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**UNIVERSITÉ
DE GENÈVE**

Design Science Research

MSc in Computer Science

MSc in Digital Systems and Services

PhD in Information Systems

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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 français 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

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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

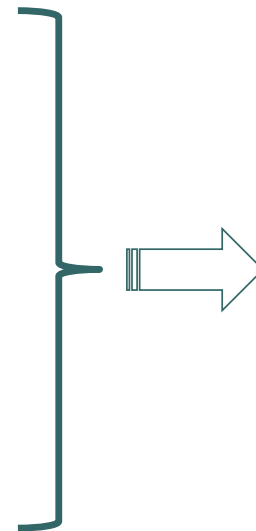
“Knowledge attained through study or practice,”
or

“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



Science



Create Knowledge

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)

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Research



Four types of research



<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).

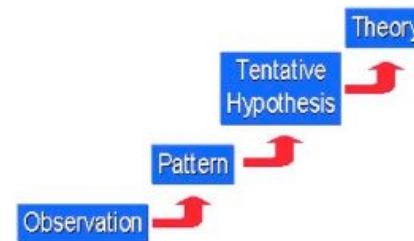
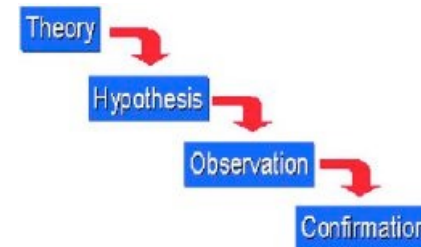


Vaishnavi et al

Research Methods

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

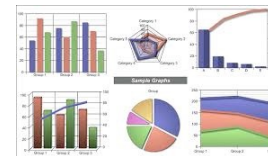
- Inductive methods
 - Start from observation
 - Deduct a pattern
 - Draw conclusion (possibly not 100% true)



