Design and Evaluation of Interactive Systems
(Conception et Evaluation des Systèmes Interactifs)

Generative Design: Overview

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in situ lab, INRIA & U. Paris-Sud
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lectures adapted from Wendy E. Mackay

Course structure

Lectures (in class)
Present fundamentals & principles from different disciplines
Relate design activities to each other and as a whole

Design activities (in class or at home)
Individual and group
Each builds upon previous results (you cannot skip any)

Project (in class and at home)
Groups of 3-4
Goal: produce a grounded video prototype

Course Schedule

Classes 1-4
First semi-complete design cycle
Christmas Break

Class 5
Midterm: fist video prototype

Class 6-8
Generative deconstruction
Principled techniques for redesign

Class 9
Final presentation (instead of exam)

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Website: https://www.lri.fr/~anab/teaching/M2Pro-DEIS/
Contains news, slides and other course material
Course project

You will create a video prototype of an original design of an interactive system that meets the needs of real users in a real setting.

Projects involve in-class exercises and homework attendance is critical so is doing your homework!

Work in groups of 3-4
some activities are individual (1/3 of your mark)
others are in groups (2/3 of your mark)

Suggested topic next, you may choose your own (check with us)

Mid-term video prototype (due 8 jan)

Executive summary (5 pages max) to describe the design
- Who is the audience?
- What is the design concept?
- Which design resources did you use?
- Initial scenario

Storyboard

Video prototype version1 (5-7 minutes)

Grading

Participation
- Class exercises
- Homework exercises

Final Presentation
- with Video Prototype

Final Report
- Executive Summary

Individual work 1/3, Group work 2/3

Final presentation

Oral presentation
- 15 minutes:
  - design problem
  - user profile
  - design alternatives considered and rejected
  - final design
  - video prototype (maximum 5 minutes)
  - justification
- 5 minutes:
  - class discussion: every group asks at least one question

Also due: video prototype, transparencies, final storyboard
Final report

Executive summary of your project
10 pages maximum

Potential users:
who are they? (refer to your data)
what do they need?
Design concept:
what is the design concept?
what alternatives were considered?
why is this a good solution? (avoid marketing!)
Next steps

Also due: final exercises from the course

Generative Design

Discovery
Who is the user?

Invention
What is possible?

Design
What should it be?

Evaluation:
Does it work?

Why this course?

Computer scientists
are trained to find the solution to a technical problem

But they rarely ask:

Is this the right question?

This course will help you to
better understand the design problem
from the perspective of the user

Which sometimes means redefining the problem
Computer capacity is increasing…

Computers are getting smarter …

but not people!

Shouldn’t we augment human capacity as well?

Human-Computer Interaction

Capabilities: action, perception, cognition

Environment: physical, social, organisational, cultural, etc.

Capabilities: computation, storage, input/output
In the real world: Situated Interaction

- Multiple users
- Multiple artifacts
- Multiple computers

Designing interactive systems

Researchers

Designing interactive systems

Researchers

Designing interactive systems

Researchers

Designing interactive systems

Researchers

Engineers

Users
Psychology: Start with theory, test, revise, retest …

![Psychology Diagram](image)

Ethnography: Start with observation, theory new observation …

![Ethnography Diagram](image)

General scientific approach

![General Scientific Approach Diagram](image)

Design approach

![Design Approach Diagram](image)
Multi-disciplinary design approach

Theory → Model → new model → revised model

Artifact design

real observation → version n → re-observation

Real world

Multi-disciplinary approach

Natural sciences → Physicality → Anthropology → Sociology → Psychology → Computer science → Typography → Architecture → Engineering

Trade-offs

Runkel & McGrath, 1972

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

Multi-Disciplinary Design Methods

Understand the user → Analyze the user → Invent new ideas → Prototype the system → Evaluate the system → Redesign the system

- Ply-on-the-wall observation
- Critical incident interview
- Questionnaire
- Cultural probe
- Grounded Theory

- Interactive Thread
- Contextual Inquiry
- Task analysis
- Scenario analysis
- Process analysis

- Oral brainstorming
- Video brainstorming
- Video processing
- Software simulation
- Design walkthrough

- Focus group
- Usability study
- Design heuristics
- Design critique (Crit)
- Usability study

- Paper prototyping
- Conceptual Design
- Wizard of Oz
- Heuristics
- Design rationale

- Cognitive design
- Critical incident interview
- Oral brainstorming
- Video brainstorming
- Design walkthrough

- Design room
- Design space
- Design scenario
- Design rationale
### Design of Interactive Systems

#### Triangulation

One technique is never sufficient
Use different methods
Take advantage of different types of expertise

Qualitative and quantitative
Objective and subjective
Local and wide-ranging
Your own and the literature

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#### Achieving balance

Competing issues

Patterns of use
Interaction details
Technology issues

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#### Design is an iterative process …

Design activities produce **resources for design**

If you create resources for design, use them!

