



End-conference with webinar

*Responsible Ethical Learning in Robotics*



"This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731726"



# Logging on to Mentimeter

## Mentimeter guide

1. Go to [www.menti.com](https://www.menti.com) on your phone, tablet or computer, or scan the QR code at the bottom of the page.
2. Type in **373808** in the box and click submit.
3. The first question will now be available for you to answer. Answer the question how you see fit and press submit.
4. Once you have submitted your answer you will be taken to a holding page. You're automatically redirected to a new question page, once the question is made available by the presenter.
5. If you are disconnected from the site for any reason, simply repeat step 1 and 2.

A screenshot of the Mentimeter login page. At the top is the Mentimeter logo. Below it, the text "Please enter the code" is displayed. There is a text input field containing the code "373808". To the right of the input field is a blue "Submit" button. Below the button, a small note says "The code is found on the screen in front of you". A blue arrow points from the second step of the guide to the input field.

Scan the QR code with your QR reader or camera app. This will take you straight to the presentation.

**All submissions are completely anonymous.**



# Some warm-up Mentimeter questions

NB! Se om vi kan finde et billede der kan bruges...

Do you attend as a webinar guest or a conference guest?



# Some warm-up Mentimeter questions



What is your professional background?





# Some warm-up Mentimeter questions

NB! Se om vi kan finde et billede der kan bruges...

What are your initial associations with the word robot?



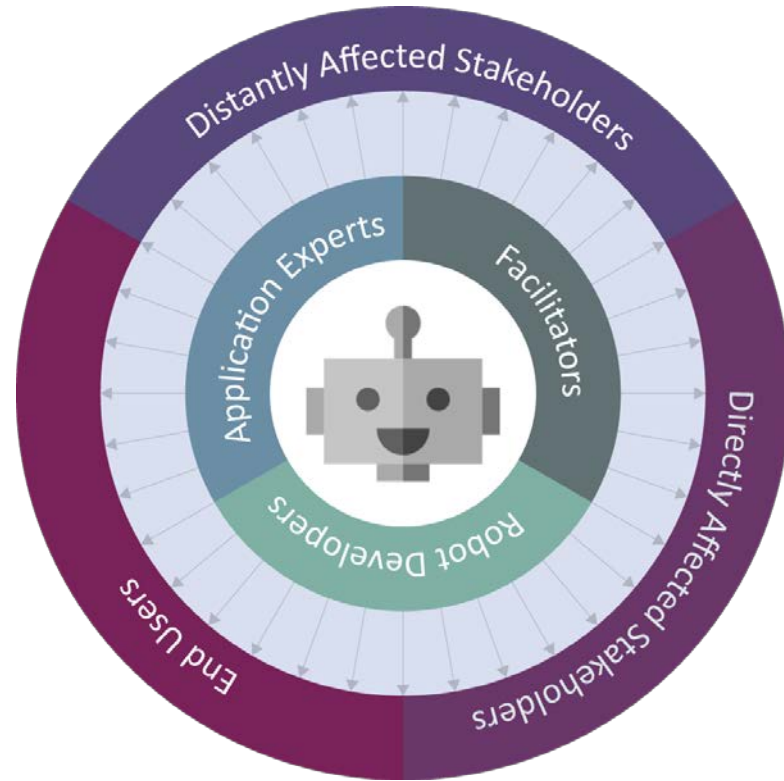
# PERSPECTIVES ON ROBOTS.

## A Reality Check on Imagined Futures

By Professor Cathrine Hasse



# Mentimeter question



Do you agree a social dimension is missing in robot technology development?



# About REELER

## The REELER partners

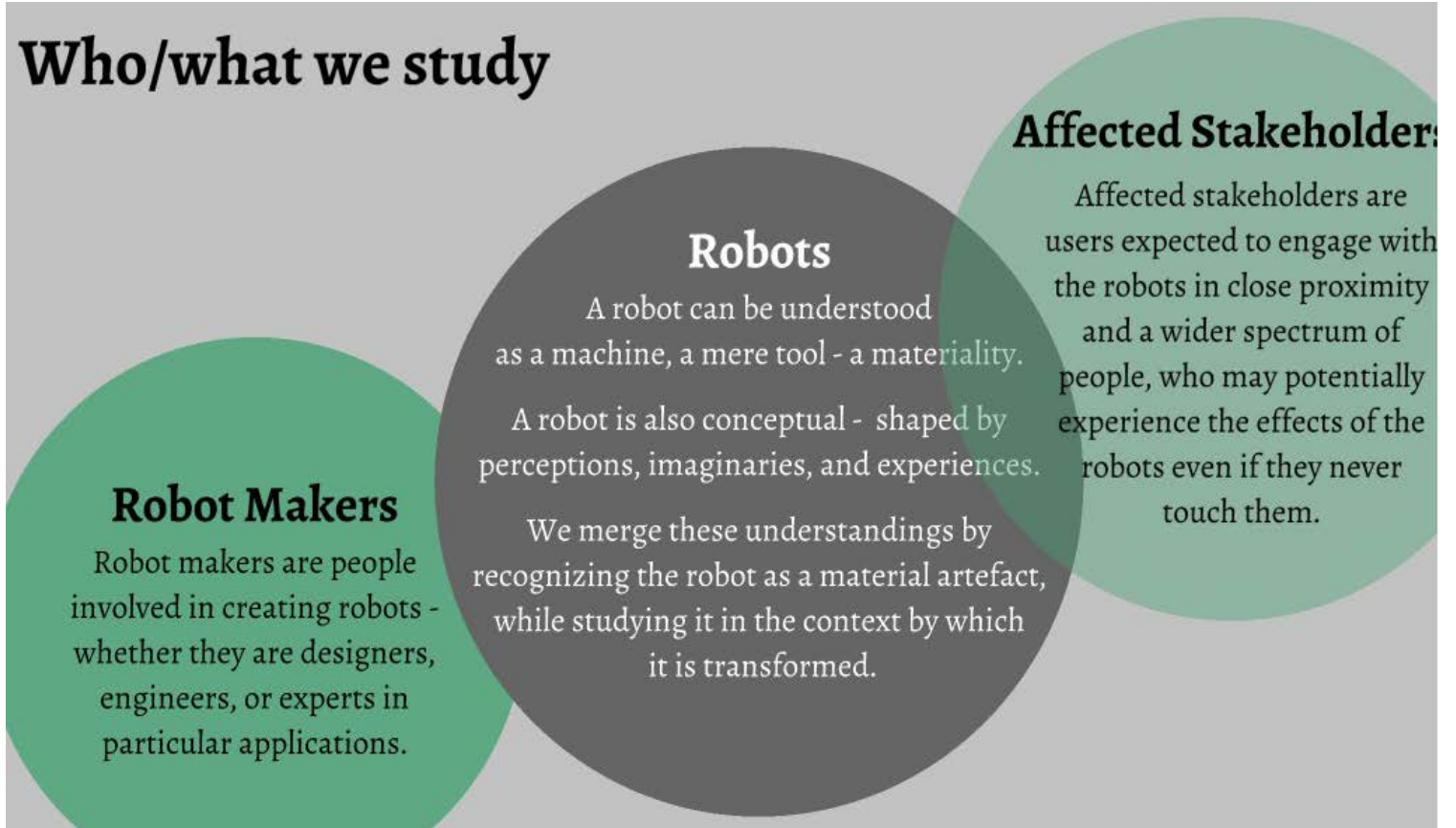
**Aarhus University:** Coordinator & Prof. of Anthropology, Cathrine Hasse

**Ab.Acus srl:** Impact partner & R&D Director, Maria Bulgheroni

**De Montfort University:** Prof. of Ethics, Kathleen Richardson

**Hohenheim University:** Prof. of Innovation Economics, Andreas Pyka

## Who/what we study



# Innovative research in robotics



The first ethnographically lead research project in robotics and DG connect.

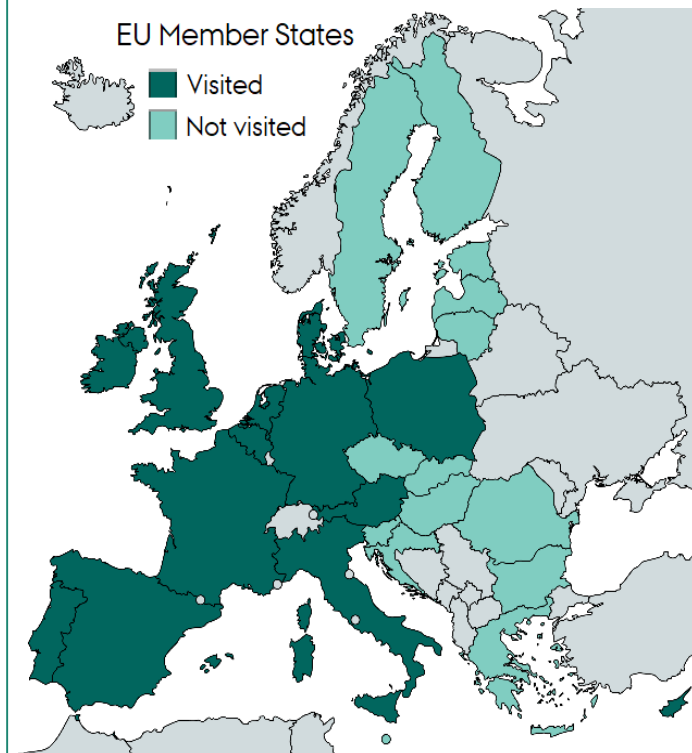
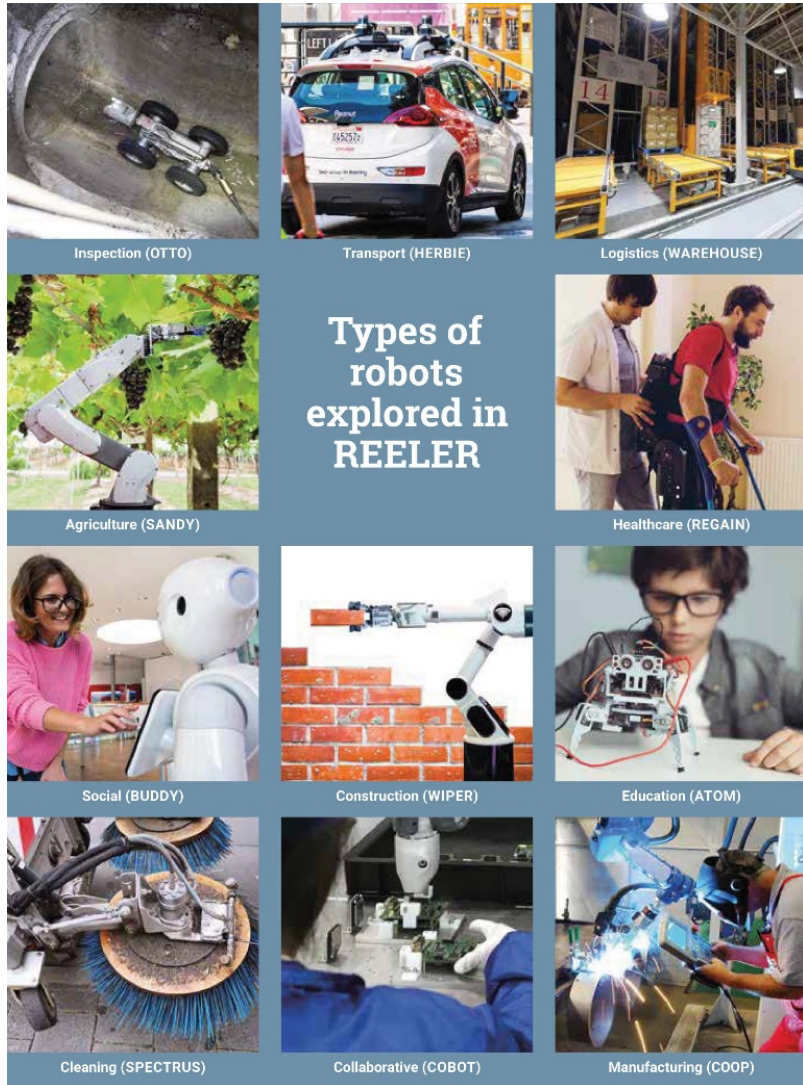
Highly interdisciplinary research involving  
**Anthropology**  
**Innovation Economics**  
**Engineering**

This Social Science and Humanities approach offers new perspectives on robots!



