Requirements Engineering

Lecture 4

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Orientation

Recap:

- Core Activities
- Engineering Models: artifact or activity-orientation
- Separation of Problem and Solution

Coming up:

- Whose problems are we trying to solve?
- How can we elicit the actual problem?
- How do we find solution ideas?

Stakeholders

Definition

A stakeholder is

- a person or a group of persons
- a group of persons/ interest groups
- an organization (also an essential source of specifications)

who is **in any way** interested in the system to be developed or wants/should/must have an influence on its development.

Addition

"Interest in the system" does not necessarily mean „interest in project success"

Examples: legislation, workers council, competing suppliers

Stakeholders

Which Stakeholders should be considered in our project Rent-a-Scooter?

Common Stakeholders

The different stakeholders have different interests and accordingly different requirements:

- Users and customers
- Operators
- Legislators, standardization committees, ...
- Workers council, data protection officer, ...
- Client, marketing, entrepreneur, (product manager)
- Domain experts
- Developers: architects, programmers, testers etc.
- Maintenance (Operation/Maintenance/Evolution/Quality)
- In case of:
  - embedded systems: hardware/mechanics/software - developers
  - regarding information systems: process owners, departments

- Many more!

Stakeholder Classification

Popular classifications:

- Active and passive stakeholders based on their participation in the project (Mahoney 1994)
- Primary and secondary based upon how much the project depends on them (Clarkson 1995)

Stakeholders can be classified according to their:

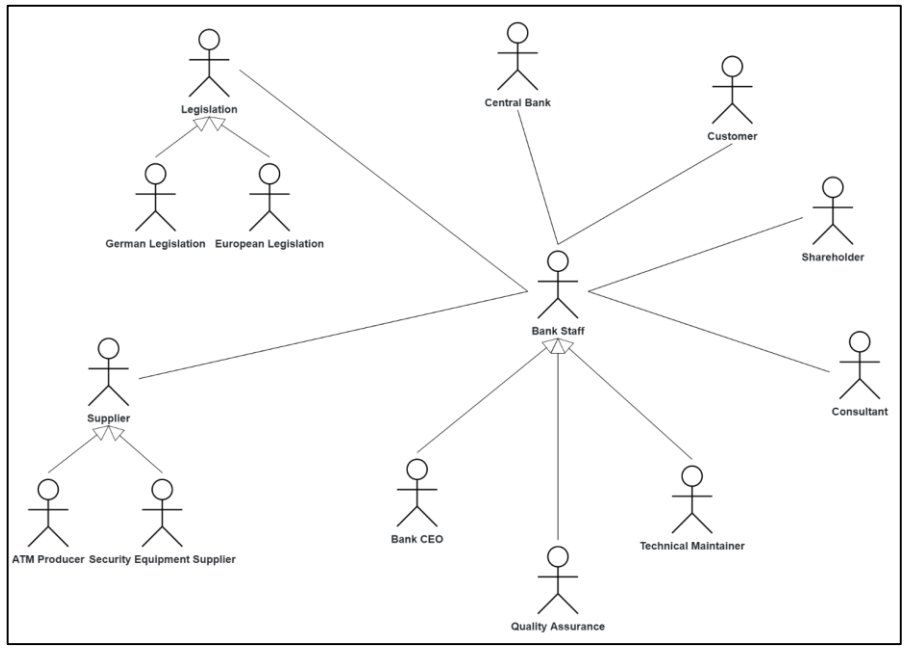
- Relevance and significance for the project success
- Type of interest
- Ability to formulate interests/requirements

