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UNIVERSITÉ DE GENÈVE

Design Science Research

MSc in Computer Science
MSc in Digital Systems and Services
PhD in Information Systems

Giovanna Di Marzo Serugendo
Giovanna.Dimarzo@unige.ch, room B 235, 022 379 00 72

University of Geneva
http://cui.unige.ch/~dimarzo

Who’s Who?

Admin Information

- Time and Place
  - Autumn
  - Batelle 316/318
  - Tuesdays: 10h00 - 12h00
- Moodle
  - Lectures / References
- Zoom
  - https://unige.zoom.us/j/61914436192?pwd=OHdBWnpET3laWm9ubUJQR3NHSkFldz09
  - Meeting ID: 619 1443 6192
  - Passcode: 618547
- Cancelled/Modified Lectures
  - To be announced
- Exceptional Lectures
  - Librarian presentations
    - To do decided
  - How to give a presentation (to be announced)

Syllabus

- Introduction and motivation
- Reviewing
  - Analysing a research paper
  - State of the art / how-what to search
  - Publications categories / Quality indicators
- Writing
  - How to write an abstract / related works
  - Typical structure of MSc thesis
  - Citations and plagiarism
- Performing research
  - Research questions, contribution, methodology results
- Design and Creativity
- Presentations
- How to make presentations, how to make slides
- Librarian workshops on finding papers

Assessment

on peut écrire en francais ou en anglais

- Coursework 1 (2/6)
  - Presentation and analysis of a research article
    - Research Questions, Methodology, ..
- Coursework 2 (2/6) – Due Dec. 21st
  - 800 words exercise
  - Specific template given during the course
  - Choice of topic and idea for a master project
- Coursework 3 (2/6) – Due Jan 25th
  - Review of 800 words on easychair

Timetable (tentative)

Week	
21/09	Intro / Motivation / Overview
28/09	Literature review / Quality indicators
05/10	State of the art / Analysing papers
12/10	Writing abstract, papers, MSc thesis
19/10	800 Words, Plagiarism
26/10	Performing research / methods
02/11	How to make a presentation (to be decided)
09/11	Reading week
16/11	Librarians presentation – how to find related works (to be decided)
23/11	Review process – Easychair (to be decided)
30/11	Performing research / methods
7/12	Students presentations (depending on the number of students)
14/12	Students presentations
21/12	Students presentations

References

- Vijay K. Vaishnavi, William Kuechler Jr, Design Science Research Methods and Patterns – Innovating Information and Communication Technology. Auerbach Publications, 2008
- Tutorial on research methods http://win.ua.ac.be/~sdemey/Tutorial_ResearchMethods/
- Robert K. Yin. Case Study Research: Design and Methods, Applied Social Research Methods Series, Vol. 5, Sage Publications, 2003
- Empirical research methods, how to be rigorous in experimentation - http://www.cs.jhu.edu/~nasmith/erm/
- Hevner et al. Design Science in IS Research. MIS Quarterly, 28(1), 2004
- Reading and writing papers http://datasearch.ruc.edu.cn/course/researchmethod/computermethod.html
- Edward de Bono. Lateral Thinking.Penguin Books, 1990.

Motivation

Why a course on Design Science Research?

Our motivations

- To write sound research papers
- How to perform research
- How to get / validate results
- How to identify gaps in knowledge
- How to “innovate”
- Different ways of getting inspiration
- Different ways of doing research

… some more motivations

- Write a good Msc project thesis
- To sharpen our critical thinking
- Improve presentation skills
- Learn about research methods
- Understand what is a contribution to the field
- Understand the need to be creative
- Bring own contribution to the Msc project field

Goal

Take advantage of this course to define and

perform design science research

(literature review, research question, contribution, writing)

on your own MSc project thesis

Science and research

Science

"Knowledge attained through study or practice,"

