CS-477

Reinventing Interactive Systems

Instrumental Interaction and Co-Adaptive Systems

Course 4: User Innovation

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Course Outline

	Topic	Exercises
1 April	Instrumental interaction and co-adaptive systems	Deconstructing interaction
8 April	Designing instruments	Idea generation
15 April	Learning	Design ideas & scenarios
22 April	User innovation	Video prototyping
29 April	Collaborative interaction	Generative walkthroughs
6 May	Instrument architectures	Function-interaction tables
13 May	Ubiquitous computing	Alternate scenarios
20 May	Tangible interaction	Alternative video prototypes
27 May	Shifting the design paradigm	Final Presentations
3 June	Final presentations	

Homework for today

Readings:

Tsandilas, T., Letondal, C. and Mackay, W. (2009)
MusInk: Composing Music Through Augmented Drawing.
In *CHI'09, Proc. ACM Human Factors in Computing Systems,* pp. 819-828.

Nardi, B. and Miller, J. (1991)
Twinkling lights and nested loops: Distributed problem solving and spreadsheet development
International Journal of Man-Machine Studies 34: 161–184.

Activity:

Create a full scenario for a basic instrument

What we've done so far

Defined the concept of "instrumental interaction"
- deconstructed interaction
- identified design principles:
  reification, polymorphism and re-use
- brainstormed ideas for instruments

Defined the concept of "co-adaptation"
- discussed the learning aspect
- begun developing use scenarios

What we'll do today

10 min	Present design process
10 min	Divide into three groups: choose suject area
30 min	Identify a real-world task and develop a use scenario
20 min	Design at least one, at most 3 instruments design 3 alternatives for each
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Participatory Design

… focuses on **situated interaction** between
users and technology
… involves **users throughout** the design process
… is fundamentally **generative** not evaluative
… values iteration and rapid **redesign**
… explores **breakdowns** and the unexpected
not perfection

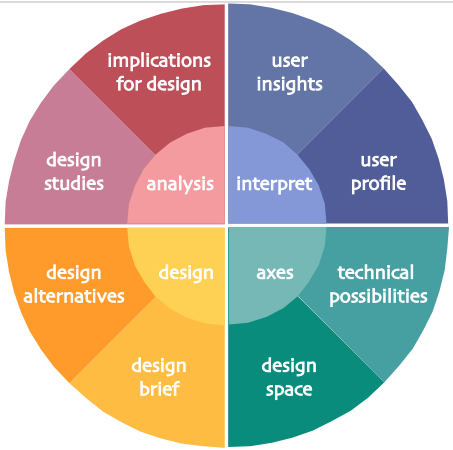
Generative Design

Discovery
Who is the user?

Invention
What is possible?

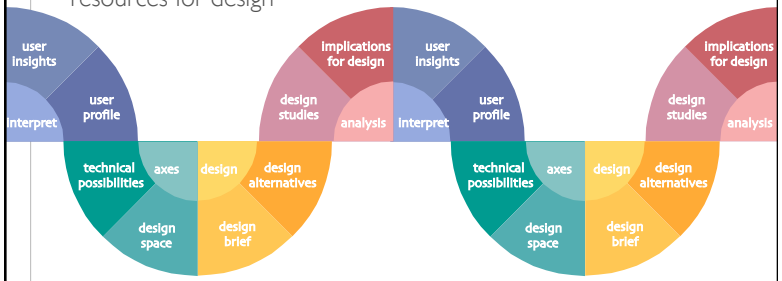
Design
What should it be?

Evaluation :
Does it work?



Design is an iterative process …

Do not perform activities that do not produce resources for design



If you create resources for design, use them!

