Research Seminar

1 October 2014

Wendy Mackay
mackay@lri.fr
(Formation à la Recherche)

My background

Disciplines:
- Experimental Psychology
- Management of Innovation
- Computer Science

Positions:
- Product Development
  - first video on a computer 1983
  - multi-media authoring
- Digital Equipment
  - media spaces, digital desk,
  - interactive paper
- Industrial Research
  - Xerox PARC, CENA
  - multi-surface interaction,
  - participatory design, medical
- Academic Research
  - MIT, Stanford, Aarhus

Interaction Situé

Interaction Situé

Research Director at INRIA,
Responsible for in|situ| joint lab with
INRIA, Univ. Paris-Sud, CNRS

Focus on Human-Computer Interaction
- to augment human capabilities
- to generate novel forms of interaction
- to explore the next generation of interactive systems

Interaction and Visualization Paradigms

Mediated Communication

Participatory Design

Engineering of Interactive Systems
My goal is to help you succeed …

- Learn critical research skills
- Conduct research
- Justify research
- Communicate research

… your final projects and/or theses should impress, not depress, your advisors!

But also,

this will help you decide on your future

Becoming a researcher…

From philosophical discussions to practical details

Philosophy:

- What does it mean to do research in Computer Science?
  - What is the scientific method?
  - What constitutes proof?
  - Which research methods does my field use?
  - How does my field relate to other research fields?
Influential authors

Fred Brooks  The Mythical Man Month
Vannevar Bush  As We May Think
James Gleick  The Information
Daniel Kahneman  Thinking Fast and Slow
Thomas Kuhn  Structure of Scientific Revolutions
Bruno Latour  Science in Action
Robert Merton  Sociology of Science
Karl Popper  Logic of Scientific Discovery
Runkel & McGrath  Judgement Calls in Research
Claude Shannon  Information Theory
Herbert Simon  Sciences of the Artificial
Strunk & White  Elements of Style
Tukey & Mosteller  Exploratory Data Analysis
Mark Weiser  Ubiquitous Computing

Becoming a researcher…

Philosophy:
- What does it mean to do research in Computer Science?

Process:
- How do you do research in your field?
  - Finding a research topic
  - Planning your research activities:
    - Masters and Ph.D. levels
  - Conducting an experiment, statistical analysis, modelling
  - What is it like to be a researcher?
    - Daily life for different types of research jobs
    - Advantages and disadvantages

Publication:
- How do you publish research?
  - What are the types of research publications?
  - What are the key publications in your field?
  - Bibliometrics: evaluating publications and authors
  - Choosing a lifetime publication strategy
  - What is the submission process?
  - Peer-review: how is a paper evaluated
  - Plagarism

Politics:
- How does it really work?
  - What happens in a program committee meeting?
  - How will people evaluate your C.V.?
  - Trade-offs between industry and academia
  - Finding grants and other research support
  - Finding or creating your research community
### Becoming a researcher…

**Philosophy:**
- What does it mean to do research in Computer Science?

**Process:**
- How do you do research in your field?

**Publication:**
- How do you publish research?

**Politics:**
- How does it really work?

**Presentations:**
- Invited guests: Mary Claude Gaudel, Serge Abiteboul, Yves Guiard, Gerard Berry
- TBD ...

### Presentations:

- **Writing:**
  - research articles
  - reviews
  - rebuttals

- **Presenting your research:**
  - Presenting your research
  - Preparing a talk
  - Asking for a recommendation
  - Managing your advisor

### What would you like to include?

Any suggestions for specific topics, guest presenters or activities?

**email:** mackay@lri.fr
Practical Information

Meet on Wednesday afternoons
Room: D203        PUIO Building
14:00 – 17:00

Seminar is taught in ENGLISH
but you can ask questions in French

Attendance and class participation make up 50% of your grade!

Course Format

When:
       Wednesdays  14 – 17 (but usually shorter)
       Room D203

Audience:
       Masters students Ph.D. students

General approach:
       Presentation (Wendy)
       Homework discussion/presentations
       Hands-on activity

Wiki:  http://insitu.lri.fr/People/ResearchSeminar

Proposed Schedule

1 October  Philosophy: Research in computer science
           Process:    Lab notebooks
           Practice:  Reading the research literature

Class every week except:

8 October  No class … but two assignments!

Key websites

Course information:
http://insitu.lri.fr/People/ResearchSeminar

Access to the ACM Digital Library:

login:  14INGUMR8623
password:  8TL3NC
Today

Philosophy:
Natural Sciences vs. Sciences of the Artificial

Process:
Research Notebooks

Practice:
Reading the literature

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Big Science vs. Computer Science

As Vice President of Research for Computer Science I gave a talk to the rest of the faculty at the University of Paris-Sud about the strategic vision for the Computer Science.

The first challenge was to convince them that we actually do science…

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What is Computer Science?

Natural Sciences vs. Sciences of the Artificial

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What is computer science?

Astronomy = Telescope Science?
### What is computer science?

<table>
<thead>
<tr>
<th>Astronomy</th>
<th>≠</th>
<th>Telescope Science</th>
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### What is computer science?