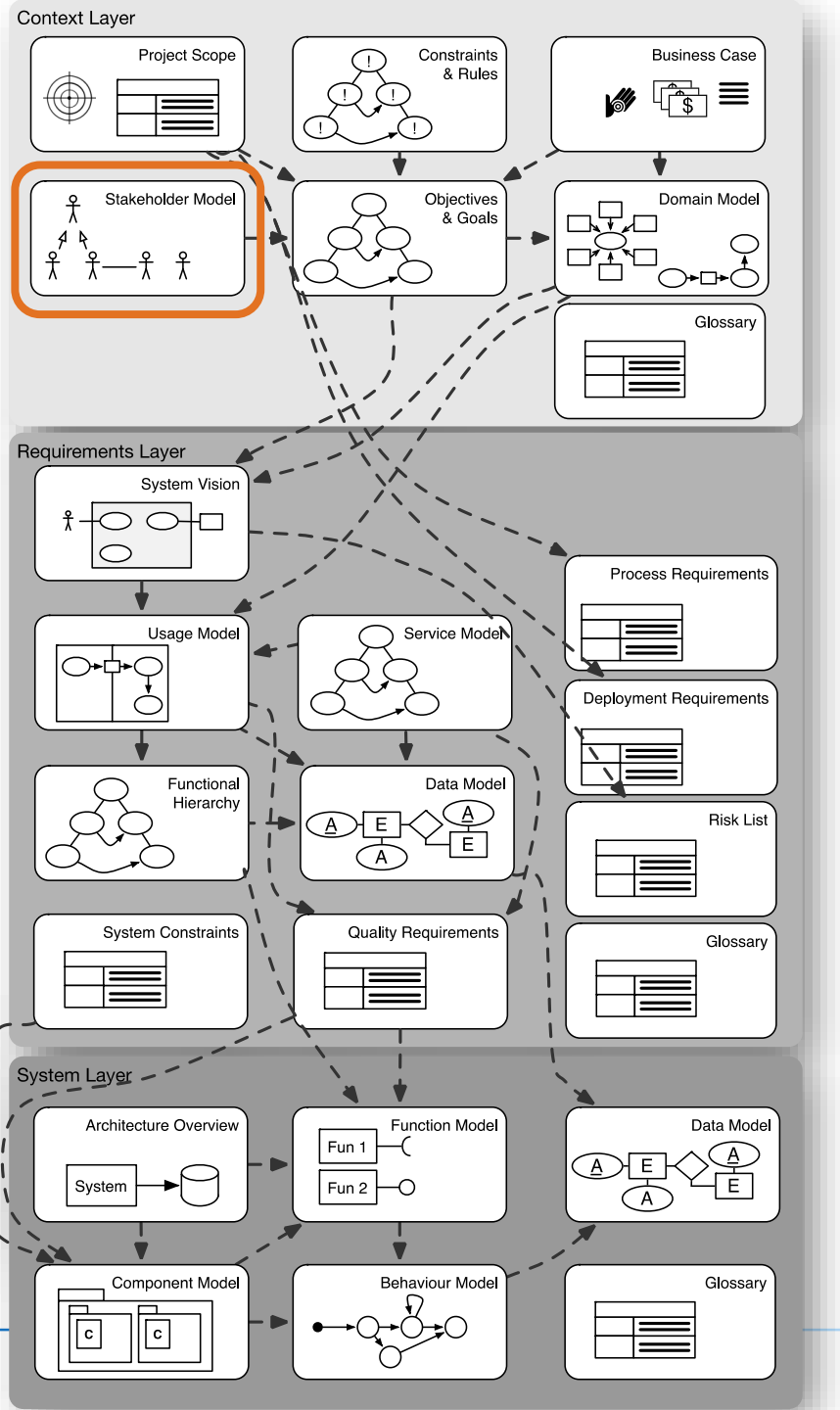
Or via their role within the project:

- Decision-making and instruction powers
- Reporting system
- If development happens for a market instead of a dedicated customer, there is no client with a user role!

Stakeholder Model in Amdire

In artifact-oriented engineering models, a model of the stakeholder is the basis to identify Objectives & Goals, which then influence the System Vision.





