

DEPARTMENT OF COMPUTER SCIENCE
UNIVERSITY OF TORONTO

CSC 428F/2514F

HUMAN-COMPUTER INTERACTION

Lecture 4

UNDERSTANDING USERS AND USER NEEDS;
RESEARCH AND EVALUATION METHODOLOGIES

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4.1 Understanding users with research and evaluation

Goals of research and evaluation

Understanding users — Who they are, what they know, what they do, what they want

Understanding how systems work in practice

- Interface quality

- Interface problems

- What factors seem to affect interface quality (for particular classes of users)

Understanding why it happens

- Building models to achieve a deeper understanding of casual factors (Lectures 15-17)

- Yet there are only a small number of examples where this has proved cost-effective, so we usually rely on empirical approaches

Research approaches — four dimensions (Ray & Ravizza, 1985)

Methodology

- Naturalistic observation (watching & recording)

- True experiments (manipulating & measuring)

Setting — Field research or laboratory research

Experimental role — Scientist as participant or observer

Size: one, few, or many subjects

Naturalistic observation

- Noninterference with phenomena

- Observations of patterns and invariants

- Useful for big picture

- Qualitative, descriptive (typically)

True experiments

Interfere, manipulate, control

Measurements of observed patterns

Detailed results

Quantitative

A deeper approach is that of McGrath... (see Ch. 2 in BGBG)...
but first lets review the relationship of evaluation to design

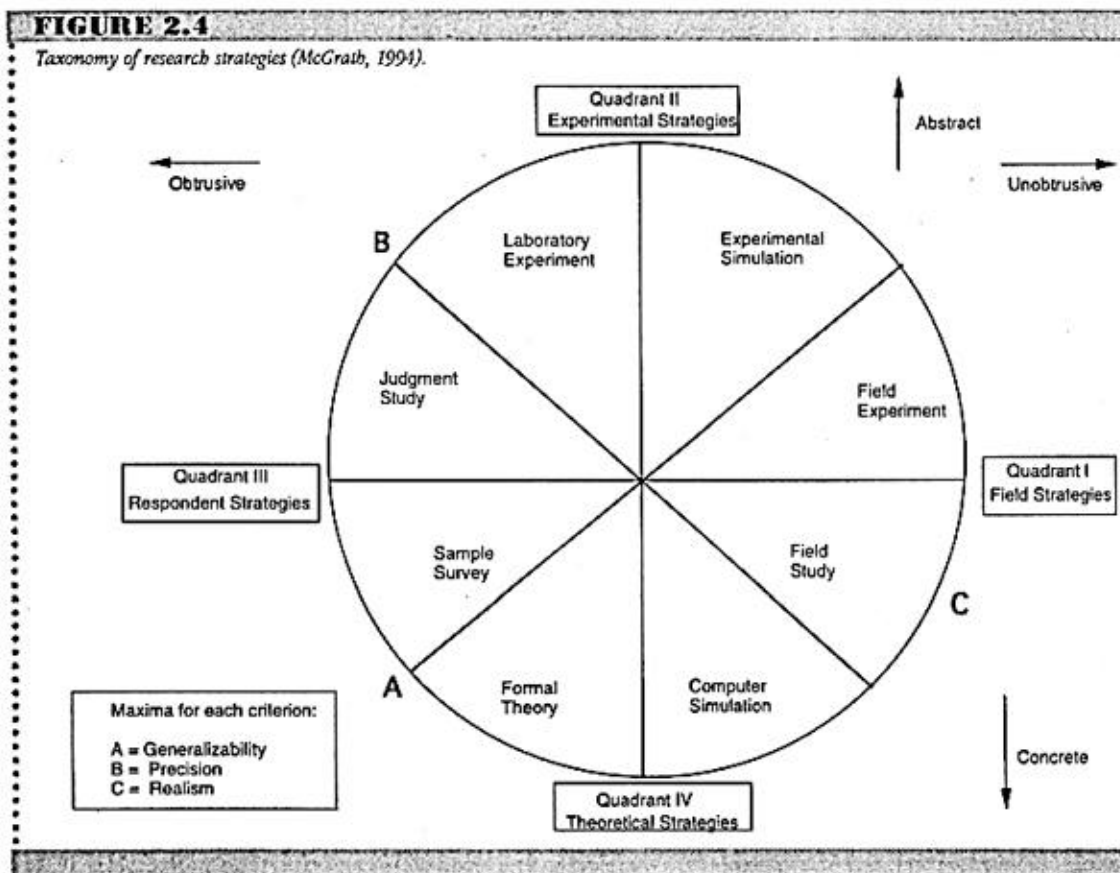
4.2 Research and empirical evaluation in design