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### What is computer science?

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### What is computer science?

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What is computer science?

Astronomy ≠ Science of Telescopes
Biology ≠ Science of Microscopes
Computer Science ≠ Science of Computers
Computer Science = Science of Information

Information Science

Information
An artificial phenomenon

Computer Science

Information processing
Notion of computation: algorithm

Execution cost for an algorithm:
in time
in memory
in bandwidth
in communication
Information processing
  Notion of computation: algorithm
  Execution cost for an algorithm:
  Problems are too complex:
    Exponential cost
  Example:
    Travelling salesman problem:
    The shortest path passes through all the points

Information
  A natural phenomenon
  DNA:
    information used by organisms
to generate new organisms

Computer Science

Information processing
  Notion of computation: algorithm
  Execution cost for an algorithm:
  Problems are too complex:
    Exponential cost
  Example:
    Travelling salesman problem:
    The shortest path passes through all the points

DNA:
  information used by organisms
to generate new organisms

Quantum waves:
  Carry information that produces physical effects
Computer Science

Aspects
Theoretical models, algorithms
Empirical experiments, tests
Technical architectures, systems

Pasteur’s quadrant

Seek fundamental understanding

Seek immediate applications

Theory vs. Empirical evidence

Psychology: Theory, experiment, new experiment, …
Ethnography: Observation, theory, new observation

Theory

- Framework
- Revised framework

Empirical Observation

- Field observation
- New observation

General scientific approach

Theory

- Model
- New model
- Revised model

Empirical Observation

- Observation
- New observation

What happens when you build what you study?

Artifact design

- Prototype
- New version

Multi-disciplinary design approach

Theory

- Model
- New model
- Revised model

Artifact design

- Prototype
- New version

Empirical Observation

- Observation
- New observation
- New observation
Major concern may be:
A. Generality over actors
B. Precise measure of behavior
C. System character of context

From: Five Research Questions
HCI research process

- From idea...
- Get an idea
- Participatory design to avoid toy problems
- Operationalize
- Extract key features

- To paper...
- Develop theory
- Fitts' law, human perception
HCl research process

1. **get an idea**
   - participatory design to avoid toy problems

2. **develop theory**
   - Fitts’ law, human perception

3. **operationalize**
   - extract key features

4. **build system**
   - develop working prototypes

**Note:**
- No standard benchmarks

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**Design Experiment**
- Controlled lab studies, longitudinal field studies

**Analyse Results**
- Quantitative and qualitative

**Run Experiment**
- Get an idea
Research process

- get an idea
- develop theory
- operationalize
- build system

Research Notebooks

**IDEA**
- participatory design to avoid toy problems
- Fitts’ law, human perception
- extract key features
- develop working prototypes

**Frame paper**
- key insights to generalize
- quantitative and qualitative
- controlled lab studies, longitudinal field studies
- no standard benchmarks

**The process**
- design experiment
- run experiment
- extract key features
- develop working prototypes
- operationalize
- develop theory
- get an idea

**Research Notebooks**

**READ**
- References, Abstracts, Keywords
- Quotable quotes … with page numbers

**THINK**
- Ideas, Observations, Problems, Surprises
- Course insights, Research meetings

**DO**
- Details of: Experiments, Analyses, Procedures
- Create: Keywords, Highlights, Index

**REREAD**
- Mark Keywords, Highlight, Question
- Create an index

Always include the date!

Research Notebooks:

You should use one!!
### Optional Formats

<table>
<thead>
<tr>
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<th>Advantages</th>
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| Paper  | More disciplined  
|        | Allows sketching  
|        | No technical problems (battery/internet)  
|        | Keep with you all the time |
| Electronic | Faster typing (for some)  
|           | Easier to read  
|           | Convenient when already on-line  
|           | Reusable text (but be careful of plagiarism) |
| Hybrid  | Paper and electronic…  
|         | but have one that is primary |

### Assignment #1: Start a research notebook

- **Due:** 15 October

Create your personal research notebook
- Choose paper, electronic or hybrid

For the next two weeks,
- Keep track of what you read
- Sketch and record ideas
- DATE every entry
- Add KEYWORDS to every entry

Continue to use these for the rest of the semester

### Reading the research literature

Find ‘best papers’:
- What makes them great?

Find influential authors:
- Where do they publish?

Identify the key publications in your field
- Conferences! Journals!
### Research Literature … is not ‘literature’

- Technical, not literary, writing
- Focus on making an argument:
  - Introduce a problem
  - Identify who else has done related work
  - Perform an activity that adds to the field
  - Provide a clear, replicable description
  - Justify the results

### Assignment #2: Report on a ‘best paper’

**Due:** 15 October

1. Find a ‘best paper’ in your field
   (Obtain the full reference and full paper)
2. Read it carefully
   (Take notes in your research notebook)
3. Write a quick summary:
   - What is the key contribution?
   - What kind of paper is it?
   - Where was it published?
   - What impact has it had?
   - What surprised you?
   - What did you learn about writing from the paper?