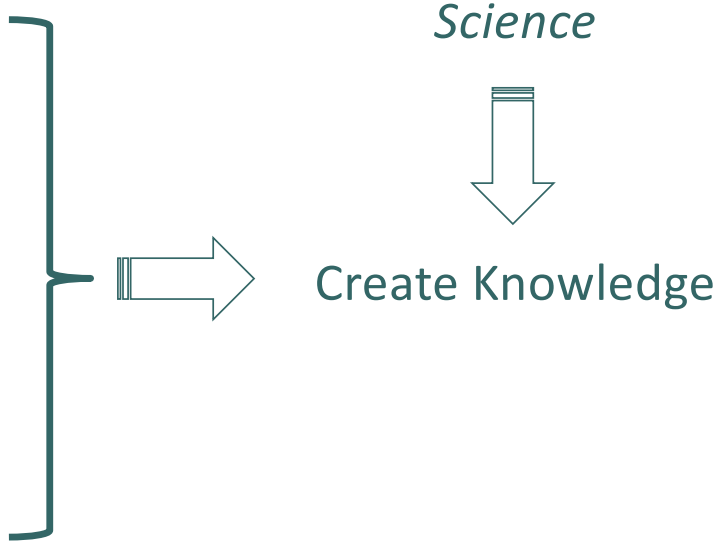
or

"Knowledge covering general truths of the operation of general laws, esp. as obtained and tested through scientific method [and] concerned with the physical world."

Webster dictionary

What is a scientist doing in his lab?

- Analysing Knowledge
- Applying Knowledge
- Defining Research Questions
- Trying to prove assumptions
  - Understanding Phenomena
  - Designing artefacts
- Drawing conclusions



Research

- Creation of Knowledge
  - Understanding of phenomena
    - Natural science: body of knowledge about some class of things – objects or phenomena – in the world (nature or society) that describes and explains how they behave and interact with each other.
  - Design: invent and bring into being
    - Creation of artifacts (man made artificial objects and phenomena) designed to meet certain desired goals.
      - Building knowledge through making (construction of artifacts and evaluation of artifact performance)

Research

Four types of research

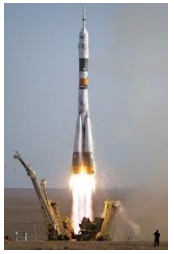
Applied Research

- Solving practical problems
- Problems chosen by the scientist
- Commercial value

Research

Government Research

- Solving problems provided by the government



Pure / Basic Research
Fundamental Research
Blue Sky Research

- Curiosity-driven
- No commercial value
- Increase understanding and knowledge
- Does not intend to solve a problem

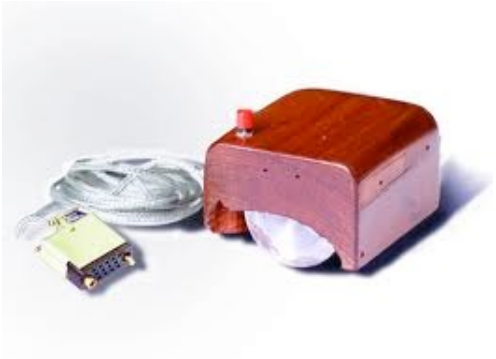
Commercial Research

- Solving problems provided by companies, businesses

http://hafeezrm.hubpages.com/hub/Types-of-Research

Research methods

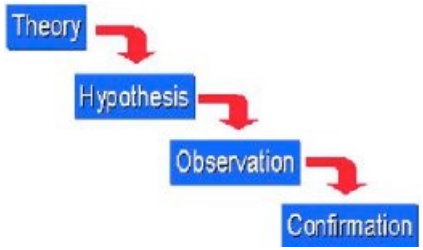
- Set of activities that a research community considers appropriate to the production of understanding (knowledge).



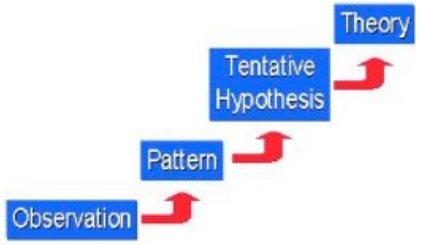
Vaishnavi et al

Research Methods

- Deductive methods
  - Start from a theory
  - Prove it right with available information



- Inductive methods
  - Start from observation
  - Deduct a pattern
  - Draw conclusion (possibly not 100% true)

