This course is a broad graduate-level introduction to HCI research. The course begins with seminal work on interactive systems, and moves through current and future research areas in interaction techniques and the design, prototyping, and evaluation of user interfaces. Topics include computer-supported cooperative work; audio, speech, and multimodal interfaces; user interface toolkits; design methods; evaluation methods; ubiquitous and context-aware computing; tangible interfaces; haptic interaction; and mobile interfaces.
CS147 students as participants
### Rich Gold’s 2x2

<table>
<thead>
<tr>
<th></th>
<th>THEORETICAL</th>
<th>APPLIED</th>
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<tbody>
<tr>
<td>AESTHETIC</td>
<td>science</td>
<td>engineering</td>
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<tr>
<td>EMPRICAL</td>
<td>art</td>
<td>design</td>
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# Hugh Dubberly’s 3x3

<table>
<thead>
<tr>
<th>Focus</th>
<th>Science</th>
<th>Humanities</th>
<th>Design</th>
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<tbody>
<tr>
<td></td>
<td>Natural World</td>
<td>The Human Experience</td>
<td>The Man-Made World</td>
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<tr>
<td>Problems Finding</td>
<td>Understand the Human Experience and Solution Finding</td>
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<tr>
<td>Discover “What Is”</td>
<td>Prototype It</td>
<td>What “Should Be”</td>
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<table>
<thead>
<tr>
<th>Primary Methods</th>
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<tbody>
<tr>
<td>Experimentation</td>
<td>Analogy</td>
<td>Modeling</td>
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<tr>
<td>Pattern Recognition</td>
<td>Memorize Pattern Formation</td>
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<tr>
<td>Analysis</td>
<td>Critique</td>
<td>Synthesize</td>
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<tr>
<td>Classification</td>
<td>Valuation</td>
<td>Compare</td>
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<tr>
<td>Evaluation</td>
<td>Induction</td>
<td>Abduction</td>
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<table>
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<tr>
<th>What Is Valued</th>
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<tbody>
<tr>
<td>Objectivity</td>
<td>Subobjectivity</td>
<td>Practicality</td>
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<tr>
<td>Rationality</td>
<td>Imagination</td>
<td>Creativity</td>
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<tr>
<td>Neutrality</td>
<td>Commitment</td>
<td>Empathy</td>
<td></td>
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<tr>
<td>Concern for “Truth”</td>
<td>Concern for “Justice”</td>
<td>Concern For “Goodness of Fit”</td>
<td></td>
</tr>
</tbody>
</table>

*Designing Social Systems In A Changing World, 1996*
“You Are Not the User”

- Seems obvious, but...
  - Different experiences
  - Different terminology
  - Different ways of looking at the world

- Easy to think of self as typical user
- Easy to make mistaken assumptions
How do you know...

- What the important problems for users are?
- Whether an idea is a good idea?
- Why fieldwork? “Data is the only reliable outside arbiter” [Beyer and Holtzblatt]
Iterative Design Is Important

- Getting it right the first time is hard
- Need better support for quick turns around loop
Fieldwork methods

- Task analysis
- Contextual inquiry
- Cultural probes
- Ethnography
- Diary studies
- Pager studies
Design Process: Discovery

- **Discovery**
  - Assess needs
    - understand client’s expectations
    - determine scope of project
    - characteristics of users & tasks
    - evaluate existing practices & products
- **Design Exploration**
- **Design Refinement**
- **Production**
Understanding the User

- How do your users work?
  - task analysis, interviews, and observation
- How do your users think?
  - understand human cognition
  - observe users performing tasks
- How do your users interact with UIs?
  - observe!
Example of Design Failure

- BART “Charge-a-Ticket” Machines
  - allow riders to buy BART tickets or add fare
  - takes ATM cards, credit cards, & cash
PLEASE READ DISPLAY

1. Select ticket type
2. Select payment type
3A. Enter value & press "OK"
3B. Insert & remove card
3C. Enter PIN & press "OK"
4. Take ticket (and receipt)

DISPLAY WINDOW
Follow instructions
PLEASE READ DISPLAY

CASH
1
SELECT TICKET TYPE
See Display for more information.

2
SELECT PAYMENT TYPE

3
INSERT MONEY
$1, $5, $10, $20 bills only.
No change returned.

3A
To issue ticket for inserted amount.
SELECT VALUE
Press OK,

3B
Insert and remove card.

3C
Enter PIN on keyboard.

4
Take ticket.

ATM
1
SELECT TICKET TYPE
See Display for more information.

2
SELECT PAYMENT TYPE

3A
Enter ticket value on "SELECT VALUE" keypad.

3B
Press OK when value is correct.

3C
Insert and remove card.

4
Take ticket and receipt.

CREDIT
1
SELECT TICKET TYPE
See Display for more information.

2
SELECT PAYMENT TYPE

3A
Enter ticket value on "SELECT VALUE" keypad.

3B
Press OK when value is correct.

3C
Insert and remove card.

4
Take ticket and receipt.
Example of Design Failure

- BART “Charge-a-Ticket” Machines
  - allow riders to buy BART tickets or add fare
  - takes ATM cards, credit cards, & cash
- Problems (?)
Lessons from the BART machine

- Failure to create convenient machine
- Did the designers understand or care:
  - range of customers using the machine?
  - what tasks they would want to carry out?
  - that some would find the behavior of the machine disconcerting?