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#### Participatory Design

… focuses on **situated interaction**
between users and technology
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

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 just perfection
Generative Design

Each phase includes:
- Collecting or sampling information
- Analyzing information
- Generating design resources

- Implications for design
- User insights
- User profile
- Design studies
- Analysis
- Interpret
- Design alternatives
- Design brief
- Design space
- Technical possibilities

Four phases

Each phase contributes to the other phases:
- The process is iterative
- Jump from any phase to any other phase as needed

Understand: Who is the user?

Collect or sample information:
- Introspection
- Observation
- Interviews
- Questionnaires

Analyze information:
- Grounded theory categories

Create resources for design:
- Scenario
- User profile

Understanding: Who is the user?

Capture users in context
- Identify key issues
- Develop personas

Categories
- Questionnaires
- Introspection
- Observation
- Interviews
- User profile
- Scenario
Invention: What is possible?

- Create axes
- Generate new ideas
- Design space

Collect or sample information
- Web search
- Oral Brainstorming
- Video Brainstorming

Analyze information
- Preference votes
- Technology dimensions

Create resources for design
- Key ideas
- Design space

Design: What should it be?

- Select & refine prototypes
- Prototype options
- Explore user-technology interaction

Collect or sample information
- Design brief
  - Plus results from earlier phases

Analyze information
- Interaction table
- Alternative designs

Create resources for design
- Design scenario
- Storyboard
- Mockup
- Video prototype

Earlier results
- Alternative designs
- Interaction Table
- Video prototype
Evaluation: Does it work?

- Collect or sample information
  - Design Walkthrough
  - Experiment
- Analyze information
  - Qualitative
  - Quantitative
- Create resources for design
  - List of problems found
  - Implications for redesign

Design implications
- Problems
- Bugs
- Statistics
- Analysis

Field Study
- Experiment
- Design Walkthrough

Emphasis on Iterative Design

Every iterative design process includes redesign activities

- but don’t just repeat the same exercises
- reevaluate your design

- Design the system
- Evaluate the system
- Understand the user
- Generate new ideas

- Design studies
- Design brief
- Design space
- Design possibilities

- Design brief
- Design space
- Design possibilities
- Design insights
Multi-disciplinary Design, this week

Lectures:
- Four phases of design
- Project description
- Phase 1: Understanding users

Class exercises:
- Interviews
- Introspection
- Questionnaires

Homework:
- Decide on situation and users
- Critical Incident Interviews

Design and Evaluation of Interactive Systems

Finding out about users

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Understanding the user

**Lectures:** Phase 1: Understanding users

**Class exercises:**
- Introspection
- Grounded Theory categories
- User profile
- Persona
- User scenario

**Homework:**
- Group: Choose topic
- Individual: Critical Incident Interviews

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Each session

**Analyse the results from last week**

**Create one or more design resource**

**Begin collecting information for the next phase**

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Today

**Finding out about users**
- Introspection
- Observation
- Interviews
- Questionnaires

**Analyzing information**
- Grounded theory

**Resources for design**
- Use scenario
- User profile
- Persona

**Techniques for finding out about users!**

**Do-it-yourself:**
- **Observation:** Watch users in field situations
- **Introspection:** Watch users in pre-arranged settings
- **Questionnaire:** Place yourself in the user's shoes
- **Interviews:** Distribute questions to many users
- **Ask individual users probing questions**

**Sampling from others:**
- **Research literature:** Anthropology, Ethnography, Sociology
- **Marketing studies:** Business
- **Web videos:** Marketing
- **Documentaries:** Journalism
Introspection

The designer tries the system
What works, what does not?
You can do this systematically:
   Begin with a clearly defined, real task
   Set aside a limited amount of time
   Make sure that you are not interrupted
   Begin the task
   Record while you talk aloud or take notes
Analyze what you did:
   Positive and negative aspects
   Surprises
   Ideas for making it better

Exercise: Introspection

Don’t forget…

Introspection is very, very common
   but is the technique most susceptible to errors
This is a design method
   but NOT a scientific research method
If you use introspection as part of a design process:
   follow a protocol
   do not forget that your opinions and experiences
      are rarely the same as those of other users
   seek insights and inspiration, rather than “truth”

