Institute of Information Management

University of St.Gallen

DT4RE: Design Thinking for RE

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20.08.2018

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TUM

Jennifer Hehn

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Research areas

- Design Thinking and Requirements Engineering
- Design Science Research

Falk Uebernickel

goo.gl/WmRyAu

Research areas

- Design Thinking and Human-centered Design for Information Systems
- Industry 4.0 / Internet of Things
- InsurTech
- Qualitative research

Daniel Méndez

www.mendezfe.org

Research areas

- Empirical software engineering w/ focus on:
  - Requirements Engineering
  - Software Process Models
  - Quality Management
- Interdisciplinary qualitative research

This session is based on...

- Previous tutorials given on either Design Thinking or Requirements Engineering
- Experiences made in projects

This tutorial will be about...

Scope

- Introduction into basic principles and methods for Design Thinking (DT)
- Sharing experiences and lessons learnt on using DT in context of RE
- Discuss synergies with RE and open research challenges

Out of Scope

- Out of the box solutions
- Universally applicable “blueprint”

Ground rule

Whenever you have questions / remarks,

please don’t ask Google, but

share them with the whole group.

Introduction - Who are you?

Quick round...

- Who are you?
- What are your experiences in Design Thinking
  in the context of software development projects/processes?

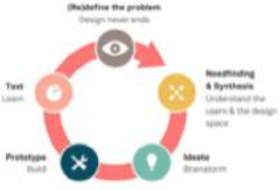
What do you know?

What is Design Thinking?

Same as with agile methods,
there are different perspectives on Design Thinking

Way of Doing

Process



(1) Define
(2) Needfinding
(3) Synthesis
(4) Ideate
(5) Prototype
(6) Test

Toolbox

Prototype

- lofi prototyping
- wireframing
- mockups
- 3D printing
- CAD Simulations
- Software programming
- Mechanical and electrical engineering
- Service Blueprinting
- Role plays
- Stories and Comics

Needfinding Synthesis

- Interviews
- Focus Groups
- Observation
- Diary Studies
- Customer Journeys
- Re-Framing Techniques
- Engaging

Way of Thinking

Mindset

Bias towards action

Radical Collaboration

Experimentation

Focus on human values

Iteration

What is Design Thinking (not)?

Design Thinking...

- … is a human-centered problem solving method that applies extensive user-research, rapid prototyping, iterative improvement cycles, and interdisciplinary team work

In contrast, Requirements Engineering

- is a holistic discipline with various principles, approaches and even more methods

Two faces of the same medal?

In Design Thinking, we often pretend that after building a high-resolution prototype, the rest is “just development”.

In RE, we often pretend that requirements are somehow present and “just need to be elicited”.

Issues in scope of current debates

When should we make use of Design Thinking?

How can we make use of Design Thinking?

How can we integrate Design Thinking and RE in a seamless manner?

Outline

1. Design Thinking in a Nutshell
   ☕
2. Design Thinking for Requirements Engineering
3. Final discussion and closure

Outline

1. **Design Thinking in a Nutshell**
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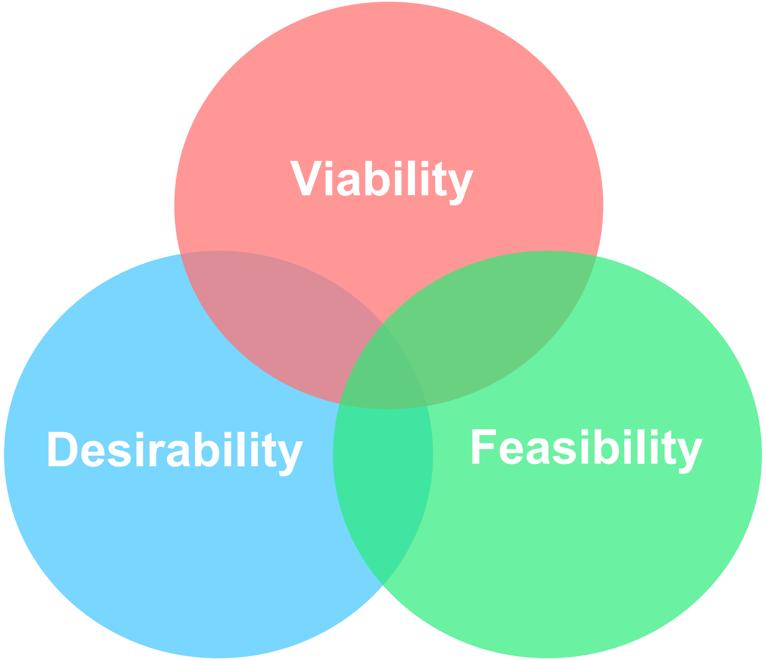
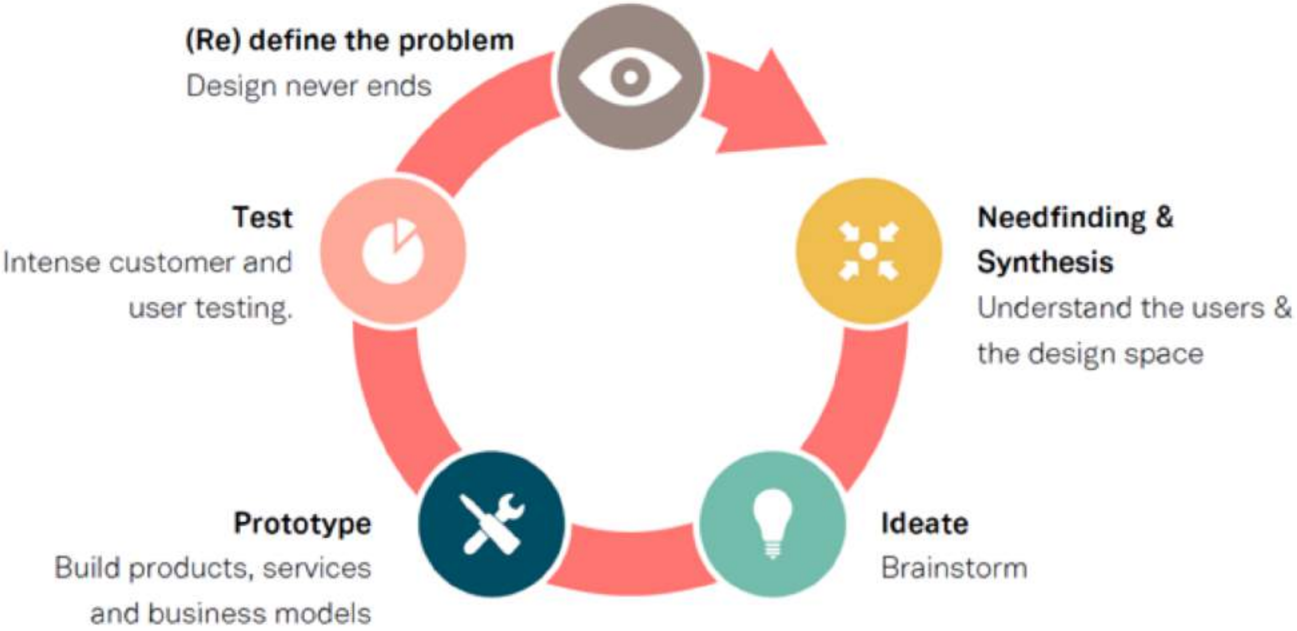
Design Thinking is a problem solving approach that starts with the human



Design Thinking is explorative and iterative



(Re) define the problem
Design never ends
Needfinding & Synthesis
Understand the users & the design space
Ideate
Brainstorm
Prototype
Build products, services and business models
Test
Intense customer and user testing.

Define the problem.

Needfinding
Empathize.

Interviewing and self-immersion in Kenya (Photographer: Falk Uebernickel)