| | Design -----> | Implement ---> | Evaluate -----> |
|------------------------------------|--|---|---|
| Information Collection | Questionnaires Interviews with discipline specialists Characterizations of users and tasks Days in the life scenarios | | |
| Concept design | Initial design concepts | Design mockups | Interviews with users to get reactions to design mockups |
| Functionality and interface design | Design of system functionality and look-and-feel | Implementation of "smoke and mirrors" prototype | Heuristic evaluation Experiments |
| Prototype implemen-tation | Design of "critical mass" of system | Implementation of partial working system | Usability tests Model-based analysis |
| Deliverable system im-plementation | Design and modification of deliverable system | Implementation and installation of this system | Usability tests |
| System en-hancement and evolution | Design of monitoring and feedback system | Implementation of this system | Interviews and questionnaires, data collection and analysis |

4.3 An HCI research and evaluation taxonomy

We list some strategies (Fig. 4.2) and organize them according to a taxonomy from McGrath (Fig 4.1); we shall later (Lecture 18) position these strategies in the development cycle

Figure 4.1. Taxonomy of research strategies (BGBG, Fig. 2.4, p. 81)



Quadrant 1 — Field strategies

Study systems in real use on real tasks in real work environments

Field studies — Study systems in situ, disturbing as little as possible

Field experiments — Observe impact of changing (ideally) one aspect of a work environment

Quadrant 2 — Experimental strategies

Study systems in a laboratory under controlled conditions

Laboratory experiments — Carry out controlled experiments studying impacts of (ideally) one interface parameter

Experimental simulations — Create in laboratory for experimental purposes a real system that is used by real users on (usually) artificially simplified tasks

Quadrant 3 — Respondent strategies

Ask informants to tell us something about themselves and/or their work or about an interface

Judgment studies — Ask respondents about an interface

Sample surveys — Ask respondents about themselves and/or their work

Quadrant 4 — Theoretical strategies

Ask a theory to tell us something about people's work or about an interface

Formal theory — Use a qualitative theory or some equations

Computer simulation — Use and run a computer model

4.4 HCI research and evaluation strategies

Figure 4.2. HCI research and evaluation methods (based on BGBG, Fig. 2.5)

Field strategies

(Settings under conditions as natural as possible)

Field studies

Ethnography and interaction analysis (Lect. 18)

Contextual inquiry (Lect. 6)

Field experiments (Lect. 18)

Beta testing of products (CSC 454)

Studies of technological change (CSC 300)

Experimental strategies

(Settings concocted for research purposes)

Experimental simulations

Usability testing (Tut. 1, Lect. 4, Lect. 18, CSC318)

Usability engineering

Laboratory experiments

Controlled experiments (Lect.'s 19-21)

Respondent strategies

(Setting is muted or made moot)

Judgment studies

Demonstrations (Lect. 4)

Usability inspection methods (e.g., heuristic evaluation) (Tut. 2, Lect. 4)

Cognitive walkthroughs (Lect. 18)

Sample surveys

Customer surveys, questionnaires, and interviews (Lect.'s 4-6)

Theoretical strategies

(No observation of behavior required)

Formal theory

Design theory, e.g., Norman's 7 Stages (Lect. 10)

Behavioral theory, e.g., color vision (Lect.'s 7-9)

Computer simulations

Human information processing theory (Lect.'s 15-17)

We shall begin with user (usability) testing, then briefly discuss demonstrations and usability inspection, then proceed to surveys, questionnaires, and interviews

4.5 Scenarios, mockups, prototyping, manuals

User testing should begin as early as possible, even before a real system is built, therefore requiring scenarios, mockups, and prototypes (Experimental simulations)

Method

- Produce facsimile of interface
 - Construct scenario — words, pictures, animation, video
 - Build physical mockups
 - “Program” interactive prototypes
 - Write manual in advance of system
- Design and produce situation
- Observe behaviour of users

Roles

- Elicits initial reactions to, problems with user's model, interface
- Engages potential users, gets them excited and involved, makes them see that they can contribute