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

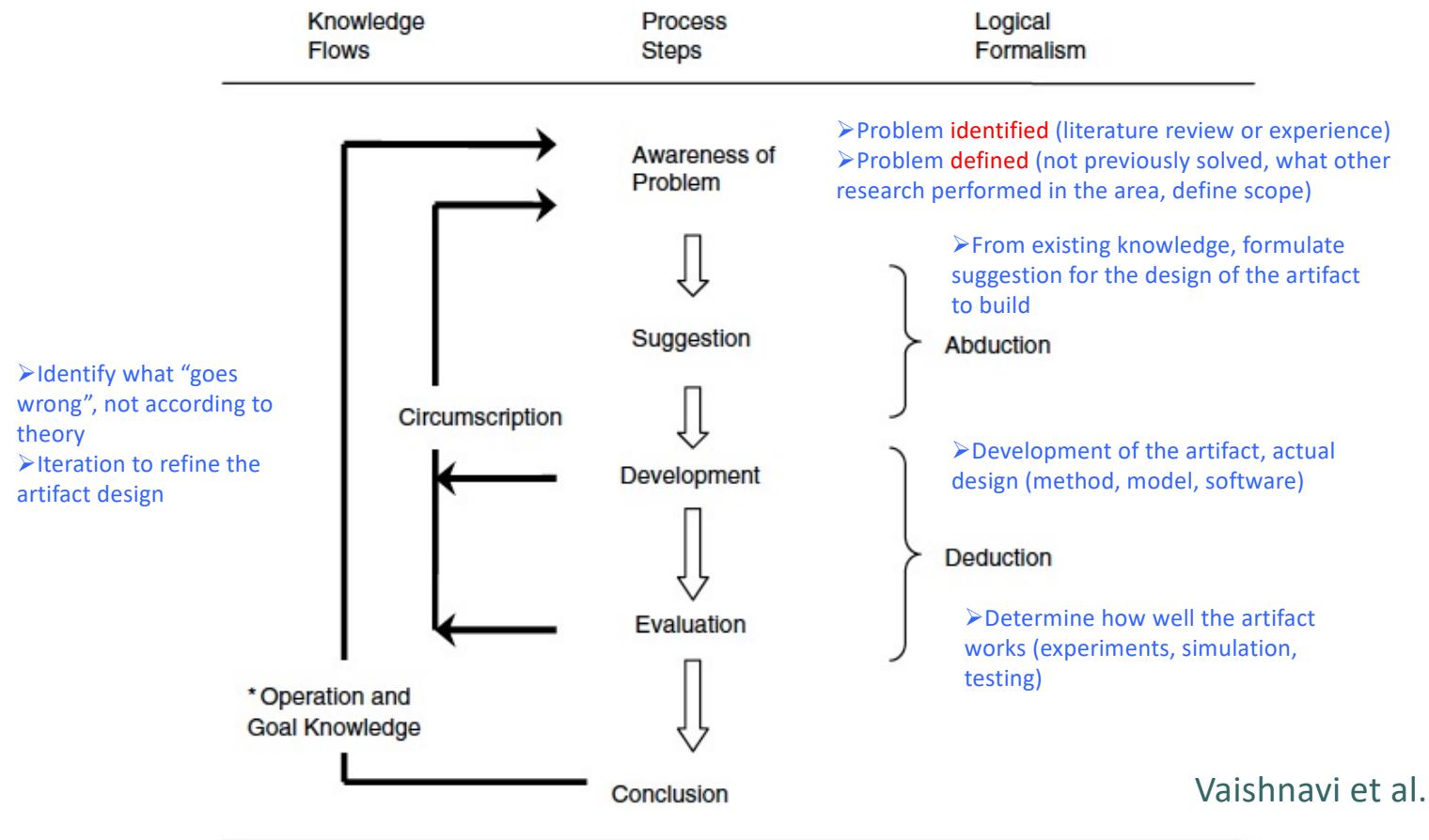
Research methods

- Qualitative methods
- Interviews
- Focus groups
- Quantitative methods
- Questionnaires + analysis
- Big data analysis



Design Science

Design Cycle



Vaishnavi et al.

Outputs - Artifacts

Table 2.1 The Outputs of Design Science Research

<i>Output</i>		<i>Description</i>
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

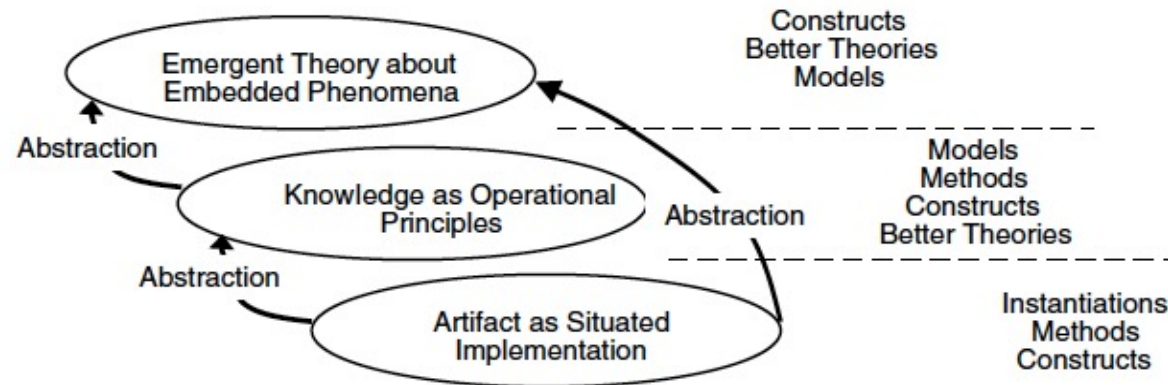


Figure 2.4 Outputs of design science (Purao, 2002).

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

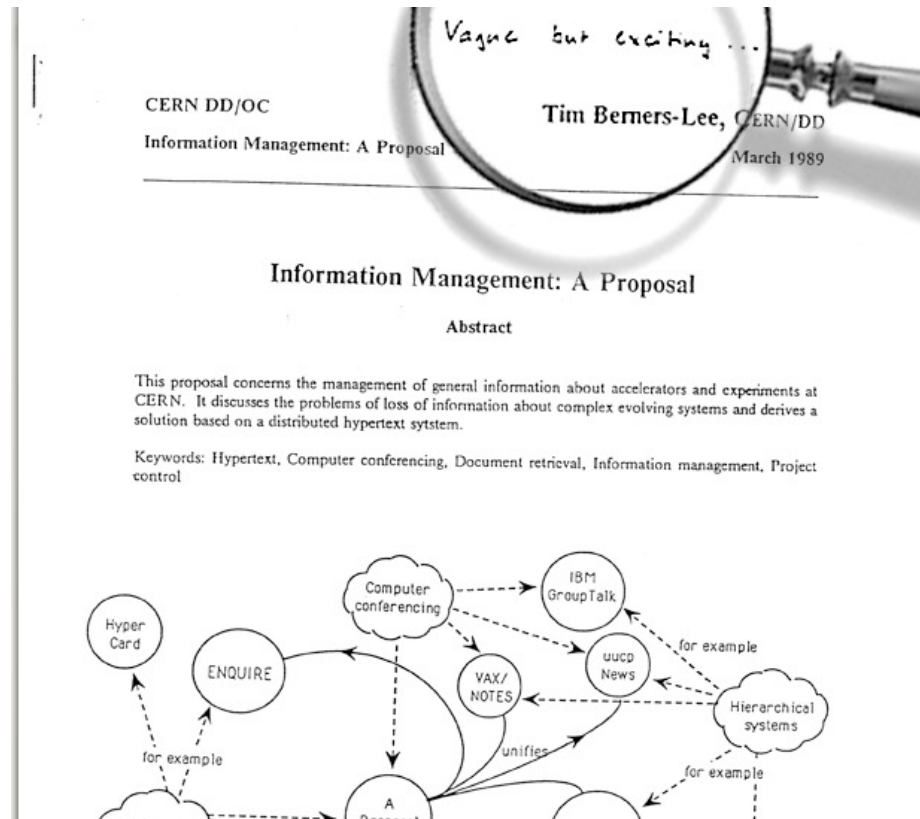
<https://www.eecs.harvard.edu/htk/phdadvice/>