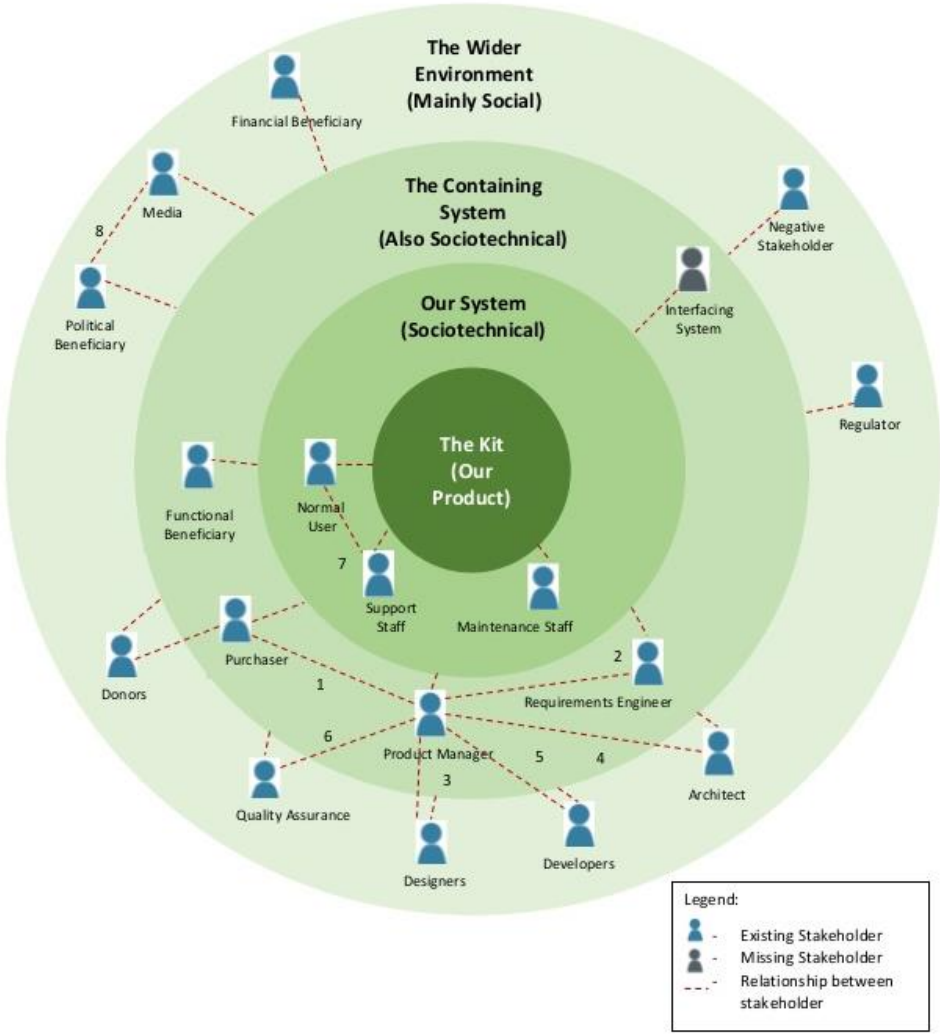
Stakeholder Model: Advantages

Make knowledge about stakeholders **explicit**:

- Supertypes and subtypes
- Function of a stakeholder
- Priority
- Availability
- Relation to other stakeholders, possibly conflicting interests or support for political reasons

Example Corona App

Choose a graphical representation that is suitable for the kind of knowledge you want to describe!



From Stakeholders to Requirements

The needs and requirements of the stakeholders need to be **„elicited“.**
The result of the elicitation is a requirement **candidate.**

Challenges:

- Finding the stakeholders
- Some stakeholders are not available for discussions (e.g. legislation, competing suppliers)
- Stakeholder are not able to express their expectation:

  „Well, I don‘t know what I imagined, but certainly not that!“
- Stakeholder might know what they want, but not what they actually need:

  „I want a Ferrari to go on safaris in the jungle.”
- Hardly any separation of problem and solution:

  „There should by a green button with a disk icon to save my progress, and a red X to dismiss my changes.“

Critical Analysis of the Requirement Candidates

The requirement candidates are not suitable for development without further processing because they are formulated from a very specific **stakeholder viewpoint**.

Therefore:

- Question why a requirement was raised
- Abstract from demands that are too concrete (get back from the solution to the problem!)

Note:

This is about extracting requirements and goals of the stakeholders.

In a next step, these candidates are sorted, refined, prioritized and maybe assessed ethically.

More details in Lecture 5

Example: Critical Analysis of the Requirement Candidates

Requirement candidate from customer:

"In a window in the upper right-hand corner of the screen, the time must be displayed so that the time of receipt can be noted when an application is received".