Advantages

- Can be done in advance of actual system construction

Disadvantages

- Facsimile will not embody all characteristics of system

Examples

- Scenarios, prototypes in CHI'89 Information Kiosk (Salomon, Case A, BGBG)
- Designing a human memory aid (Newman and Lamming, 1995; Case Study B)

4.6 User (usability) testing

Methods

- Design scenario for the experimental simulation
- Record user behaviour in the experimental simulation
 - Typical usage, or critical incidents
 - Keystroke recording (Lecture 18)
 - Thinking aloud protocols (Lecture 18)
 - Videotape protocols (Lecture 18)
- Interviews for subjective impressions
- Analyze user behaviour
 - Protocol analysis (Lecture 18)

Roles

- Understanding user methods
- Understanding user problems
- Discovering user thought processes

Advantages

- Observation of real usage of real system

Disadvantages

- Individuals often know only limited aspects of a system
- Scenarios often exercise only limited aspects
- Scenarios may be artificial, not encompassing complexity or real work on real tasks in real environments

Examples

- Mack, et al. studies of text editor learning (BGBG, Ch. 10)
- Usability tests of SASE, SASSE (BGBG, Ch. 12)

Typical steps in user testing – Gomoll (in Laurel, pp. 85-90)

1. Set up the observation
2. Describe the purpose of the observation
3. Tell the user that it's OK to quit at any time
4. Talk about & demonstrate the equipment in the room
5. Explain how to “think aloud”
6. Explain that you will not provide help
7. Describe the task and introduce the system
8. Ask if there are any questions before you start;
then begin the observation
9. Conclude the observation & debrief (interview) subjects
10. Analyze the data
11. Tabulate the results
12. Interpret the results in the context of other results

More detailed procedures — BGBG, Fig. 2.8, also Assignment 1

4.7 Demonstrations

Method for this kind of judgment study

Demonstrate system to anybody, potential customers, “power-that-be,” etc., and take detailed notes

Role

Elicit reactions to user's model, functionality, interface

Advantages

Get feedback early in prototype or system construction
Always have to demo — why not learn from them?

Disadvantages

System still rough, which introduces noise into process

Examples — Pick your favorite project!

4.8 Usability inspection methods

Methods for more advanced kinds of judgment studies
Heuristic evaluation (one kind of usability inspection)
Cognitive walkthroughs (Lecture 18)

Roles

Studies that don't involve users (in contrast to demos, usability testing, etc.)
Elicit expert opinion re functionality, user's model, interface

Advantages

Structured method of using accumulated wisdom of experts

Disadvantages

Doesn't take advantage of real insights from real users

Nielson's 10 heuristic evaluation usability guidelines

- Visibility of system status
- Match between system and real world
- User control and freedom
- Consistency and standards
- Error prevention
- Recognition rather than recall
- Flexibility and efficiency of use
- Aesthetic and minimalist design
- Help users recognize, diagnose, and recover from errors
- Help and documentation

See BGBG, Fig. 2.7, tutorials, Assignment 1

4.9 Customer surveys, interviews and questionnaires

Methods

Sample surveys, in language of McGrath
Via questionnaires or interviews

Roles

- Understanding user needs and characteristics
 - Background, work practices, attitudes
 - Satisfaction/dissatisfaction in use, suggestions
- Carrying out a task analysis
- Understanding the work context

Advantages

- Broad coverage of the user population
- Interviews can be free-ranging, uncover unexpected and novel insights

Disadvantages

- Subjects may not be able to conceptualize new technology
- Abstract, may not be well grounded in real application
- Danger of low response rate for surveys
- Danger of bias – Putting words into people's mouths
- Need for careful design, pre-testing

Examples

- Gould & Boies interviews with principals that led to design of SDS/ADS (B&B, pp. 8-37)
- Posner's interviews w. collaborative writers (BGBG, Ch. 11)
- Designing a human memory aid
(Newman and Lamming, 1995; Case Study B)

More on interviews and questionnaires in the next 2 lectures

4.10 References

- Baecker, R. and Buxton, W. (Eds.) (1987). *Readings in Human-Computer Interaction: A Multidisciplinary Approach*. Morgan Kaufmann Publishers.
- Ray, W. and Ravizza, R. (1985). *Methods Towards a Science of Behaviour and Experience*. 2nd Edition. Wadsworth.