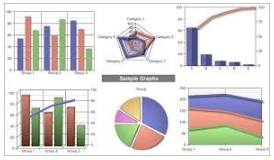


http://hafeezrm.hubpages.com/hub/Types-of-Research

Research methods

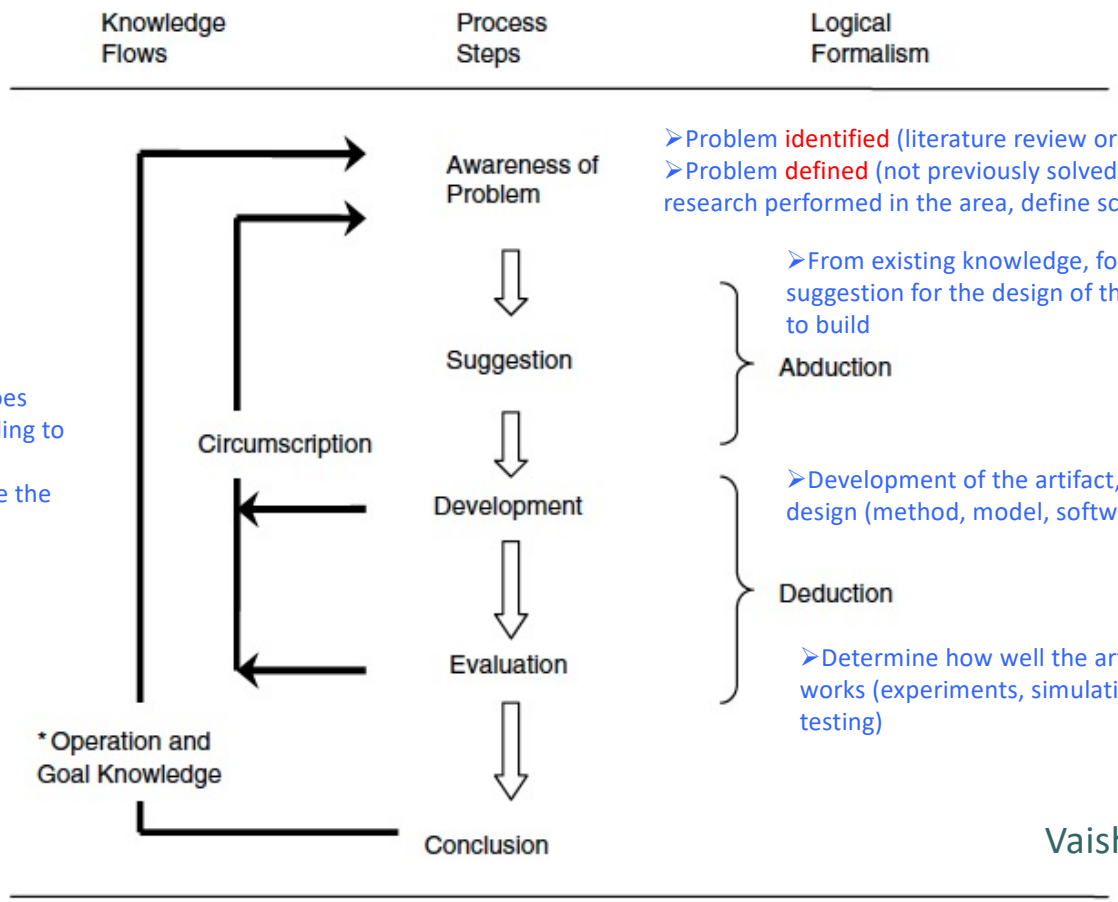
- Qualitative methods
- Interviews
- Focus groups

- Quantitative methods
- Questionnaires + analysis
- Big data analysis



Design Science

Design Cycle



➢Identify what "goes wrong", not according to theory
➢Iteration to refine the artifact design

Vaishnavi et al.

Outputs - Artifacts

Table 2.1 The Outputs of Design Science Research

Output		*Description*
1	Constructs	The conceptual vocabulary of a domain
2	Models	A set of propositions or statements expressing relationships between constructs
3	Methods	A set of steps used to perform a task — how-to knowledge
4	Instantiations	The operationalization of constructs, models, and methods
5	Better theories	Artifact construction as analogous to experimental natural science