Possible motivation:

Customer is influenced by previous solution and workflow

Possible requirement:

“The time of receipt must be noted for each application”.

Examples of sources for requirement candidates

- Stakeholders
- Literature; increasingly: social media
- Existing systems and artefacts
- Interview / workshop / questionnaire with users or experts
- Interview with Help Desk / Hotline / Schools / Marketing / Sales

- Laws / Norms / TÜV / Standards / Regulations
- Competitive products
- Prototypes
- Analysis of business processes and goals

This depends on the project type and the incentive of the project.

Creativity-based techniques (overview)

Relying on stakeholder interviews can be problematic (compare prev. slides) for several reasons. Alternative ways to find and collect requirements and user needs are Design Thinking and creativity-based methods such as

- Brainstorming
- Morphological box
- Progressive Abstraction
- Osborn Checklist
- …

Attribute	Variation						
Case material	Steel	Aluminium	Plastic	Wood	Aluminium and Plastic	Aluminium and Wood	
Paper supply	10 pages	20 pages	50 pages	100 pages	200 pages	500 pages	
Connectivity	USB	WIFI	Bluetooth	Ethernet			
Ink	Black	b/w, color	3 cartridges	4 cartridges			
Cartridge volume	20 ml	30ml	40ml	60ml	100ml	150ml	200ml
Throughput	2 pages/min	10 pages/min	20 pages/min	40 pages/min	60 pages/min	80 pages/min	100 pages/min
Service contract	None	Warranty with on site service	Warranty	24h	24h; free		
Additional features	None	Ink level measurement	Copying	Fax	Scanner	2 paper trays	A3 printing

Brainstorming

Brainstorming done right:

1

Let your imagination run free
Ideas are freely formulated without having to justify or defend them
Taking up and developing ideas
Producing as many ideas as possible in a short time
No criticism in Phase 1!

Short break between both phases

2

Evaluate ideas
Sort ideas
Merge ideas

Charles Hutchison Clark: *Brainstorming: How to Create Successful Ideas.1989*

For Completeness: Facts using the example of "Black Stories"

In the middle of the desert lies a corpse...
Completely naked...
Holds in his hand an object that has caused death ...
What happened?

- Only those questions are allowed that can be answered with yes/no (closed questions).

For Completeness: W questions

In the middle of the desert lies a corpse...
Completely naked...
Holds in his hand an object that has caused death ...
What happened?

- Only those questions are allowed that can be answered with yes/no (closed questions).

It is difficult to open up facts with closed questions.
Better suited: **W questions**

- What?
- Who?
- Where?
- When?
- How?
- Why?

Morphological Box (Zwicky Box)

List all possible values for every attribute in a brainstorming-like manner.
Then, find combinations that are promising and feasible within the project.

Attribute	Variation						
Case material	Steel	Aluminium	Plastic	Wood	Aluminium and Plastic	Aluminium and Wood	
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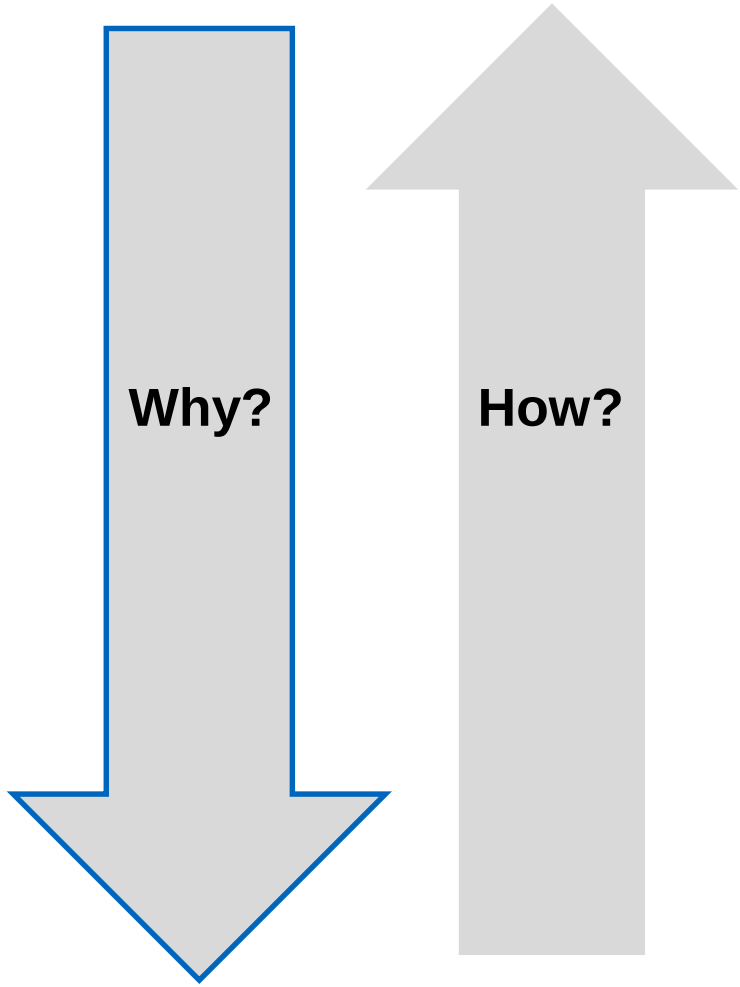
Adapted from Fritz Zwick: Discovery, Invention, Research through the morphological approach”

