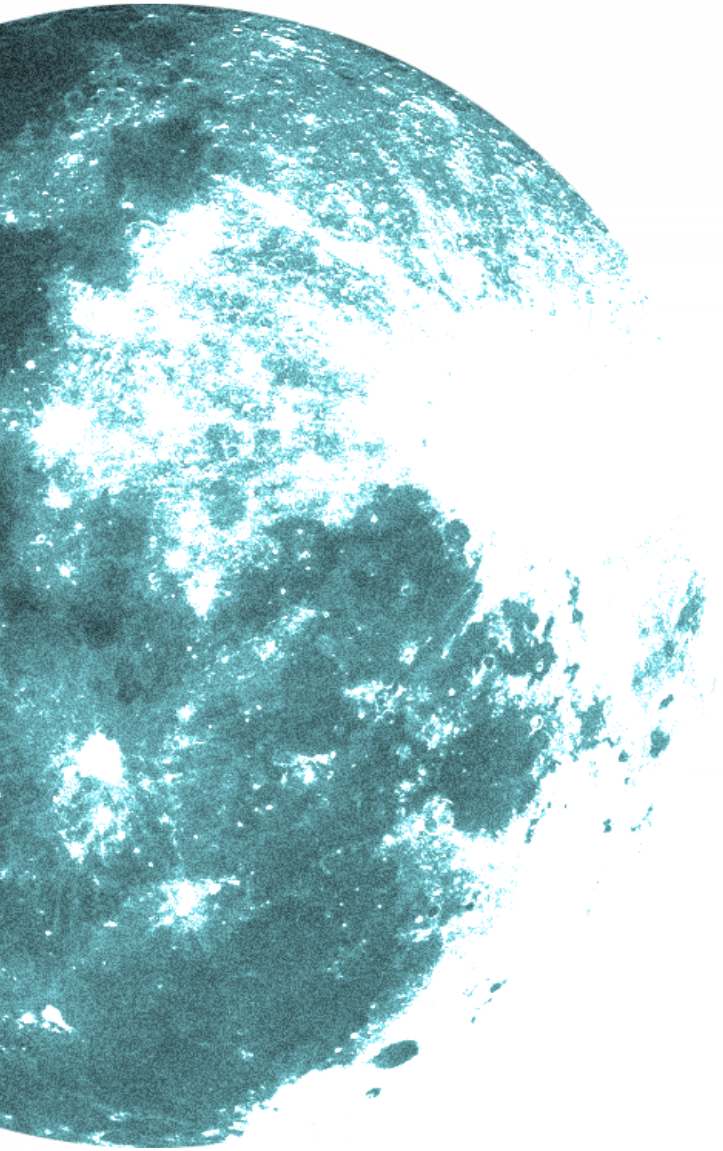


An Overview of Systems Architecting Approaches

SWISSED21, 06.09.2021

Anne-Marlene Rüede

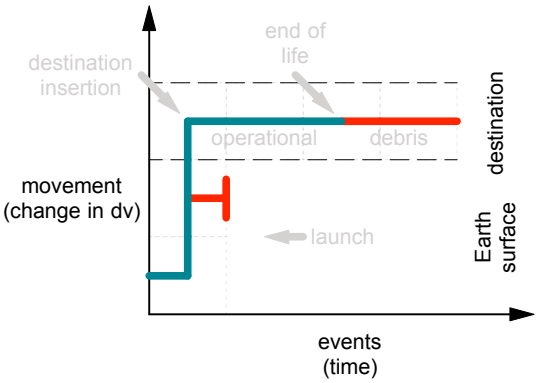
EPFL Space Center (eSpace)

Presentation

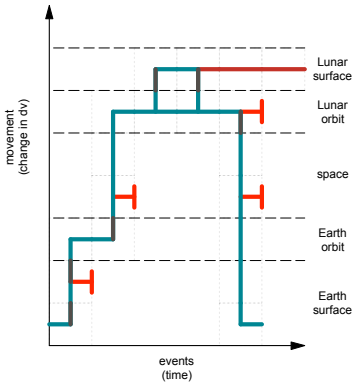
- Anne-Marlene Rüede
- Architecture & Space Technologies
- Doctoral Student
- eSpace (EPFL Space Center)
- Support Systems Design

