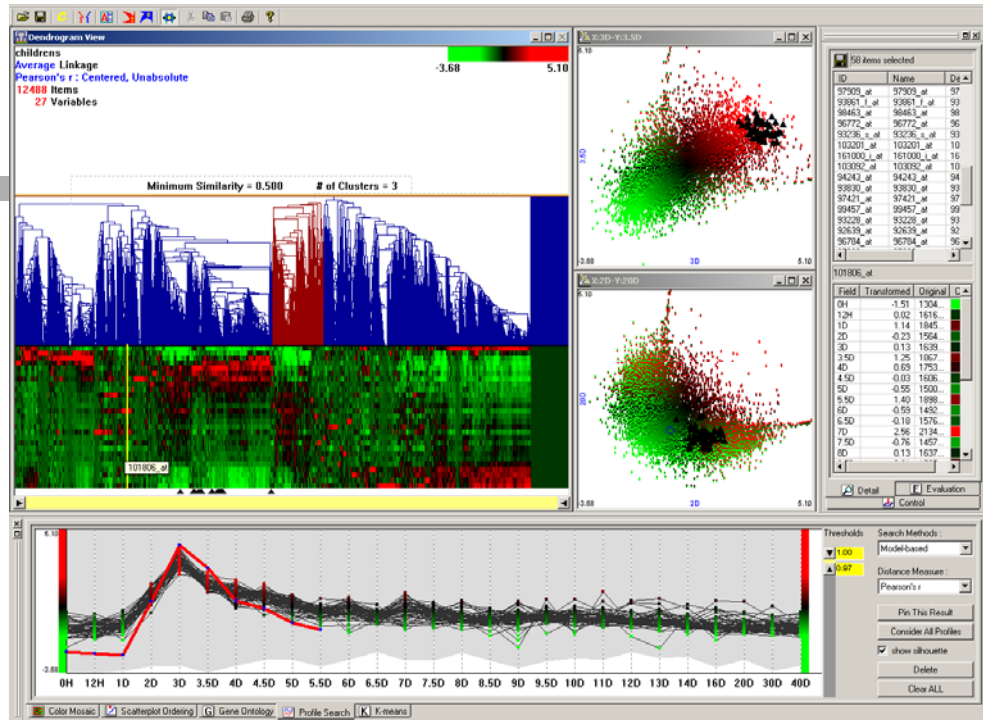
MILC example

- Evaluate
  Hierarchical
  Clustering Explorer

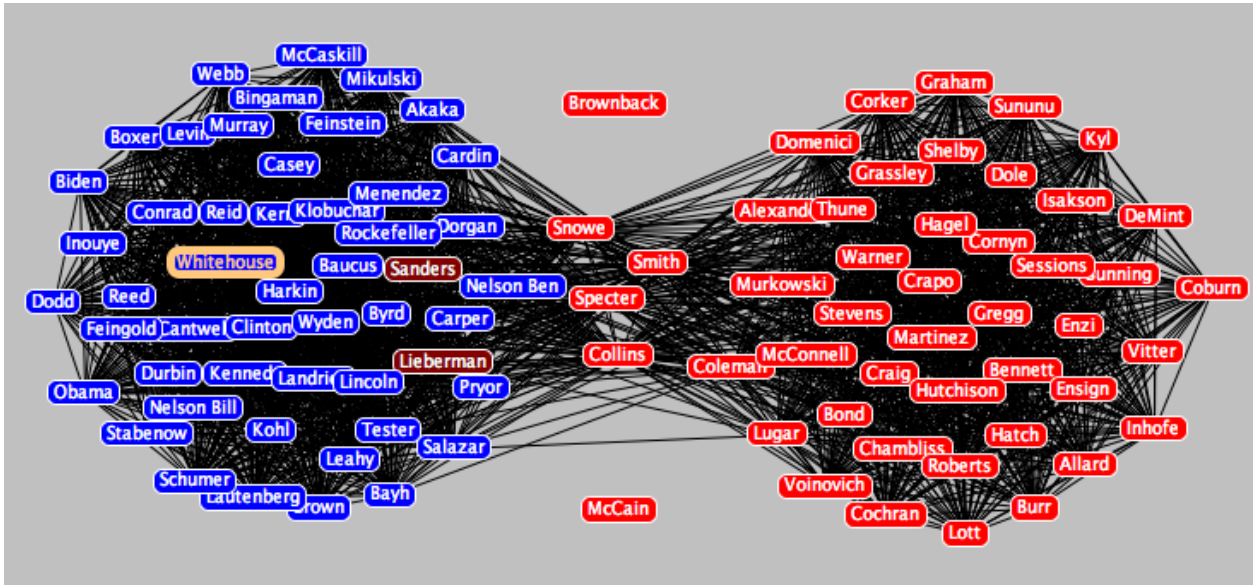


- Focused on rank-by-feature framework
- 3 case studies, 4-8 weeks
  (molecular biologist, statistician, meteorologist)
- 57 email surveys
- Identified problems early, gave strong positive feedback about benefits of rank-by-feature

Seo & Shneiderman, *IEEE TVCG* 12,3, 2006

MILC example

- Evaluate SocialAction



- Focused on integrating statistics & visualization
- 4 case studies, 4-8 weeks
  (journalist, bibliometrician, terrorist analyst, organizational analyst)
- Identified desired features, gave strong positive feedback about benefits of integration

Perer & Shneiderman, 2007

Case Study Methodology

1) Interview (1 hr)
2) Training (2 hr)
3) Early Use (2-4 weeks)
4) Mature Use (2-4 weeks)
5) Outcome (1 hr)