Progressive Abstraction

Stepwise increase of abstraction (change of perspective)

Examples

→How can we make the display more readable?
→How can we make the driver information system more comfortable?
→How can we make the driver assistance system more comfortable?
→How can we outperform our competitors?



Osborn Checklist

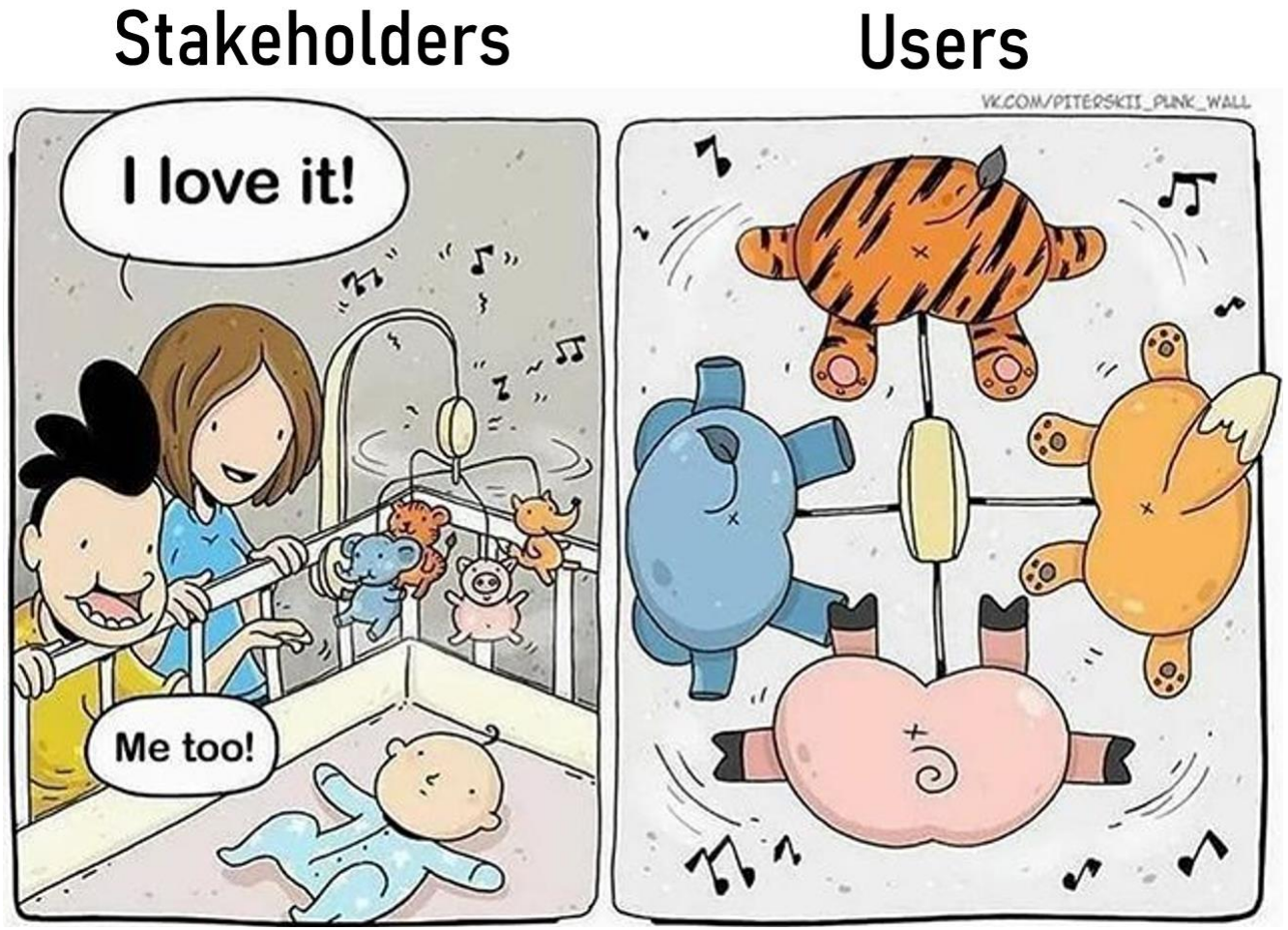
Use differently: What else can I use it for? Can I use it differently?
Customize: Does the problem point to other ideas? Is it similar to something else?
Change: Which properties can be redesigned?
Zoom in/out: Is it possible to enlarge or reduce something?
Replace: What can be replaced?
Change over: Can the order or structure be changed?
Reverse: Can the idea be reversed?
Combine: Can ideas be combined or ideas connected?