In Needfinding we apply three methods

Observe

Immerse

Ask

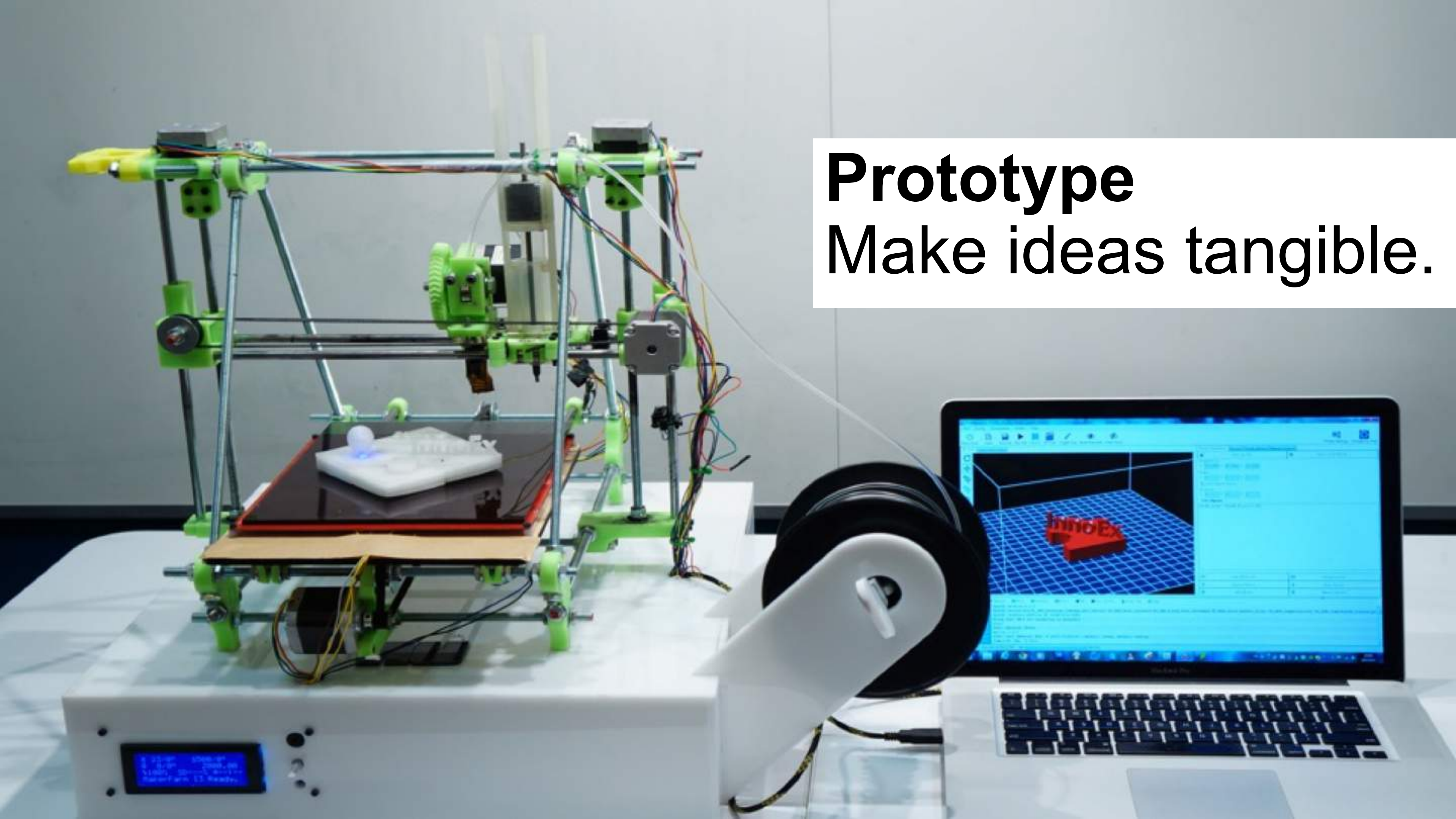
Synthesis

Make sense.

Pictures: project for an insurance company (2017)

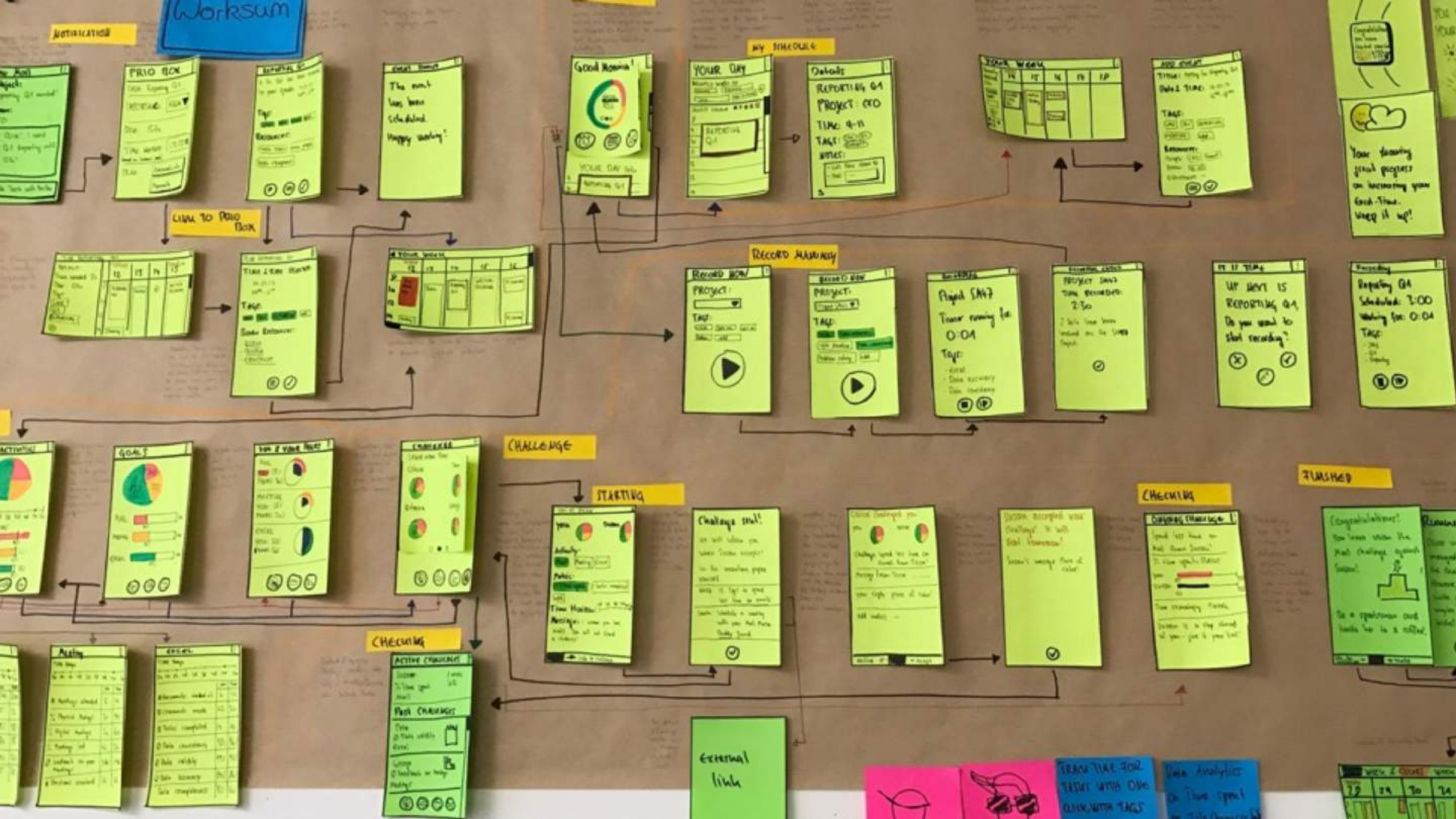
Ideate

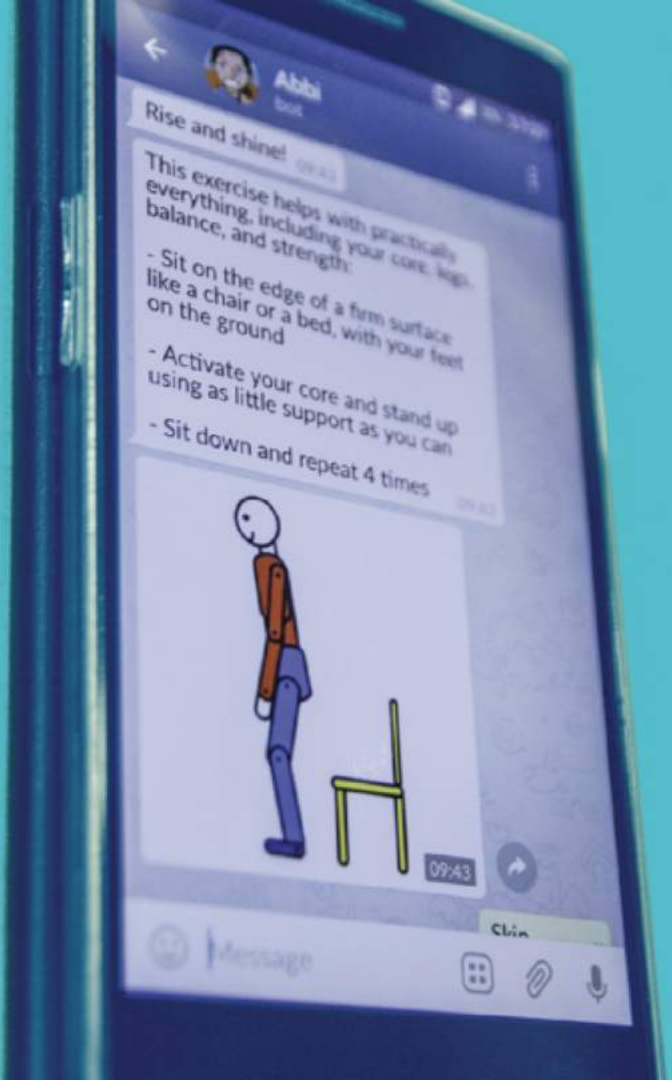
Generate ideas.



Prototype
Make ideas tangible.

Norway
Explore 300+ Lines
barcelona
Suggestions
Barcelona
Spain
Barcelona


Worksum
NOTIFICATION
PRIO BOX
The event has been scheduled. Happy working!
Good Morning!
YOUR DAY
MY SCHEDULE
Details
REPORTING Q4
PROJECT: CFO
TIME: 9-11
TAGS:
NOTES:
YOUR WEEK
ADD EVENT
Your showing great progress on increasing your Good-Time. Keep it up!
LINK TO PRIO BOX
RECORD MANUALLY
RECORD NOW
PROJECT:
TAGS:
Project SA47
Timer running for 0:01
Tags:
UP NEXT IS REPORTING Q4. Do you want to start recording?
Reporting Q4
Scheduled: 2:00
Working for: 0:04
GOALS
CHALLENGE
STARTING
Challenge send!
CHECKING
FINISHED
Congratulations!
ACTIVE CHALLENGES
PAST CHALLENGES
External link
TRACK TIME FOR TASKS WITH ONE CLICK, WITH TAGS
Data Analytics on Time spent



Rise and shine! 09:43

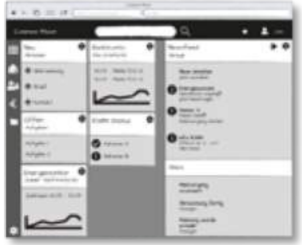
This exercise helps with practically everything, including your core, legs, balance, and strength:

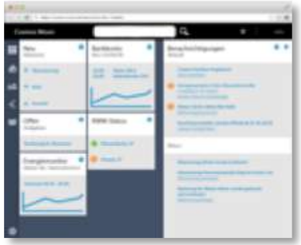
- Sit on the edge of a firm surface like a chair or a bed, with your feet on the ground
- Activate your core and stand up using as little support as you can
- Sit down and repeat 4 times