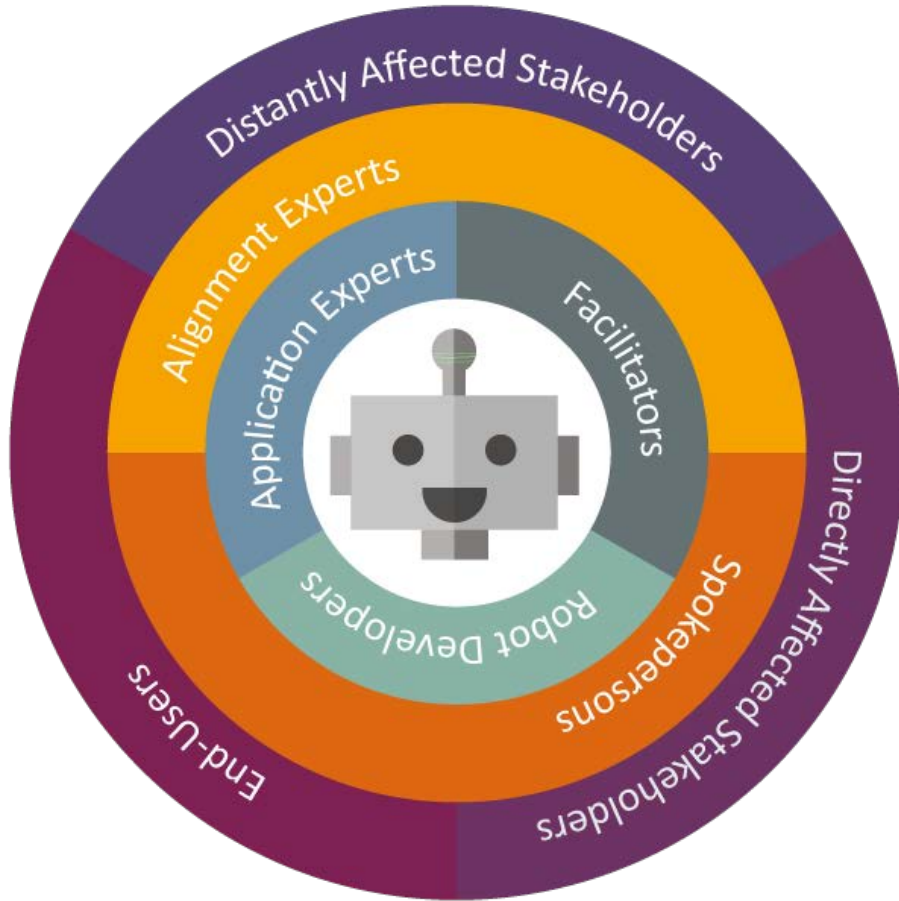
# Multi-variation approach

- Multi-variation approach looking across 11 different types of robots.
- Interviewed 177 people across Europe.
- Focus on patterns across cases gives generic and relevant results for the development of robotics and AI.
- Today's healthcare examples represent patterns across all REELER cases.

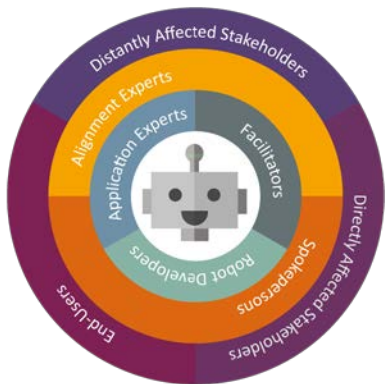




# Human Proximity Model



REELER has developed a Human Proximity Model (HPM) to explain the complexity and understand the gap between robot makers and affected stakeholders.

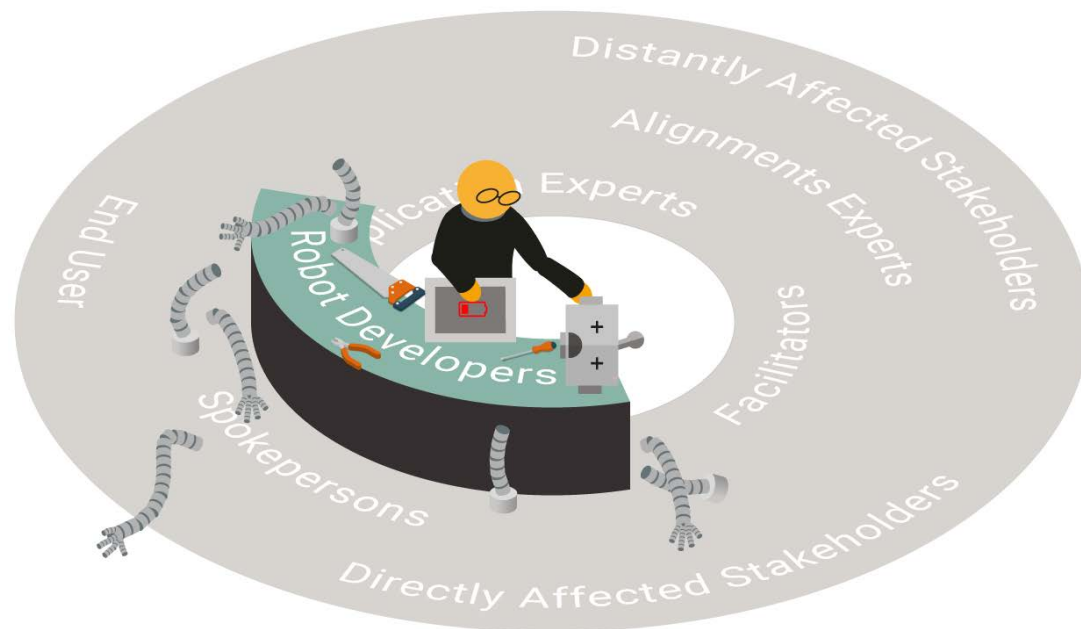


# Robot developers

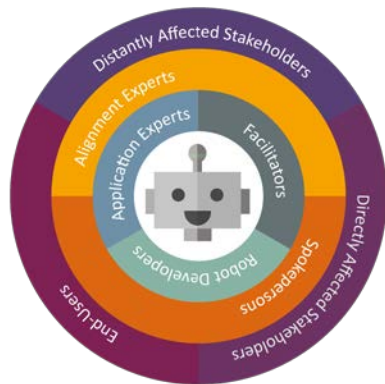
## Robot Developers:

People with technical expertise, whose role is to develop robots in whole or in part.

- Mechanical engineers
- Computer scientists
- Industrial designers





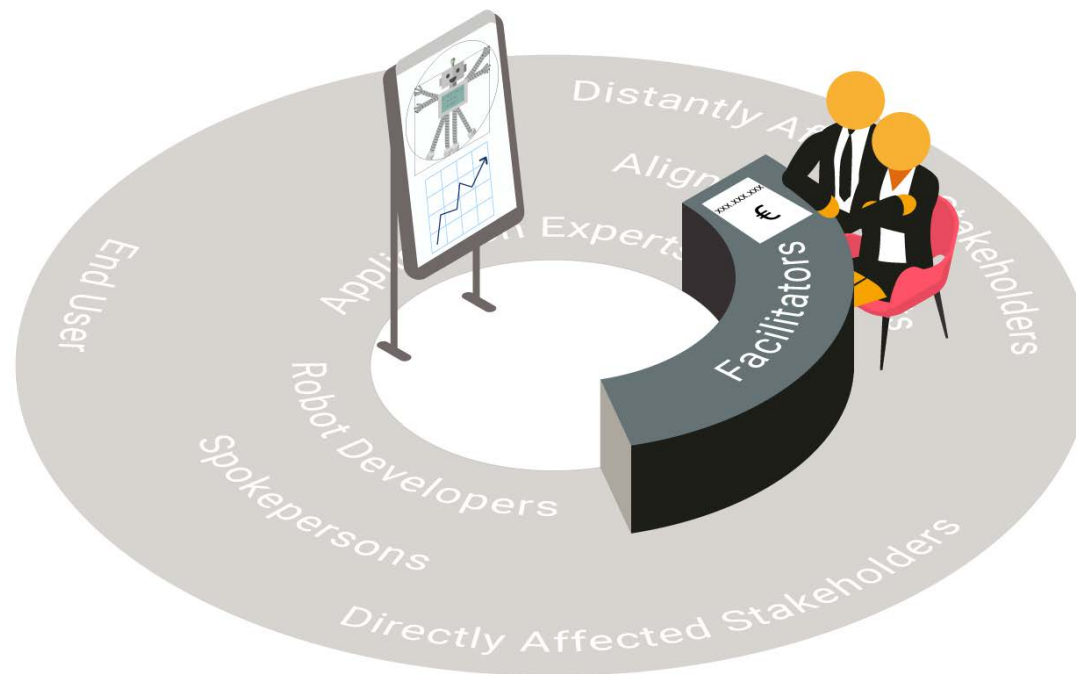


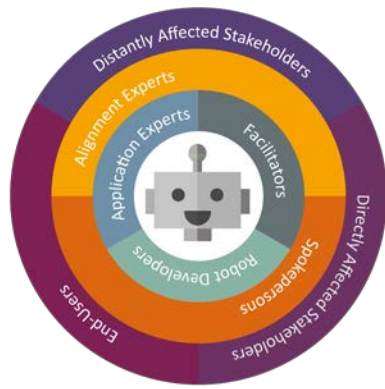
# Facilitators

## Facilitators:

Decision-makers who set the framework for development. This includes people with legal, regulatory, or bureaucratic expertise, and people who facilitate funding, access to market, or testing.

- Funding bodies
- Regulatory agencies
- Lawyers
- Marketing or public-relations





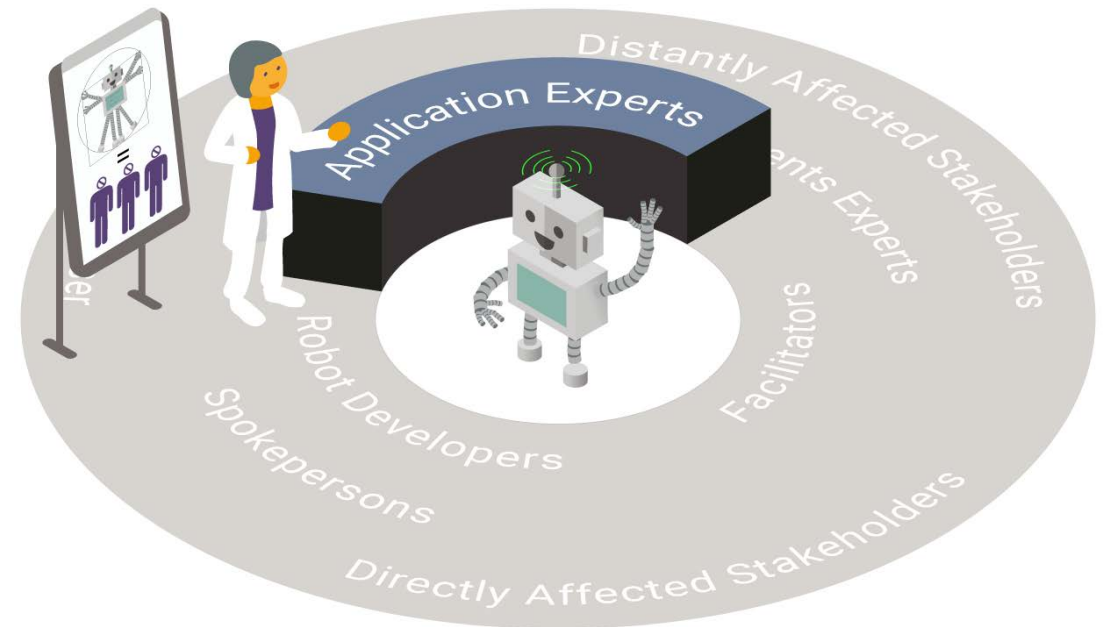
# Application Experts

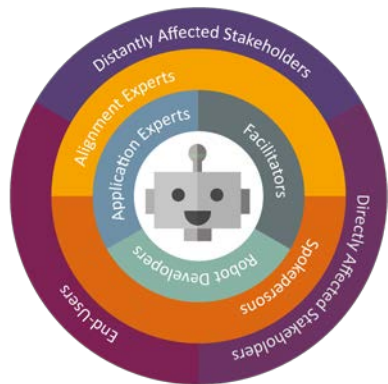
## Application Experts:

People with an expertise in the application area or sector of the given robot. They share their expertise with developers, and are often robot buyers.