Design Thinking

Concerned with both finding solution ideas and identifying the problem from the **user perspective** and considering the complete **customer journey.**

We will possibly have a guest lecture on that!

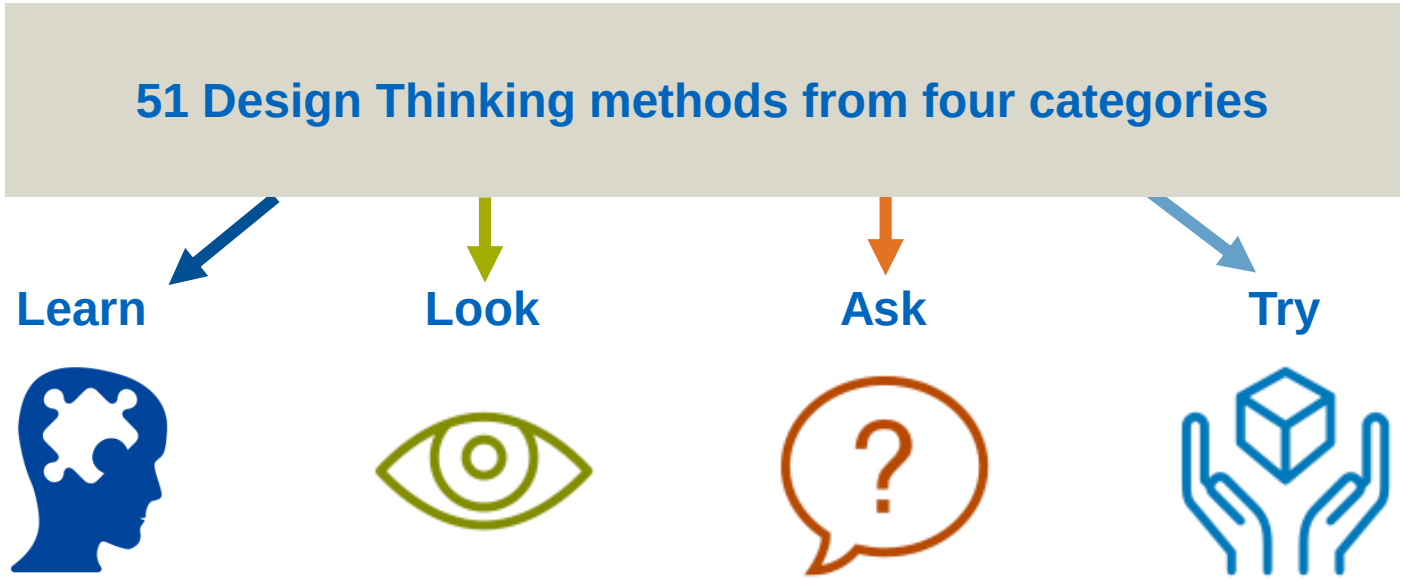
Why user-centered approaches?



