

## Human-Computer Interaction CS 5340

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Prof. Stephen Intille

(Many thanks to Prof. Tim Bickmore)

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## Overview for Today

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- Introductions
- Overview of the Course
- First homework exercise
- Model Paper Presentations
- Logistics
- Quick Break----
- Overview of HCI
- Some basic concepts
- Project Brainstorming exercise

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## Who am I?

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- BSE in CSE from Penn
- Ph.D. from MIT (computer vision)
- "Home of the Future" and architects
- Health and House\_n
- Northeastern! (Sep 2011)
  - New Ph.D. Personal Health Informatics)
  - Interests: mobile health, games for health, mobile and home sensing and pattern recognition, UI design, AI

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## Introductions

- Name
- Your background
- Worst user interface you have ever used & why

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## Administrivia

- Stephen
  - 450 WVH, [s.intille@neu.edu](mailto:s.intille@neu.edu)
  - Office hours
    - TBD
    - After class
    - Send email
- Facilitator/Grader - Zeeshan Sayyed
  - [sayyed.z@husky.neu.edu](mailto:sayyed.z@husky.neu.edu)
  - Office hours: TBD
- Class discussion/questions: Piazza  
<http://piazza.com/northeastern/spring2012/cs5340>

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## Overview of Course

<http://bit.ly/neu-hci-spring-12>

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## Overview of Course

- Topics covered
  - HCI theory & practice
  - A bit on good design
  - A lot of hands-on experience  
(You haven't learned it until you can apply it!)
  - Cutting-edge HCI research
- Topics on your own:
  - GUI programming in your favorite language
- Prerequisites
  - Programming basics (or see me)

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## Overview of Course



- Texts
  - Required:
    - Dix, et al, *Human-Computer Interaction*
      - A bit dated, but comprehensive
      - In bookstore
    - Other chapters/articles to be provided on Blackboard
  - Recommended:
    - Nielsen, *Usability Engineering*
    - Norman, *The Design of Everyday Things*

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## Overview of Course

- Weekly Requirements
  - Read (and absorb!) 50-150 pages
  - Your reading notes
  - Individual homework assignment
  - Team project assignment
  - Describe and discuss assignments in class
- Periodic Requirements
  - Perform a design session in class
  - Present a research paper in class

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## Typical Class\*

1. Review assignments. Presentation and discussion by randomly selected students
2. Lecture on HCI practice topic
3. Discussion of next week's assignments
4. Break
5. Intro to research topic by instructor
6. Research paper presentations or design session presentations by students

\* Changes may be made based on composition of the class

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## Overview of Course

- Your reading notes
  - Bullet lists of most important ideas
  - Bullet lists of thoughts/ideas generated during reading
  - Show evidence of thoughtful reading and synthesis of readings throughout course
  - Post prior to class and hand in hardcopy at class

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## Course Website

<http://bit.ly/neu-hci-spring-12>

(Papers on Blackboard)

(Discussion on Piazza)

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## Grading

- Prior experience suggests that **work in this course will generally fall into one of four categories:**
  - Superior, striking, or unexpected pieces of work with excellent effort demonstrating a mastery of the subject matter and a thoughtful use of concepts discussed in class; work that shows imagination, clarity of presentation, originality, creativity, effort, and attention to detail (A)
  - Good work demonstrating a capacity to use the subject matter, with adequate preparation and clear presentation (B)
  - Work that is adequate but that would benefit from increased effort or preparation (C)
  - Work that needs more effort (D)

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## Breakdown

- Your reading notes (10%)
- Class presentation(s) (10%)
- Individual assignments (30%)
- Team assignments (20%)
- Final project and project presentation (30%) } 50%

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## Writing matters

- Assignments that involve writing and presentation will be judged on clarity of presentation as well as content.
  - Proof what you write
  - Have friends proof what you write
  - If you have trouble, visit the Northeastern University Writing Center
- Plagiarism results in a 0; 2<sup>nd</sup> instance: F

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## To Do for Next Week

1. Answer the email survey I will send you
2. Sign up for Piazza
3. Read
  1. Dix Intro, Chapters 1, 2 (skim), 4
  2. 4 research papers on HCI for Health (on blackboard soon)
4. Setup individual course web page (with photo)  
*Note: All assignments must be posted 1 hour before class on due date.*
5. Do Homework I1 (UI Critique)
6. Look over research papers when they are emailed – select a few you'd like to present
7. Read through T1
8. Look over HCI for older adult bibliography when emailed and start thinking about a final project

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## Individual Homework #1 UI Critique

- Find 2 good & 2 bad examples of UI design
- Some criteria
  - Consistency (inter & intra application)
  - Prevent errors
  - Permit error correction
  - Obviousness (“affordances”)
  - Feedback
- Include visuals if possible
- Some examples...