Outputs

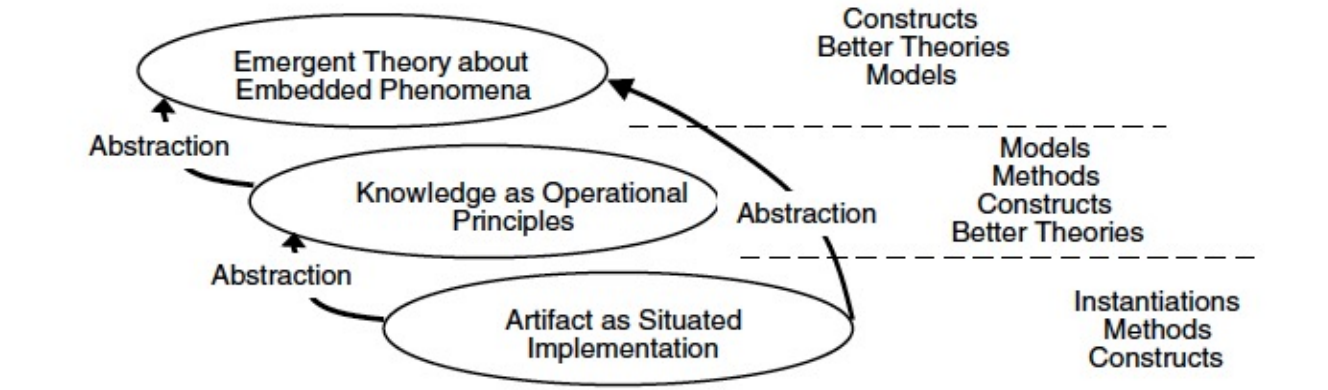


Figure 2.4 Outputs of design science (Purao, 2002).

Types of PhD theses – Types of contribution

- Opens up new area
- Provides unifying framework
- Resolves long-standing question
- Thoroughly explores an area
- Contradicts existing knowledge
- Experimentally validates theory
- Produces an ambitious system
- Provides empirical data
- Derives superior algorithms
- Develops new methodology
- Develops a new tool
- Produces a negative result

https://www.eecs.harvard.edu/htk/phdadvice/

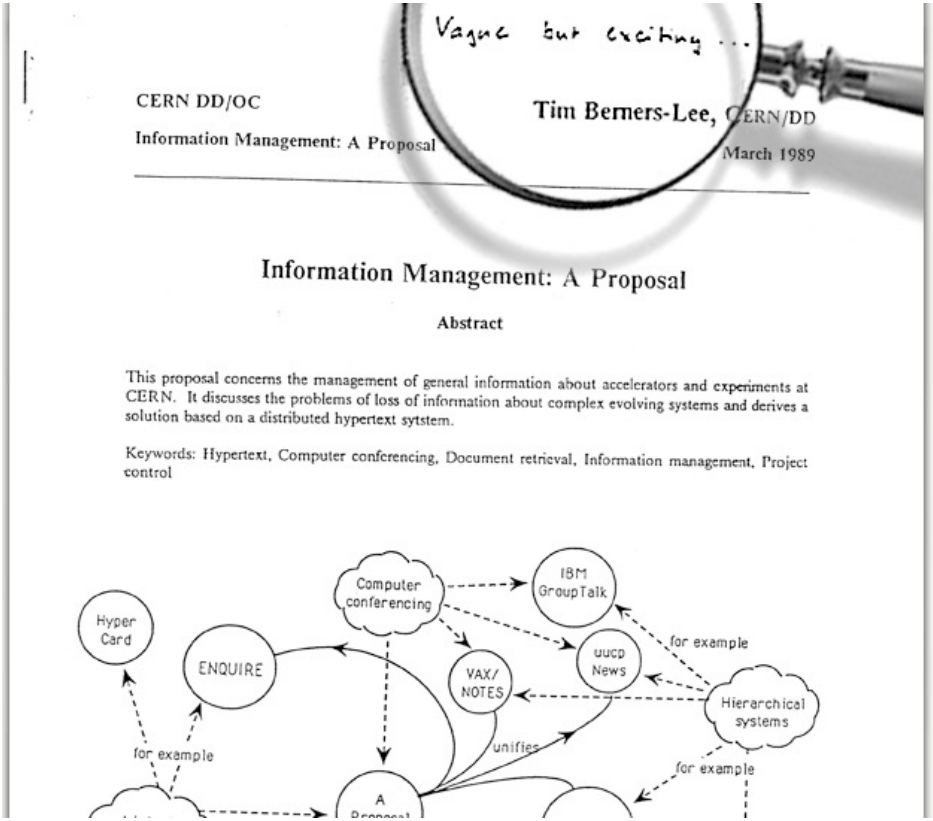
Design vs Design Science Research

- Design: create new product using state of the art practices (no new knowledge is created)

- Design Science Research: produce new knowledge by creating artifacts

Exercise 1 – what is the artefact?