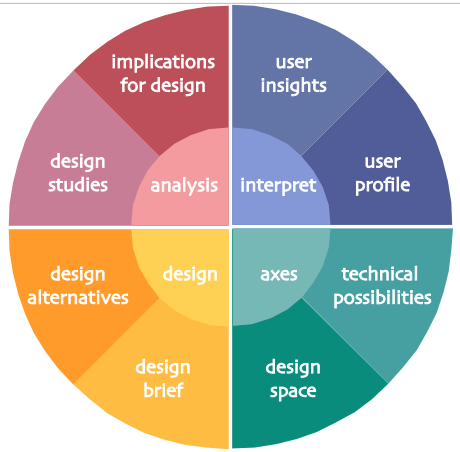
Generative Design

Each phase includes:

Collecting data

Analyzing information

Generating design resources

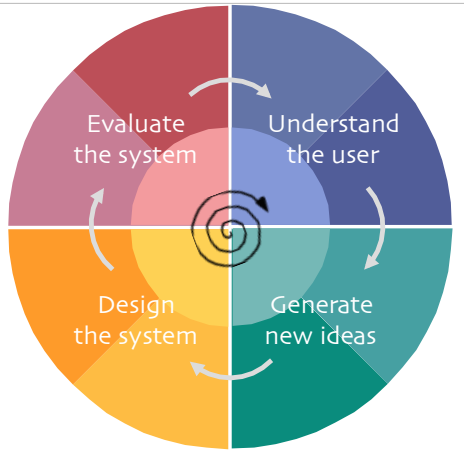


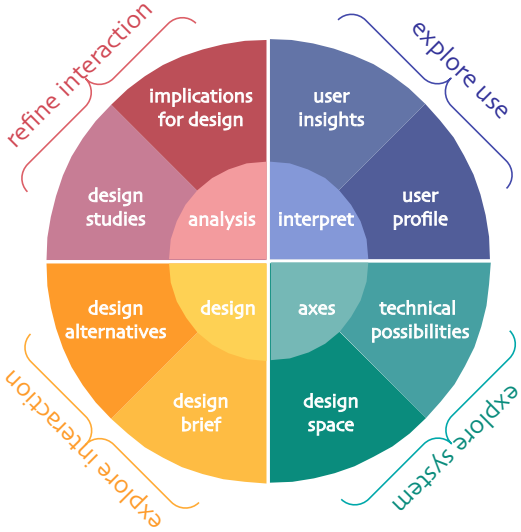
Four phases

Each phase contributes to the other phases:

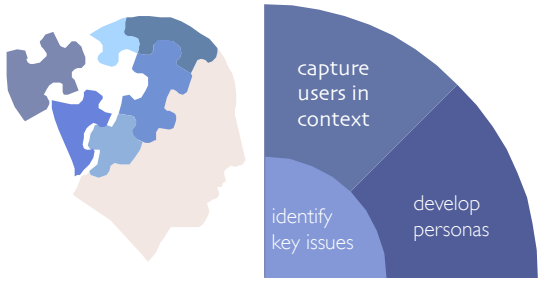
The process is iterative

Jump from any phase to any other as needed





Understand: Who is the user?

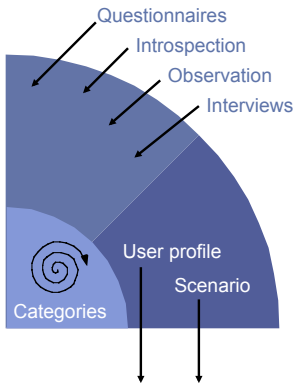


Understanding: Who is the user?

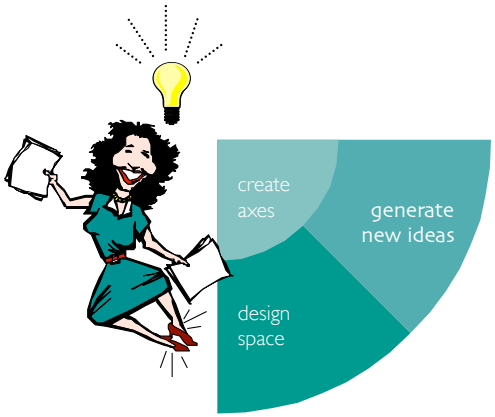
Collect information
- Introspection
- Observation
- Interviews
- Questionnaires

Analyse information
- Grounded theory categories

Resources for design
- Scenario
- User profile



Invention: What is possible?