IDEO Method Cards

Method Cards provide a simple way to get started with Design Thinking concepts and techniques without prior training.

Intention: Spark your own creativity and help to get new perspectives and new ideas.



IDEO Method Cards

LEARN | *Error Analysis:*
List all things that could possibly go wrong when using the product and determine their causes.
This is a good way to understand how to mitigate human errors or other failures.

ASK | *Five Whys:*
Ask „Why?“ in response to five consecutive answers.
This forces people to examine and formulate the underlying reasons, hidden motivations and goals.

LOOK | *Fly on the Wall:*
Observe and record users in their context without interfering, to see what people actually do within the real contexts instead of relying on their statements.

TRY | *Paper prototyping:*
Sketch, layout, print / build a concept as early as possible using paper or cardboard.
This is a good way to quickly organize, articulate and visualize your ideas.

IDEO Method Cards

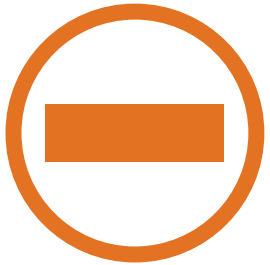
More examples:

- **Learn:** Cross-cultural comparisons, Error Analysis, Long-range Forecasts, …
- **Look:** A Day in a Life, Fly on the wall, Still-Photo-Survey, Time-lapse video
- **Ask:** Card Sort, 5 Whys, Unfocus Group, Extreme User Interviews, …
- **Try:** Bodystorming, Paper Prototyping, Role-Playing, Be your customer, …

Why use creativity techniques?

Advantages

- **Foster thinking outside usual patterns:**
  Finding solutions that you would not otherwise come up with
- Easier identification of underlying problem and easier separation of problem/solution
- Better understanding of the actual problems and goals of the stakeholders
- Can help if other requirement sources are not available



Problems and Disadvantages

- Learning curve
- Time consuming
- Requires willingness to open up (often difficult for tech-focused people)
- No guaranteed return on invest
- Some techniques require the existence and active participation of stakeholders

depends on method

Discussion: Elicitation Techniques

For which subsystems of Rent-a-Scooter is „Paper Prototyping“ a suitable method?

It is your task to design the handlebars of the scooter. Which method is applicable and why?

Finding requirements **if there is no client**

A large share of systems are developed for the market, meaning there is no client at the beginning of the project! This bears challenges not only for marketing but also for requirements engineering.

How can we anticipate what the user wants if we cannot ask them?

Requirements Elicitation without customer interaction

Some requirement sources are still available, e.g: business processes, literature, creativity techniques, laws, competitor products, …

But we need early and frequent user feedback for agile development!

- Find test users as early as possible - perhaps by offering discounts and early delivery if they get involved in development
- Imagine potential customers and users (Personas)!

Personas and Target Groups

Personas

- Imaginary individuals using the system with concrete characteristics and behaviours.
- Often inspired by observation and ethnographical studies
- Usually cheaper than interviewing real potential customers.
- Example: *Peter, IT-Consultant, age 54, earning 80.000$, married and has two children (Paul and Mary), drives 29km per day from Garching to Munich,…*

Target Groups

- Abstract social segment likely to contain potential users
- Example: *males between 40 and 60, earning between 70k and 100k $, living in suburban areas and commuting to work by car.*

Attributes of a Persona

A persona consists of two aspects: personal characteristics and usage scenario

General Characteristics:

- Motivation
- Budget
- Residence and relationship status
- Hobbies and Job
- Art of interest in the system
- B2B or B2C?