- A consultant in healthcare

A building developer for a construction robot



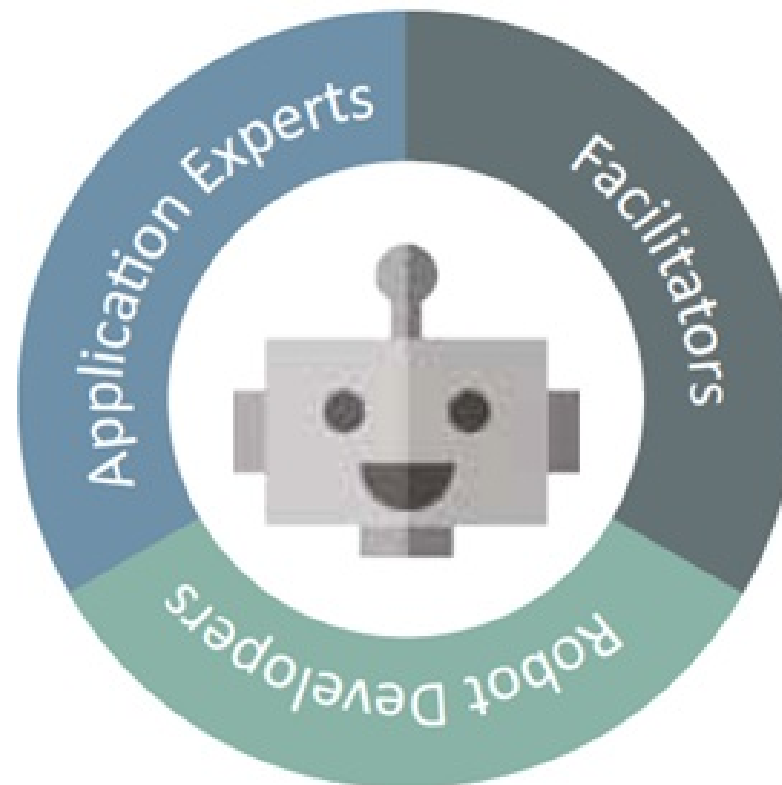


# The inner circle of robotics

Robots are developed in an inner circle of robotics.

The social dimension is lacking, when there is a gap between those who design robots and those who use, and are affected by, robots.

Consequence: Normative design?



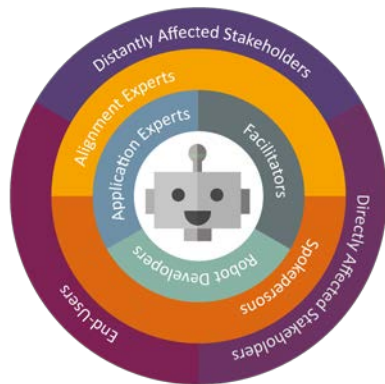
# Normativity in design processes



1. Normative body size
2. Normative cognitive skills
3. Normative environmental understanding

**Result:** Robots are designed on normative understandings that are not tailored to real-life people.

**Consequence:** The robot creates problems instead of solving problems.  
Resistance to use or sabotage of robots.

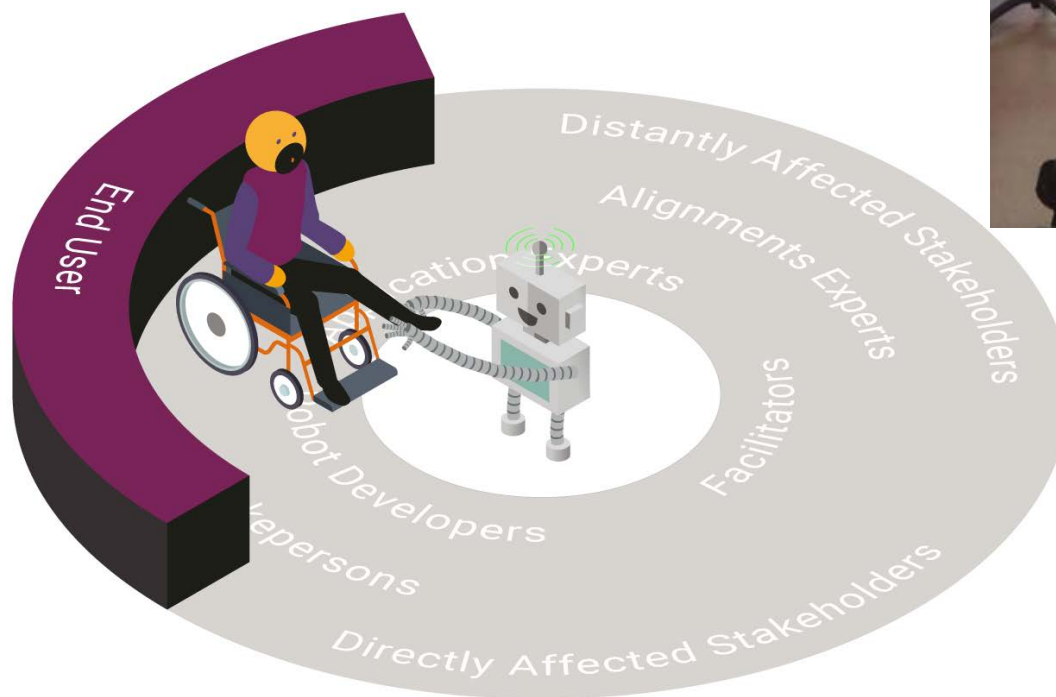


# End-users

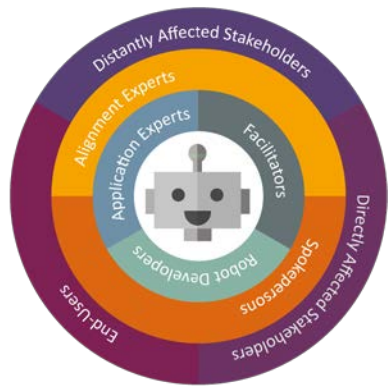
## End-Users:

People who will use (operate or interact with) the robot directly.

- Patient using a rehabilitation robot.





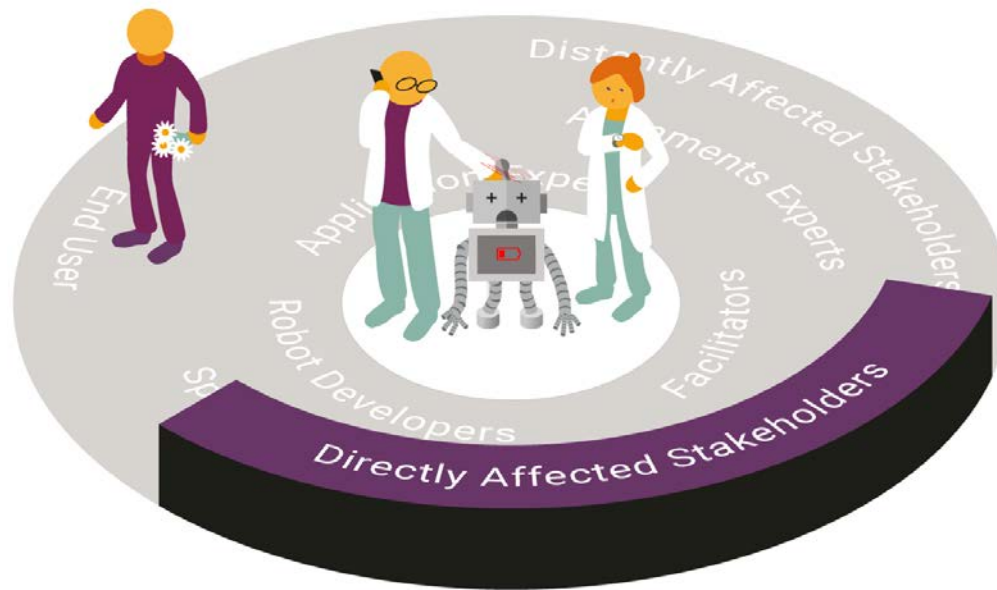


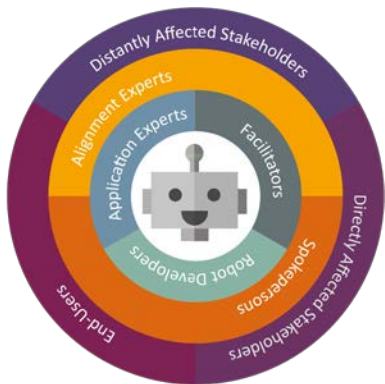
# Directly affected stakeholders

## Directly Affected Stakeholders:

People who are not using the robot, but must accommodate and collaborate with and around it.

- Family member assisting patient with use of a rehabilitation robot.
- Nurse interacting with the robot.



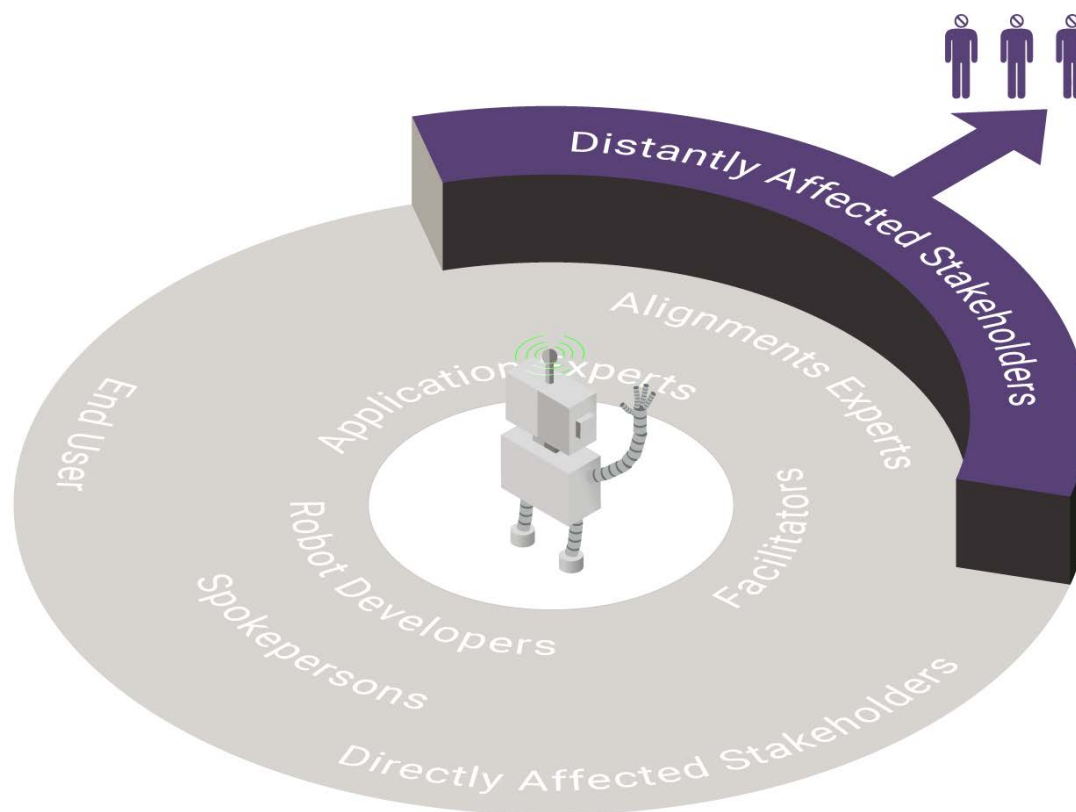


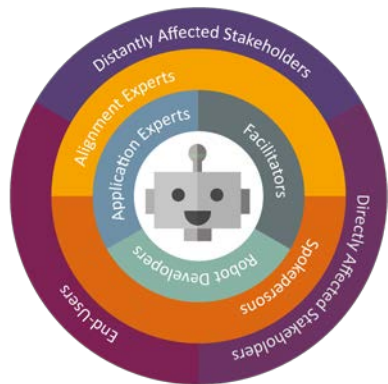
# Distantly affected stakeholders

## Distantly Affected Stakeholders:

People who will likely never operate, use, or interact directly with the robot, but may nevertheless be affected by it.

- Physiotherapist or helper made superfluous.