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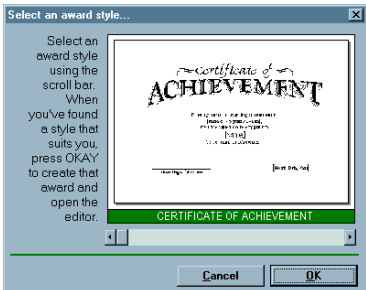
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## Example 1



Select an award style...  
Select an award style using the scroll bar.  
When you've found a style that suits you, press OKAY to create that award and open the editor.

Certificate of ACHIEVEMENT  
[Preview of a certificate with the word 'ACHIEVEMENT' in large, stylized letters]

CERTIFICATE OF ACHIEVEMENT

Cancel OK

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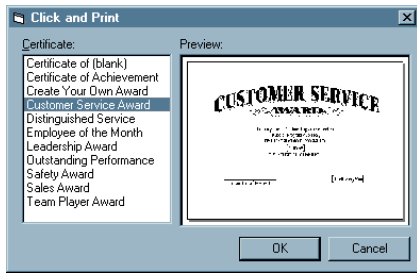
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### Example 1 - redesign



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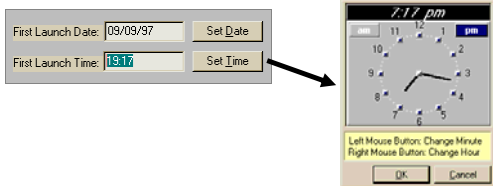
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### Example 2



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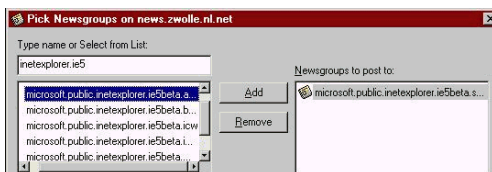
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### Example 3



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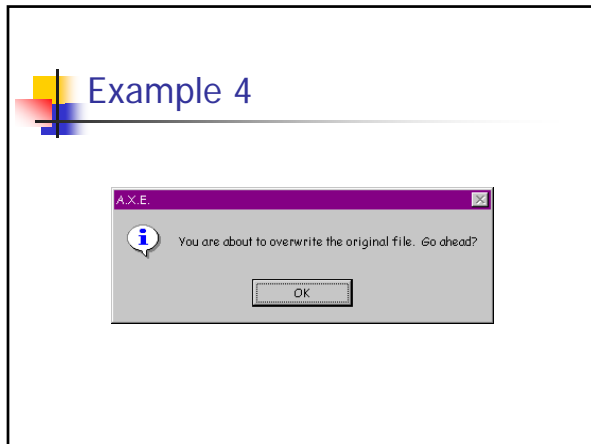
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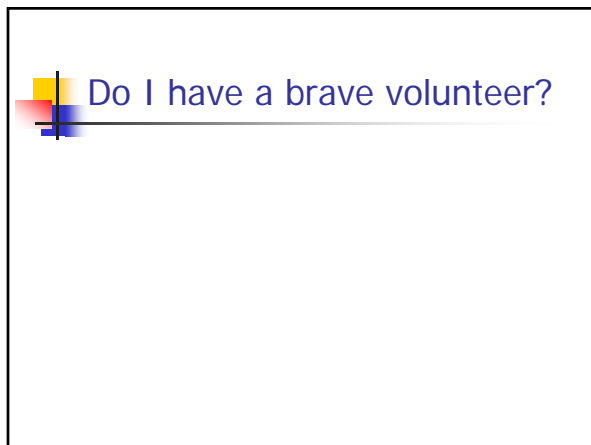
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### Individual Homework #1

#### UI Critique

- Find 2 good & 2 bad examples of UI design
- Some criteria
  - Consistency (inter & intra application)
  - Prevent errors
  - Permit error correction
  - Obviousness ("affordances")
  - Feedback
- Include visuals if possible

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## Paper Presentations

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## Paper Presentations

- Format
  - Pecha Kucha format (6 min, 40 seconds)
    - Brief description (least important - everyone has read it)
    - Your evaluation of the ideas
    - How you would extend it (most important part)
  - Demo/inspiration
    - 3 minute demo, video, or mock up of something that goes beyond the paper. Show us, or teach us, something new that we would not have learn just from reading the paper.
    - If you need to, you can do this in the middle of Pecha Kucha
- Load on your own laptop, test
- Do not
  - Cut and paste text from paper!
  - Read your slides!
- Practice, practice, practice...
- Grading: See the web page – 10% of grade!

