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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  
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Research areas
● Empirical software engineering in focus:
  ○ 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.

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<th>Way of Doing</th>
<th>Way of Thinking</th>
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<td>- IoT prototyping</td>
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<td>(2) Needfinding</td>
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- Needfinding & Synthesis: Understand the user & the design issue
- Prototype: Build & test prototypes
- Iterate & refine
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
   🍵

2. Design Thinking for Requirements Engineering

3. Final discussion and closure
Design Thinking is a problem solving approach that starts with the human

Viability

Desirability

Feasibility
Let’s try it...
Re-design the wallet of your partner.

Your challenge for the next 30 minutes.
Find a teammate.

2 people per team
Interview. Explore. Understand.


3 minutes each
Point-of-View

Synthesize.
Let’s hear it.
Share your Point-of-View (POV).
Ideate.

Brainstorm. The more ideas the better.
Prototype.

Express one idea through a prototype.

5 minutes
Test it.

Get some feedback from your user.

2 minutes each
Let’s see it.

Share your Prototype.
What was our process?

What did we just do?
Design Thinking is explorative and iterative

1. **(Re) define the problem**
   - Design never ends

2. **Test**
   - Intense customer and user testing.

3. **Needfinding & Synthesis**
   - Understand the users & the design space

4. **Prototype**
   - Build products, services and business models

5. **Ideate**
   - Brainstorm
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.
Ideate
Generate ideas.
Prototype
Make ideas tangible.
This exercise helps with practically everything, including your core, leg 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
The outcome of a Design Thinking project is one or more tested prototypes

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

High Resolution Prototype
- 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

[Image of Toolbox with text: Toolbox]

https://www.dt4re.org/
People and Making are the heart of Design Thinking

Principles
See the human behind the user
Do not stop at your corporate doors
Making instead of over-thinking
Experiment and prototype continuously ("kill your darlings")
Field testing even in early project phases ("fail forward")
Shape your view with interdisciplinary teams
Design Thinking transforms wicked into ill- and well-defined problems
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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.

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

Exemplary DT Artefacts

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

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

(Re) define the problem
Design never ends

Test
Intense customer and user testing.

Needfinding & Synthesis
Understand the users & the design space

Prototype
Build products, services and business models

Ideate
Brainstorm
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

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

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

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

Revised vision: Home Improvement Platform
Design Thinking Toolbox: User Testing & Prototyping; Product Owner Role is inhabited by Design Thinking Team

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)

Revised vision: Home Improvement Platform
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

Upfront DT

Infused 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?
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