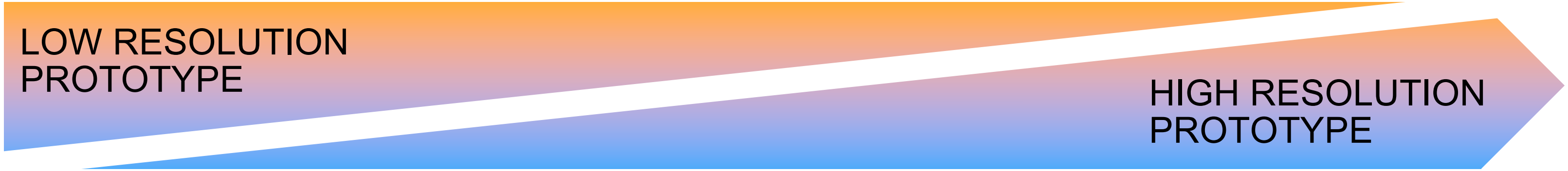
09:43

09:43

The outcome of a Design Thinking project is one or more tested prototypes







LOW RESOLUTION PROTOTYPE

HIGH RESOLUTION PROTOTYPE

Simple and easy to handle prototypes
Quickly created
Focus is on few features / critical functions
Costs: low

Complex simulations and prototypes of the future product, service or process and business model
All important functions are implemented
Costs: higher

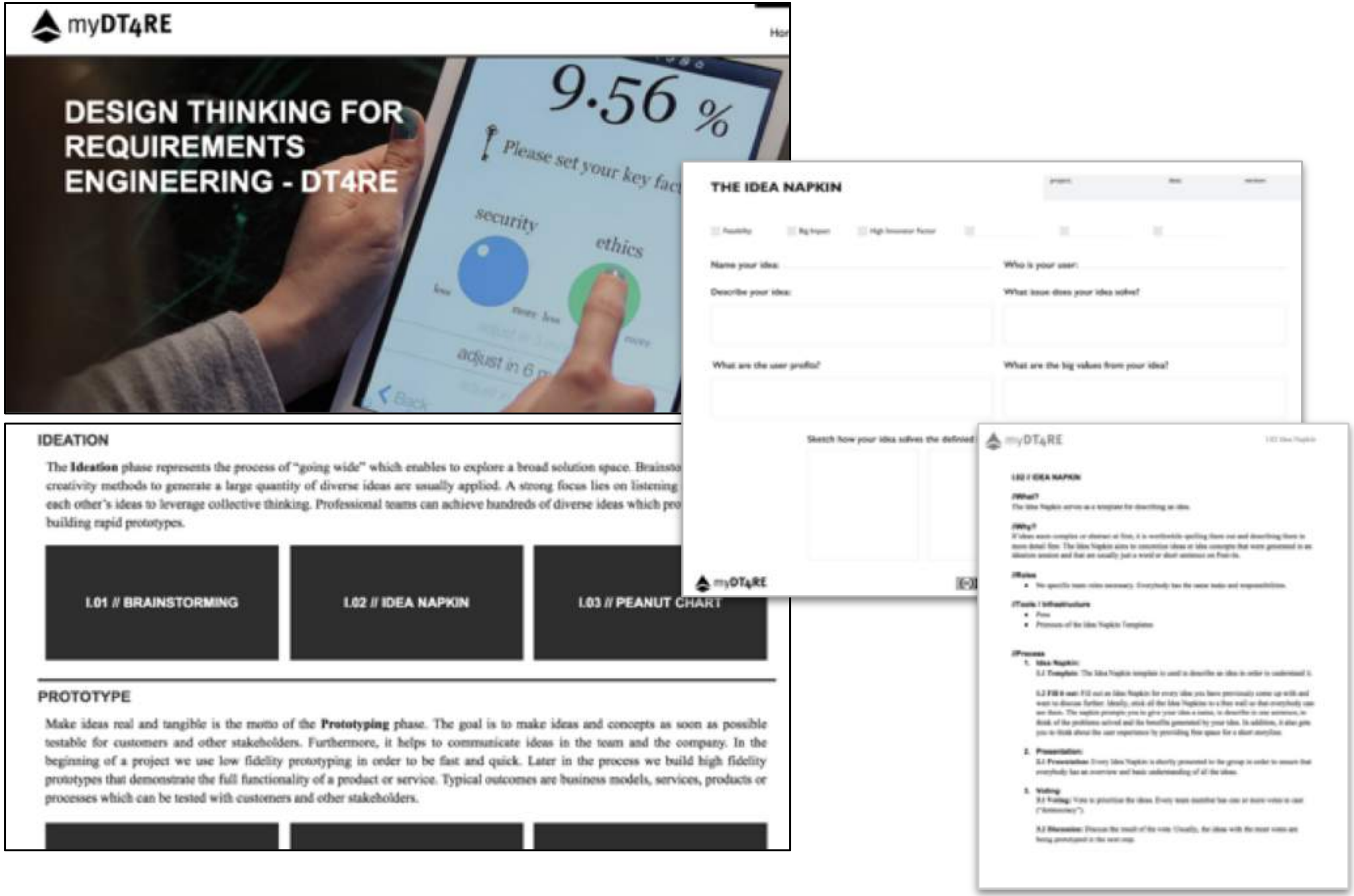
Test

Collect feedback.

(Re-)define
Iterate.

Toolbox

https://www.dt4re.org/



myDT4RE

DESIGN THINKING FOR REQUIREMENTS ENGINEERING - DT4RE

IDEATION

The **Ideation** phase represents the process of "going wide" which enables to explore a broad solution space. Brainsto creativity methods to generate a large quantity of diverse ideas are usually applied. A strong focus lies on listening each other's ideas to leverage collective thinking. Professional teams can achieve hundreds of diverse ideas which pro building rapid prototypes.

I.01 // BRAINSTORMING

I.02 // IDEA NAPKIN

I.03 // PEANUT CHART

PROTOTYPE

Make ideas real and tangible is the motto of the **Prototyping** phase. The goal is to make ideas and concepts as soon as possible testable for customers and other stakeholders. Furthermore, it helps to communicate ideas in the team and the company. In the beginning of a project we use low fidelity prototyping in order to be fast and quick. Later in the process we build high fidelity prototypes that demonstrate the full functionality of a product or service. Typical outcomes are business models, services, products or processes which can be tested with customers and other stakeholders.

THE IDEA NAPKIN

project: date: version:

□ Feasibility □ Big Impact □ High Innovation Factor □ □ □

Name your idea:

Who is your user:

Describe your idea:

What issue does your idea solve?

What are the user profile?

What are the big values from your idea?

Sketch how your idea solves the defined

myDT4RE

myDT4RE

I.02 Idea Napkin

I.02 // IDEA NAPKIN

//What?

The Idea Napkin serves as a template for describing an idea.

//Why?

If ideas seem complex or abstract at first, it is worthwhile spelling them out and describing them in more detail first. The Idea Napkin aims to concretize ideas or idea concepts that were generated in an ideation session and that are usually just a word or short sentence on Post-Its.

//Roles

- No specific team roles necessary. Everybody has the same tasks and responsibilities.

//Tools / Infrastructure

- Pens
- Printouts of the Idea Napkin Templates

//Process

1. **Idea Napkin:**
   1.1 **Template:** The Idea Napkin template is used to describe an idea in order to understand it.

   1.2 **Fill it out:** Fill out an Idea Napkin for every idea you have previously come up with and want to discuss further. Ideally, stick all the Idea Napkins to a free wall so that everybody can see them. The napkin prompts you to give your idea a name, to describe it one sentence, to think of the problems solved and the benefits generated by your idea. In addition, it also gets you to think about the user experience by providing free space for a short storyline.
2. **Presentation:**
   2.1 **Presentation:** Every Idea Napkin is shortly presented to the group in order to ensure that everybody has an overview and basic understanding of all the ideas.
3. **Voting:**
   3.1 **Voting:** Vote to prioritize the ideas. Every team member has one or more votes to cast ("democracy").

   3.2 **Discussion:** Discuss the result of the vote. Usually, the ideas with the most votes are being prototyped in the next step.

People and Making are the heart of Design Thinking

Principles

See the human behind the user

Picture: FIFA Project (DT@HSG 2012/13)

