How to study Future Human Robot Interaction in the Wild?

Presentation Summerschool 2025

ACM SIGSOFT Summer School for

Software Engineering in Robotics

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imec SMIT Vrije Universiteit Brussel

DIGITAL HEALTH & WORK – TEAM, lead prof. An JACOBS

Cocreate & evaluate future practices

Study current practices micro-meso-macro to ideate on new ideas/concepts of digital services in health and work

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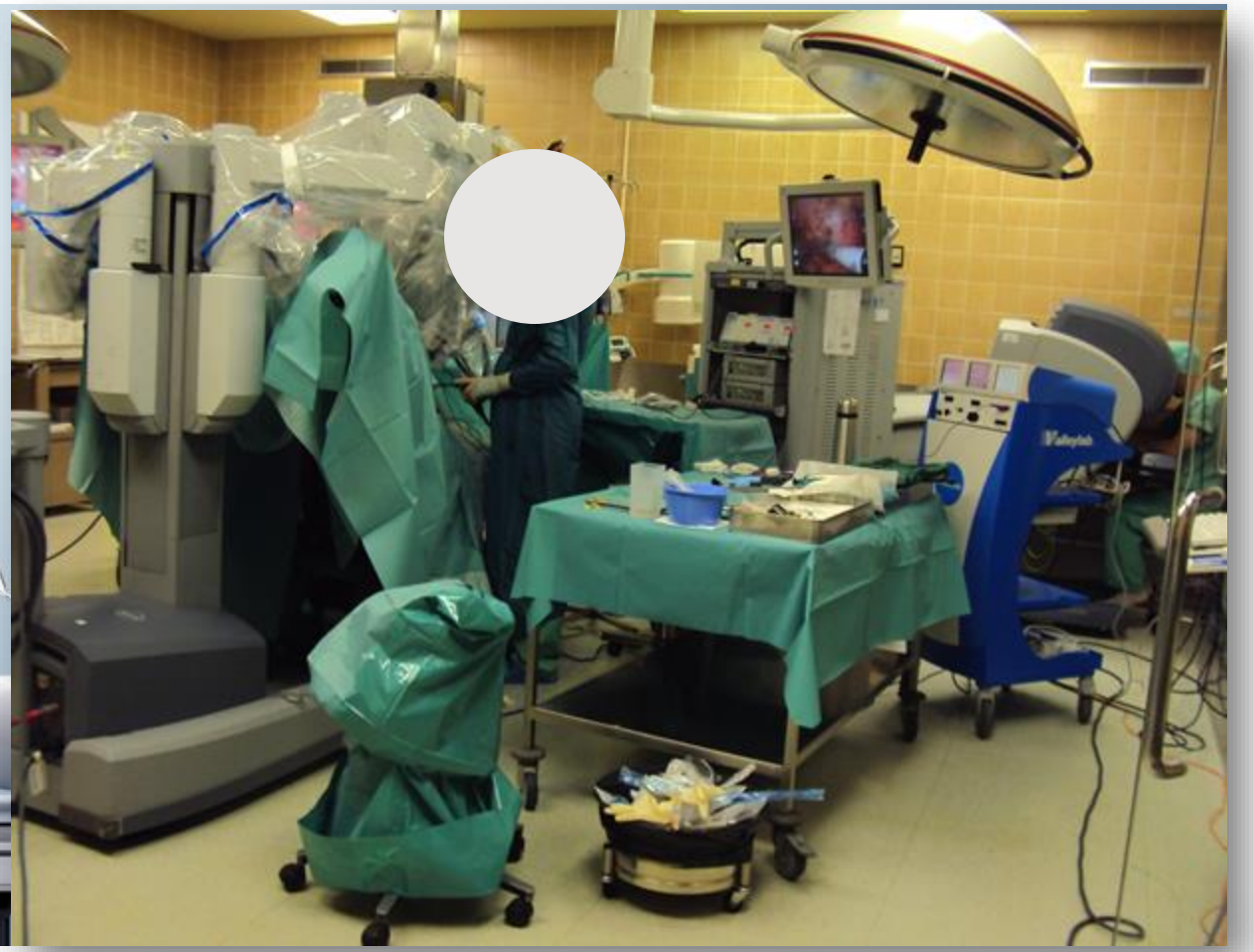
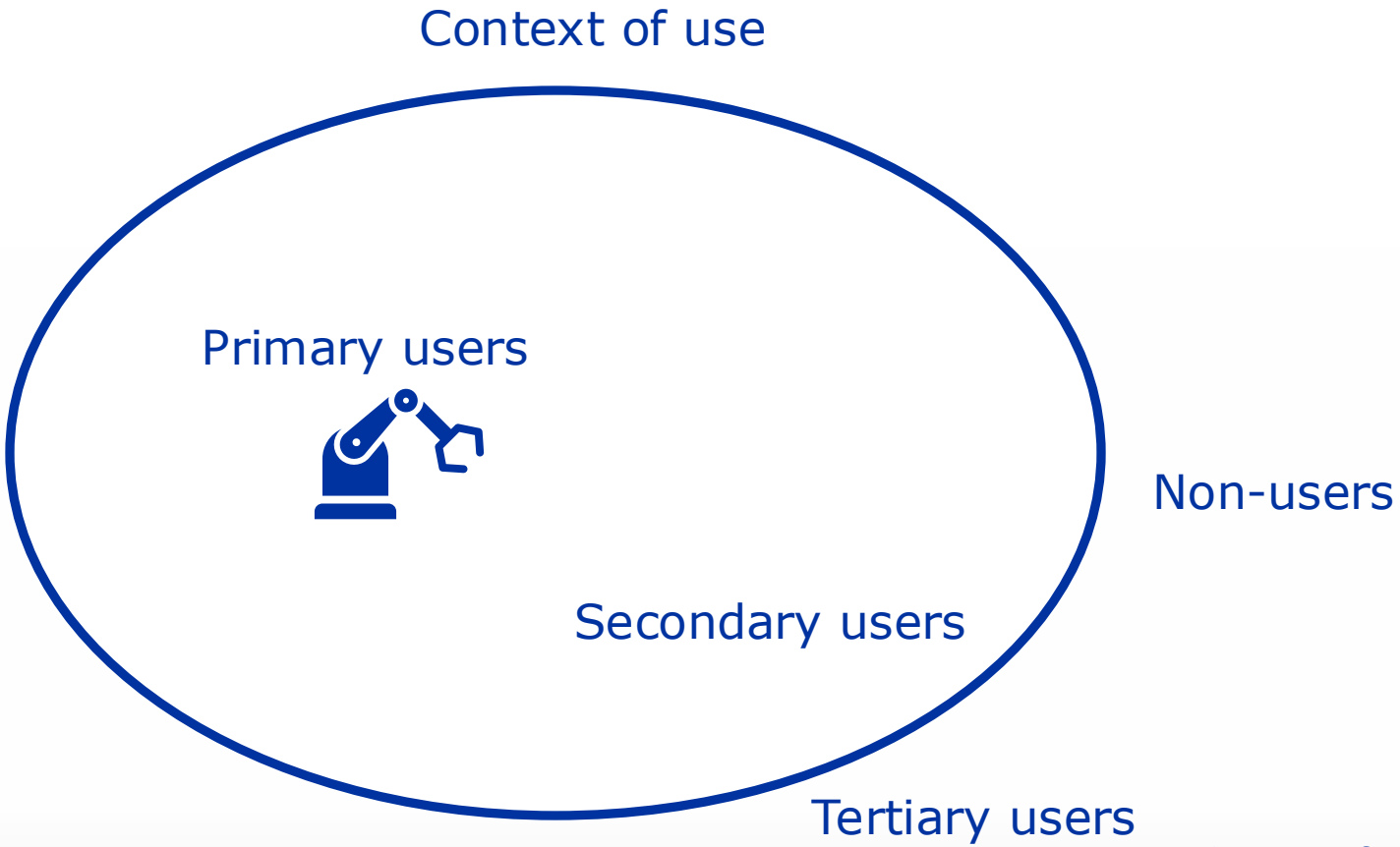
IN THE WILD … WHY CARE ?