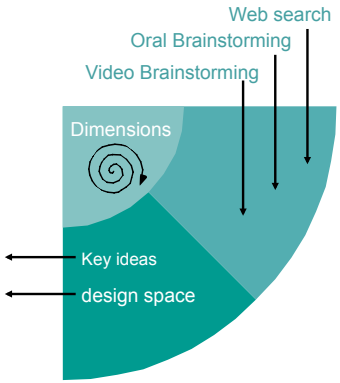


Invention: What is possible?

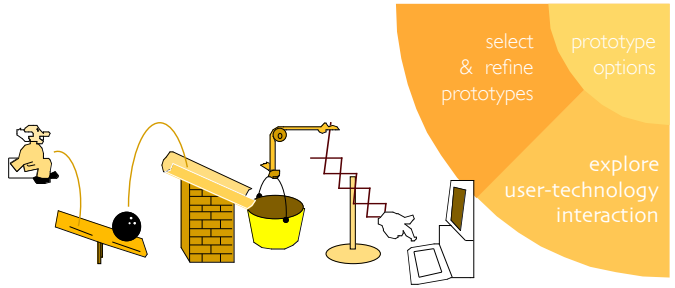
Collect information
- Web search
- Oral Brainstorming
- Video Brainstorming

Analyse information
- Preference votes
- Technology dimensions

Resources for design
- Key ideas
- Design space



Design: What should it be?

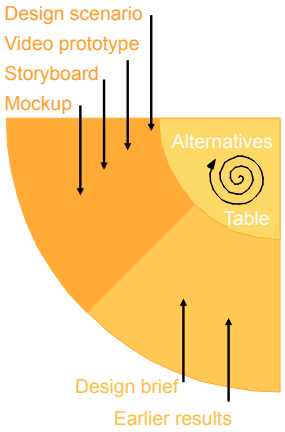


Design: What should it be?

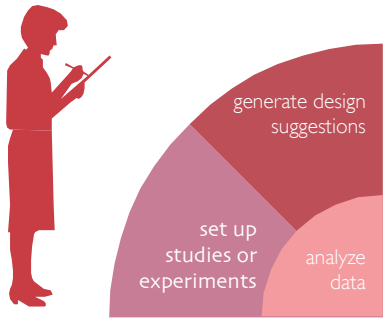
Collect information
- Design brief
- plus results from earlier phases

Analyse information
- Interaction table
- Design alternatives

Resources for design
- Design scenario
- Storyboard
- Mockup
- Video prototype



Evaluation: Does it work?

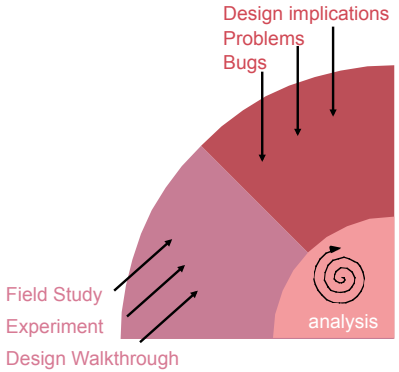


Evaluation: Does it work?

Collect information
- Design Walkthrough
- Experiment

Analyse information
- Qualitative
- Quantitative

Resources for design
- List of problems found
- Implications for redesign



Multi-Disciplinary Design Methods

Understand the user	Analyse the user	Invent new ideas	Prototype the system	Evaluate the system	Redesign the system
"Fly-on-the-wall observation (Ethnography)	Interactive Thread (HCI)	Oral brainstorming (Psychology)	Paper prototyping (Participatory Design)	Focus group (Marketing)	Generative Walkthrough (HCI)
Critical incident interview (Human Factors)	Contextual Inquiry (Antrhopology)	Design space (Design)	Video prototyping (Participatory Design)	Usability study (Human Factors)	Technology probe (Design/Arts)
Questionaire (Sociology)	Task analysis (Human Factors)	Sketching (Design/Arts)	Wizard of Oz (Human Factors)	Heuristics (HCI)	Design Rationale (HCI)
Cultural probe (Design/Arts)	Scenario analysis (Activity Theory)	Video brainstorming (Participatory Design)	Software simulation (Computer science)	Design walkthrough (Psychology)	
Grounded Theory (Cognitive Psychology)	Protocol analysis (Cognitive Psychology)	Design room (Design/Arts)	Design scenario (HCI)	Design Critique (Crit) (Design/Arts)	