- Read Cern Memo:
  - http://info.cern.ch/Proposal.html
  - http://www.w3.org/History/1989/proposal.html
- Ercim News: https://ercim-news.ercim.eu/
- Horizon: https://www.horizons-mag.ch/
- IEEE Spectrum: https://spectrum.ieee.org/



- http://info.cern.ch/Proposal.html
- http://www.w3.org/History/1989/proposal.html

- What artefact is proposed in the papers you read?

Two types of design

Two types of design

User-Centered Design

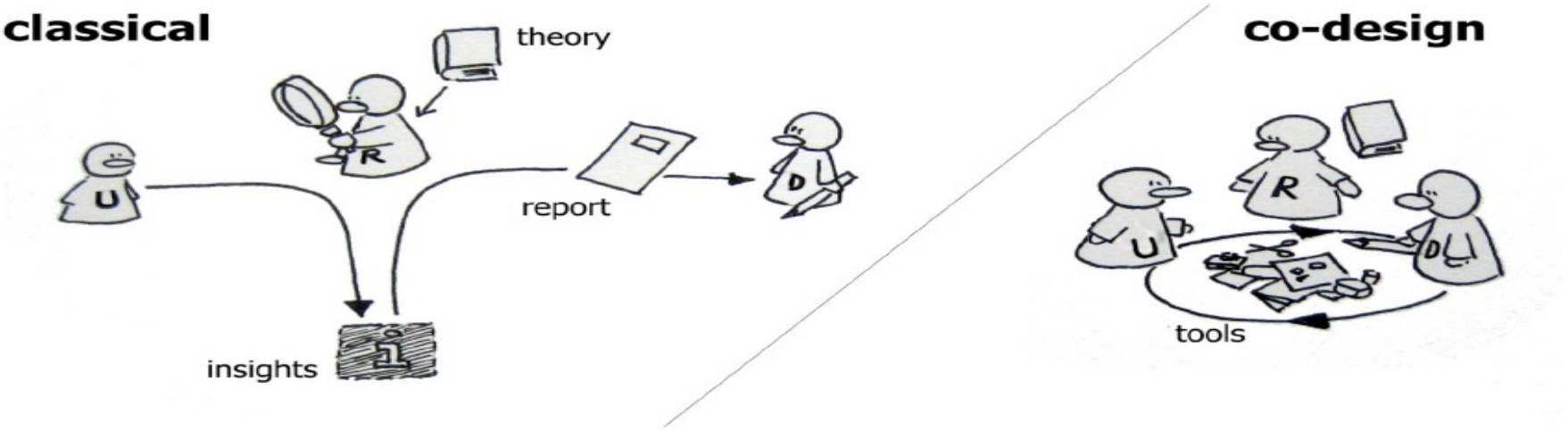
- User as subject
- Passive user
- Gives opinions about concepts provided by others
- Researcher is the expert

Participatory Design

- User as partner
- User participates in the concept in the early phase of design
- User provides his expertise

http://www.maketools.com/articles-papers/CoCreation_Sanders_Stappers_08_preprint.pdf

User-centric vs Participatory



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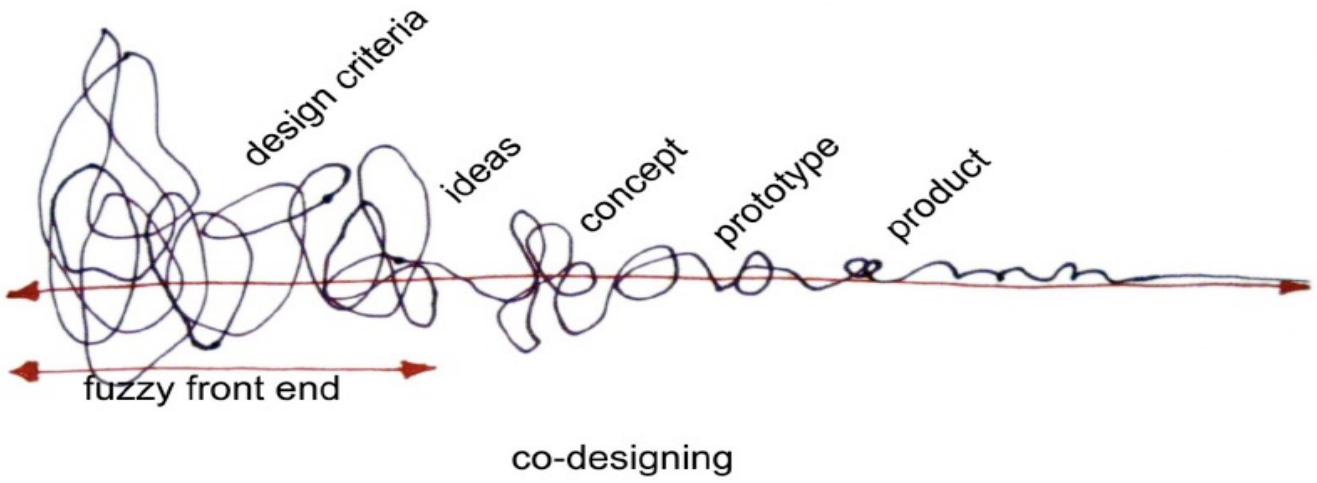
Participatory design