Characteristics important in our context:

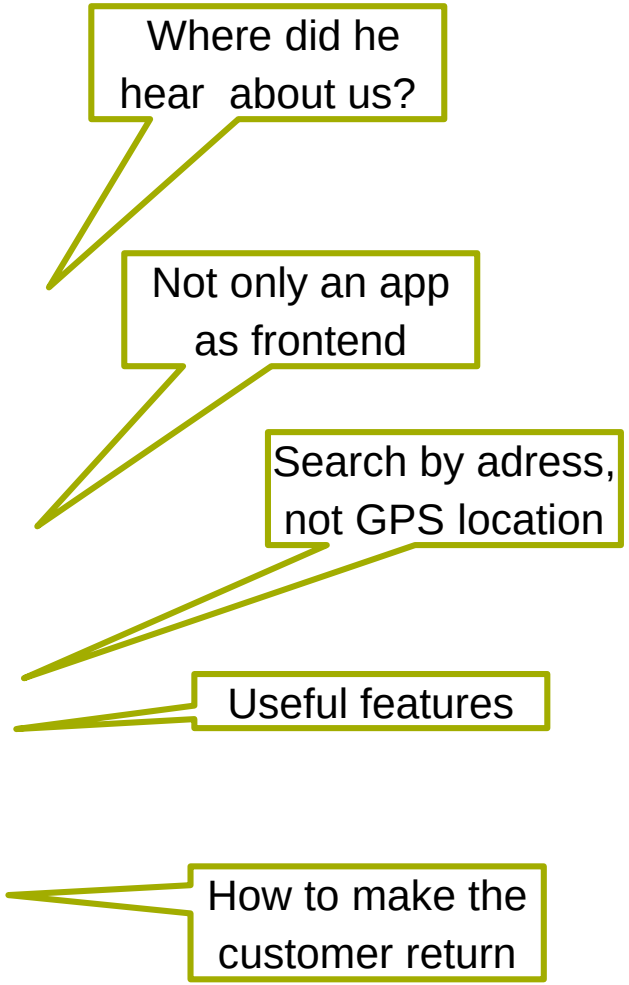
- Offline behavior:
  - How does the person usually achieve the goal?
  - Usually follows recommendations of experts and friends
  - …
- Online behavior:
  - Available payment methods
  - Usability needs, e.g. languages, font size
  - Loves to share things on social media
  - …

Persona: Usage Scenario

The scenario is a detailed narrative how the persona would use the system. Being as concrete as possible often opens new viewpoints.

<u>Example for Rent-a-Scooter:</u>

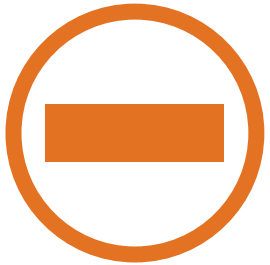
Peter knows about Rent-a-Scooter from advertisements broadcasted on the radio. The next day, he has a meeting with a business partner that takes place 15 minutes from his office. He decides to try Rent-a-Scooter and opens the website. […] He enters his office adress and available scooters are visualized as pins on a map. Using a filter, he chooses to display only scooters he can reach within a 3 minute walk. Moving the mouse above one of them, he checks if the battery is sufficient for his trip. Then [...]
using his business credit card. […] confirmation email and receipt that he forwards to his secretary. […] After the trip, Peter receives an email with a 10% off code for his next trip.



Personas: Discussion

Advantages

- **Does not need access to actual users**
- Specific usage scenarios reveal user needs and required features
- Elicit actual needs of a target group by imaging a person as detailed as possible



Problems and Disadvantages

- Different personas need to be created to represent different user types
- Difficult to separate from your own desires and ideas
- Temptation to invent an ideal user with unrealistic skills and interests

Personas do not deliver requirements, only candidates, which then have to be consolidated!

Discussion: Finding requirements for Rent-a-Scooter

Which techniques would you apply in the context of Rent-a-Scooter to find the requirements for the user frontend?

Which techniques would you use to find requirements for the backend?

What are the user journeys?

Outline and Outlook

Terms and Definitions
Core activities
Quality models for Requirements
Engineering Models

Stakeholders and Stakeholder Models
How to elicit requirement candidates, e.g. via Personas

Goals and Goal-oriented RE
Non-functional requirements
Functional requirements
Formalization
Agile Processes
Requirements Management and Quality Assurance
Trends in Research