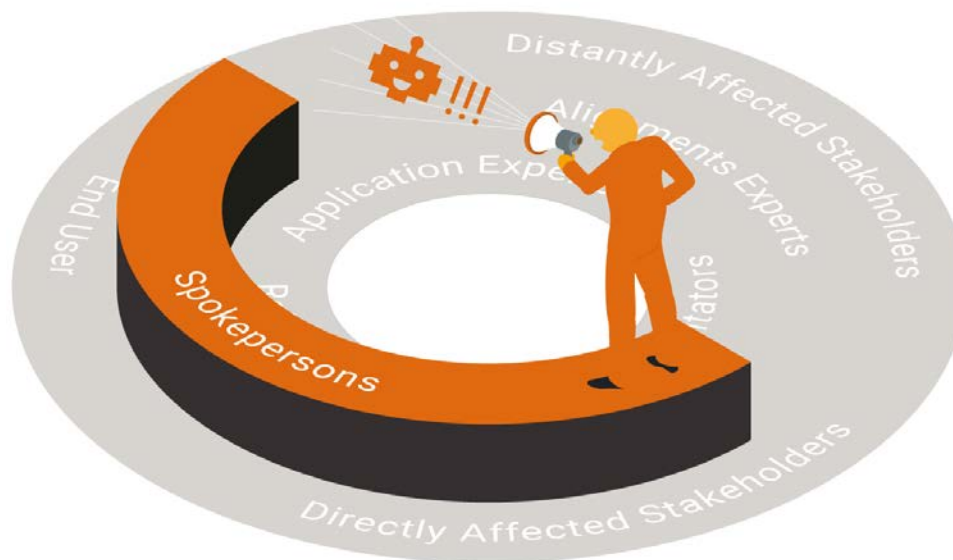


# Spokepersons

## Spokepersons:

An intermediary who speaks on behalf of recipients based on their own experiences.

- A municipality wishing to introduce the robot technology
- A manager.



**REELER** Working Paper Series  
Responsible Ethical  
Learning with Robotics

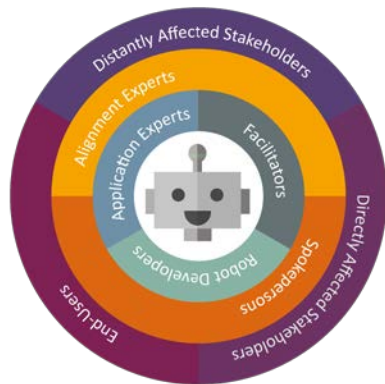
Feeding assistive robotics,  
socio-technological  
imaginaries, and care

The case of Bestic

Niels Christian Mossfeldt Nickelsen  
Aarhus University

Working paper 1, version 2.0, November 2017



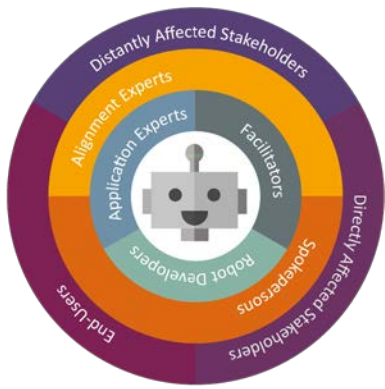


# A new suggestion: Alignment Experts

## Alignment Experts:

- A new profession
- Knowledge of anthropology, Ethics, robotics/AI, and business economy.
- An intermediary seeking to align robot makers and affected stakeholders based on empirical knowledge of both.
- Alignment experts should have an expertise in Social Sciences or Humanities (SSH) and knowledge of robotics/ engineering.





# Main recommendations

See more at: <https://responsiblerobotics.eu>

## Two main recommendations to ensure ethical and responsible robot design

1. Develop and disseminate tools that enhance robot developers' awareness of what is to be gained from collaborating with and taking end-users and affected stakeholders' perspectives into account early on in the development phase.
2. Develop alignment experts as a new profession, where people are educated in methods of aligning the views and visions of robot makers and affected stakeholders. Alignment experts can also give voice to distantly affected stakeholders, when relevant.



# Learn more at:

<https://responsiblerobotics.eu>

## A Reality Check on Imagined Futures

Perspectives on Robots

### Not a traditional 'roadmap'

This website presents the results of the project REELER (Responsible Ethical Learning in Robotics), as a roadmap for closing the gap between users and designers of robots. This is no traditional roadmap. You can take as many detours as you like. The main point is to raise awareness through our different contributions. At the bottom of each page is the REELER Roadmap, with different waypoints for navigating your way through responsible robotics, including:

- **Toolbox:** A number of fun awareness-raising tools, including the BuildBot board game.
- **Outreach:** New methods for engaging with different stakeholder groups, as well as policy recommendations.
- **Research:** Our methodology and findings, including an interdisciplinary publication that brings a reality check on robots and presents an expanded notion of the user.
- **About REELER:** Meet the whole interdisciplinary team behind this site and an overview of our main objectives.

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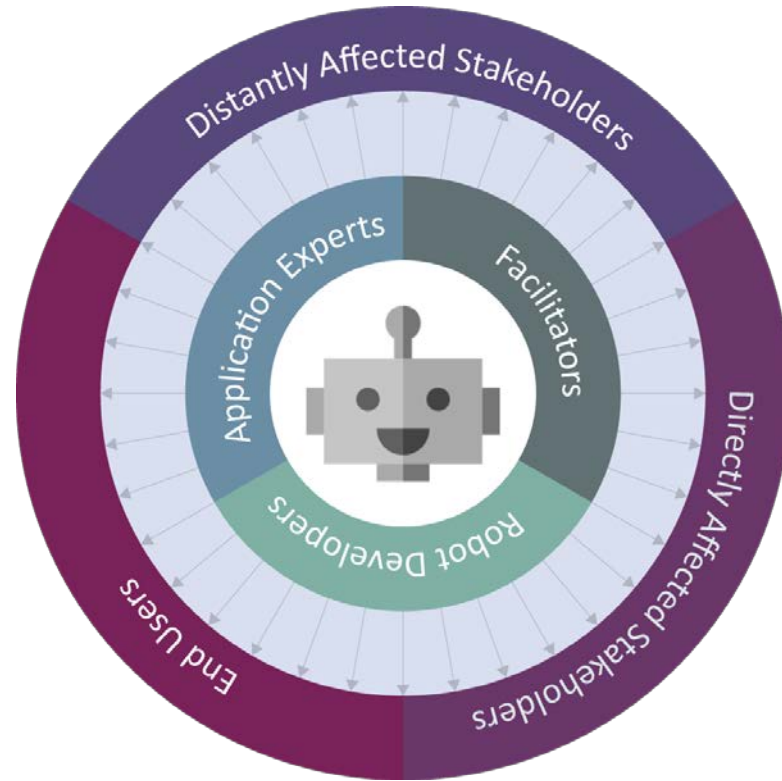
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# Mentimeter response



Do you agree a social dimension is missing in robot technology development?





# Ethnographic research in robotics

Jessica Sorenson, Aarhus University

Karolina Zawieska, De Montfort University

# Mentimeter questions



Which words do you associate with their work?



# Why ethnography?

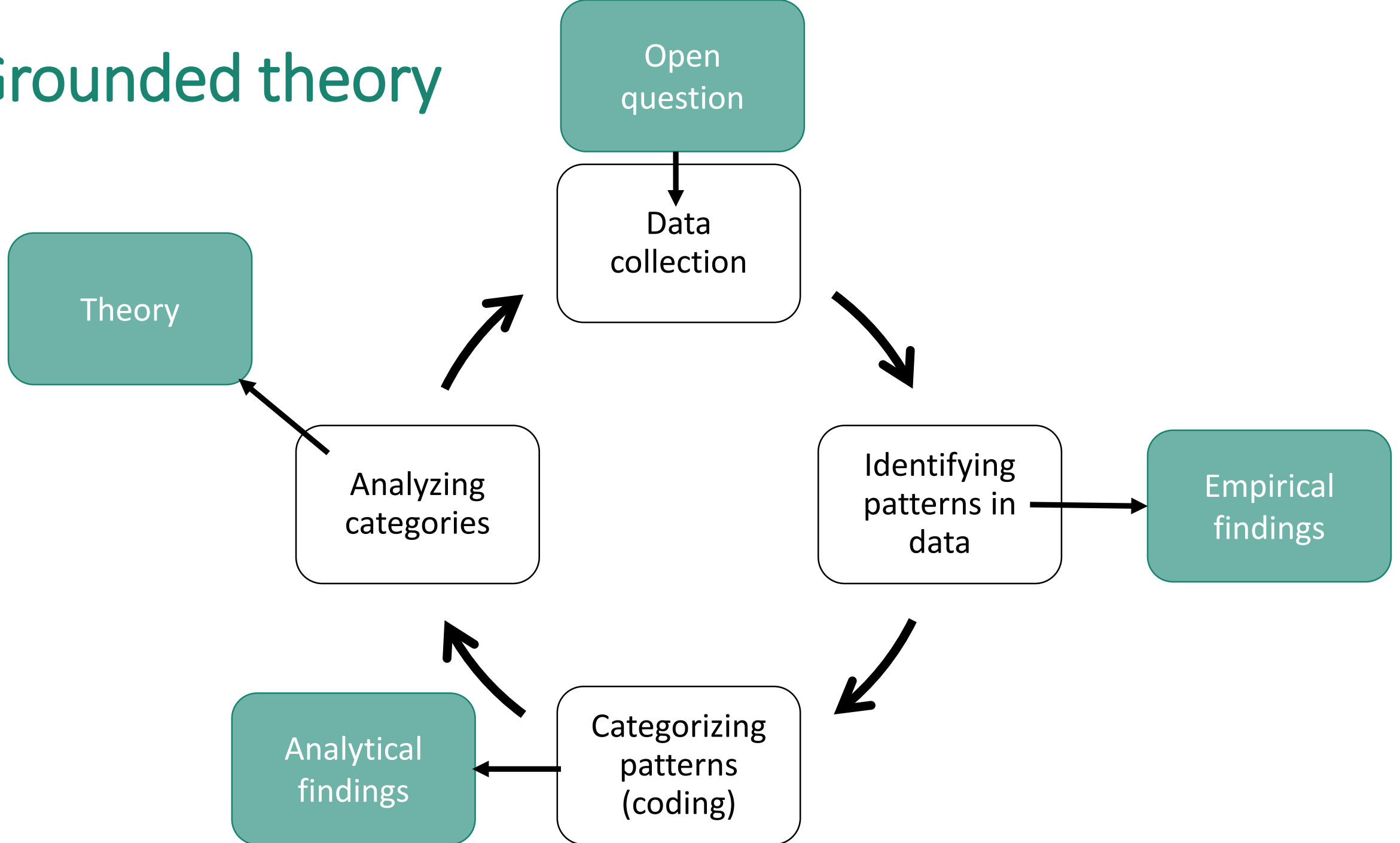
What ethnography can bring to robot ethics and engineering design practice.







# Grounded theory



# Ethnographic methods

- Qualitative interviews
- Participant observation
- Field notes
- Document & media analysis
- Visual elicitation







Case examples





Case examples



# Challenges



Common language



Access

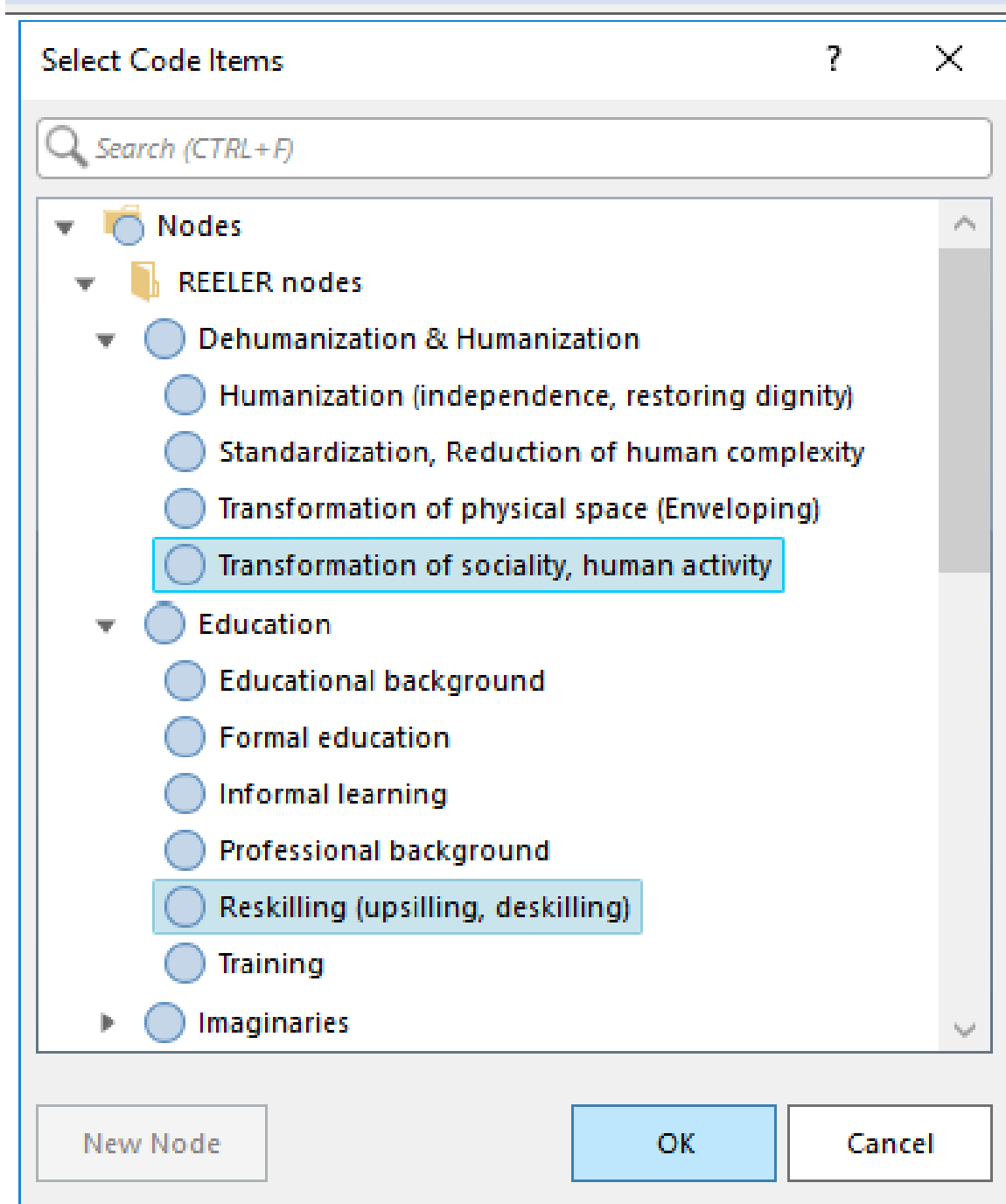


What kind of data did we produce?