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## Presentation

### Volunteers for Next Week

- Jogging the Distance - CHI'07
- Pride and prejudice: learning how chronically ill people think about food - CHI'06
- PmEB: A Mobile Phone Application for Monitoring Caloric Balance – CHI'06
- A New Research Challenge: Persuasive Technology to Motivate Healthy Aging

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## Team Project

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Major focus of course

Will dominate your grade

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## Team Project Guidelines

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- Your project **MUST**
  - Have a substantial UI
  - Be interactive
  - Work robustly
  - Contribute to health or health research
  - Solve a real-world problem
  - Be targeted for and tested with older adults

*Why?*

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## Team Project Guidelines

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- Your project **SHOULD**
  - Be creative
  - Be original
  - Be non-obvious
  - Have a "wow" factor
- Allow you, at the end of this course, to leapfrog your peers with an amazing demo!

*Why?*

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## Team Project Constraints

- Team: 3-4 members, ideally multi-disciplinary
- Focus: Health Application for (or used by) older adult users
- Context: Senior center, home, etc.
- Platform: Your choosing
- Input/output/sensing: Your choosing

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## Team Project Categories

- App for older adults in senior center (to facilitate goals/tasks you identify)
- "Serious game" for older adults to generate food nutrition database
- App for older adults that meets guidelines for an available app competition (e.g., [caveats](#))

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## Team Project Guidelines

### Why Older Adults?

- Pedagogical reasons...
  - High variability in sensory, cognitive, and motor abilities
  - High variability in computer literacy
  - For our population of users – high variability in reading and health literacy
  - Forces you to think thoroughly about usability & accessibility issues
  - Drives home "I am not my user"
  - Makes an otherwise abstract exercise very real
- And...
  - We will be helping an underserved population
  - Demographic shift in US
  - Older adults in more need of health interventions

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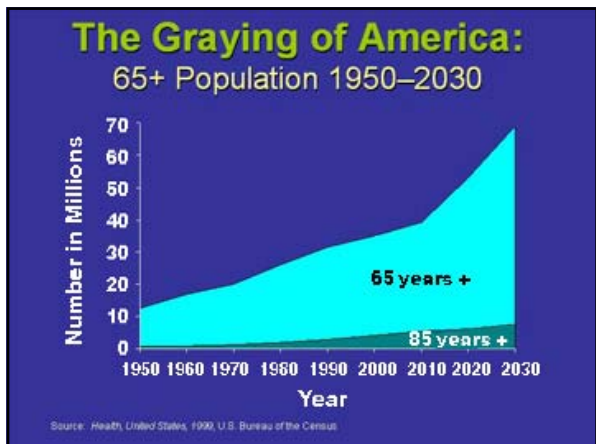
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### Observational studies

- Be prepared to get out into the real world
- Be prepared to use your own ingenuity to seek people out
- Be prepared to spend significant time *observing* and *testing* "In the field"
- Sensitivity is of utmost importance!

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### Project idea generation

- Brainstorming
- Observation
- Iteration
- Be prepared:
  - To get a good idea, have lots of ideas
  - Do not be surprised if I send you back to the drawing board multiple times

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## Questions then break

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## Overview of HCI

- What is HCI?
- Motivation for HCI
- Some basic concepts

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## What is HCI?

*ACM SIGCHI Curricula for HCI*

- Human-computer interaction is a discipline concerned with the **design, evaluation and implementation** of interactive computing systems for **human use** and with the study of major phenomena surrounding them.

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## What is HCI?



Ethnography  
Robotics  
Graphics  
Human factors  
Social Psychology  
Computational Linguistics

Cognitive Psychology  
Software engineering  
Communications  
Experimental Methods  
Art/Design

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## What is HCI?

