HCI Research Methods

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Founding Director (1983-2000), Human-Computer Interaction Lab Professor, Department of Computer Science Member, Institute for Advanced Computer Studies
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
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
Scientific Method - Controlled Experiment

• Practical Problem & Existing Theory

  Two Parents

  Three Children

• 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](http://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

Contextual Design Process

1. Talk to customers while they work
   Provides reliable knowledge about what customers actually do and what they care about

2. Interpret the data in a cross-functional team
   Develops a shared perspective of the data

3. Consolidate data across multiple customers
   Creates a single statement of work practice for your entire customer population

4. Invent solutions grounded in user work practice
   Provides a way to imagine and develop better ways to work

5. Structure the system to support the new work practice
   Represents the system for planning, marketing, UI design, and specification

6. Iterate with customer through paper mockups
   Offers early verification of design before any ideas are committed to code

7. Design the object model or code structure for implementation
   Defines the implementation architecture and ensures support of work structure

8. Iterate visual designs with the customer
   Design the implementation and final interaction and visual 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
- **Education, Enforcement, Exemption & Enhancement**

HCiL
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)
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
Evaluation Methods

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MILCs

Shneiderman & Plaisant, BeLIV workshop, 2006
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)