# Analysis

- Nvivo qualitative data analysis (QDA) software
  - 177 interviews
  - 139 coded transcripts
  - 15,789 coding references
  - 114 codes per interview



## Analysis

“We have a joint WhatsApp conversation thread where we write down observations...about calving, about udder infections...”



# Mentimeter questions



Which words do you associate with their work?



# Ethnographic research in robotics

By research assistant Jessica Sorenson, Aarhus University  
Postdoc Karolina Zawieska, De Montfort University

# Mentimeter question

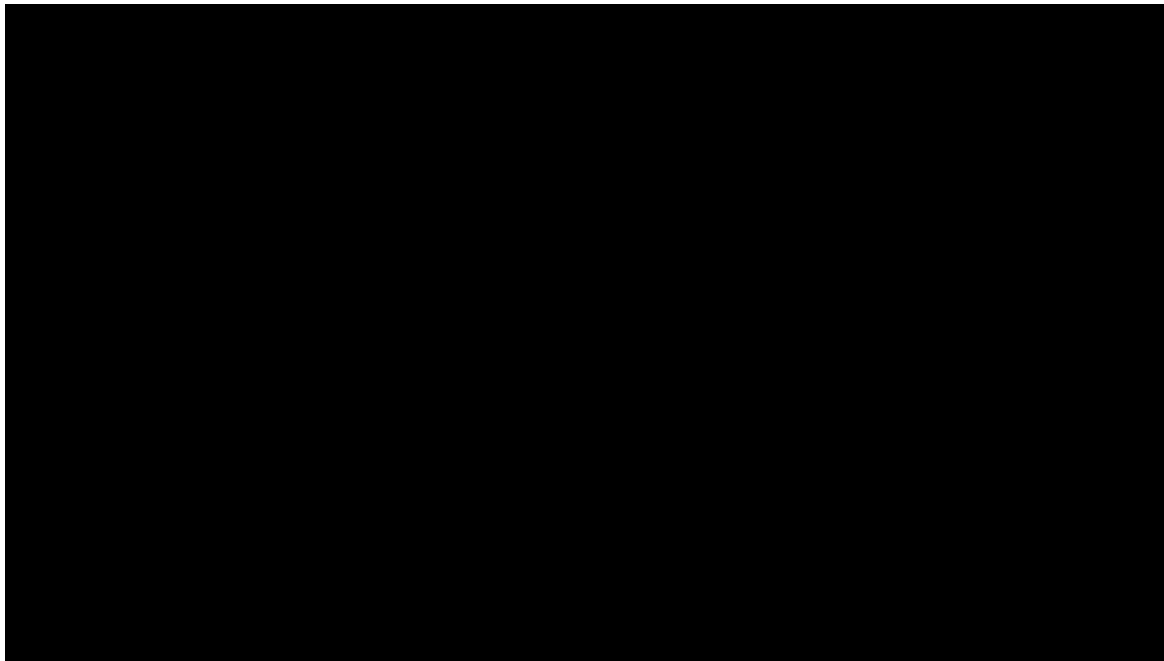


Which words do you associate with their work?



# Why ethnography?

What ethnography can bring to robot ethics and engineering design practice.







Karolina Zawieska

De Montfort University

# REELER Ethnographic methods

- Qualitative interviews
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Case examples





Case examples



# Challenges



Common language

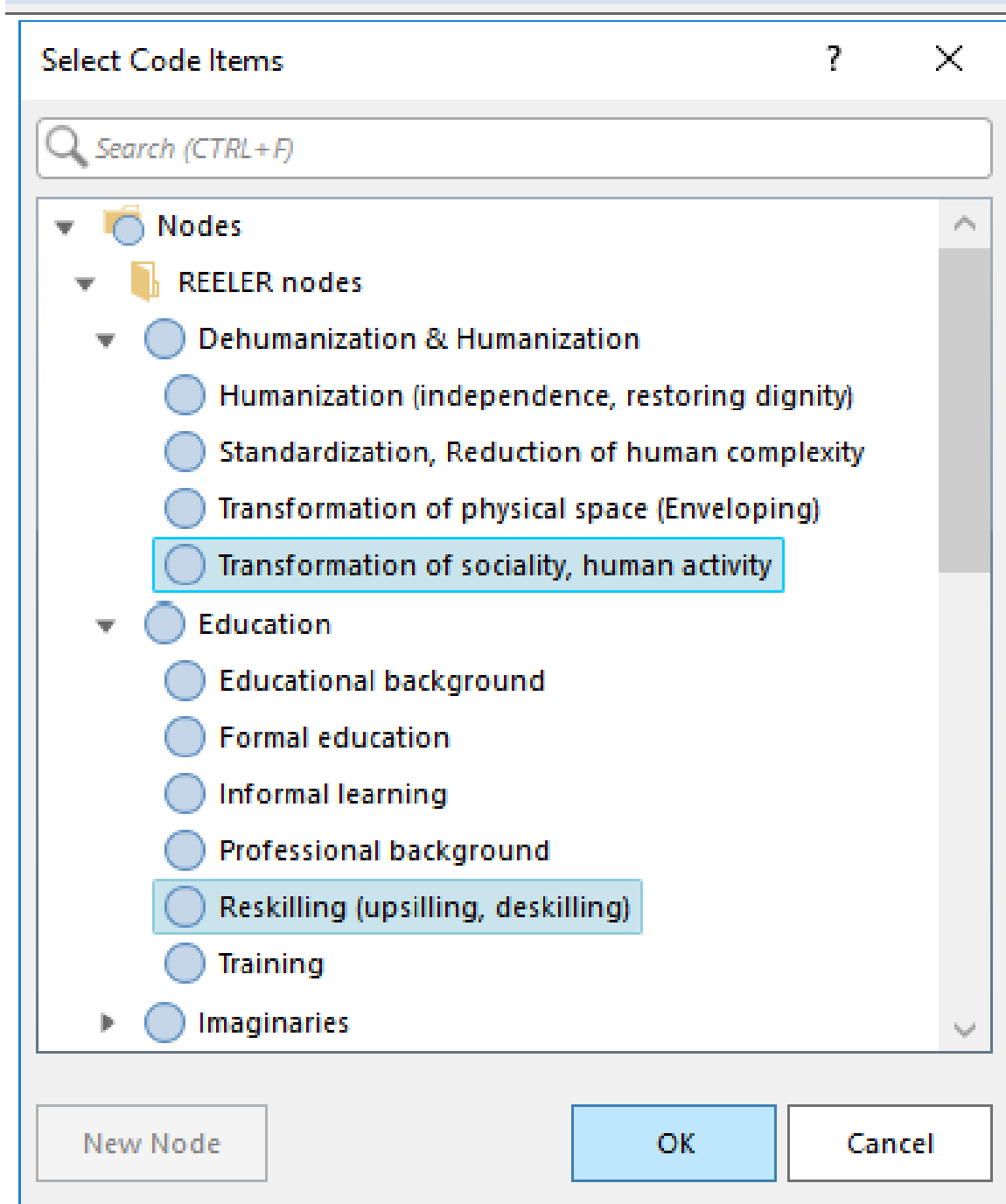


Access



# Analysis

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# Analysis

“We have a joint WhatsApp conversation thread where we write down observations...about calving, about udder infections...”



# What kind of data did we produce?







# Mentimeter question



Which words do you associate with their work?



# Outreach methods in REELER

## Mini-publics, Sociodrama and Social drama

By Professor Cathrine Hasse and  
Professor Kathleen Richardson



# Mentimeter question



Could you imagine using mini-publics  
in technology design?



# Learn more at:

<https://responsiblerobotics.eu>

## A Reality Check on Imagined Futures

Perspectives on Robots

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# Mentimeter response



Could you imagine using mini-publics  
in technology design?



# Development of Robots: Coping with Uncertainty, bounded Rationality and Complexity

By Professor Andreas Pyka



# Mentimeter question

NB! Se om vi kan finde et billede der kan bruges...

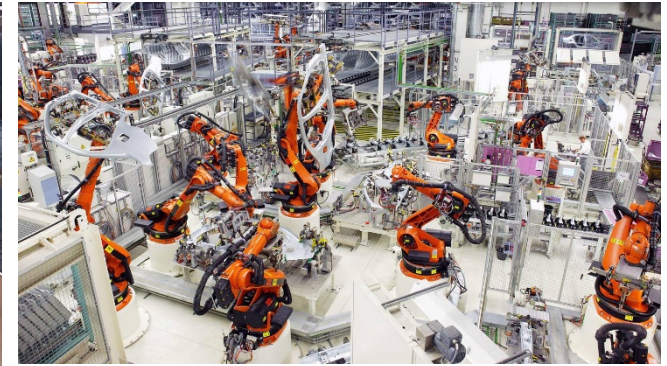
What are important and meaningful sources of knowledge in robot design and development?



# REELER Development of Robots: Coping with Uncertainty, bounded Rationality and Complexity

Robot technology is one of the 21<sup>st</sup> century's megatrend and will penetrate all sectors (agriculture, industry and services).

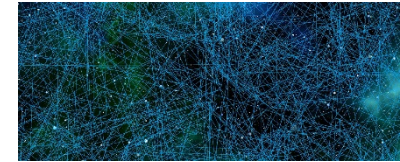
Successful robot development will play an outstanding role in determining firm, region and national competitiveness.







# Development of robots is part of the combinatorial innovation process



We are observing a fundamental transformation of economic systems driven by new technologies with far-reaching implications for society as a whole:

- Robotics, artificial intelligence, bioeconomy, digitalization, renewables ....
- Most technologies are still in an infant phase.

→ innovation economics matter!

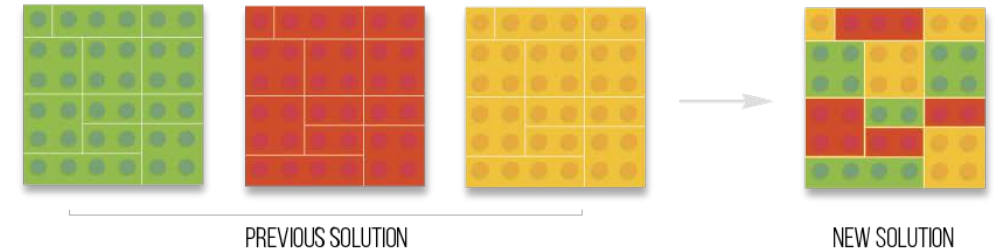


# Development of Robots is part of the combinatorial innovation process

Technological Developments are not independent, but massively influence each other and create enormous new opportunities and challenges:

- Cross-fertilization (combinatorial)
- Societal implications
- Sustainability
- Ethics
- ....