Relation between human-robot & - human-AI interaction and the quality of life/work

TYPES OF END USERS

WHO ARE THE STAKEHOLDERS?



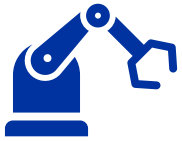
Concepts from Eason (1989) and Wyatt (2014)

TYPES OF END USERS

WHO ARE THE STAKEHOLDERS?

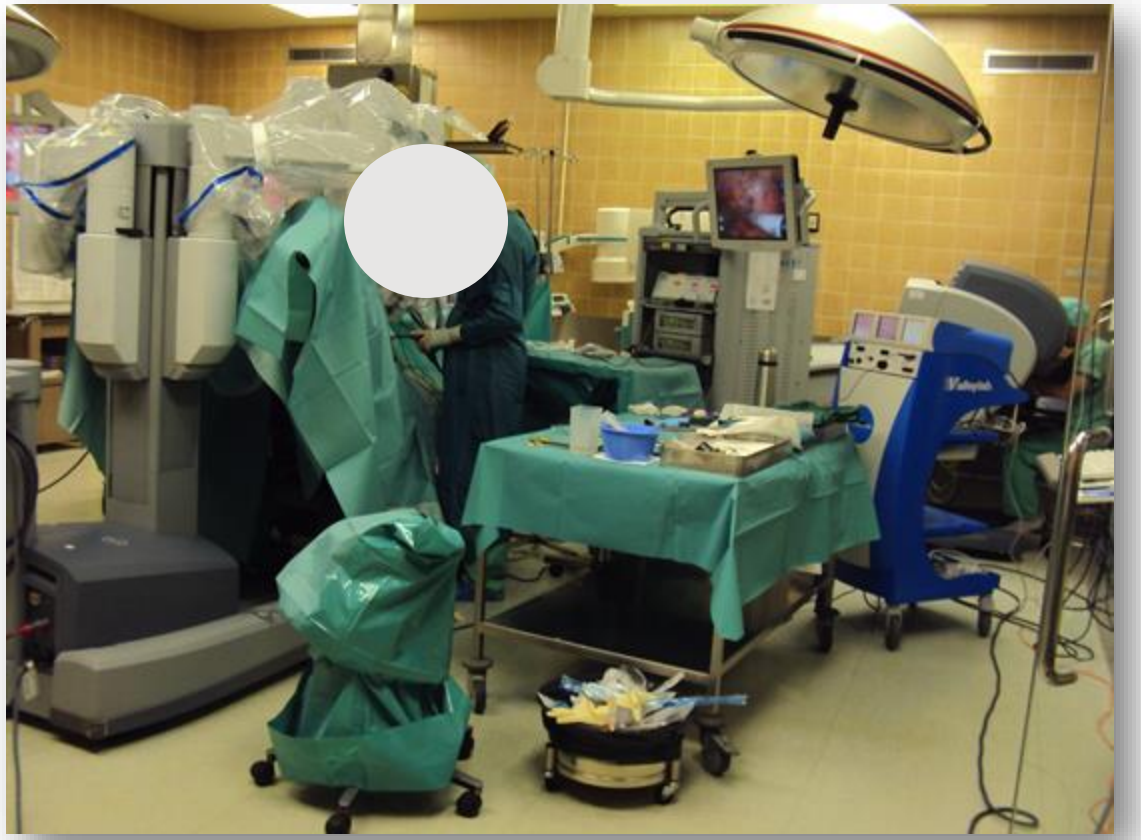
Context of use

Primary users: surgeon



Da Vinci robot

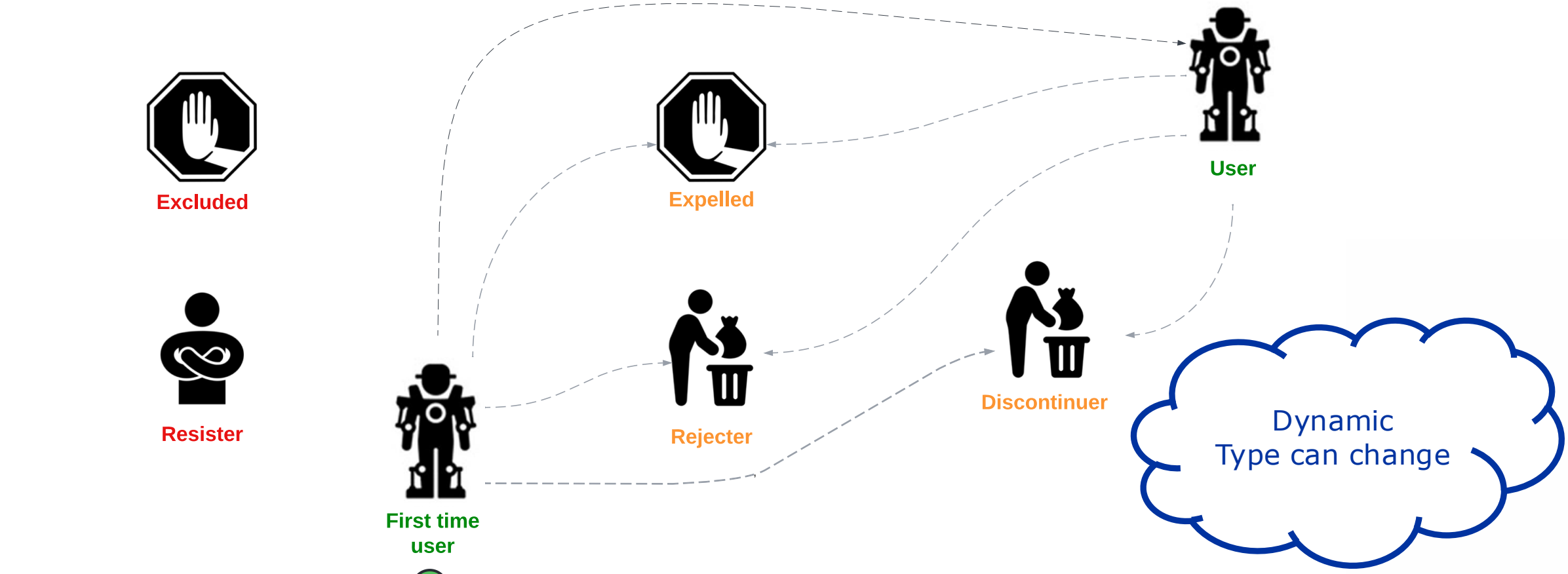
Secondary users:
scrub nurse



Non-users: surgeons who do not want to work with Da Vinci robot

Tertiary users: circulating nurse, patients

TYPES OF (NON) USERS



Based on Wyatt et al. (2002) and De Graaf et al. (2017)

Studying future HRI solutions in the wild ?

An recent example on self-driving vehicles in a warehouse

CHI 2025
April 26–May 1, 2025 in Yokohama, Japan

colruyt

INTRODUCING ROBOTS IN A WAREHOUSE LESSONS LEARNED FROM A FIELD STUDY AT A SUPERMARKET CHAIN

KRISTÝNA SIRKA-KACAFÍRKOVÁ, SHIRLEY ELPRAMA, MELISSA WITTENS, AN JACOBS

Image from De Morgen

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Sirka Kacafírková et al. (2025)
https://doi.org/10.1145/3706599.3706668

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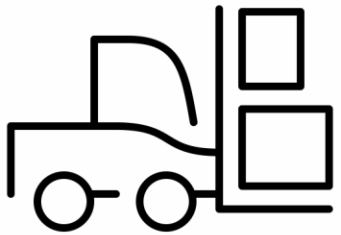
SUPERMARKET CHAIN

COLRUYT



Created by fae frey
from Noun Project

Image from De Morgen

Warehouse

Loading in trucks

Delivered to supermarket

CASE STUDY: AMRS IN A WAREHOUSE

colruyt

Reasons for implementing AMRs:

- Worker shortages
- Improving logistics efficiency
- Minimise repetitive tasks for workers