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Video Prototype 3 co-adaptive instruments

Sample instruments to explore:

1. Creativity: Help musicians express musical ideas
2. Spell check: Help dyslexics find and spell words
3. Procedures: Help emergency staff follow checklists
4. Communication: Help people stay in touch

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Creating scenarios

Create a realistic account,
ideally grounded in real-world observation of users,
of a series of activities that
illustrate and challenge the use of a new tool

Goal: to help you think through interaction issues
NOT to 'sell' the prototype

Techniques:

Extreme users
Theme and variations
Breakdowns

Scenario: HIV vaccines example

Title	Why do two new HIV vaccines work only when combined?
Who?	Thierry, M, 38, Professor, Cellular Biology, host George, M, 42, Professor, Biochemistry, worked on study 2 Ivan, M, 28, Gene therapist, Genentech Manuela, F, 37, Asst. Prof, Evolutionary biology Jun, M, 32, Post-doc, U. Paris, Computer Science Ann, F, 55, Prof., MIT, Bioinformatics Jason, M, 43, Prof., CMU, Physician, Designed study 2 Sun Lee, F, 48, Prof. U. Vietnam, Epidemiologist, Public Health
What?	Emergency research meeting
Where?	University Paris-Sud, France
When?	12:00, Friday, 22 April

Scenario: HIV vaccines example

Motivation:

Finding an effective HIV vaccine has proven elusive: vaccines that seemed promising in the lab have systematically failed to provide clinical results in the field. However, a recent double-blind field study in Southeast Asia produced astonishing results.

The study tested two vaccines, organized into four groups: no vaccine, vaccine A, vaccine B, and both vaccines A and B together. Neither vaccine alone, nor the control condition, reduced HIV infection rates. However, when the two vaccines were combined, HIV rates dropped by 30%. This was completely unexpected and none of the scientists has an explanation.

The U. Paris-Sud Biology department is hosting an emergency working session, with local participants from the Institute Pasteur and INRA, as well as world-class experts from around the world, with experience in these specific vaccines and different types of biology, including geneticists, cellular biologists, biochemists, epidemiologists, bioinformaticians as well as physicians and public health officials associated with the field trials.

Scenario: HIV vaccines example

Situation:

The meeting begins at 12:00 at U. Paris-Sud, with several remote participants from MIT. Most participants arrive with their own hard drives and laptops (Mac, Linux and various versions of Windows).

The 'wet' biologists also bring their paper laboratory notebooks and one brings a set of gels, the results of a recent experiment. They have a wide variety of different forms of data, including images, data tables, spreadsheets with dosage levels, experimental protocolas, scripts and alogrithms for running specific analyses, models of specific molecules and results of relevant genetic analyses, as well as published research articles.

Some of this data is highly confidential and cannot be viewed by the others. Other information can only be reviewed under non-disclosure agreements. Still other data and results can be shared, with varying levels of protection, within the confines of the group. In addition, the group has access to a large number of on-line databases and research libraries.

Scenario: HIV vaccines example

Host Thierry has identified a series of research articles from Nature, Science and JAMA and displays the abstracts, so everyone can see. He then moves them into a small pile in the lower right-hand corner of the wall. (As the meeting progresses, people will add articles and documents to the pile, which can be printed or leafed through at any point in the meeting.)

Thierry begins the session by showing an extremely large 3d model of the molecule of the active ingredient in vaccine A, written in Pymol and displayed at very high resolution. He wants to demonstrate how this molecule prevents the 'docking' of the HIV virus with normal cells.

George has a different type of model of vaccine B. Thierry shrinks his molecule and George displays his model next to Thierry's. They work together to see how the two molecules interact with each other, in the presence of normal cells. This raises a question at the genetic level.