→ complexity and uncertainty

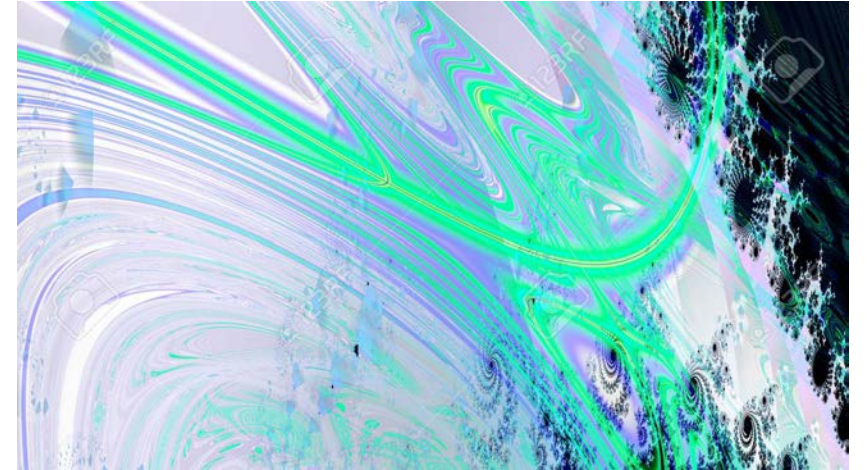




# Uncertainty and Complexity

**Complexity** is related to the huge combinatorial possibilities and the dynamic relationships between different technologies (e.g. robotics and AI)

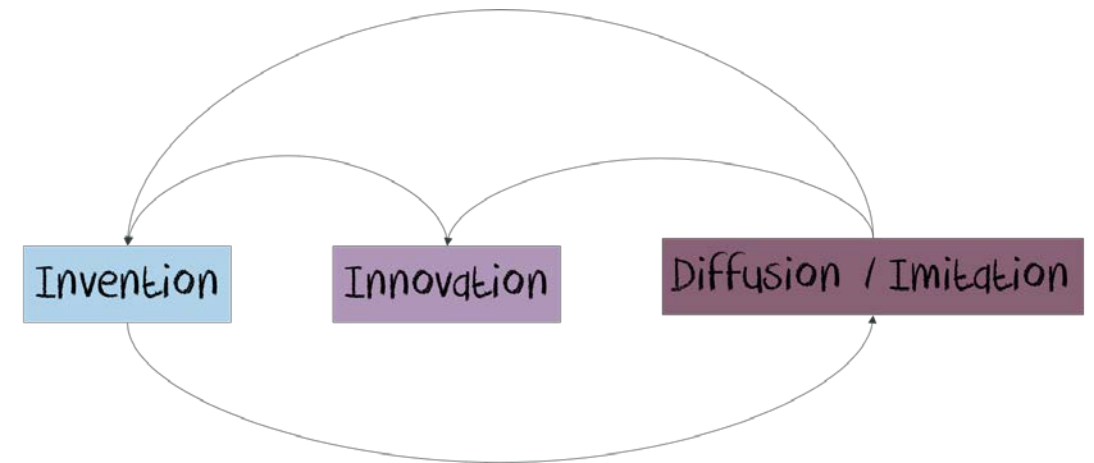
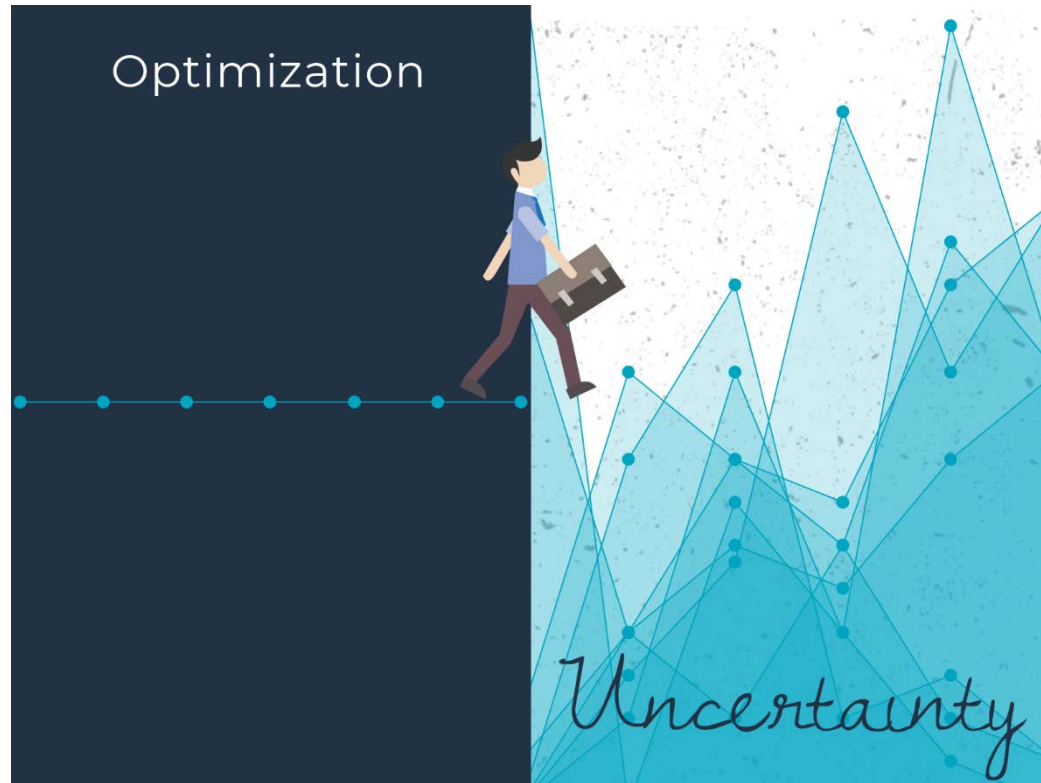
**Uncertainty** is an inherent feature of innovation. Innovation by definition cannot be known ex-ante and always includes surprises.







# Experimental instead of Optimization Behavior

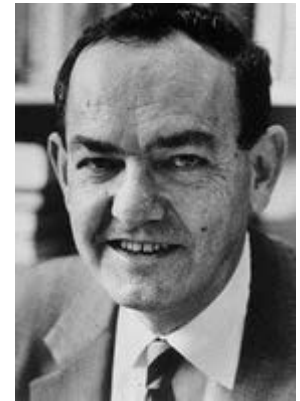


⇒ no simple linear processes and no profit maximization!

# Bounded Rationality

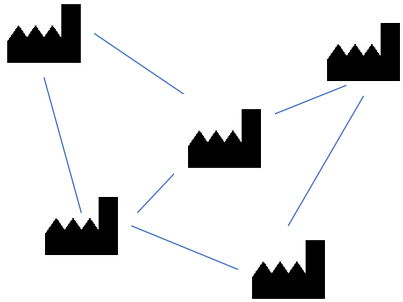
„A body of theory of procedural rationality is consistent with a world in which human beings continue to think and continue to invent; a theory of substantial rationality is not.“

*Herbert A. Simon*



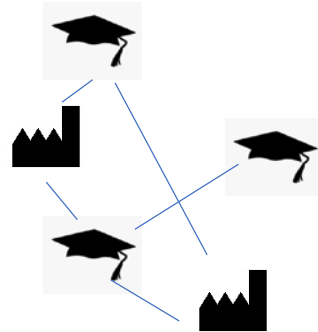


# Development of Robots: Encompassing Innovation Networks



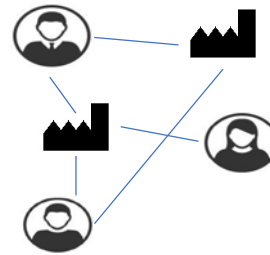
Inter-firm  
innovation  
network

+



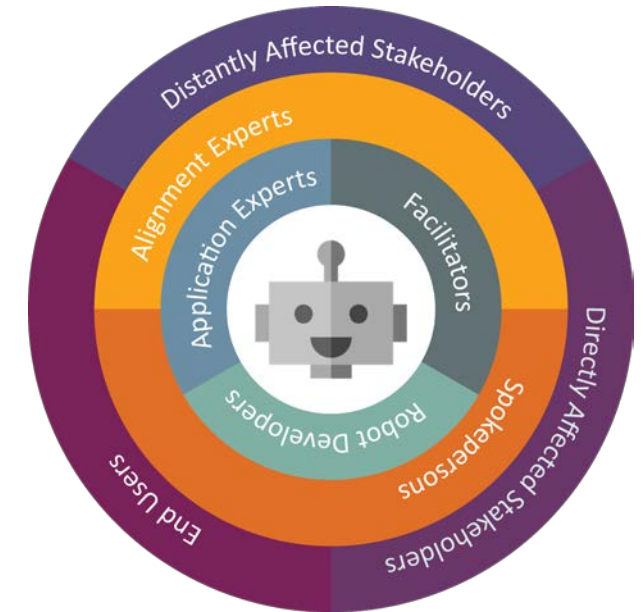
university-  
industry  
network

+



user-  
producer  
network

=



REELER's  
Human  
Proximity  
Model





# Conclusions

We emphasize a stylized new product development method, notably recognizing that roboticists have to:

- Acknowledge for market and technological uncertainty,
- Modularize robot designs and iteratively and recursively solve technical bottlenecks therein,
- Develop absorptive capacities concerning the overall technological development to design interfaces to connect with other technologies,
- Conduct repeated develop-test-plan cycles thereby possibly extending the set of stakeholders involved over time.



# PERSPECTIVES ON ROBOTS

## A Reality Check of Imagined Futures!



"This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731726"

# Mentimeter

Mentimeter question:

1. How will robotization affect the labour market?
  - a. Mass ***un***employment
  - b. Continued high rates of employment

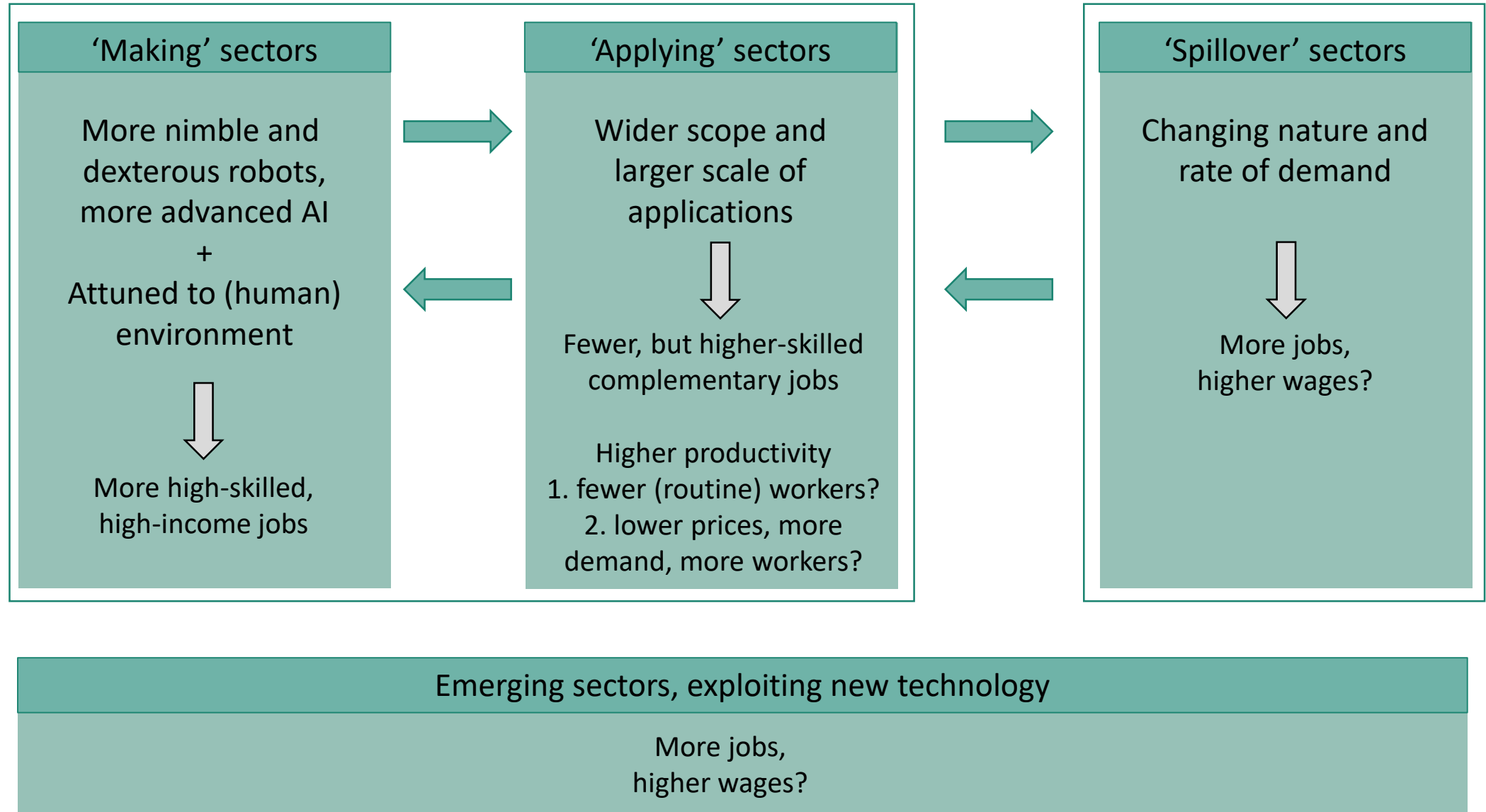


# Impact of robotization

- Robots do dull, dirty, dangerous work?
- People left to do 'meaningful' work?
  - Genuine creativity,
  - Social skills,
  - Physical dexterity?
- Mass unemployment? Exacerbating inequality?
- Role of education? Who can keep up?
- Social security, UBI? Robot tax?