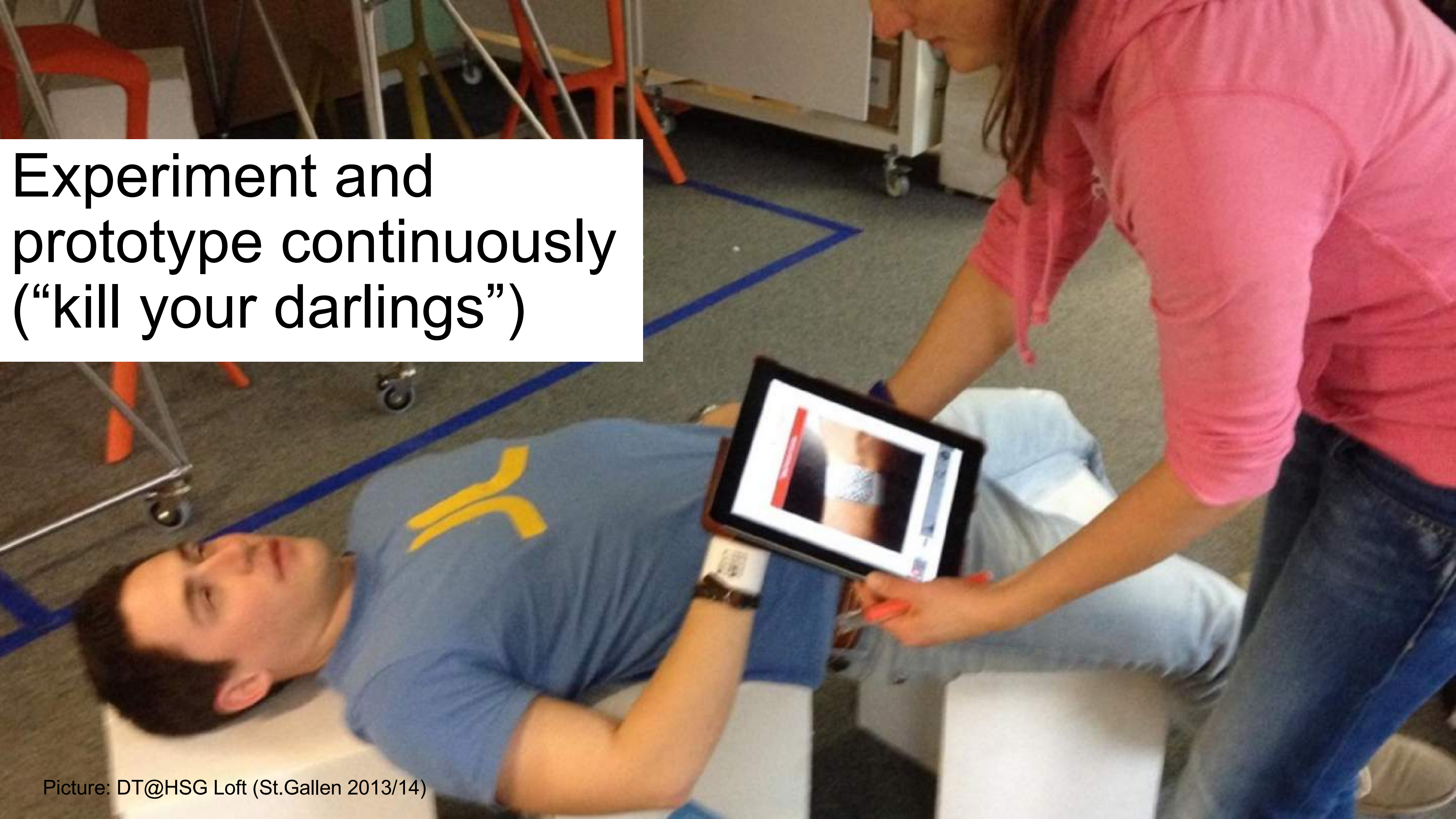
Do not stop at your corporate doors

Picture: DT@HSG (2016)

Making instead of over-thinking

Picture: Stanford ME310 Loft

Experiment and prototype continuously ("kill your darlings")



Picture: DT@HSG Loft (St.Gallen 2013/14)

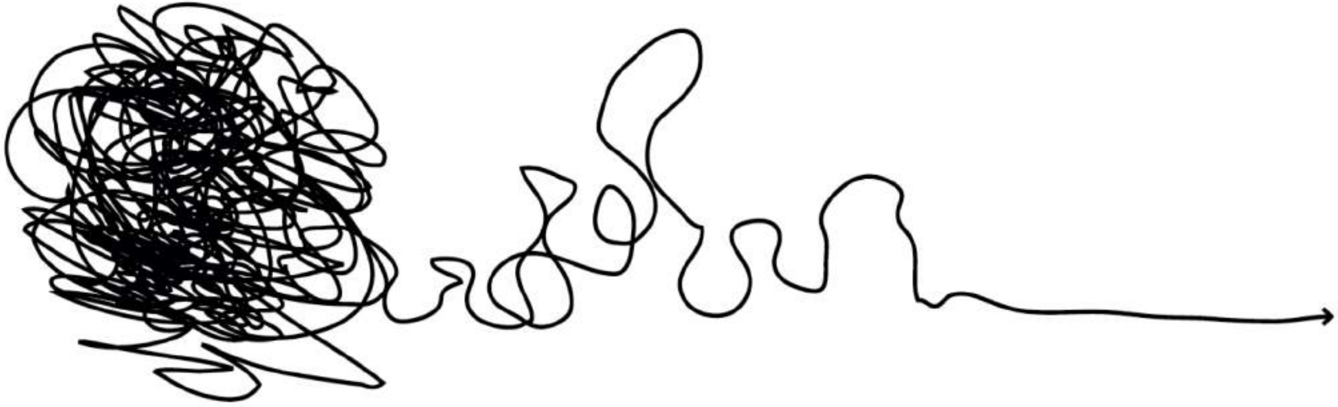
Field testing even in early project phases (”fail forward”)

Picture: DT@HSG (2013/14)

Shape your view with interdisciplinary teams

Picture: DT@HSG (2013)

Design Thinking transforms wicked into ill- and well-defined problems



Outline

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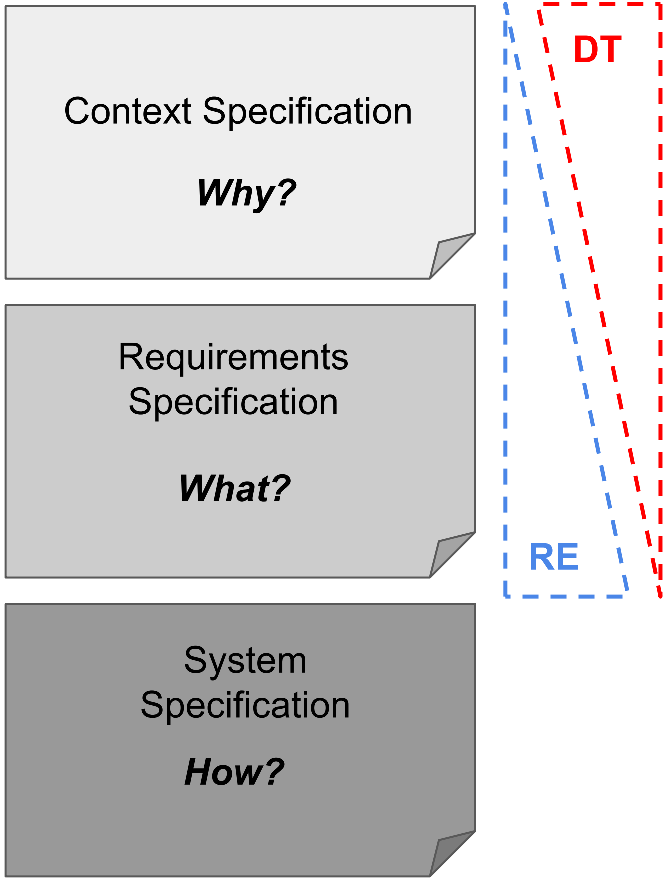
Cross Comparison

DT largely concentrates on **identifying/empathising with the stakeholders and end-users**, and understanding the domain and problem space to enable distilling needs and requirements.

RE typically concentrates on **subsequent requirements elicitation, analysis, and documentation**



Source: Artefact-based Requirements Engineering: The AMDiRE Approach - https://arxiv.org/abs/1611.10024

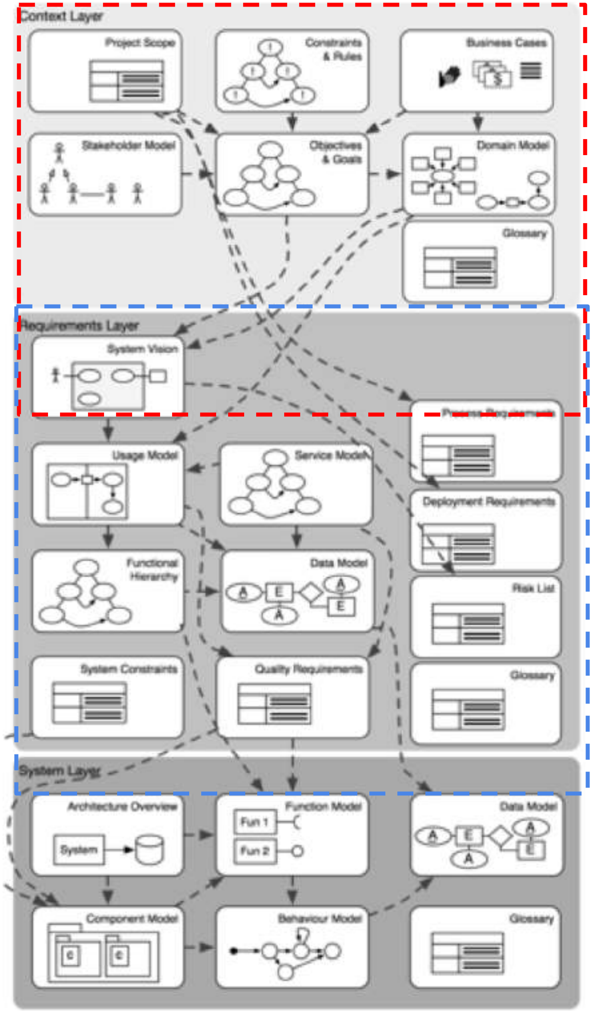
Cross Comparison

DT largely concentrates on...