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



newer model
↓

Participatory Design

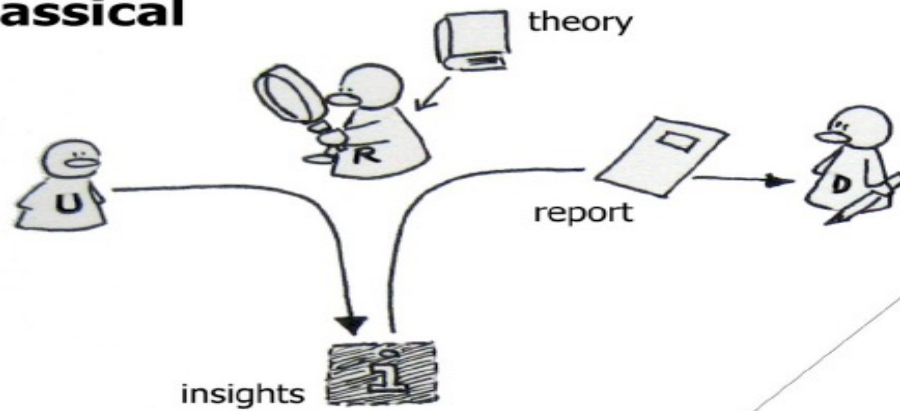
- User as partner
- User participates in the concept in the early phase of design
- User provides his expertise



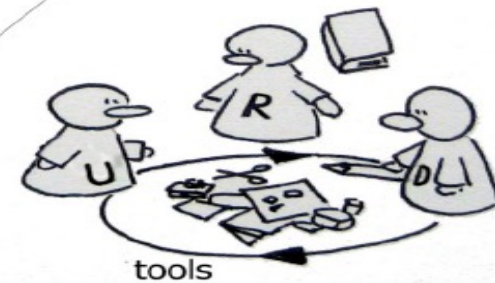
http://www.maketools.com/articles-papers/CoCreation_Sanders_Stappers_08_preprint.pdf