Doctoral Research

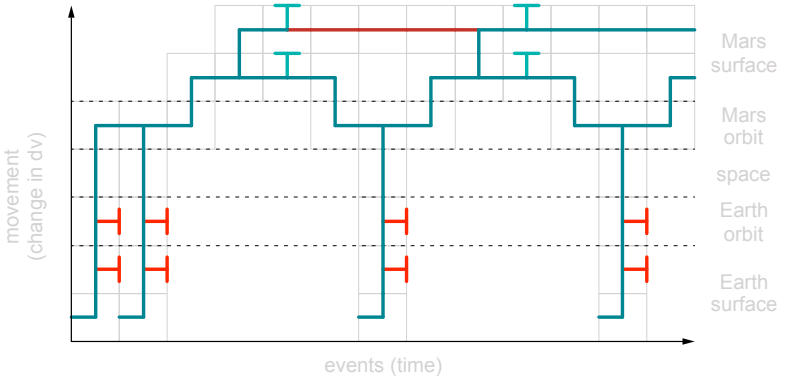
satellite

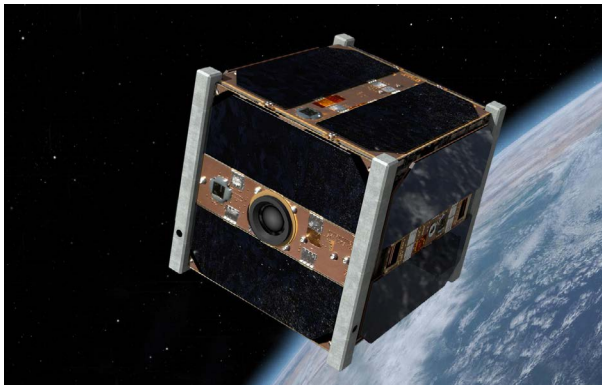


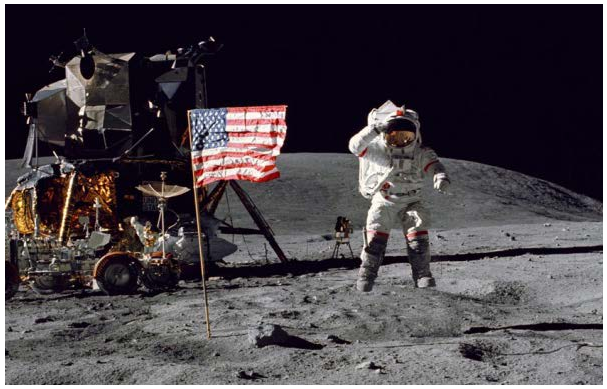
Moon landing

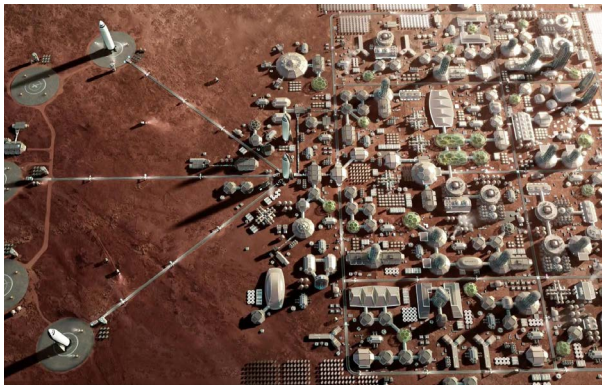


Mars Settlement









complexity

Objectives

- Compose overview of approaches used for Systems Architecting used by SWISSED/European Systems community:
  - Models & model languages (e.g. SysML, DSM/N2, FBD, IDEF0)
  - Tools (e.g. Cameo, Doors)
  - Methods (e.g. functional analysis, stakeholder mapping, morphological matrices)
  - Standards & processes (e.g. ISO 15288, ISO 16355)
  - Other (e.g. heuristics)

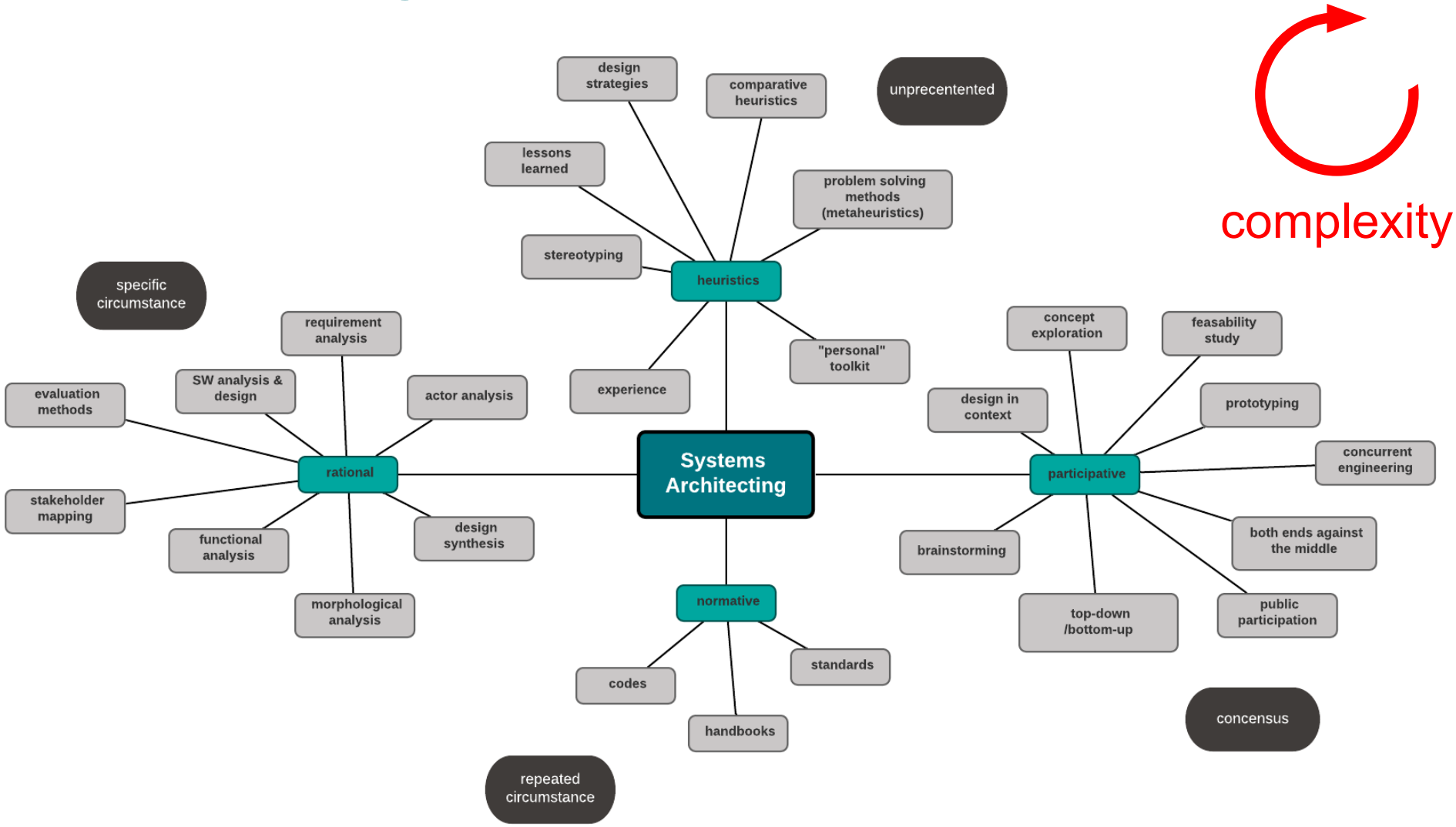
Scope

- Processes as diagrams, e.g.:
  - Model-Driven Software Development (MDSD)
  - Harmony
  - Functional Analysis Task Flow and Work Products
  - OOSEM
  - Integrated Approach to Design for Safety
  - Operations Research
  - Etc.