Ivan displays the results of his research on gene therapy on chimpanzies, in which vaccine A proved to be effective in the laboratory. However, the corresponding mouse studies were inconclusive and he wonders whether this particular gene has an unusual incidence within this particular population. He diplsays 1000 gene sequences, aligned in multiple columns on the display wall and rearranges them to highligh particular patterns.

Scenario: HIV vaccines example

Manuela is an expert on the origins and early evolution of the HIV virus first traced in the green monkey in Africa. She has developed a software visualisation tool that allows her to compare different gene sequences in different animals and humans and highlight differences, with about 10,000 nodes.

George has a different approach, and shows the results of a comparative analysis he did by hand, over a period of three days, that identified two unexpected relationships.

Jun contributes a new algorithm that builds upon these two relationships and generates a new visualisation. He writes down the algorithm on paper, and projects it onto the wall.

They ask Ann, participating at a distance from MIT, if she can run several additional analyses and display them when she is finished.

Sun Lee has been working with her colleagues in Vietnam and has the results of two recent epidemediological studies of HIV incidence rates in each of the villages where the two vaccines were tested. She describes how the study was conducted, the details of the experimental protocol and the statistical analysis assumptions.

Jason has brought a geneological map that shows the genetic lineage of this part of the country. Victoria begins exploring several on-line databases to see if she can answer his question. She diplays the top 40 results of her search in a series of windows on the wall. Jason updates his map accordingly.

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Course exercise

Video prototype a co-adaptive instrument (or suite)

- for real users
  - range of expertise, within and across users
- on different platforms
  - multi-surface, tangible
- addressing different situations
  - collaborative
  - distributed

Reminder: Encapsulating interaction

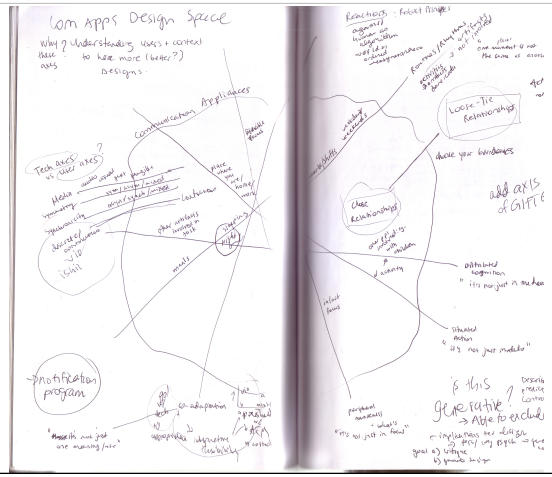
Encapsulating interaction involves three basic principles:

Reification take an action and turn it into an object that can be manipulated.
Example: action of scrolling can be turned into a scrollbar.

Polymorphism let interactive objects perform coherently with different inputs
Example: copy-pastse object that can handle text, graphics and video.

Reuse capture previous interaction sequences & turn into reusable objects
Example: capture series of paragraph settings, turn them into reusable style

Design space



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Resources for design: Scenarios

Tell a story that illustrates how one or more people interact (with technology) in a real-world setting

Current scenario:

Draws from real-world observation of people who face challenges that a new technology might address

Design scenario:

Builds upon current scenarios and speculates how these people would interact with new technology, in this setting

Writing a current scenario

Potential *design resources:*

Raw data:

- Real-world observations, interviews,
- Personal experience (if applicable)
- Research literature, marketing materials

Interpreted data:

- Analysis of user characteristics and needs
- Design brief / design requirements
- Personas and extreme characters

Current scenario: What happens now

Write a tiny, branching one-act play,
- sub-divided into one-paragraph micro scenes
- that describes the interaction

Create one or more characters, each with:
- name, age, gender, motivation
- usually with a profession, expertise
- usually with a goal or motivation

Create one or more realistic setting(s):
- date, time, place, context

Identify a series of events over a period of time

Design scenario: What could be

Design resources:
- Current scenario
- Selected technology ideas to explore

Revise the current scenario to see what happens
- when the characters use the new technology