User-centric vs Participatory

classical

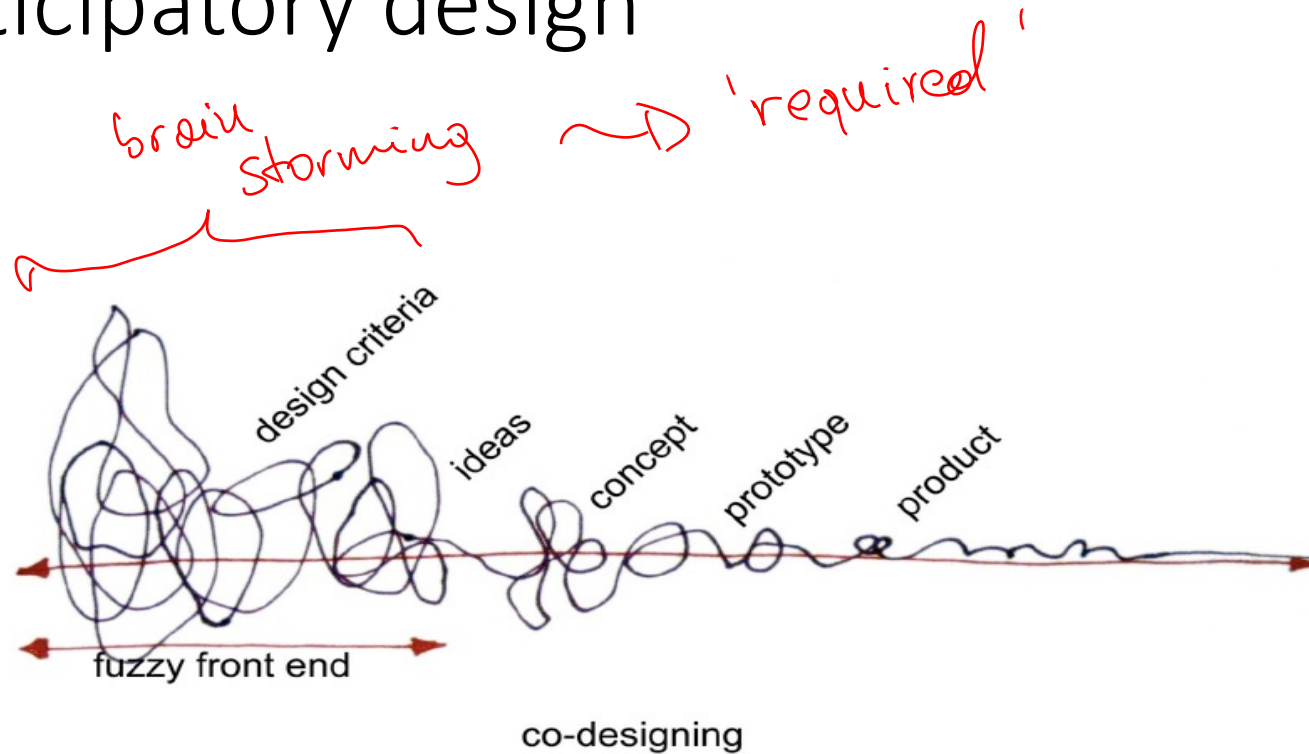


co-design



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

Participatory design



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

User-centric vs Participatory

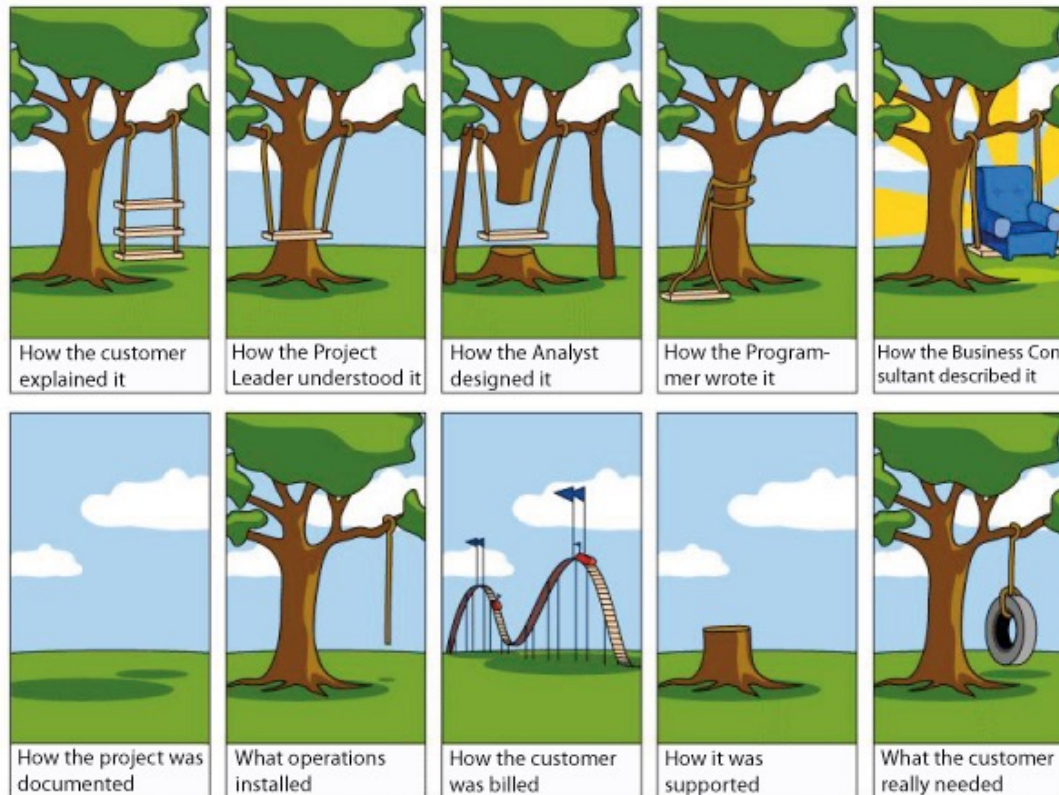
The traditional design disciplines focus on the designing of “products”. while the emerging design disciplines focus on designing for a purpose
visual communication design interior space design product design information design architecture planning	design for experiencing design for emotion design for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