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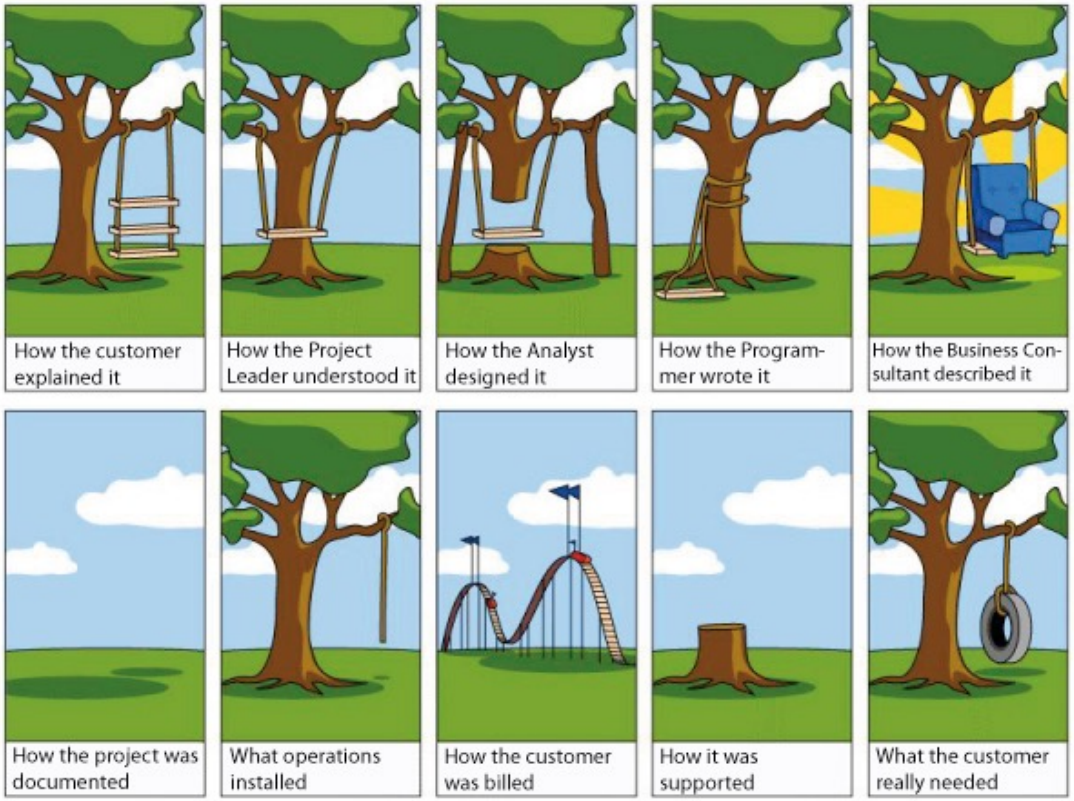
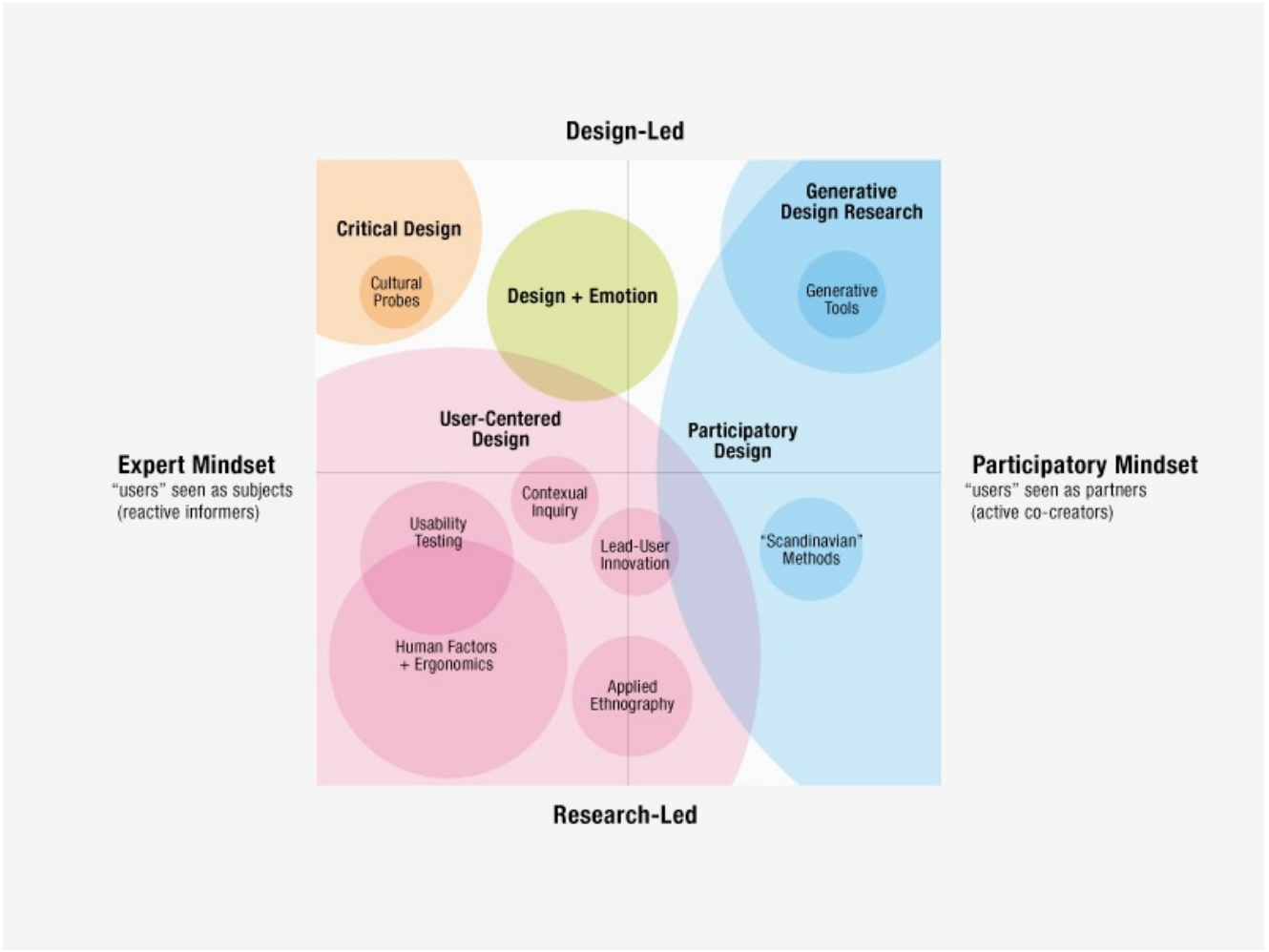
User-centric vs Participatory

The traditional design disciplines focus on the **designing of** "products".	. . . . . while the emerging design disciplines focus on **designing for** a purpose
visual communication design interior space design product design information design architecture planning	design for experiencing design for emotion design for interacting design for sustainability design for serving design for transforming

http://www.maketools.com/articles-papers/CoCreation_Sanders_Stappers_08_preprint.pdf

User-Centered Design




Design-Led
Critical Design
Cultural Probes
Design + Emotion
Generative Design Research
Generative Tools
User-Centered Design
Participatory Design
Expert Mindset
"users" seen as subjects
(reactive informers)
Contexual Inquiry
Usability Testing
Lead-User Innovation
"Scandinavian" Methods
Human Factors + Ergonomics
Applied Ethnography
Participatory Mindset
"users" seen as partners
(active co-creators)
Research-Led

Participatory design

- No idea about the final result:
  - Product, service, interface, building, software, app, web site, paper game, …
- Answer open questions like:
  - *"how can we improve the quality of life for people living with a chronic illness?"*
  - *"what is the next big thing in family leisure time?*

Example: thinkdata.ch

Summary

- Introduction to different types of research
- Design science research cycle
- Outputs
- Exercises
- Two types of design