*extensional definition*

- Human factors
- GUIs & toolkits
- Mobile computing
- Speech interfaces
- Social interfaces
- Multimodal interfaces
- ...

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## Why Study HCI?

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## HCI is Important

*from Nielsen – Usability Engineering*

- Redesign of rotary dial telephone speeded up users' dialing behavior by 0.15 sec/digit, saving \$1M in reduced demand on central switches.
- Redesign insurance forms to reduce customer errors: cost Aus\$100,000; savings Aus\$500,000/year.
- Redesign of Boeing 757 flight deck interface to reduce flight crew from 3 to 2

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## HCI is Important

*from Nielsen – Usability Engineering*

- Study of software engineering costs
  - 63% significantly overran budgets
  - 4 reasons rated with highest responsibility:
    - Frequent change requests by users
    - Overlooked tasks
    - Users' lack of understanding of their own req'ts
    - Insufficient user-analyst communication & understanding

Lederer & Prasad, CACM '92  
115 surveys of projects >=\$50K

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## HCI is Important

- UI strongly affects perception of software
  - Usable software sells better
  - "Ease of use" ratings
- For many shrink-wrapped products a single call to customer support can wipe out profits



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### HCI is Important

*FDA Center for Devices and Radiological Health report*

- Many deaths and injuries attributable to poor human interface (hardware & software) design.
  - oxygen flow control knob, smooth rotation but with discrete settings and no flow at intermediates
- FDA Do It By Design - An Introduction to Human Factors in Medical Devices
  - <http://1.usa.gov/a3FtP5>

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### HCI is Important

*JAMA. 2005;293:1197-1203*

- Study of a hospital computerized physician order entry system (CPOE)
  - Identified 22 ways in which the system caused patients to get the wrong medicine, e.g.
    - fragmented displays that prevent a coherent view of patients' medications
    - pharmacy inventory displays mistaken for dosage guidelines
    - separation of functions that facilitate double dosing and incompatible orders
  - Three quarters of the house staff reported observing each of these error risks, indicating that they occur weekly or more often




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### HCI is Important

*Therac-25 Accidents*

Therac-25 performed both radiation treatment and X-rays

Figure 1. Typical Therac-25 facility.