You CAN change the current scenario
- if it helps you to explore alternatives

Design scenarios lead to
- storyboards lead to
- video prototypes

Design scenarios ➡ Video Prototypes

Design scenarios lead to
- storyboards which lead to
- video prototypes

Each provides a successively deeper way to think
- about situated interaction

Each should be considered highly iterative:
- Creating alternatives is cheap
- Use them to explore
- Don't be afraid to try and reject ideas

Design scenarios ➡ Video Prototypes

Scenarios use words to describe situations
- Create multiple paragraphs to explore options

Storyboards break up the action and illustrate it
- forcing you to think more deeply about interaction
- They take more time, so select options carefully

Video prototypes are dynamic sketches of interaction
- Acting out the interaction:
  - enhances thinking deeply,
  - remembering ideas
  - sharing with users, designers & management

Tip: Choosing character names

Make names short, ideally one syllable

Either alphabetize them:
- Ann, Bob, Chuck, Dave, Eli

Or link names to functions:
- Pat is a patient
- Sue is a surgeon

Scenarios: What to do

Create a theme … and variations
to explore alternatives

Balance both 'normal' and unusual situtions
especially breakdowns and errors
(… and normal is rarely normal)

Consider external events that affect interaction
as well as motivated action by the user

Include patterns of interaction over time
including repetitions and wasted effort

Highlight surprises

Scenarios: What NOT to do

Avoid 'selling' the technology
Explore options rather than one solution

Avoid irrelevant detail
Focus on interaction, not users' personal lives

Avoid flowery description
Stick to the facts

Avoid humor
It's hard and not the point

Summary: Creating scenarios

Create a realistic account,
ideally grounded in real-world observation of users,
of a series of activities that serve to
illustrate and challenge the use of a new technology

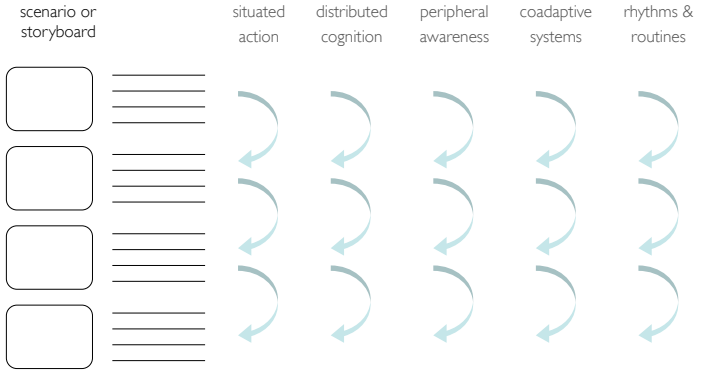
Goal: to help you think through interaction issues
NOT to 'sell' the prototype

Techniques:
- Extreme users
- Theme and variations
- Breakdowns

Scenario format

Title:	Event or technology being designed
Who?	Characteristics: name, sex, age, profession, ...
What?	Event that sparks the story
Where?	Location
When?	Date, time
Motivation:	Why is this happening?
Situation:	Relevant detail to aid understanding
Story:	Paragraph-by-paragraph description of who does what and why.

Storyboards



Exercises

Previous exercises:

Design notebook	Record instances of observed interaction: yours and others
Deconstruct interaction	Break down interaction into components
Design principles	Encapsulate interaction via reification, polymorphism, reuse
Brainstorming	Generate maximum ideas in limited time, avoid criticizing
Paper prototype	Create tangible example and show interaction
Video brainstorming	Video interaction ideas, one director, theme & variations
Design space	Categorize ideas along dimensions, populate with ideas
Design scenario	(Extreme) characters in a series of real-world actions using new technology. Positive and negative results
Storyboard	Illustrate scenario, step-by-step, for video prototype

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Next week:

Turn in:

- Scenario - at least one page with at least three 'events'
- Instrument - (at least two)
  - What data does it operate on?
  - What does it reify?
  - Is it polymorphic?
  - How does it support reuse (user or system or both?)

Discuss:

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