- … better understanding the problem space by identifying and empathising with stakeholders
- … providing a system vision by defining key (functional) features
- … the rationale for (“formal”) requirements

RE largely concentrates on…

- … identifying, analysing/refining, and specifying/modelling requirements going beyond functional ones



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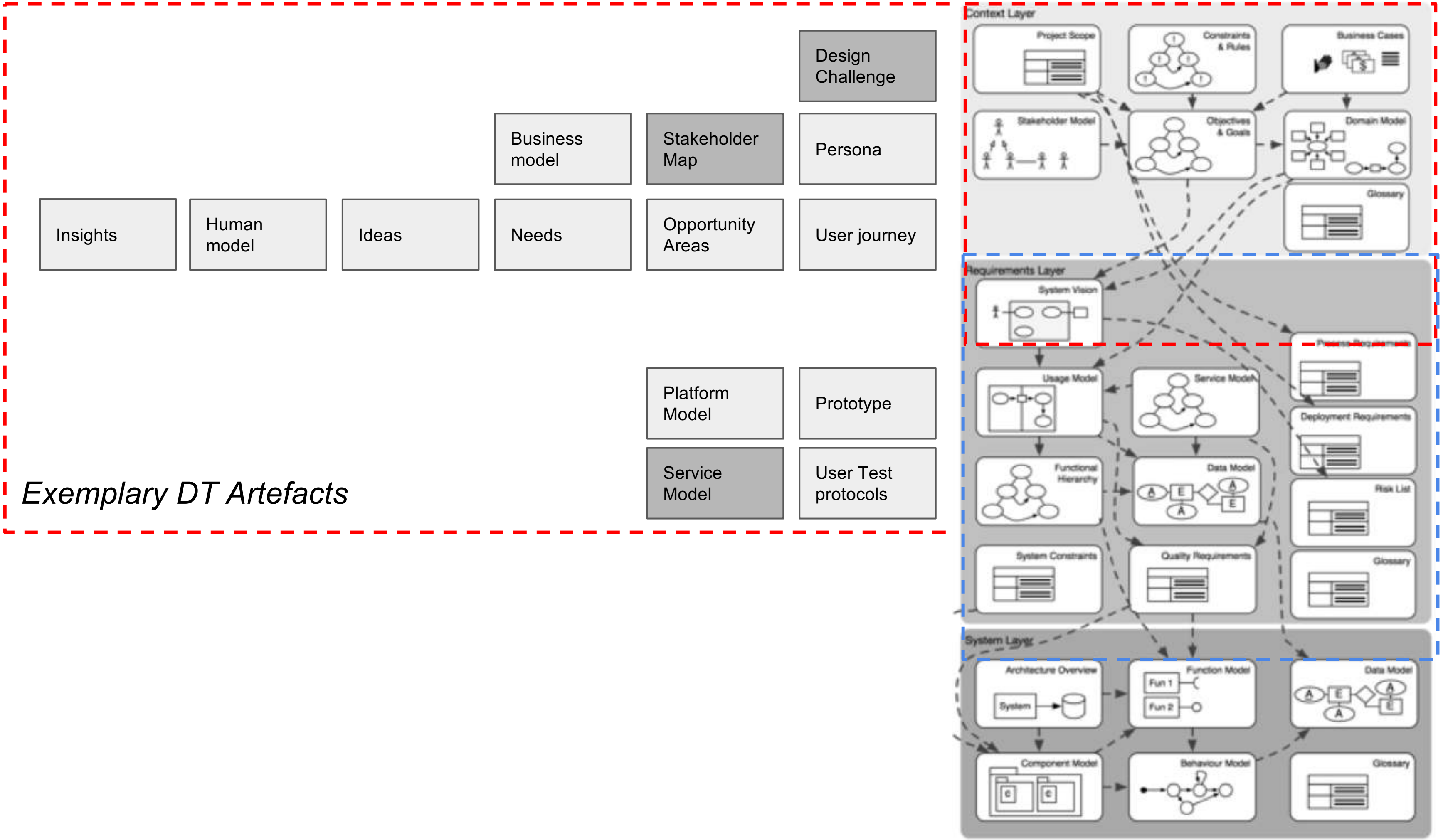


Design Challenge

Business model

Stakeholder Map

Persona

Insights

Human model

Ideas

Needs

Opportunity Areas

User journey

Platform Model

Prototype

Service Model

User Test protocols

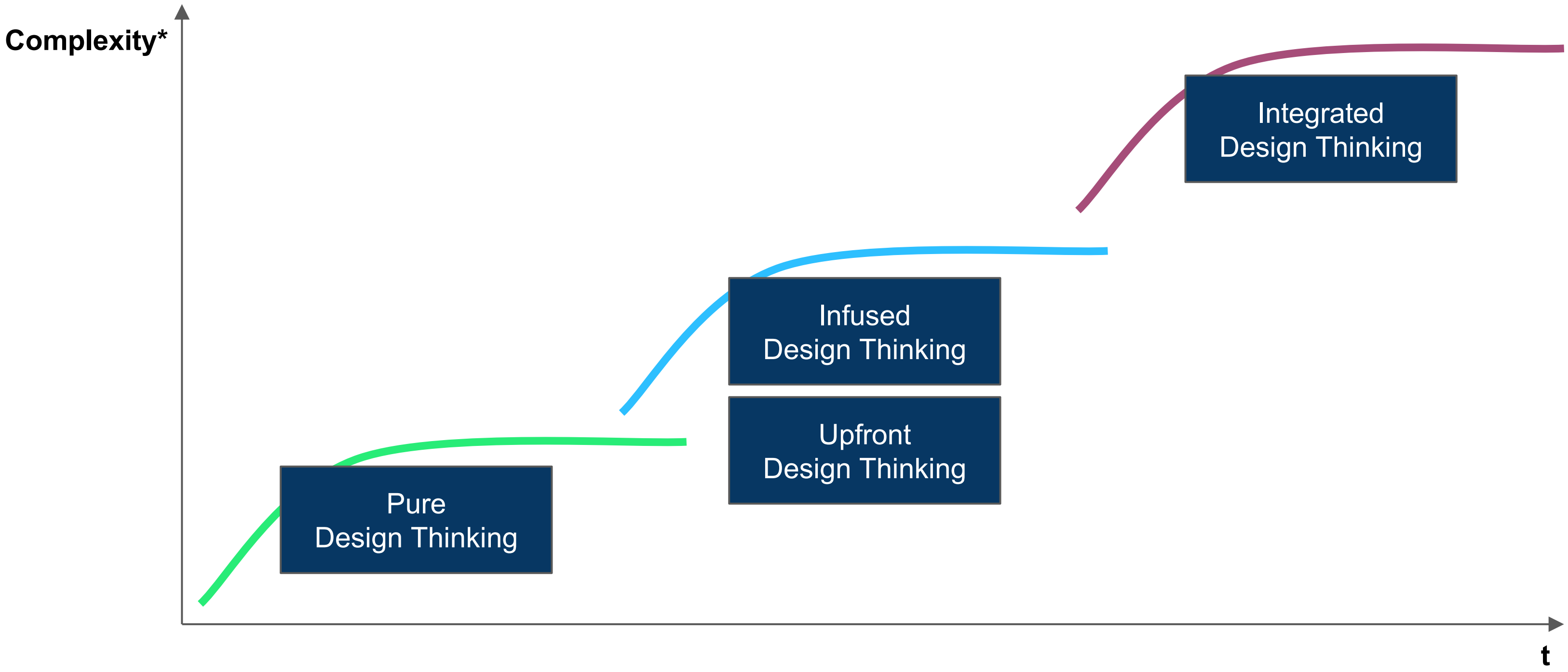
Exemplary DT Artefacts

Source: Artefact-based Requirements Engineering: The AMDiRE Approach - https://arxiv.org/abs/1611.10024