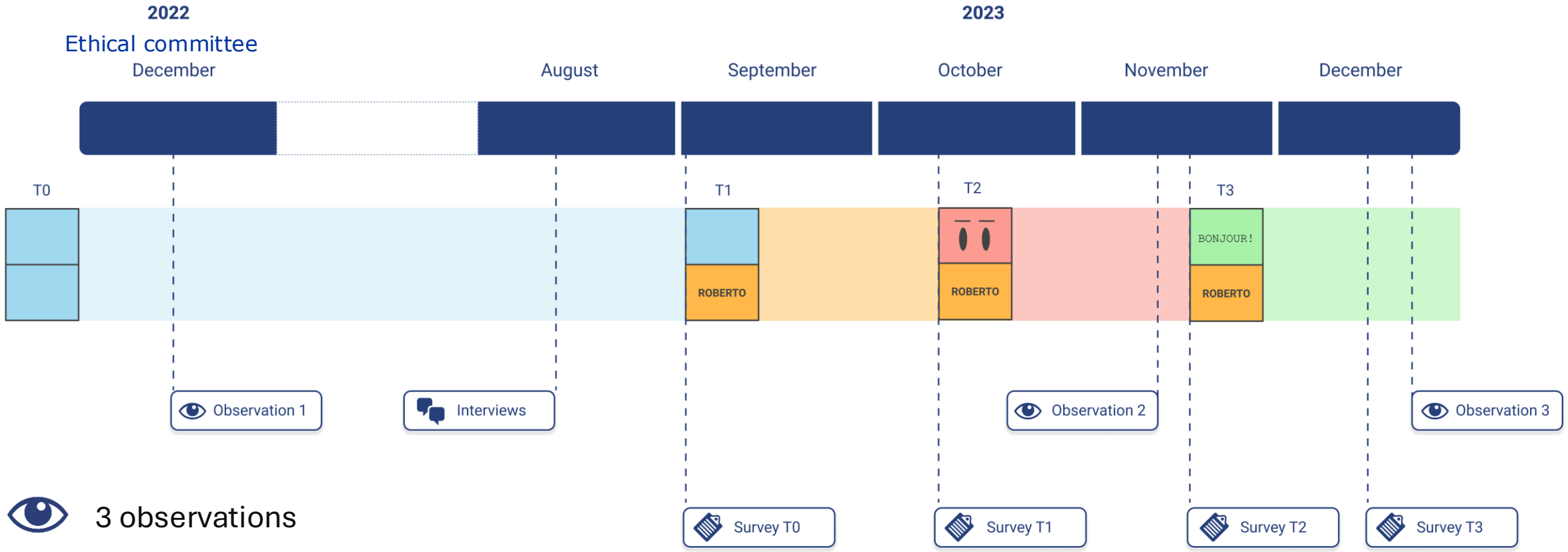
CASE STUDY: AMRS IN A WAREHOUSE

Goal of the Study

- What is employees' experience with AMRs?
- What features improve acceptance of AMRs**?**

METHODS

TIMELINE

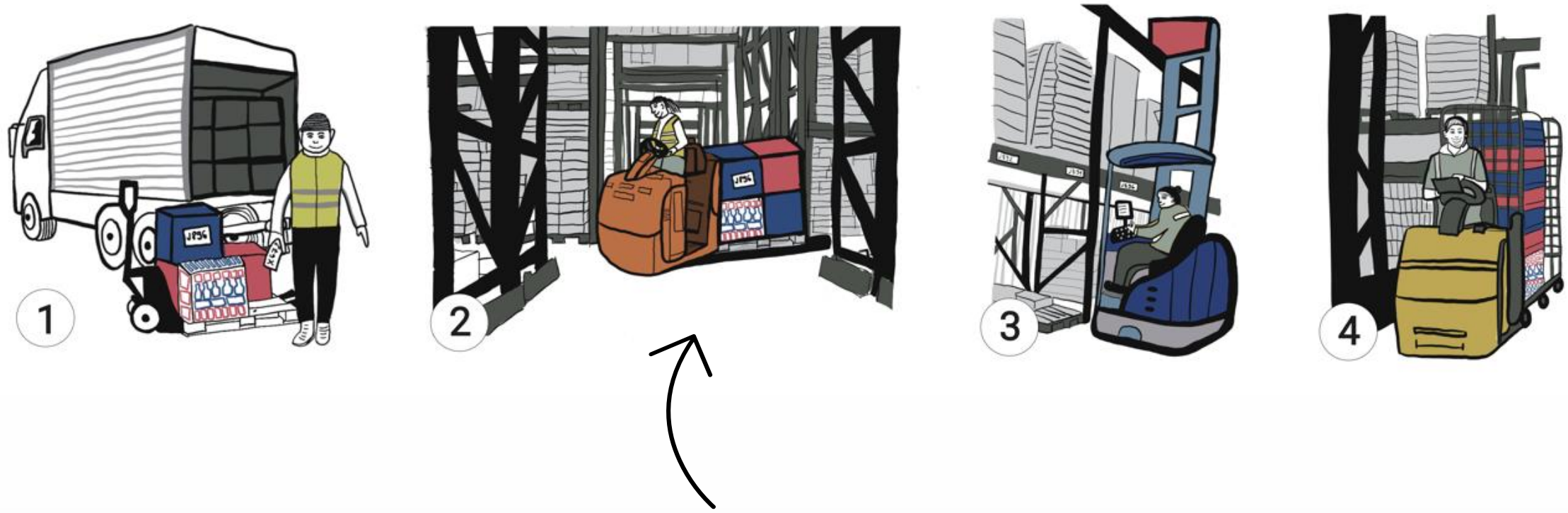


3 observations

4 interviews

4 surveys (n=37-59 workers)