In situ observation

Observe and record how users perform the task today
Do not forget:
   All observers are biased
   Validity depends upon the details
   Observing ≠ interacting with users
Consider ethical questions
   Ask for permission
   Accept “no” for an answer
   Do not distribute personal data
Artists observe through sketches
Log books, Diaries and Journals

- Capture your observations about people
- Sketch ideas
- Keep it with you and jot things down as you think of them

Observation in the lab

- Ask users to perform specific tasks
- Basic observation
- Talk aloud protocol
- Pairs and shared discovery

Recording pros and cons
- Paper: Cheap, fewest details, incomplete
- Audio: Often useful, but cumbersome to analyze
- Video: Very detailed, may be too intrusive
- Lengthy analysis, permits later analysis
- Logs: Record every keystroke or mouse click
- Requires a computer, statistical analysis

Direct observation: User studies

- Specify a specific activity
  - Execute a series of tasks
  - Solve a problem
  - Follow a scenario
- Always provide standard instructions
  - Choose at least three real users
- Data coding:
  - Define the categories: discrete or continuous events
  - Measure the degree of confidence

Interviews

- Goals:
  - Understand the tasks and activities of the user
  - Identify the user’s needs
  - Obtain the user’s perspective on the system
- Suppositions:
  - Responses are subjective:
    - but their perceptions are important to know!
  - Users often rationalize their responses
    - take this into account in your analysis
  - Users understand their own experiences
    - but very few can design a better system …
  - BUT … look for user innovations
Interviews: Considerations

Who is your real audience?
User? Boss? Buyer?

What do you want to know?
Facts or opinions?
Details or generalities?
Real stories or abstractions?

Distinguish among:
Interviews - questionnaires - marketing surveys
Each have different purposes

Interviews (and questionnaire): Question types

Directed or open
Multiple choice or free response

Facts or opinion
events, data vs. preferences and ideas

Specifics or generalities
focused on something or abstract

Beginning or end
Different question types belong at each point of an interview

How to ask questions (also for questionnaires)

The form of the question
provides the form of the response (habitable sub-languages)

If you want specific, real answers,
you must ask the questions correctly

If not, you will get vague general answers
that provide little help with design

Careful!
We are not conducting marketing surveys
Our goal is to better understand users
to design a better system

Questions: two dimensions

Directed vs. open
directed limited response, imposed format
open unlimited response, free form

Specific vs. general
specific details related to a specific object, time or event
general abstractions, generally applicable
What are your questions for?

Designing a new system
- Interviews help you discover facts:
  - stories of use
  - data from users
  - examples of activities

Marketing a system
- Interviews help you discover opinion:
  - user preferences
  - what they would like to buy

Choose questions that support design

Question order matters!!!
- Start specific then general
- Start with directed then open
- Start with facts then opinions

Choose questions that support design

Interviews
- Few answers
- Can delve deeper to find out more
- Analyze by hand

Questionnaires
- Many answers
- Difficult to ask follow-on questions
- Automated analysis possible

Design an interview

Same questions, same format for everyone, but … as new questions arise, add them

Begin with specific, directed questions: name, job, etc.

Next, use specific, open-ended questions
- Critical incident technique asks about:
  - Recent memorable event (within a week)
  - Specific artifact that you point to (e.g. mobile)
  - Specific recent time or place

Get specific detailed stories
Specific and open questions

Help users reconstruct their memories

Critical incident technique
  Describe a recent, memorable event
  Time specified by the interviewer:
    What happened, step-by-step, at that time
    (place, date, time)
Specific object
  Describe how this object was created or
  how did it get here and why?
Specific situation
  Describe the last time that you were in
  <specific situation> specified by the interviewer

Careful …

Do not ask for generalizations until after the interviewee
has told you a specific story, based on their experience

Ask the user to generalize from specific artifacts or events:
  Is this typical?  If so, why?
  If not, why not?

Conclude with general, open questions
  Allow the user to explain what they do in their own way

Interviews

Users think you want a lesson on how it is supposed to work
  You don't. You can read a manual for that.

Your goal is to get real stories
  that reveal both the positive and negative aspects of
  the current system

You want to help users remember things they would otherwise
  forget

You want to gain insights into how and why users
  do what they do

Information Lens

Filtering electronic mail (2-year study at Xerox PARC)

Users changed their ways of managing their email
  but
Users also changed how the system designers
  thought about the system
Specific, directed questions

1. How many messages did you receive today? (count them)
2. Is this a typical day? If not, why not?
3. How many times did you read your mail yesterday?
4. Did you read every message?
5. How many messages did you delete without reading?
6. How many filtering rules do you have?
7. Did any of them fire when you read your mail yesterday?