Methods

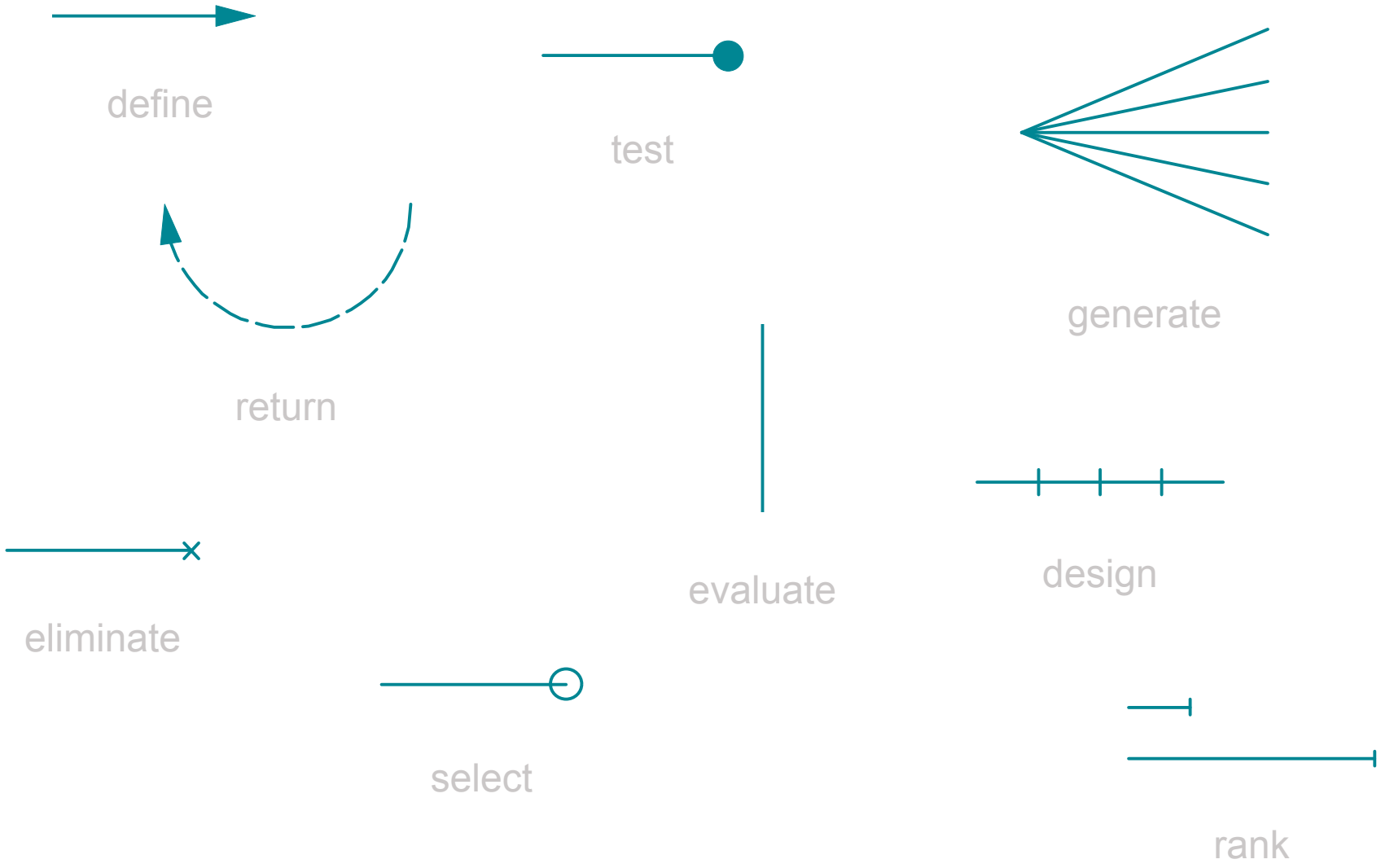
- Literature Review
- Methods Mapping
- Preliminary Conclusions
- Questions to the audience
- Responses integrated into distributed material

Systems Architecting



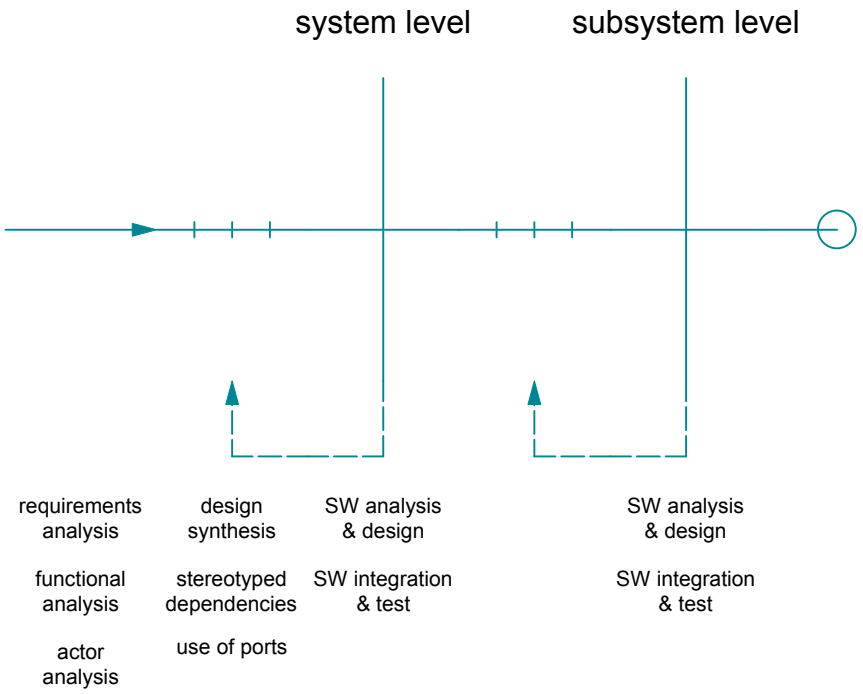
Four Most Important Methodologies, The Art of Systems Architecting, Rechtin, E. & Maier, M., 1997