Disclaimer

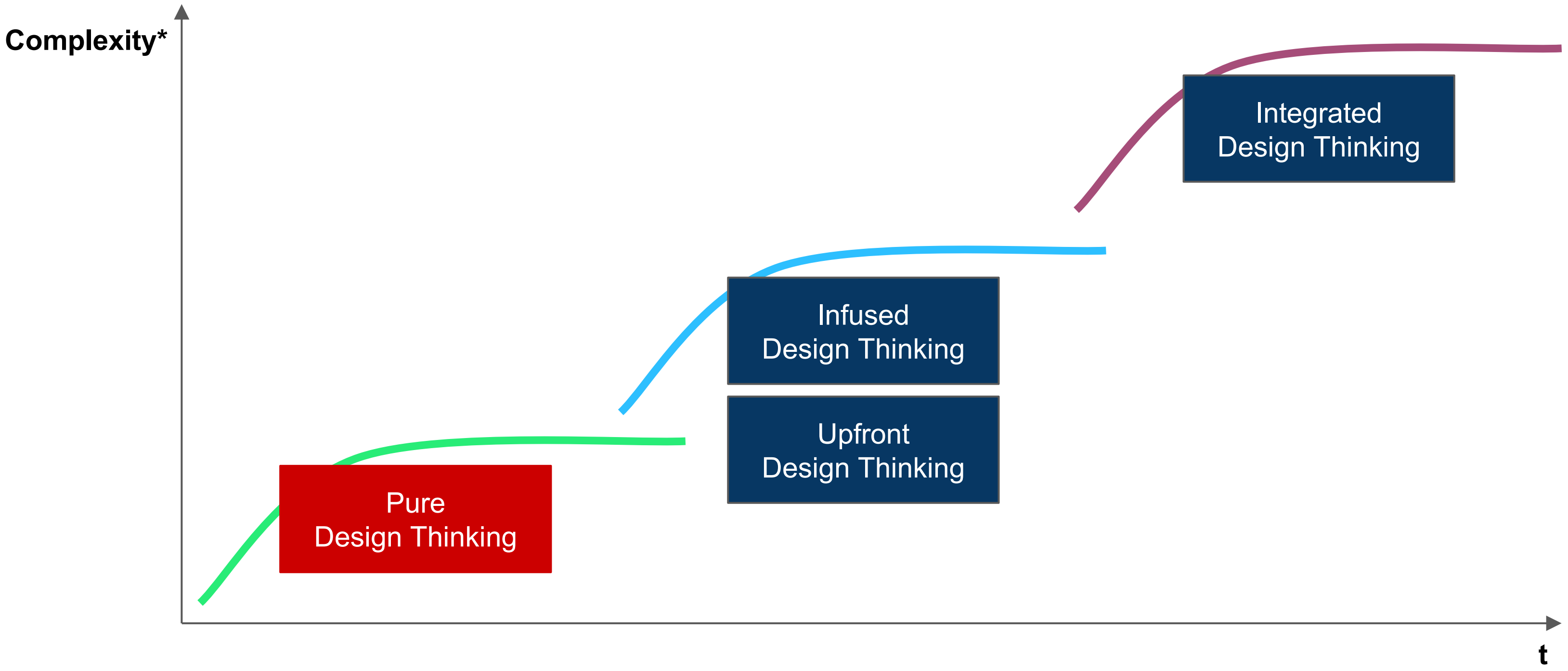
… but many lessons learnt

Evolution of Design Thinking and RE



* Note: one is not per-se “better” than the other; everything has its place

Evolution of Design Thinking and RE



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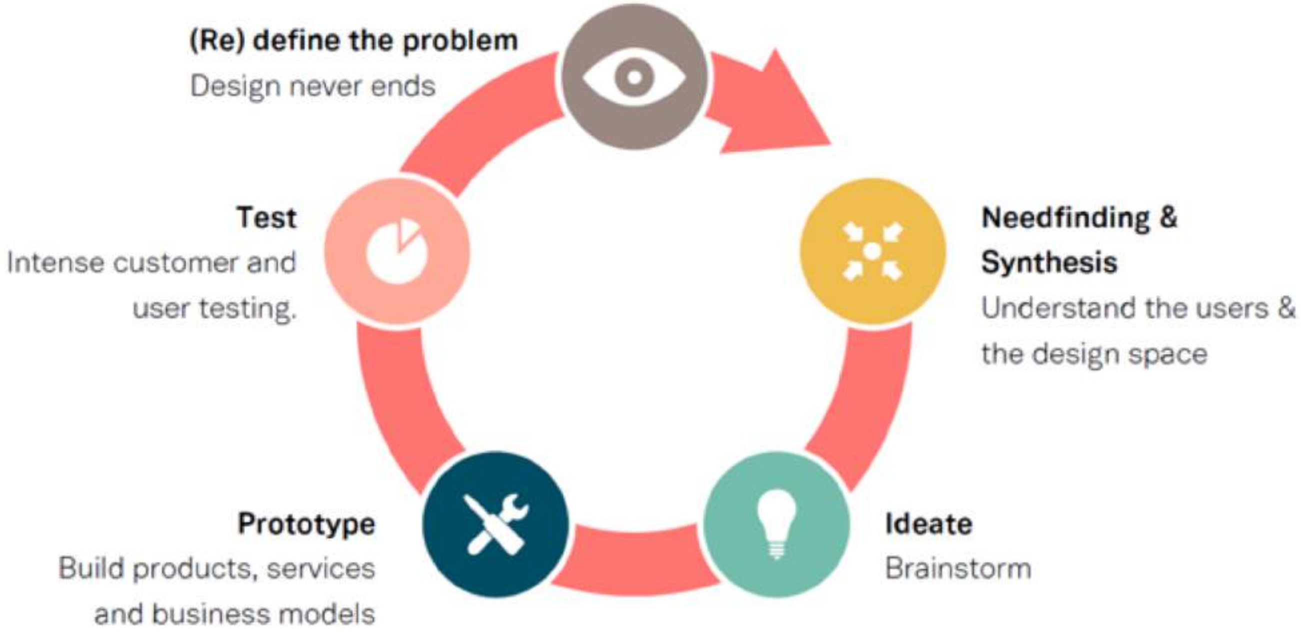
Pure Design Thinking



(Re) define the problem
Design never ends

Needfinding & Synthesis
Understand the users & the design space

Ideate
Brainstorm

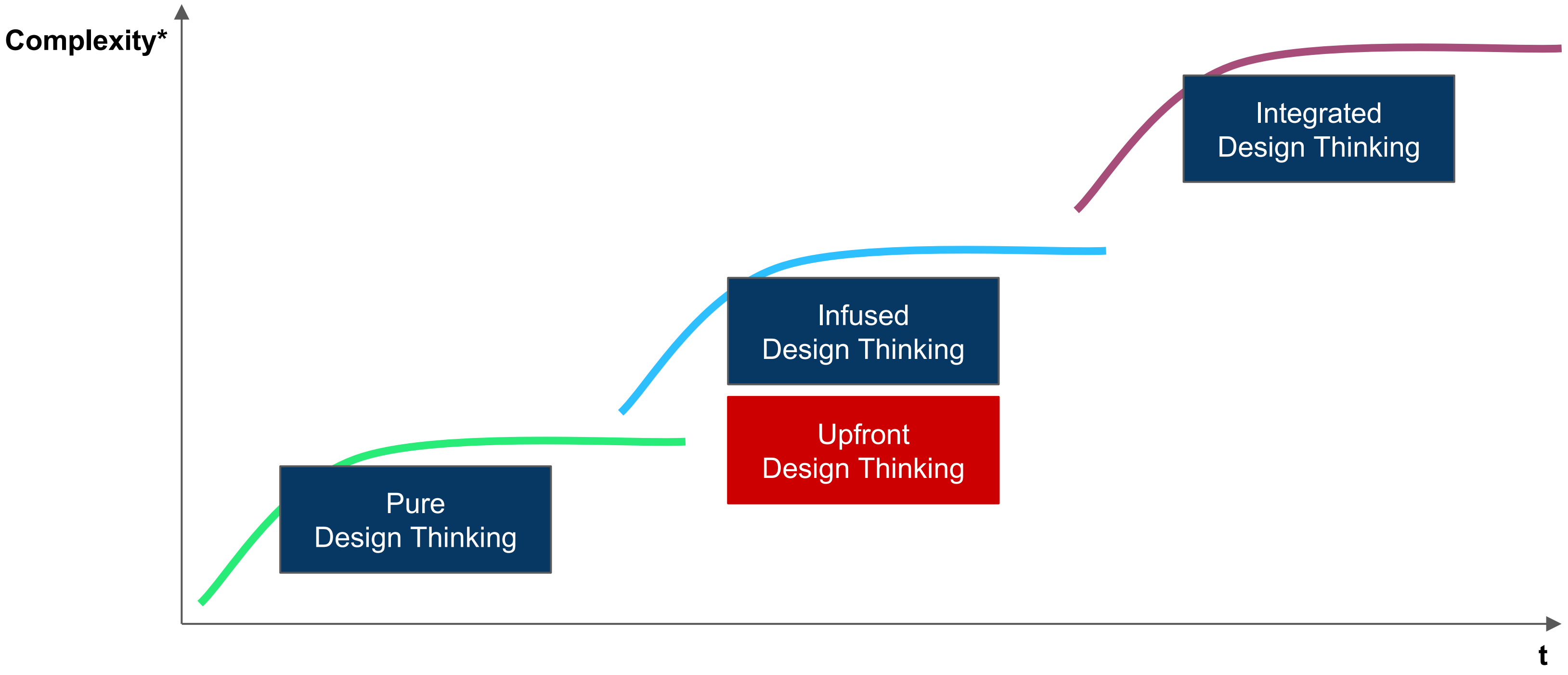
Prototype
Build products, services and business models

Test
Intense customer and user testing.

Take-Aways

- Much like RE, DT shouldn’t suddenly stop
- DT is human-centric, but also team-driven
    - Team members (skills, motivation, participation) are crucial
    - Make explicit implicit assumptions (e.g. to avoid gold plating)
    - Beware dependencies to implicit knowledge
- Potentially working towards the void
    - No immediate counterpart and no institutionalised “hand-shake”
      → Software process model? Needs and team culture?
    - No continuity and potentially no champion
- No guaranteed operationalisation (and feasibility) of prototype

Evolution of Design Thinking and RE



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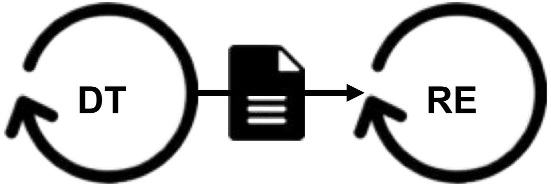
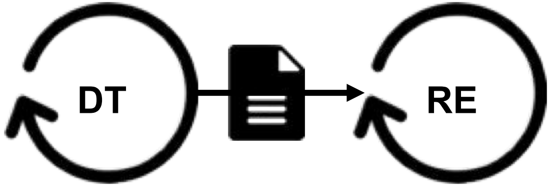
Upfront Design Thinking



- German Software Company (SME)
- Problem Statement: Development of an offering for a new target group (private landlords) in real estate management
- Team: Requirements Engineer, Product Manager, IT-Architect, Designer, Hotline Support, Project Lead, Design Thinking Coach
- Design Thinking Project: 4 months