Specific, open questions

1. Within the last week, did you look for a specific mail message? Were you able to find it? Describe what you did to find it.
2. Within the last week, did you look for a specific piece of information within your email? Did you find it? Describe what you did to find it.

Critical incident Question:

3. Within the last week, did one of your filtering rules not work as you expected it to? If so, what did you do?

General, open questions

NEVER start with these … but ok after they have told you specific, detailed stories of their use of the system

1. Describe how you use your email.
2. Describe how you classify your messages.
3. When do you prefer to use:
   - email, telephone, face-to-face meetings?
4. Has the Information Lens changed how you communicate with your colleagues?

One more time: Order is important !!!

Specific questions
before general questions

Directed questions
before open questions

Why?
Remember that the form of the question influences (a lot) the form of the answer
Users can be put in the correct frame of mind
Questionnaires

Goal: Obtain data from a large number of users

Careful:
- Users are more or less likely to respond honestly
- Questions may not really address the questions or needs; it's what you think they have (external validity problem)

Design a questionnaire

What information are you seeking?
- Ask only what is necessary
- Frame the questions correctly

Who is the audience?
- 50 - 1000 users ... or more?

How will you send your survey?
- Most often with a survey web app
- But sometimes paper is better

How will you analyze your results?
- Consider the statistical analysis first

Question styles in questionnaires

Background
- Age, profession, years in the job

General information
- How many years have you used this email system?

Directed questions
- How many messages did you receive yesterday?

Multiple choice
- I move messages to project folders
  - never
  - rarely
  - often
  - always

Scalar
- I can easily manage my email
  - Strongly disagree
  - Disagree
  - Neutral
  - Agree
  - Strongly agree

Ranking
- Rank the following functions in order of usefulness
  - Blind copy
  - Automatic copy to a distribution list
  - Automatic to myself

Open questions
- Describe how you use electronic mail.
### Principles for designing questionnaires

- Use parallel structure for sentences
- Keep the order coherent, e.g., positive to negative
- Zero can mean two things:
  - neutral, middle response
  - "I do not know"
- Consider adding a degree of confidence
- Avoid asking 'obvious' questions
- Ask the same question in two different ways to see if you get the same result

### Interviews vs. questionnaires

- The same question types work for both but the goals are different and the analysis is different
- Advantages of interviews:
  - easier to get in-context information
  - easier to get real-world stories
  - easier to probe deeply into an interesting situation
- Advantages of questionnaires:
  - can ask lots of people
  - simple questions are easy to tabulate
  - often used for opinions

### One more reminder

- Directed, specific questions are easiest to code (analyze) belong at the beginning of the questionnaire provide the fewest interesting results
- Open, general questions are very difficult to code and analyze may provide very interesting responses but also risk giving stereotypical responses

### Consider a series that builds:

- Do they build on each other?
- Are they redundant or get at different issues?
- What is the balance between:
  - Direct vs. Open?
  - Specific vs. General?
  - Factual vs. Opinion?
  - Design-oriented vs. marketing-oriented?
### Design vs. Marketing

Designers need facts to inform the design examples of problems, stories about events, data about use.

Marketing wants opinions what people like and do not like, what they think they want.

Emphasize facts first, then opinions
- Directed questions (specific or open-ended) often elicit facts
- General questions (specific or open-ended) often lead to opinions

### Summary: Discovering who is the user

Collect or sample information
- Introspection
- Observation
- Interviews
- Questionnaires

Analyze information
- Grounded theory categories

Create resources for design
- Scenario
- User profile

### Many ways to find out about users

You can collect information yourself!
- Observation, Introspection, Interview, Questionnaire
- (More advanced techniques!
  - Focus group, Usability study, Logging study, Diary study …)

You can also take advantage of work done by others:
- Market studies, Government reports, Research literature,
  - Youtube, Ads, Novels, Films, Cartoons …

### Many ways to analyze results

Analysis activities
- Grounded theory analysis!
- List of related examples!

You could also do a:
- GOMS analysis
- Contextual inquiry
- Task analysis
- Protocol analysis
- Log analysis
- Survey analysis
Many possible design resources

In this course, we'll talk about:
  User profile
  Persona
  Extreme character
  Use scenario

But you can also create:
  Requirements list
  Storyboard of use
  Clips of related examples
  Summary video

… and your own design brief

Homework (due Dec 11)

1. Group: Choose a topic for your project
   You need to identify a problem and a set of users

2. Individual: At least two interviews each
   Use at least one critical incident question
   Probe for details