Systems Engineering Elements

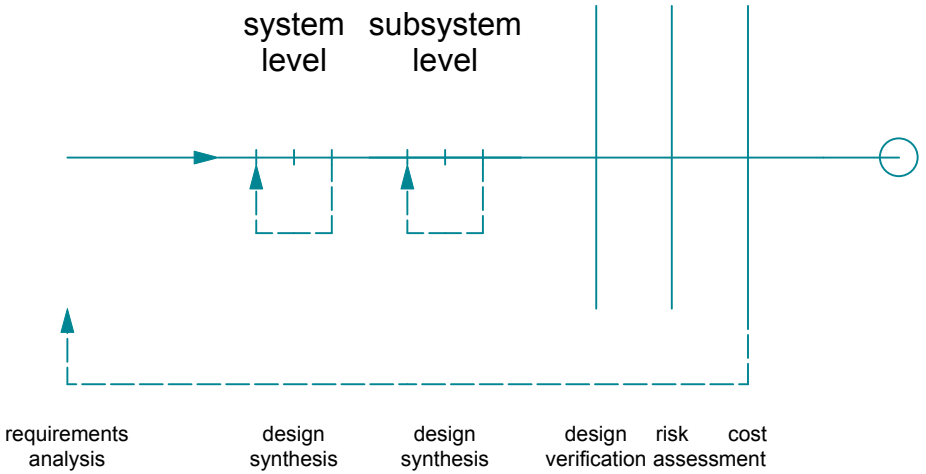


Processes Diagrams

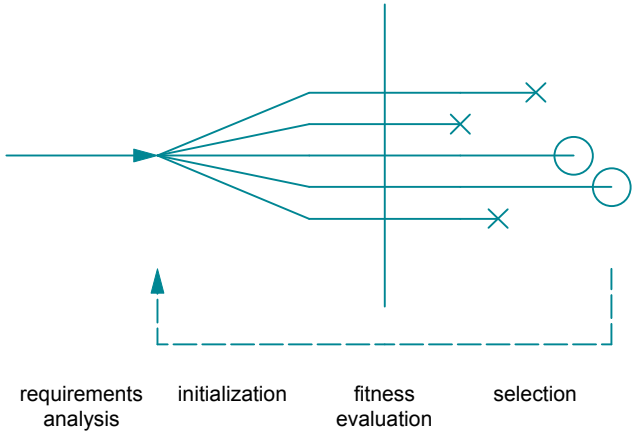
Harmony



ESA Concurrent Engineering



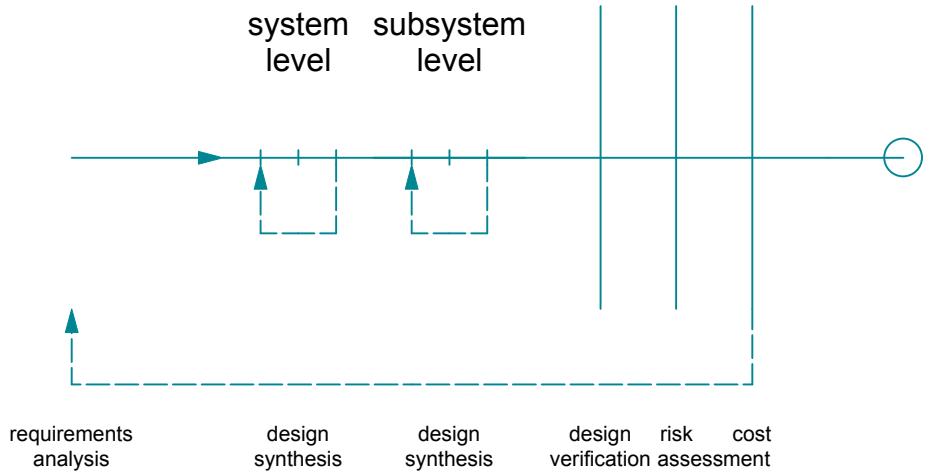
Genetic Algorithms



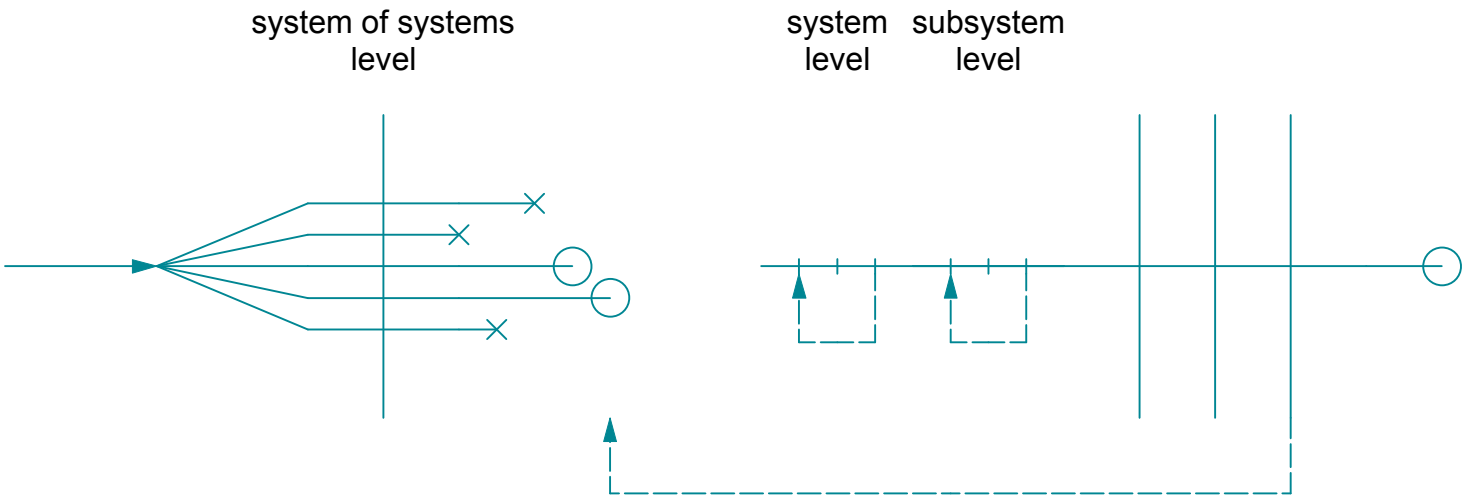
APPLICATION

+ concept level

ESA Concurrent Engineering



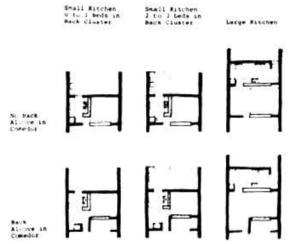
Application



Pattern Languages

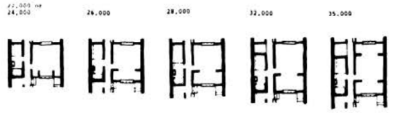
STEP 12: Kitchen and laundry

The arrangement of the kitchen is determined by the kitchen size (choice 4), by the presence or absence of a second family room alcove (step 10), and by the number of beds in the back cluster upstairs (choice 5). Draw according to table.



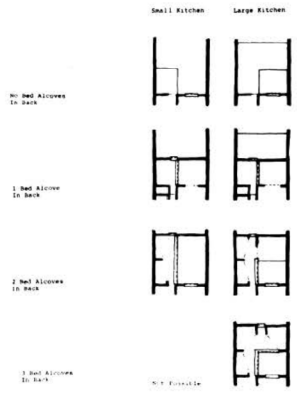
STEP 13: Master bedroom and bathroom layout

The layout of the master bedroom is given directly by the length of the family room below (step 10). Draw as shown.



STEP 14: Back cluster of bed alcoves

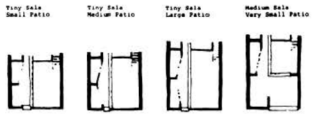
The layout of bed alcoves in the back cluster depends on the number chosen by the family (choice 5), and the kitchen size (step 12). Draw according to table.

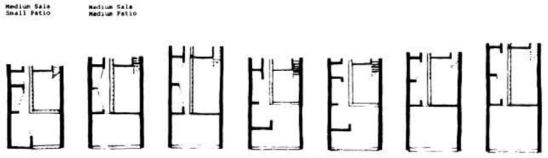


STEP 15: Front cluster of bed alcoves

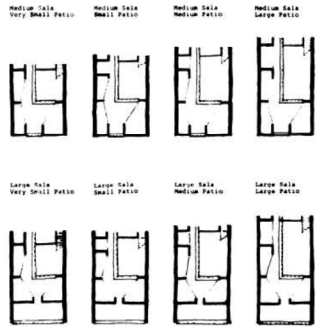
The layout of bed alcoves in the front cluster depends on the number chosen by the family (choice 5). Draw according to table.