# Structural change in composition of labor market (simplified)

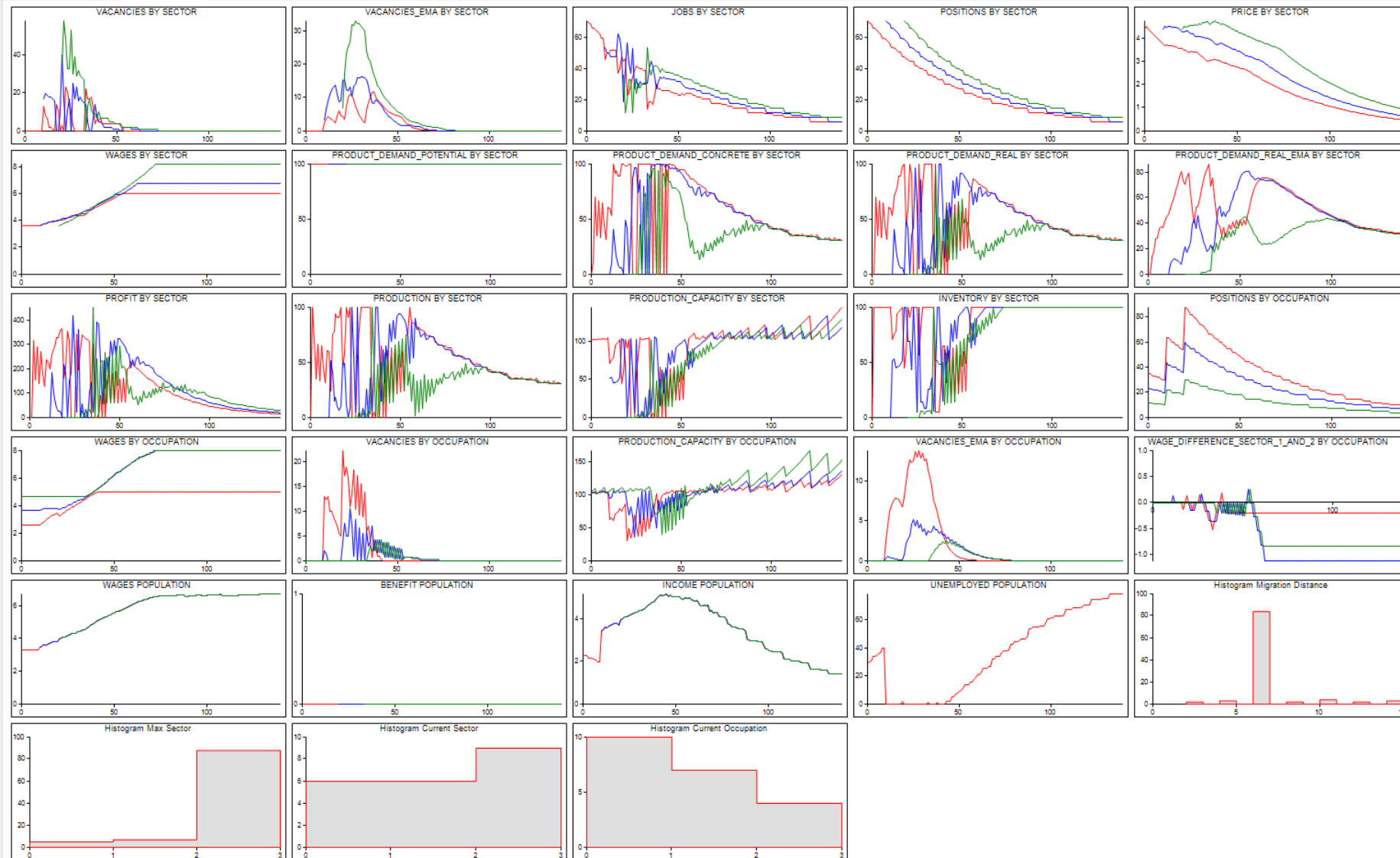


# Agent-based model

- Worker/ consumer agents
  - Employed at firm or unemployed
  - Skills, can upskill
  - Demand for products (in chronological order)
- Firm agents
  - Active in certain sector
  - Makes products (requiring different skills)
  - Product price depends on wages and # workers required
  - Hire/ fire workers
  - Change wages
  - Robotization increases productivity, lowers demand for labor
- Experimental variable: add sectors



Sector-occupation matrix Timeseries plots Monte Carlo Agent stats Migration graph



10 Step

3SECTOR30CI Simulate New sector

Entry frequency 10

Wage heuristics

Wage increase 0.04 ☐ OLD wage / po

Wage-adj vac.l. 0.9 ☒ NEW wage: all

Wage migr. cap. 0.00 ☐ Vacancy EMA

☐ Base-wage incr

General variables

Productivity gain 0.02 ☐ Occ1

UBI Price Percentage 0

Robot tax 0.00

Labour market matching

☒ Skill distance-based migration

# periods empl. history 1

w down occup 1 w down sect 1

w up occup 2 w up sect 4

Skill distance threshold 10

Applicant handling Internal allowed

Production

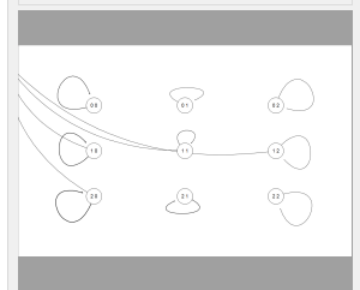
Concrete vs potential 0.0

Markup 1.0

Demand

Demand order CHRONOLOGICAL

Capital spread 0



# Structural change in composition of labor market (simplified)

- Robotization
  - ⇒ Productivity +
  - ⇒ Labor demand — [i.e. increasing unemployment]
  - ⇒ Wage competition across sectors —
  - ⇒ Stalls wage-price spiral
  - ⇒ Stagnation of wages & income gap low- and high-skilled
- Emergence of sectors
  - ⇒ Labor demand + [i.e. increasing employment]
  - ⇒ Wages + / Labor mobility required +

# Policy interventions: differentiated by labor market conditions

- labor **surplus**, robotization:

- Unemployment +  
→ product demand –  
→ labor demand –

- labor **scarcity**, robotization:

- “Free up” workers +
  1. curbs wage-price spiral  
→ international competitiveness +
  2. labor migration possible  
→ exploitation new opportunities

- universal basic income\*\* + → product demand +  
→ labor demand + → employment +
- robot tax + → labor displacement –
- creation of new sectors & education + →  
employment + (→ demand + → employment +)

- universal basic income + → product & labor  
demand + → wages + → product prices + →  
international competitiveness –
- robot tax + → “freeing up” labor – →  
sustained tension on the labor market →  
exploitation new opportunities –
- creation of new sectors → sustained tension  
on the labor market



# Changing *nature* of work

- Robots take over routinized work in predictable environments
- More nimble, dexterous robots, increasing prominence of creativity, social skills, physical dexterity



# Awareness-raising tools developed in REELER

By R&D Director Maria Bulgheroni



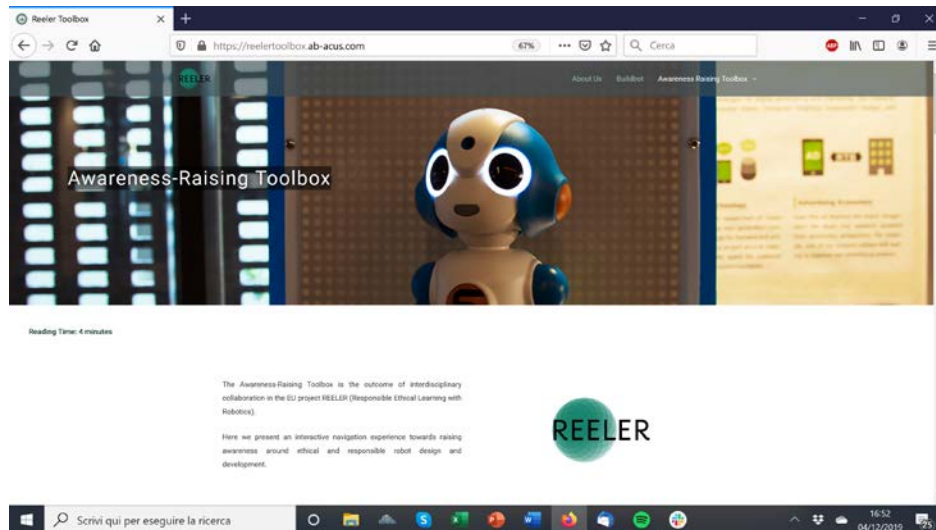
# Mentimeter question



Gaming is learning!



# How to build multidisciplinary engagement?



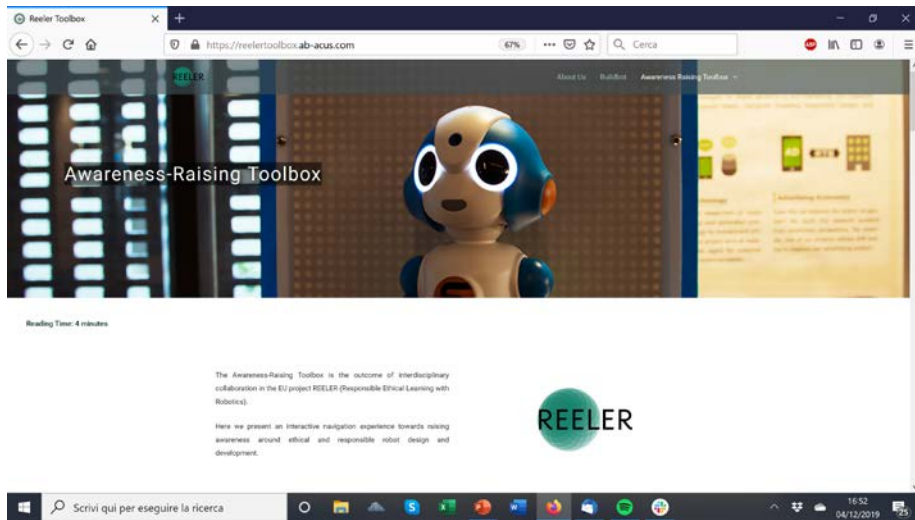
The interactive toolbox  
[reelertoolbox.ab-acus.com](https://reelertoolbox.ab-acus.com)



BuildBot:  
A board game to learn multi-perspective  
design

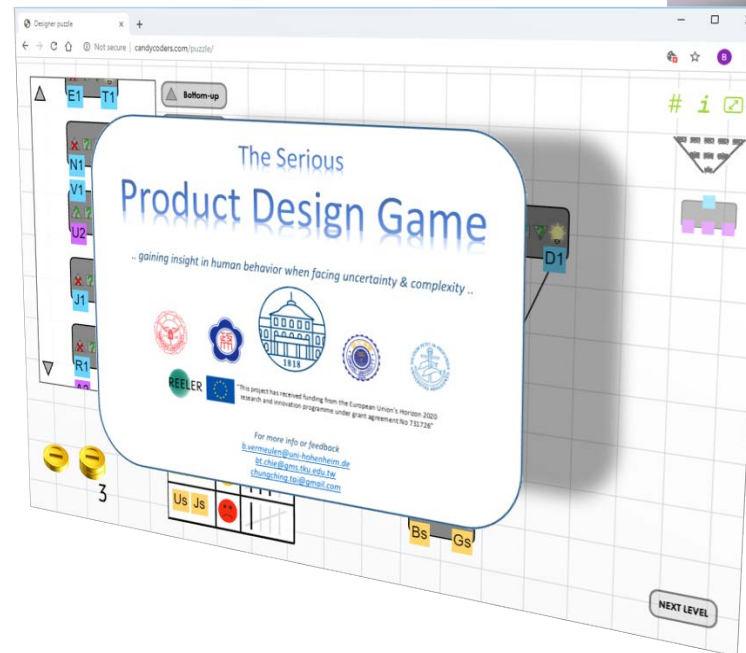


# How to build multidisciplinary engagement?



The interactive toolbox  
[reelertoolbox.ab-acus.com](https://reelertoolbox.ab-acus.com)

Brickster:  
An online game to understand the  
impact of choices in the process  
design



BuildBot:  
A board game to learn multi-  
perspective design

# Brickster: a serious game on product design

- “Text adventure” style using repurposed ethnographic narratives for
- Confront player with *ethical dilemma's* and *innovation economic issues* in product design
- Reveal consequences of choices in terms of:
  - Technical design options available
  - Evaluation of stakeholders of design





# The REELER toolbox: structure

Reeler Toolbox

https://reelertoolbox.ab-acus.com

67%

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REELER

About Us Buildbot Awareness Raising Toolbox

Awareness-Raising Toolbox

Reading Time: 4 minutes

The Awareness-Raising Toolbox is the outcome of interdisciplinary collaboration in the EU project REELER (Responsible Ethical Learning with Robotics).