Upfront Design Thinking



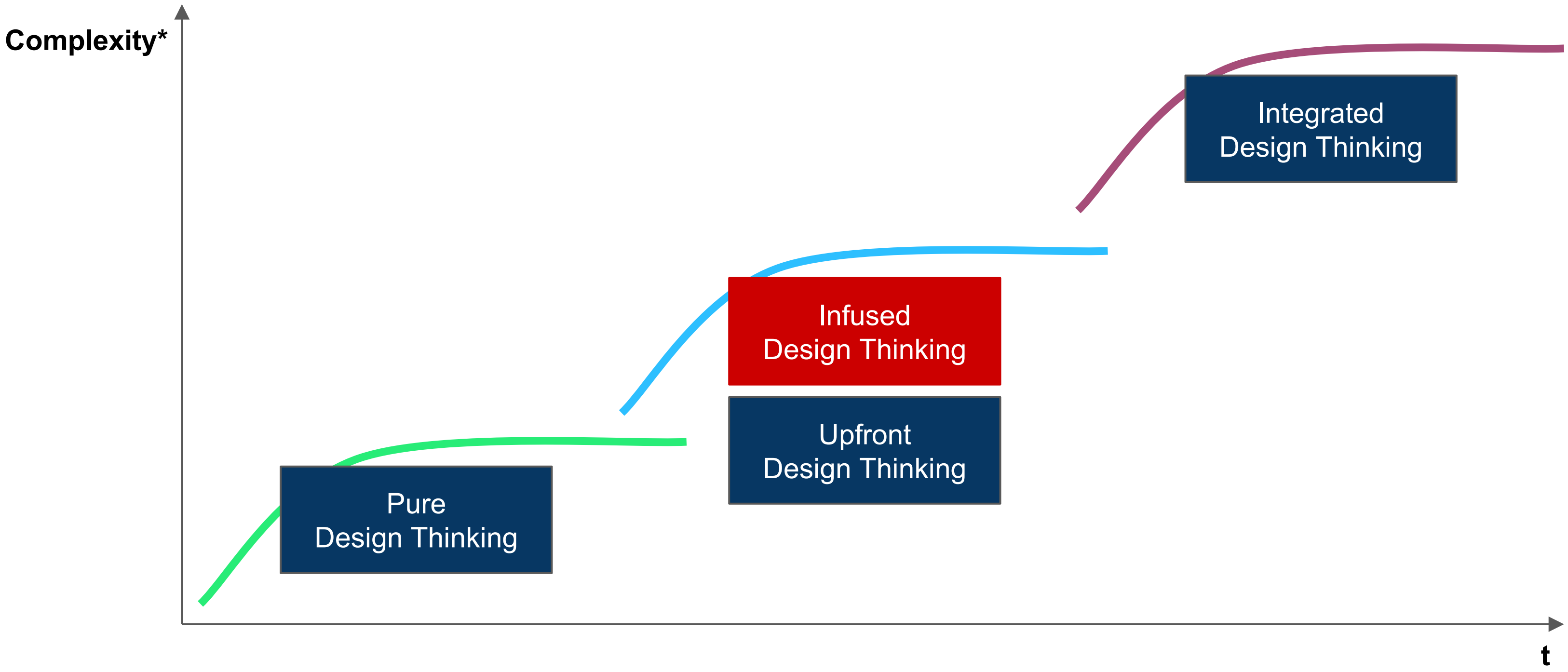
- 12 qualitative interviews
- 1 quantitative questionnaire
- 2 Personas
- 4 prototypes

- User story definition via project team
- User stories and high resolution prototypes are handed over to implementation

Take-Aways

- What works:
  - Fostering a collaborative working environment
  - Fostering a failure tolerant culture through rapid prototyping and continuous experimentation
  - Broadly validated key features / user stories
- Open challenges:
  - Final deliverable via user stories and HighRes prototype
  - No further feedback cycles
  - Potential starvation of results with no implementation (or control over it)

Evolution of Design Thinking and RE



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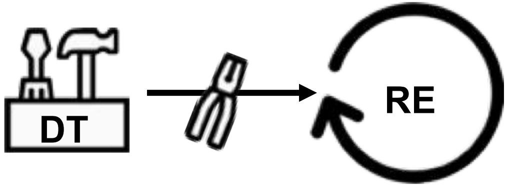
Infused Design Thinking

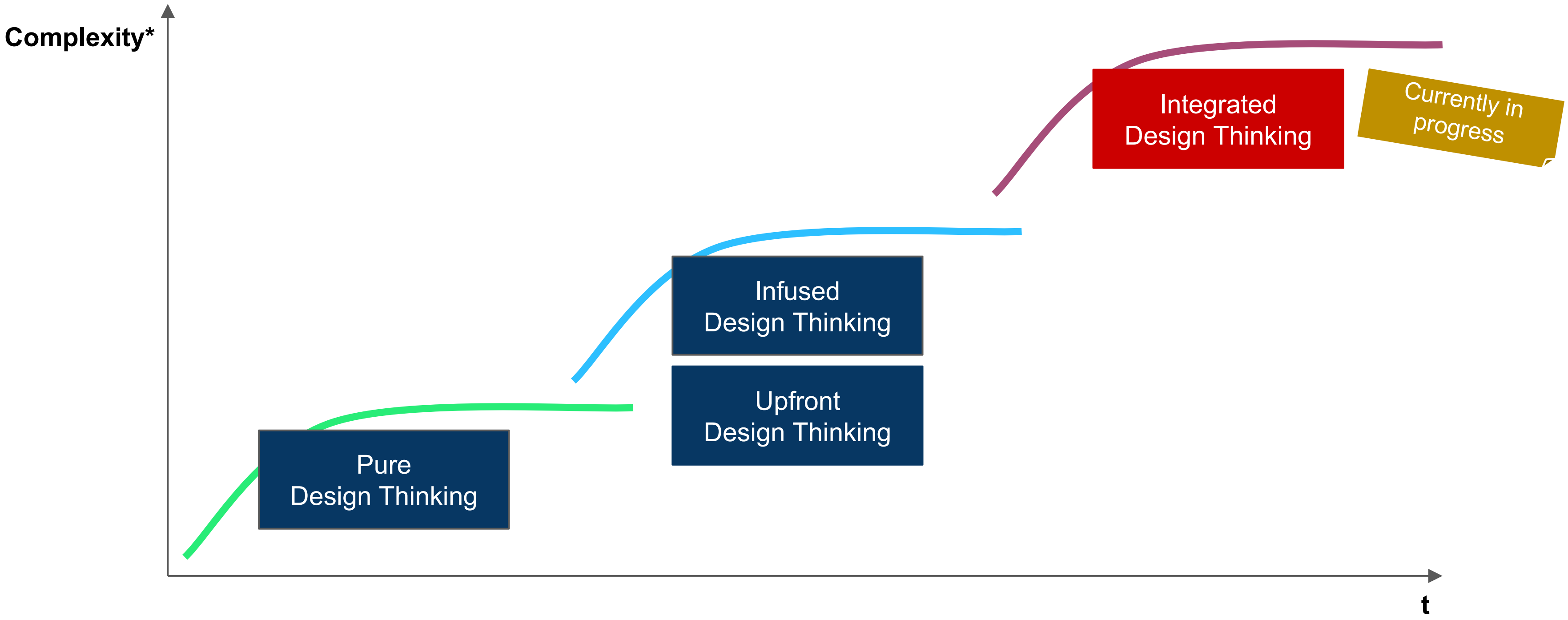


- International Electronics group
- Headquarter in Germany,10.500 employees
- Needfinding and Prototyping Infusion

Take-Aways

- What works:
  - Fostering a broader collaborative working environment
  - Integrating creative idea generation in context of a software development life cycle
- Open challenges:
  - No further development-critical artefacts, e.g. NFRs, technical constraints, or data models
  - Still no seamless and sustainable integration of DT methods into software development activities
  - Limited learning curve for reuse in further projects

Evolution of Design Thinking and RE



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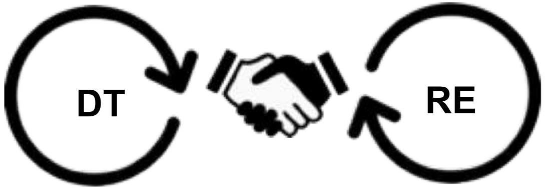
Integrated Design Thinking approach



- German Utility Company
- Problem statement: Development of an offering to boost photovoltaik sales
- Team: multidisciplinary
- Design Thinking process: 3 months
- Integrated approach: 12+ months

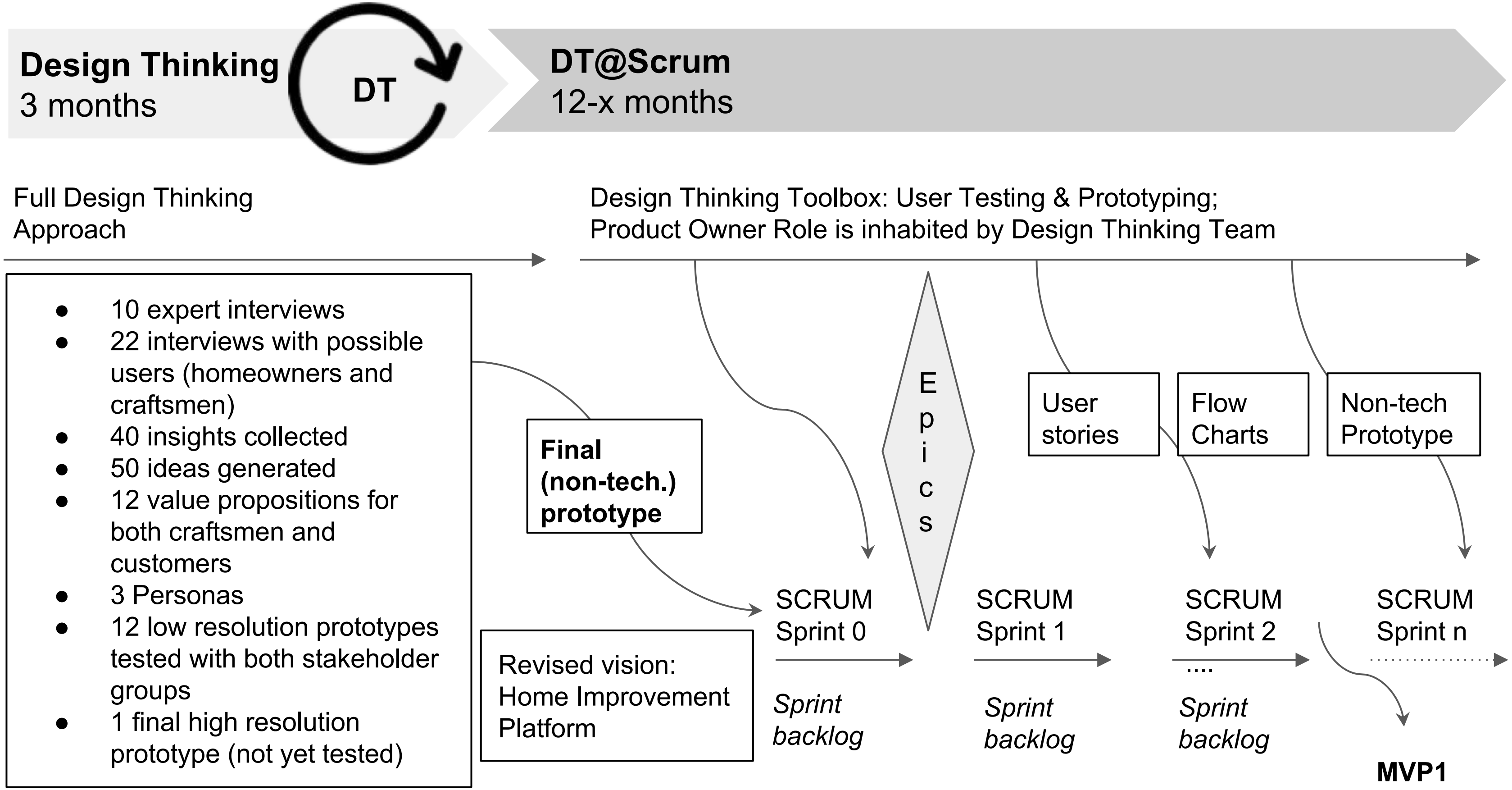
Design Thinking
3 months

Full Design Thinking Approach

- 10 expert interviews
- 22 interviews with possible users (homeowners and craftsmen)
- 40 insights collected
- 50 ideas generated
- 12 value propositions for both craftsmen and customers
- 3 Personas
- 12 low resolution prototypes tested with both stakeholder groups
- 1 final high resolution prototype (not yet tested)