- How can we avoid similar results?
  - “What is required to perform the user’s task?”
Task Analysis

- Find out
  - who users are
  - what tasks they need to perform
- Observe existing work practices
- Create scenarios of actual use

- This allows us to try out new ideas before building software!
  - Get rid of problems early in the design process
Why Task Analysis?

- System will fail if it
  - does not do what the user needs
  - is inappropriate to the user
  - “the system must match the users’ tasks”

- Can’t we just define “good” interfaces?
  - “good” has to be taken in context of users
    - might be acceptable for office work, not for play
    - infinite variety of tasks and users
  - guidelines are too vague to be generative
    - e.g. “give adequate feedback”
Task Analysis Questions

- Who is going to use the system?
- What tasks do they now perform?
- What tasks are desired?
- How are the tasks learned?
- Where are the tasks performed?
- What’s the relationship between user & data?
Task Analysis Questions (cont.)

- What other tools does the user have?
- How do users communicate with each other?
- How often are the tasks performed?
- What are the time constraints on the tasks?
- What happens when things go wrong?
Who?

- Identity
  - in-house or specific customer is easy
  - need several typical users for broad product
- Background
- Skills
- Work habits and preferences
- Physical characteristics
  - height?
Who (BART)?

• Identity?
  • people who ride BART
    • business people, students, disabled, elderly, tourists

• Background?
  • may have an ATM or credit card
  • have used other fare machines before

• Skills?
  • may know how to put cards into ATM
  • know how to buy BART tickets
Who (BART cont.)?

- Work habits and preferences?
  - use BART 5 days a week
- Physical characteristics?
  - varying heights → don’t make it too high or too low!
Talk to Them

- Find some real users
- Talk to them
  - find out what they do
  - how would your system fit in
- Are they too busy?
  - buy their time
    - t-shirts, coffee mugs, etc.
  - find substitutes
    - medical students in training
What Tasks?

- Important for both automation and new functionality
- Relative importance of tasks?
- Observe users, see it from their perspective
  - on-line billing example
    - small dentists office had billing automated
    - assistants were unhappy with new system
    - old forms contained hand-written margin notes
      - e.g., patient A’s insurance takes longer than most, etc.
How are Tasks Learned?

- What does the user need to know?
- Do they need training?
  - academic
  - general knowledge / skills
  - special instruction / training
Where is the Task Performed?

- Office, laboratory, point of sale?
- Effects of environment on users?
- Users under stress?
- Confidentiality required?
- Do they have wet, dirty, or slippery hands?
- Soft drinks?
- Lighting?
- Noise?
What is the Relationship Between Users & Data?

- Personal data
  - always accessed at same machine?
  - do users move between machines?
- Common data
  - used concurrently?
  - passed sequentially between users?
- Remote access required?
- Access to data restricted?
What Other Tools Does the User Have?

- More than just compatibility
- How user works with collection of tools
  - Ex. automating lab data collection
    - how is data collected now?
    - by what instruments and manual procedures?
    - how is the information analyzed?
    - are the results transcribed for records or publication?
    - what media/forms are used and how are they handled?
How Do Users Communicate With Each Other?

- Who communicates with whom?
- About what?
- Follow lines of the organization? Against it?
- Example: assistant to manager
  - installation of computers changes communication between them
  - people would rather change their computer usage than their relationship [Hersh82]

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Harry Hersh 1982 Electronic Mail Usage Analysis

At the inter-personal level, we found that users saw the EMS system as providing increased flexibility in inter-personal communication through this additional, welcomed communication mode. It avoids the real-time, two-party requirements for telephone usage while preserving the phone’s timeliness. Interestingly, 49% of the respondents access the mail system from locations in addition to their offices, with half of these people accessing the system from their homes. Also at the inter-personal level, we found that users were adjusting the intended purpose of the system in order to preserve existing organizational relations. For example, within the current organization there is typically manager. Secretaries often produce and distribute outgoing mail, as well as screen incoming mail. As a result, the secretary is often an integral part of the communications loop involving the manager. The EMS system, however, only recognizes one type of user, and messages only go to designated users. If a manager is an official user of the EMS system, but the secretary is not, the secretary is effectively cut out of the
How Often Do Users Perform the Tasks?

- Frequent users remember more details
- Infrequent users may need more help
  - even for simple operations
  - make these tasks possible to do
- Which function is performed
  - most frequently?
  - by which users?
  - optimize system for these tasks will improve perception of good performance
What are the Time Constraints on the Task?

- What functions will users be in a hurry for?
- Which can wait?
- Is there a timing relationship between tasks?
What Happens When Things Go Wrong?

- How do people deal with
  - task-related errors?
  - practical difficulties?
  - catastrophes?
- Is there a backup strategy?
Involve Users to Answer Task Analysis Questions

- Users help designers learn
  - what is involved in their jobs
  - what tools they use
  - i.e., what they do
- Developers reveal technical capabilities
  - builds rapport & an idea of what is possible
  - user’s can comment on whether ideas make sense
- How do we do this?
  - observe & interview prospective users in work place!
A Better BART Machine

Hong Kong MTR System
Diary Studies
Cultural Probes
Genevieve Bell
Next Time... Evaluation

Heuristic Evaluation, Jakob Nielsen
Methodology Matters: Doing Research in the behavioral and social sciences, Joseph E. McGrath