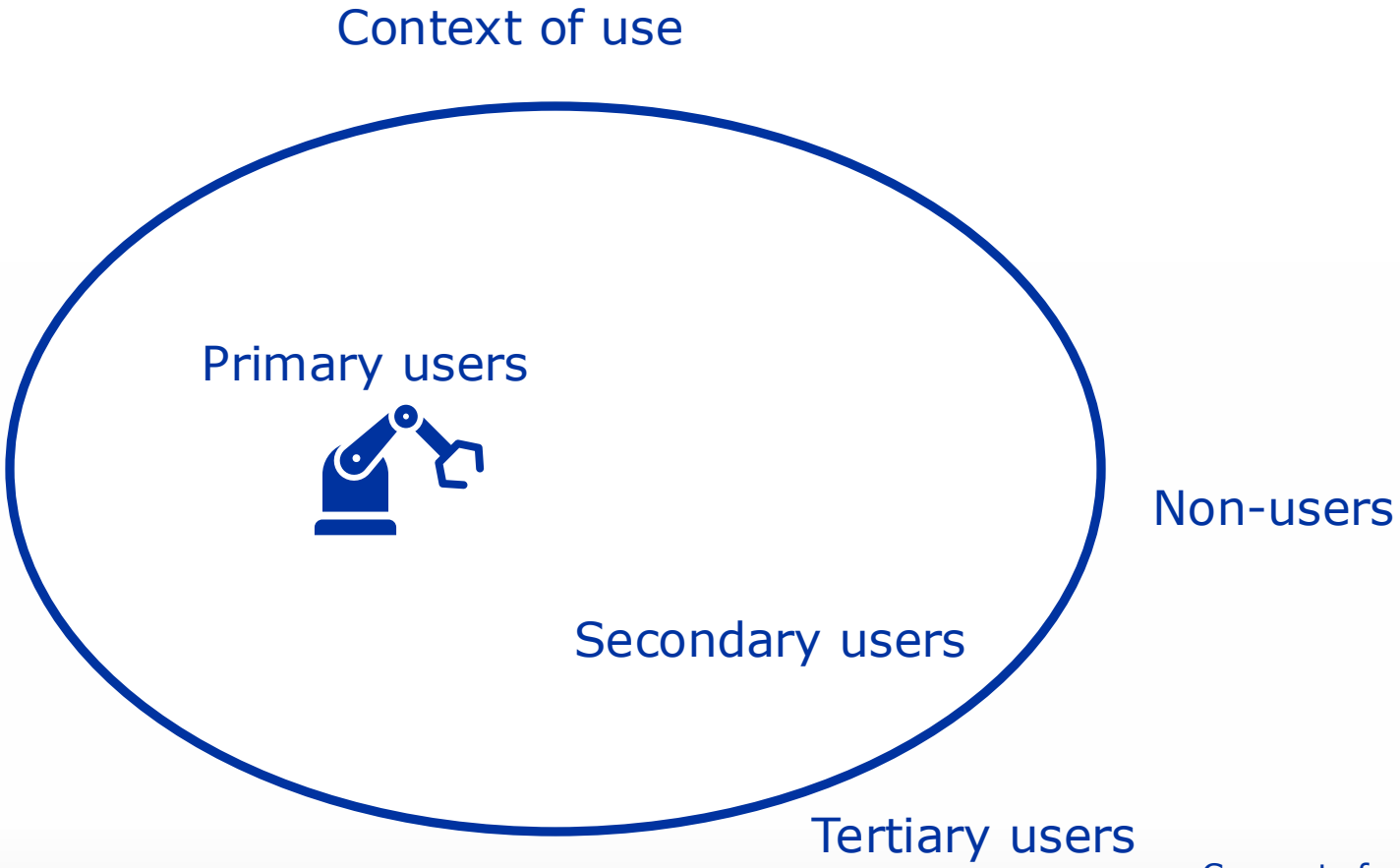
CURRENT PROCESS IN THE WAREHOUSE



will be supported by AMRs
[autonomous mobile robots]

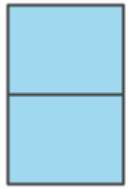
TYPES OF END USERS

WHO ARE THE STAKEHOLDERS?