Two front bed alcoves

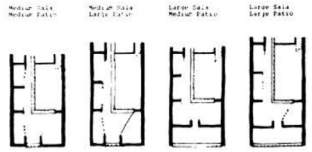




Three front bed alcoves



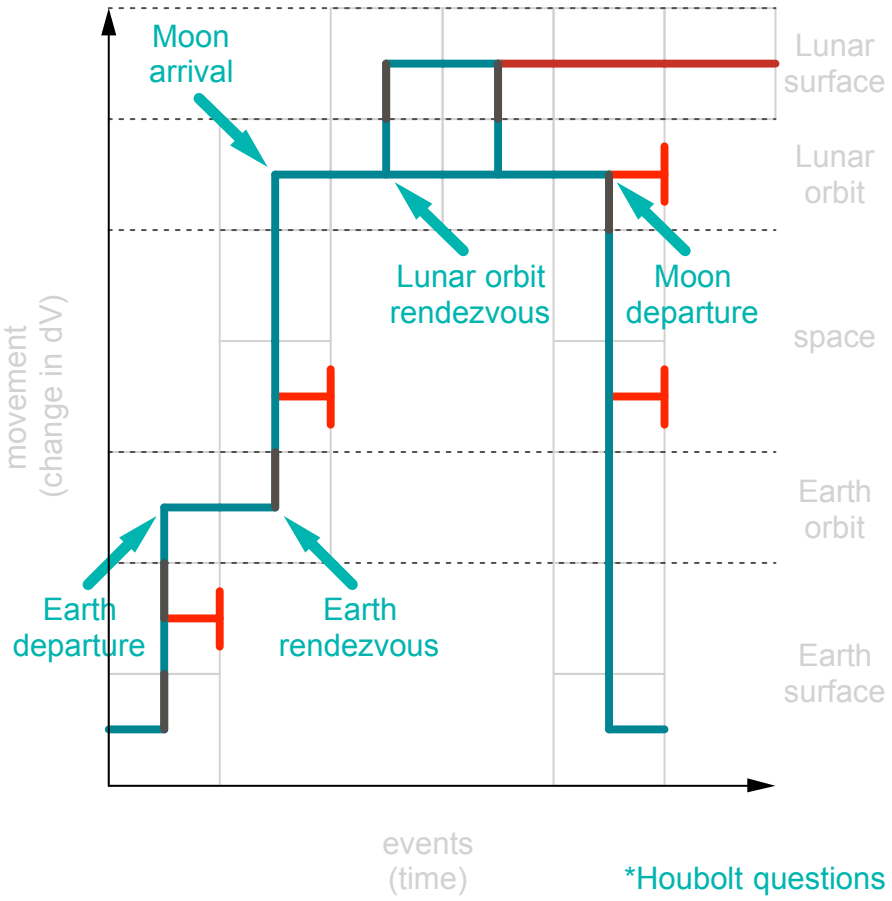
Four front bed alcoves



Houses Generated by Patterns, Christopher Alexander, 1970

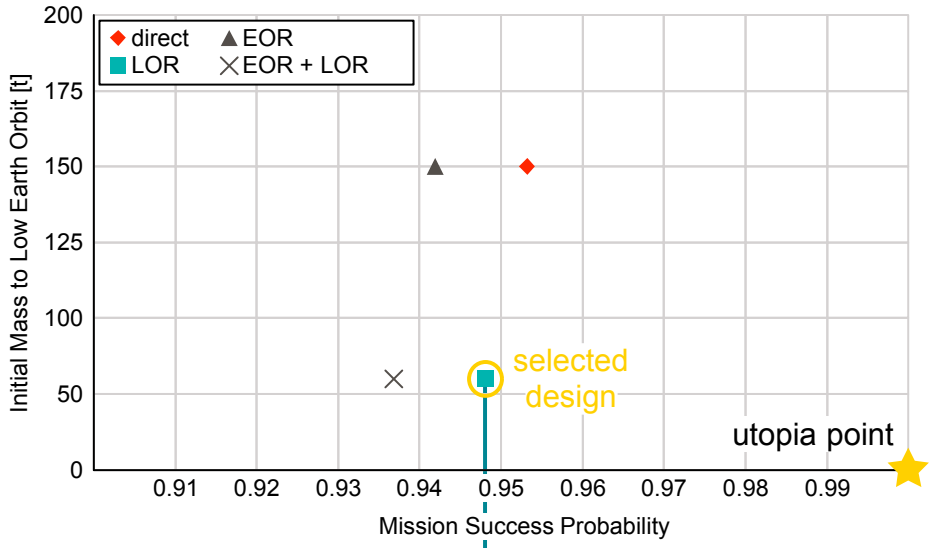
Doctoral Research

mission diagrams



*Houbolt questions

identification of candidates (e.g. risk vs. ImLEO)



Other characteristics

design

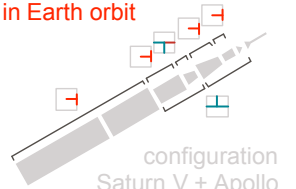
4x add stage(s)

1x add separable module
=> design for in-situ (dis)assembly

1x separable payload
=> design for in-situ repair

other

1x debris in Earth orbit

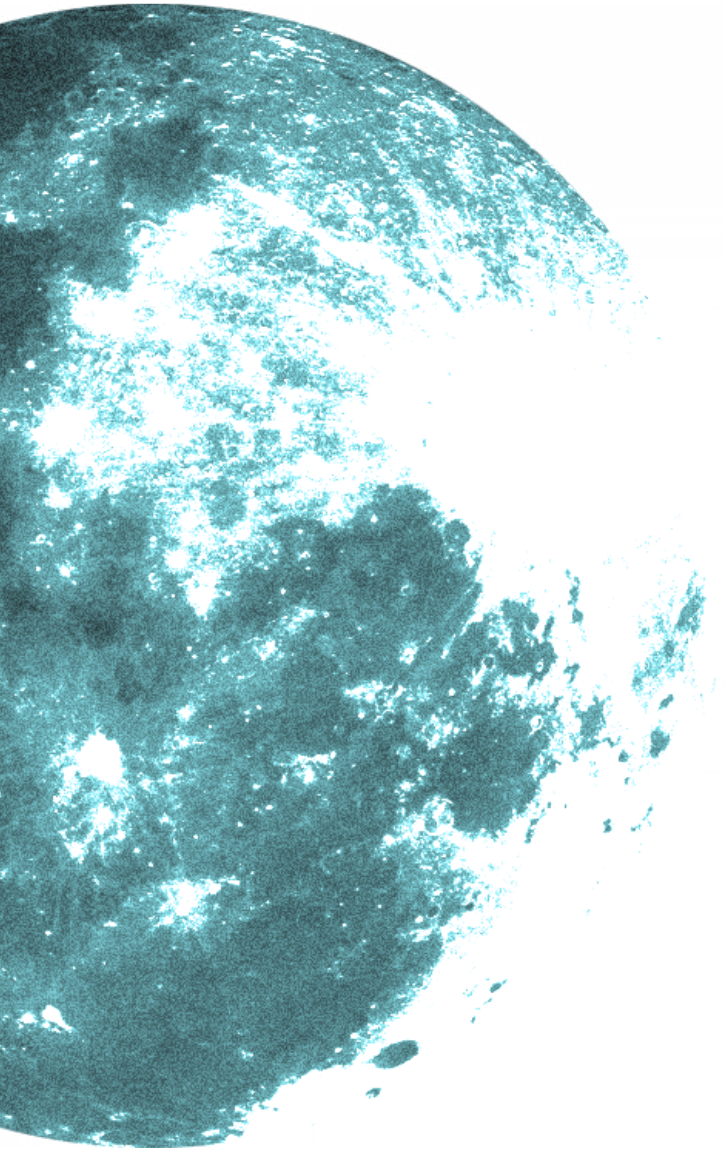


configuration
Saturn V + Apollo

Proof-of-Concept Study - Apollo missions, Rüede, A.-M.