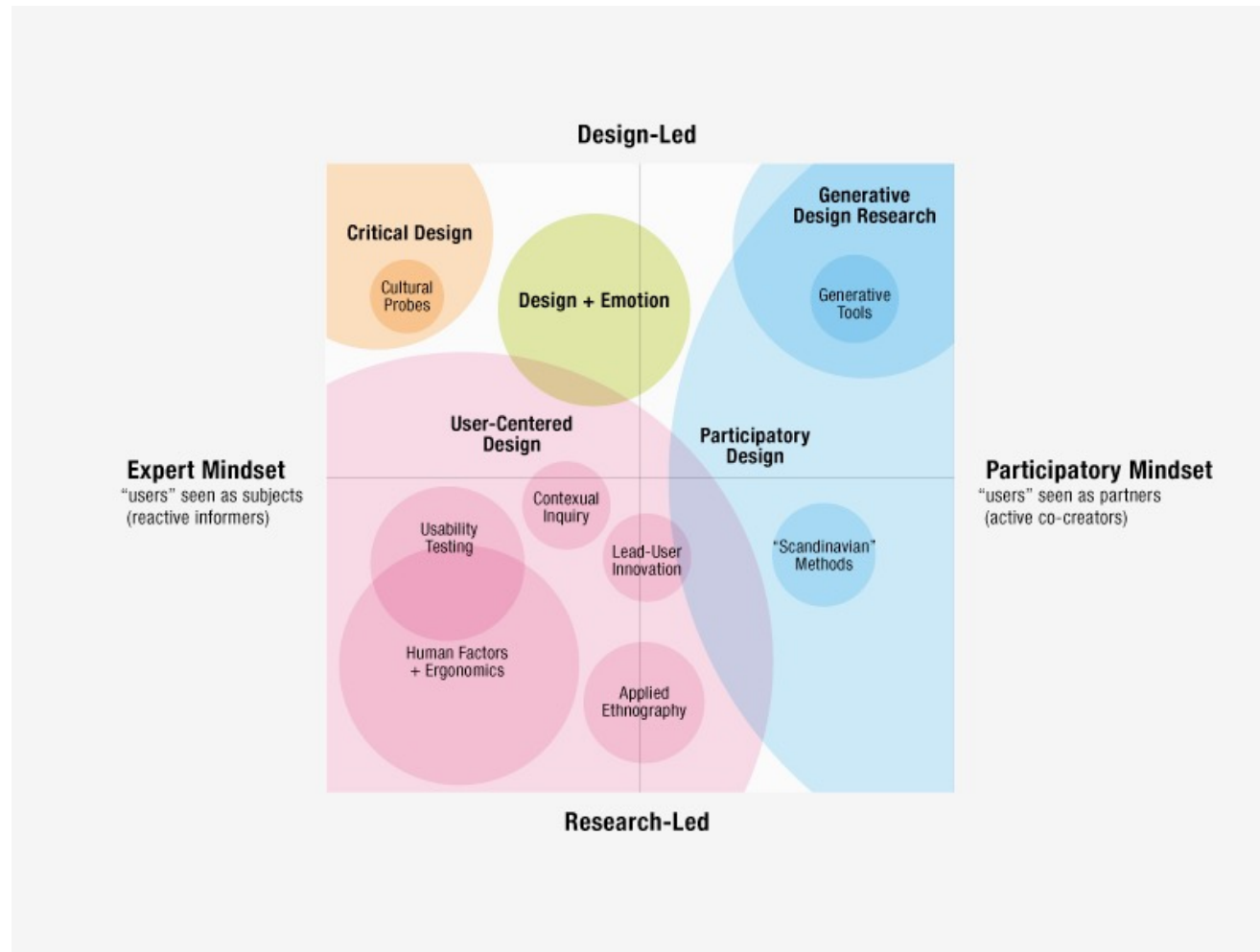
http://www.maketools.com/articles-papers/CoCreation_Sanders_Stappers_08_preprint.pdf

User-Centered Design

result with
User centered
approach

✗
better to have
the client in
the discussion





Participatory design

- No idea about the final result: *status open minded*
 - 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