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## HCI is Important

*Therac-25 Accidents*

```
PATIENT NAME : TEST A 1
TREATMENT MODE: FIX BEAM TYPE: X ENERGY (KeV): 25

UNIT RATE/MINUTE 0 ACTUAL 200 PRESCRIBED
MONITOR UNITS 50 50 200
TIME (MIN) 0.27 1.00

GANTRY ROTATION (DEG) 0.0 0 VERIFIED
COLLIMATOR ROTATION (DEG) 359.2 359 VERIFIED
COLLIMATOR X (CM) 14.2 14.3 VERIFIED
COLLIMATOR Y (CM) 27.2 27.3 VERIFIED
WEDGE NUMBER 1 1 VERIFIED
ACCESSORY NUMBER 0 0 VERIFIED

DATE : 84-OCT-26 SYSTEM: BEAM READY OP.MODE: TREAT AUTO
TIME : 12:55. 8 TREAT : TREAT PAUSE X-RAY 173777
OPR ID: T25V02-R03 REASON: OPERATOR COMMAND:
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## HCI is Important

*Therac-25 Accidents*

- Six accidents involving massive overdoses to patients occurred between 1985 and 1987
- Occasional machine malfunctions with little feedback, resulting in repeated dosages (6 in one case)
- Poor feedback about which mode the machine was in caused treatments with 125x the expected dose
- Machine occasionally underreported dosage

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## HCI is Transformational



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## HCI is Ignored at Your Peril

Your Web Development project here?

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## More reasons to work in HCI?

- Interdisciplinary work
- Interact with people, learn about them and their work
- Help people with software that actually works
- Change our industry
- It's cool...

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## HCI is Cool



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HCI is Cool



A photograph showing a person wearing a VR headset. Another person is standing next to them, adjusting the headset. In the background, a computer monitor displays a 3D rendered scene of a room with a yellow wall and a white door.

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HCI is Cool



A photograph of a person pointing at a large screen. The screen displays several terms related to HCI: "interface design", "renderi", and "scene analysis". The text is in red and white.

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HCI is Cool



A photograph of a person sitting at a desk, looking at a computer monitor. The person is holding a handheld device in their right hand. The monitor displays a 3D rendered scene of a person's face.

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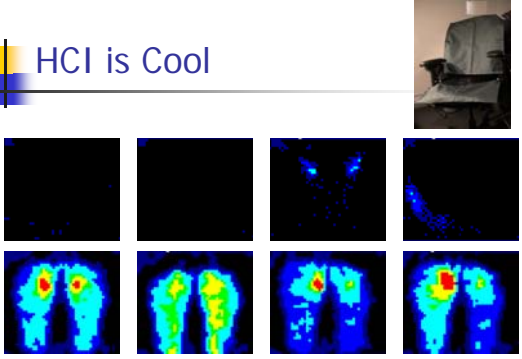
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HCI is Cool



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HCI is Cool

I/O Brush

Ryokai & Marti  
MIT Media Laboratory (C) 2005

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## Some basic issues & concepts

- Building good UIs is **hard**
  - Many iterations
  - Much user interaction
  - Many kinds of expertise
  - 50% of the total lifecycle effort in modern software
    - *Survey of 74 projects, Myers & Rosson, CHI'92*

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## Typical user interface design

- Observation
- Model tasks
- Simplify/refine/stress-test the task models
- Lo-fidelity prototyping (paper)
- Test in context
- Iterate
- Eventually...
  - High fidelity prototyping
  - Test in context
  - Iterate (entire process)

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## Observation



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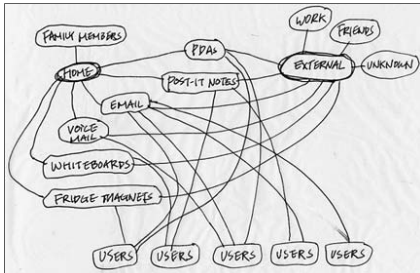
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## Model the tasks



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## Simplify/refine/stress-test tasks

- Gotchas
  - Missing what's truly important to user
  - Interruptions
  - Influence of environment/context
  - Boredom/lack of novelty
  - Dealing with problems created by
    - Environment
    - Other people
    - Technological limitations

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## Paper prototyping



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Paper prototyping



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Test in context (or try)



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Test in context (or try)



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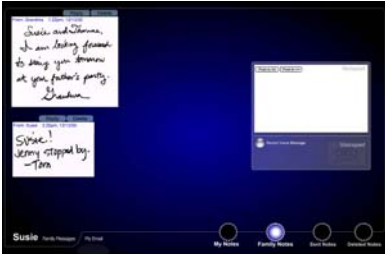
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## High-fidelity prototyping



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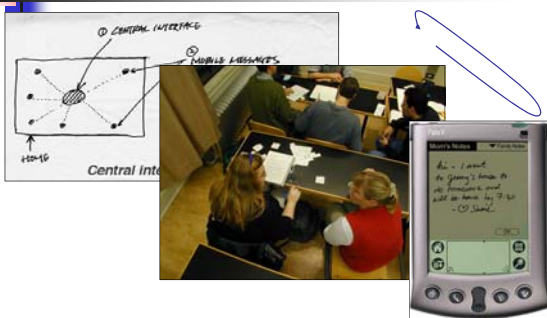
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## Iterate!



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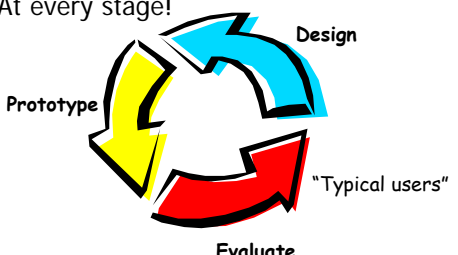
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## Iteration

At every stage!



Design

Prototype

"Typical users"

Evaluate

Diagram from J. Landay

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## Simplicity is Hard!

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## Some basic issues & concepts

System acceptability

- Social acceptability
- Utility
  - Whether the functionality of the system in principle can do what is needed.
  - Usefulness
    - How well users can use the system's functionality.
    - Usability
      - Easy to learn
      - Efficient to use
      - Easy to remember
      - Few errors
      - Subjectively pleasing

- Reliability
- Etc.

**Figure 1** A model of the attributes of system acceptability.  
*From Nielsen, Usability Engineering*

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## Some basic issues & concepts

Design

- Ethnography
- Task analysis
- Design guidelines
- Scenarios

Implement

- Prototyping
- GUI tools

Evaluate

- Expert evaluation
- Usability testing

*The HCI development process*

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## To Do for Next Week

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