Expected Outcomes

- Visibility of approaches that may be beneficial
- Understanding of strengths, weaknesses and typical usage of approaches
- Comparison of one's approach(es) with others



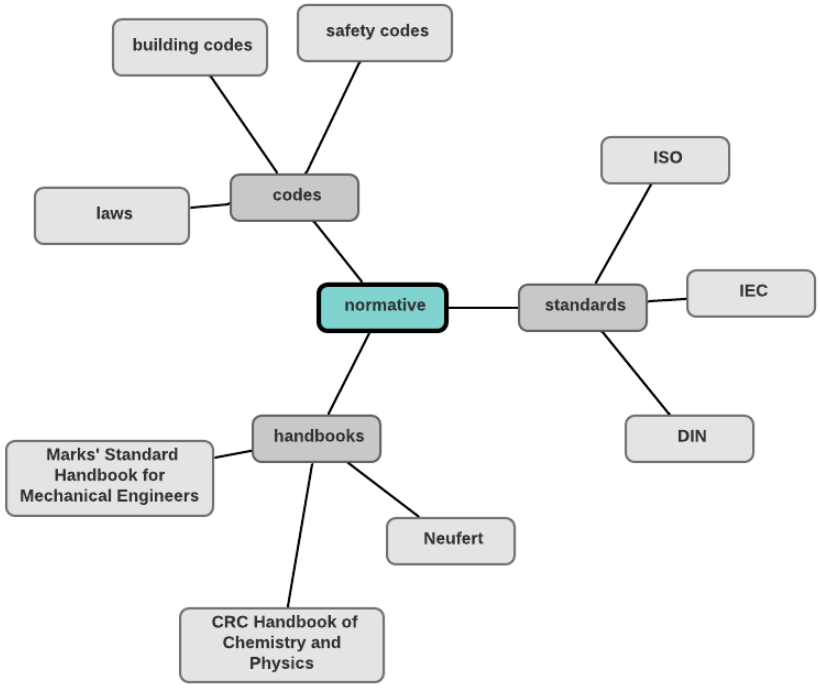
Questions

- Which factors do you consider when choosing methods?
- Which methods do you use?
- Which industry do you work in?

Thank you.