Final (non-tech.) prototype

Revised vision: Home Improvement Platform



Design Thinking
3 months

DT

DT@Scrum
12-x months

Full Design Thinking Approach

Design Thinking Toolbox: User Testing & Prototyping;
Product Owner Role is inhabited by Design Thinking Team

- 10 expert interviews
- 22 interviews with possible users (homeowners and craftsmen)
- 40 insights collected
- 50 ideas generated
- 12 value propositions for both craftsmen and customers
- 3 Personas
- 12 low resolution prototypes tested with both stakeholder groups
- 1 final high resolution prototype (not yet tested)

Final (non-tech.) prototype

Revised vision:
Home Improvement Platform

Epics

User stories

Flow Charts

Non-tech Prototype

SCRUM Sprint 0

Sprint backlog

SCRUM Sprint 1

Sprint backlog

SCRUM Sprint 2

....

Sprint backlog

SCRUM Sprint n

MVP1

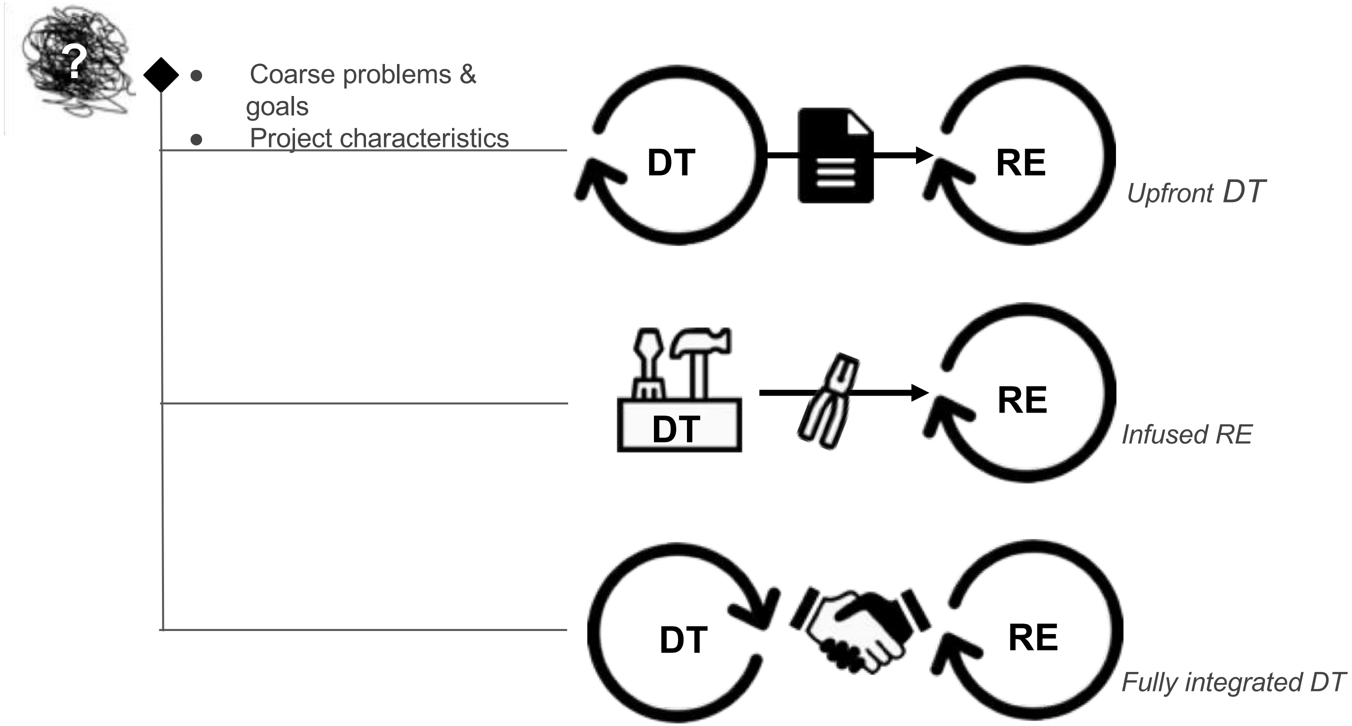
Take-Aways

- What works:
  - DT as a structured, domain-agnostic approach to requirements elicitation
  - Extended arm into wicked problems and re-define actual problems and SW system context
  - Sufficiently correct and complete key features / user stories via continuous experimentation and testing of non-technical and technical prototypes
  - Clear roles and responsibilities
- Currently open challenges:
  - Difficulty in integrating further RE-specific artefacts, e.g. NFRs, technical constraints, or data models

How can we efficiently integrate DT and RE?

Reminder

Towards a pragmatic approach to human-centric RE



?

- Coarse problems & goals
- Project characteristics

DT

RE

Upfront DT

DT

RE

Infused RE

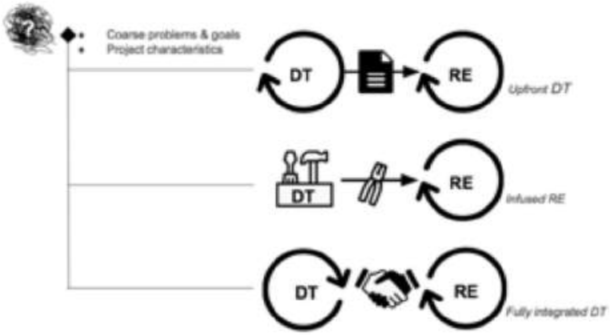
DT

RE

Fully integrated DT

Open research challenges

General Challenges

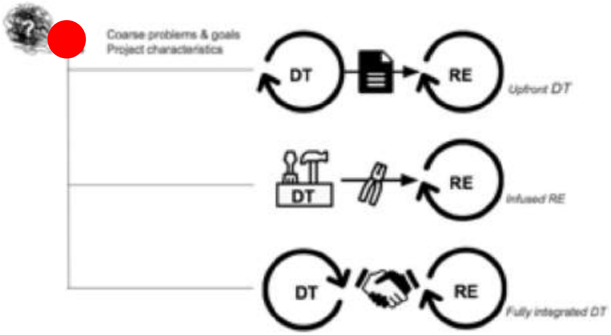


- Principles: Which principles and approaches in DT can be found in more holistic human-centred software development approaches and how do they differ?
- Boundary objects: How can artefacts with similar purposes, but different forms, be integrated?

Open research challenges

Project Influences

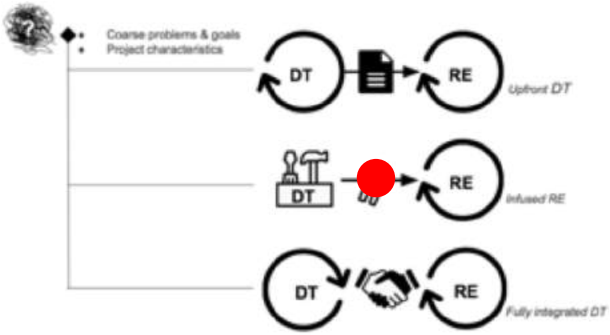
- How can problems be efficiently classified?
- What are typical project situations which influence the choice of a strategy?
- How do these situations and the class of systems influence the choice of a strategy and single methods?
- How can these situations be characterised and assessed in early stages of a project (with which confidence)?



Open research challenges

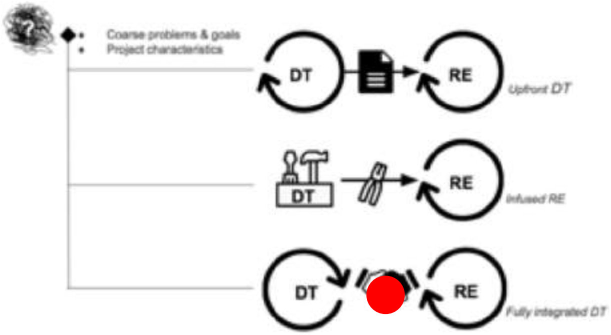
Method adoption

- Which methods in DT can be found in / reused for other software engineering disciplines (e.g. HCI, TDD)?
- How do these methods differ? How can they be integrated?



Open research challenges

Interface and Operationalisation



Interfaces

- How can artefacts, roles, and methods be seamlessly integrated?
- Which artefacts do overlap? Are shifts in roles and responsibilities necessary?
- How can milestones be efficiently defined?

Operationalisation

- How can resulting processes be integrated (into the overall life cycle) - for instance SCRUM?
- How can resulting processes be tailored?

Outline

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   ☕

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3. **Final discussion and closure**