Here we present an interactive navigation experience towards raising awareness around ethical and responsible robot design and development.

REELER

Scrivi qui per eseguire la ricerca

16:52 04/12/2019 25



# The REELER toolbox: structure

Reeler Toolbox

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This Awareness-Raising Toolbox is composed by eleven topics, that can be splitted in two sections. The first section, **"While Developing"**, aims at embracing an ethical and responsible approach towards robot design and development. The second section, **"Beyond Development"**, contains topics that don't necessarily impact development itself, but might interest you!

**WHILE DEVELOPING...**  
Learn to introduce different perspectives into your robot design and development process.

- Robot Beginnings:** Learn about what drives robot design and development. **4 min read.**
- Collaboration in the Inner Circle:** Does interdisciplinarity impacts research and development? Find out here. **3 min read.**
- Ethics Beyond Safety:** Learn about the role of ethics in the context of research and development. **4 min read.**
- Inclusive Design:** How to enhance your design and development process? Read more here! **5 min read.**
- Innovation Economics:** Go deep into innovation economic systems around research and development. **5 min read.**
- Learning in Practice:** Robotics imply an ongoing learning process. Find out how and who. **4 min read.**

**Economics of Robotization:** Learn about what comes after the introduction of a robot on a large-scale. **5 min read.**

**Imagines around Robots:** Find out what are common perceptions of robots among different people. **4 min read.**

**Meaningful Work:** Learn how robotization impacts work organization. What should you consider? **5 min read.**

**Gender Matters:** Go deep into the gender issues within robotics culture. **5 min read.**

**Human Proximity:** Learn to better align different perspectives towards close collaboration. **4 min read.**

**BEYOND DEVELOPMENT**  
Learn how robots introduce change and impact lives...

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16:55  
04/12/2019

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# The REELER toolbox: the navigation

Reeler Toolbox

https://reelertoolbox.ab-acus.com

67%

Cerca

Follow the arrows to go through the linear navigation path described in the Content Overview

Go To: Previous Page




Go To: Next Page

Go through our recommendations at the end of each page

Related Topics

By going over each icon with the mouse you will get a brief description of the corresponding topic.

Look for these icons to go deeper into our learning material

**Key Concepts:** Here you will find the key terms addressed in each topic and the corresponding definitions.

**Giving Voice:** Here you get to listen to affected stakeholders from REELER's case studies.

**Reflection Points:** Here you get to question yourself and your design practices as you go through each topic.

# The REELER toolbox: the voices from the field

Robot Beginnings – Reeler Tool X

https://reelertoolbox.ab-acus.com/front-page/robot\_beg


90%

Cerca

ABP

1996

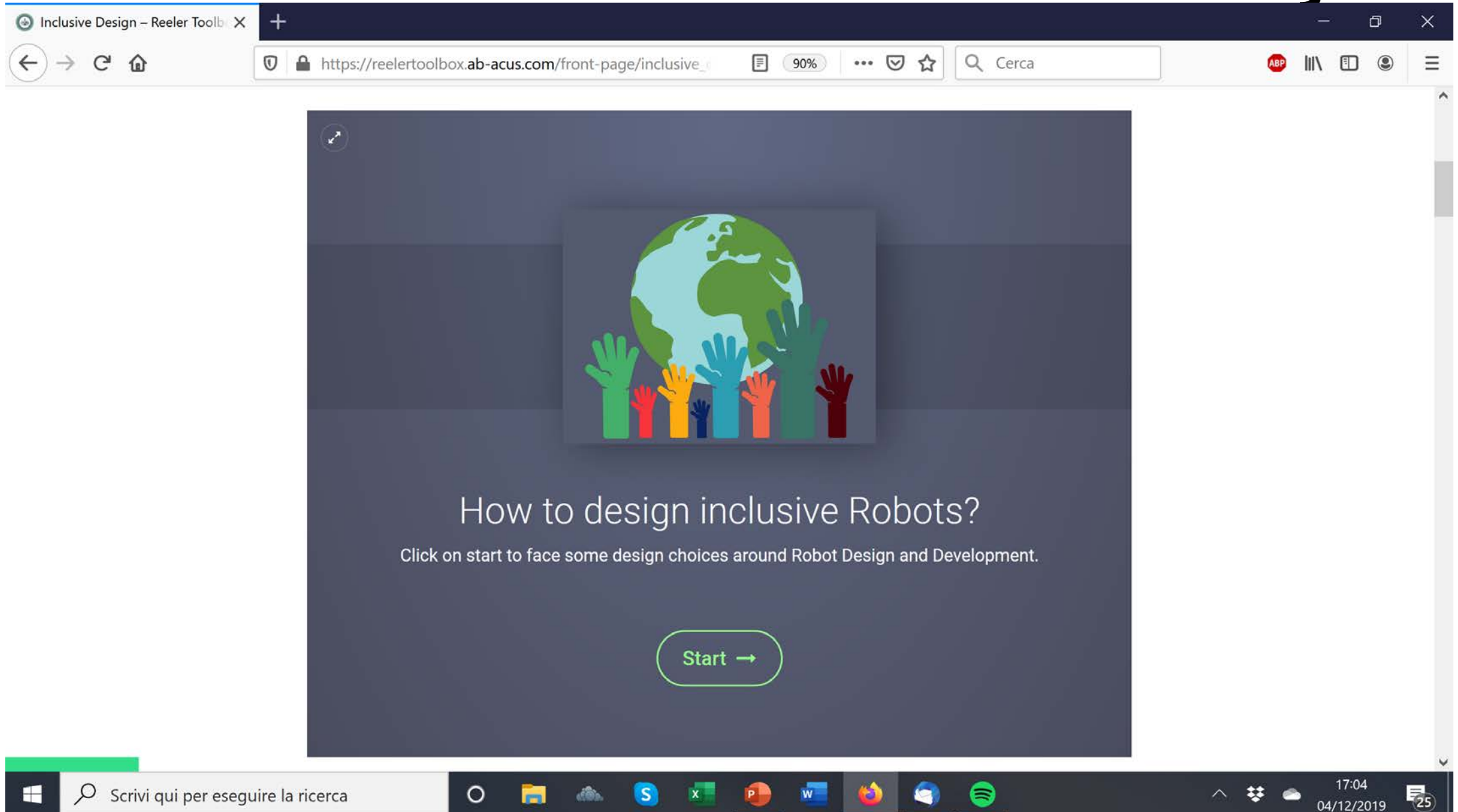
A group of (male) robot makers decided to develop a cucumber-slicing kitchen robot. They were passionate about robots and had previously worked on a cooking aid robotic device at their university. One of the guys, Jannick, became a CEO of KIT, the company they formed together as an off-shot of their university passion.

Click on  to listen to the Affected Stakeholder. Click on the [arrows](#) to navigate. You can expand the content to full screen by clicking on the bottom right corner.

Scrive qui per eseguire la ricerca

17:00 04/12/2019 25

# The REELER toolbox: the interactive minigames





**The REELER toolbox:  
.... and much more**

**Navigate it!**

**[reelertoolbox.ab-acus.com](http://reelertoolbox.ab-acus.com)**



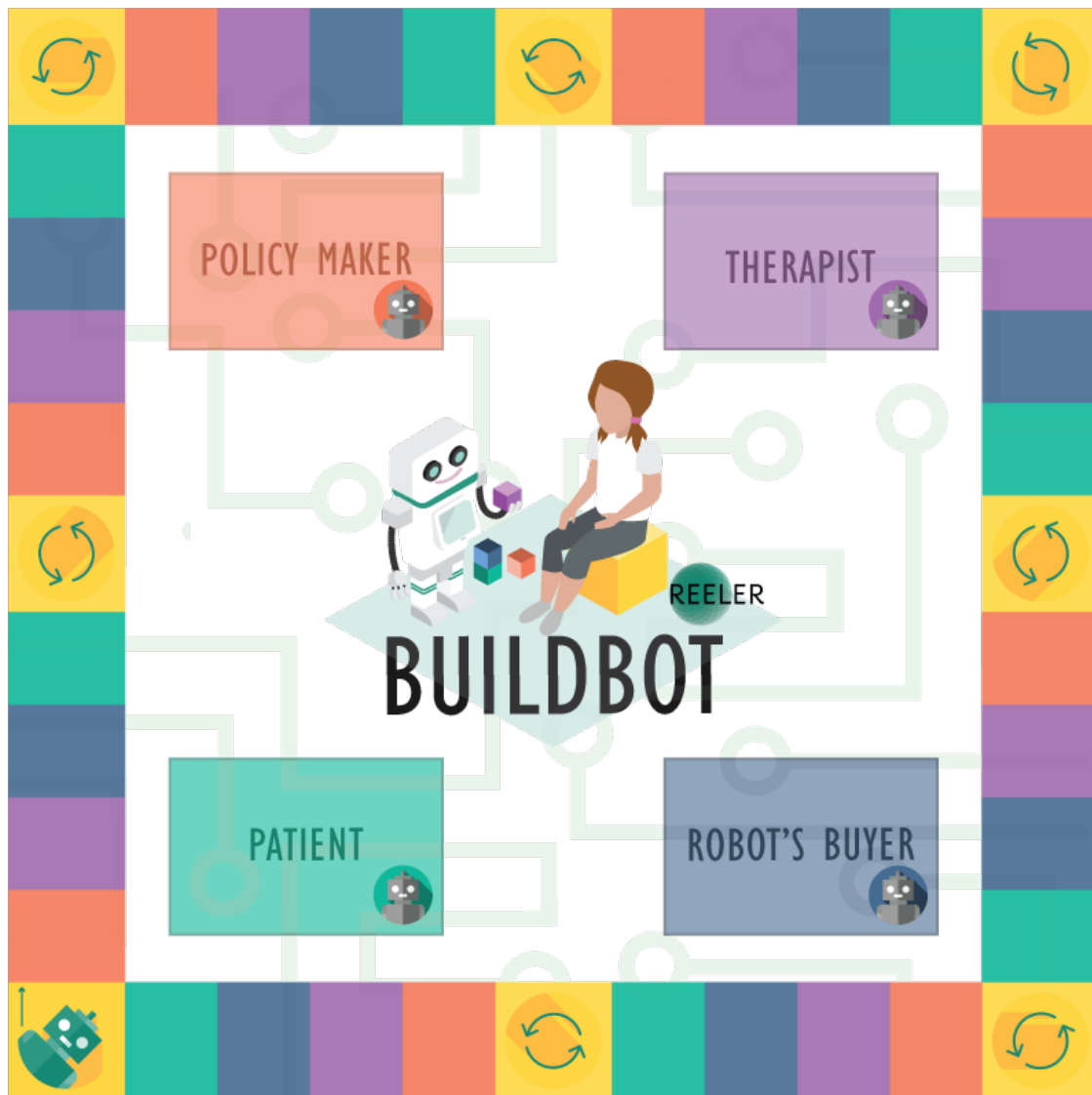


# BuildBot: learning to play and playing to learn





# BuildBot: the board and the cards





# BuildBot: how to play



Thanks!

... and enjoy playing! ...