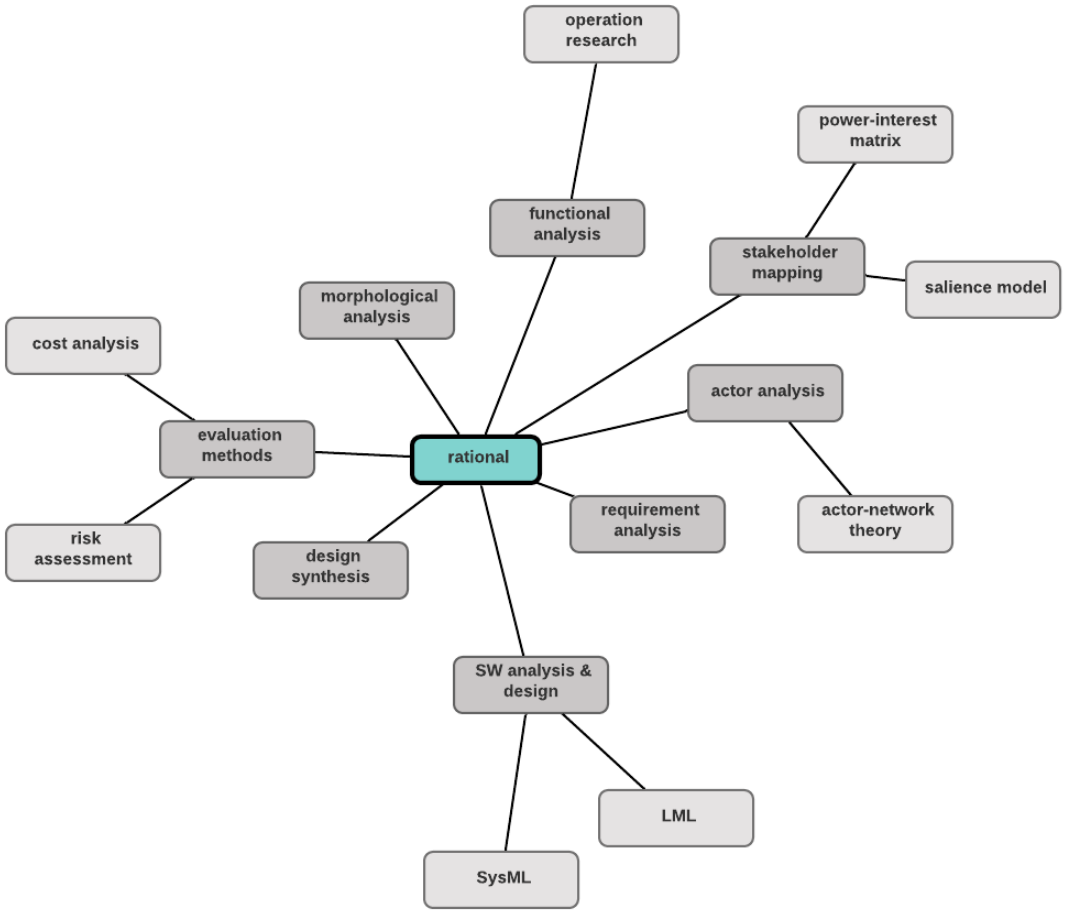
anne-marlene.ruede@epfl.ch

Normative Methods



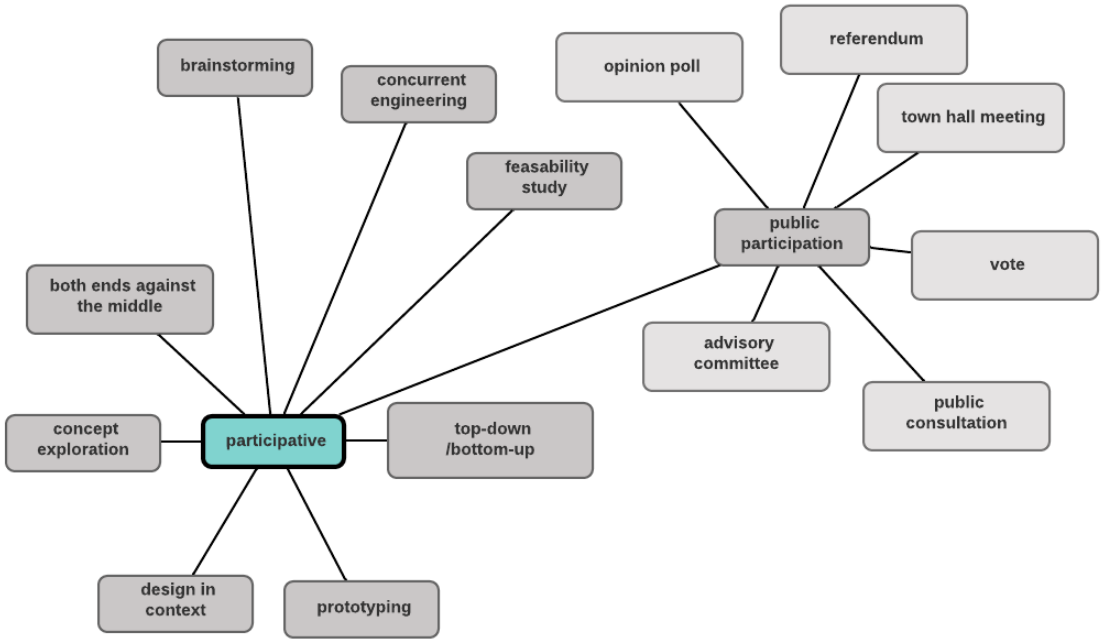
Additional Slide

Rational Methods



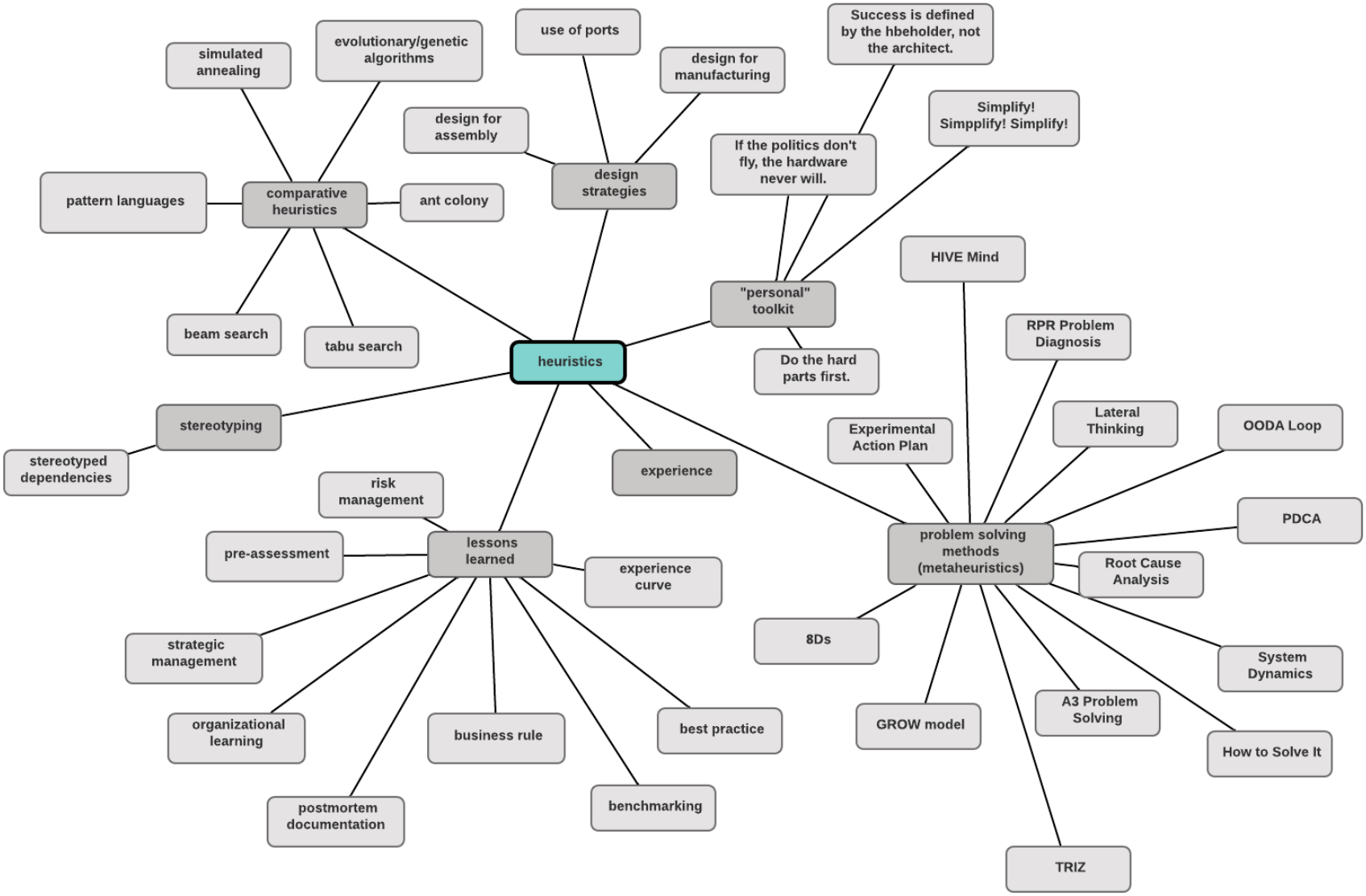
Additional Slide

Participative Methods



Additional Slide

Heuristic Methods



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