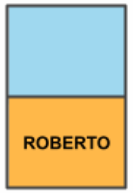
Concepts from Eason (1989) and Wyatt (2014)

T0



AMR without any features

T1

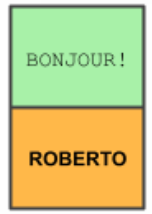


AMR with name

T2

AMR with name & eyes

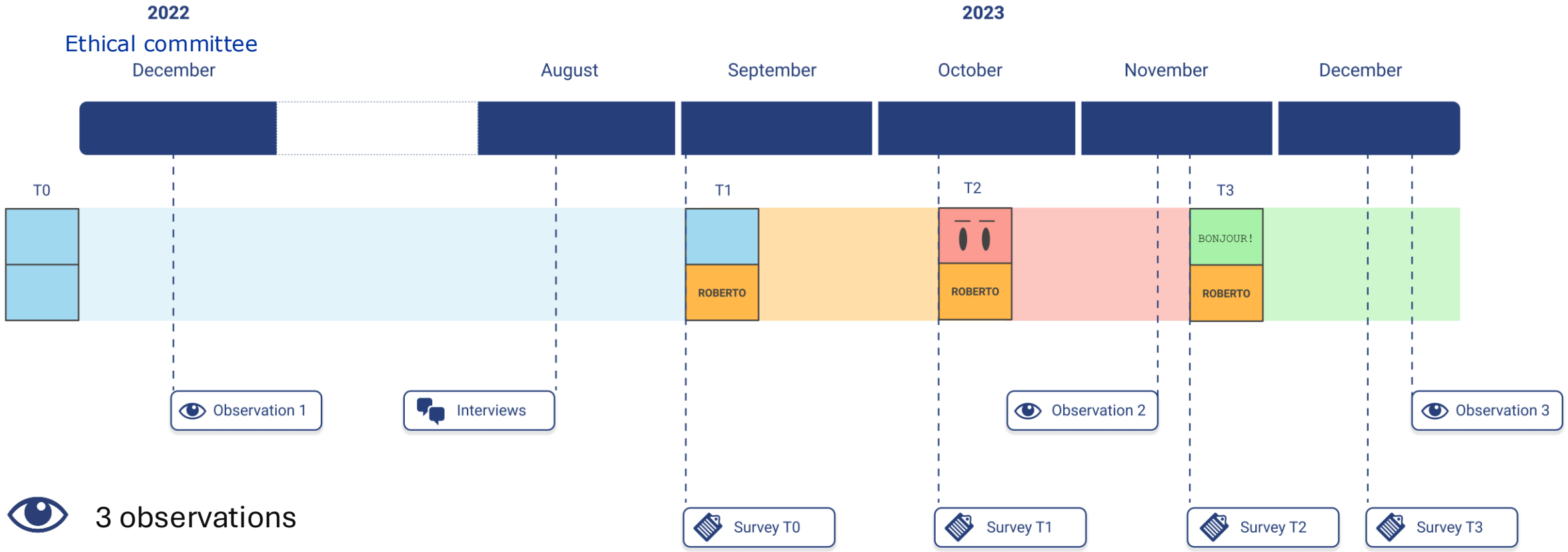
T3



AMR with name & display

METHODS

TIMELINE



3 observations

4 interviews

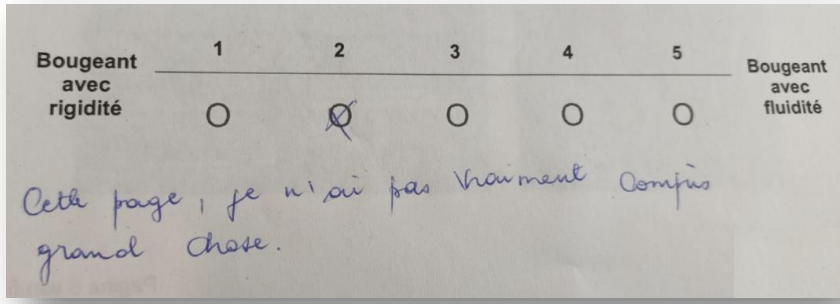
4 surveys (n=37-59 workers)

FINDINGS

- Dust
- Contact: engineers vs. drivers
- Functionality was more important for workers than design
- Biggest concern: Robot speed & technical robustness
- Some features were not visible enough
- No significant difference found in Trust, Performance expectancy, Safety and Intention to use
- Antropomorphic scale: AMR with eyes performed the worst, seen as the least human-like
- Workers needed more information about future of AMRs
- 73% (n=41) of workers liked being involved in the study

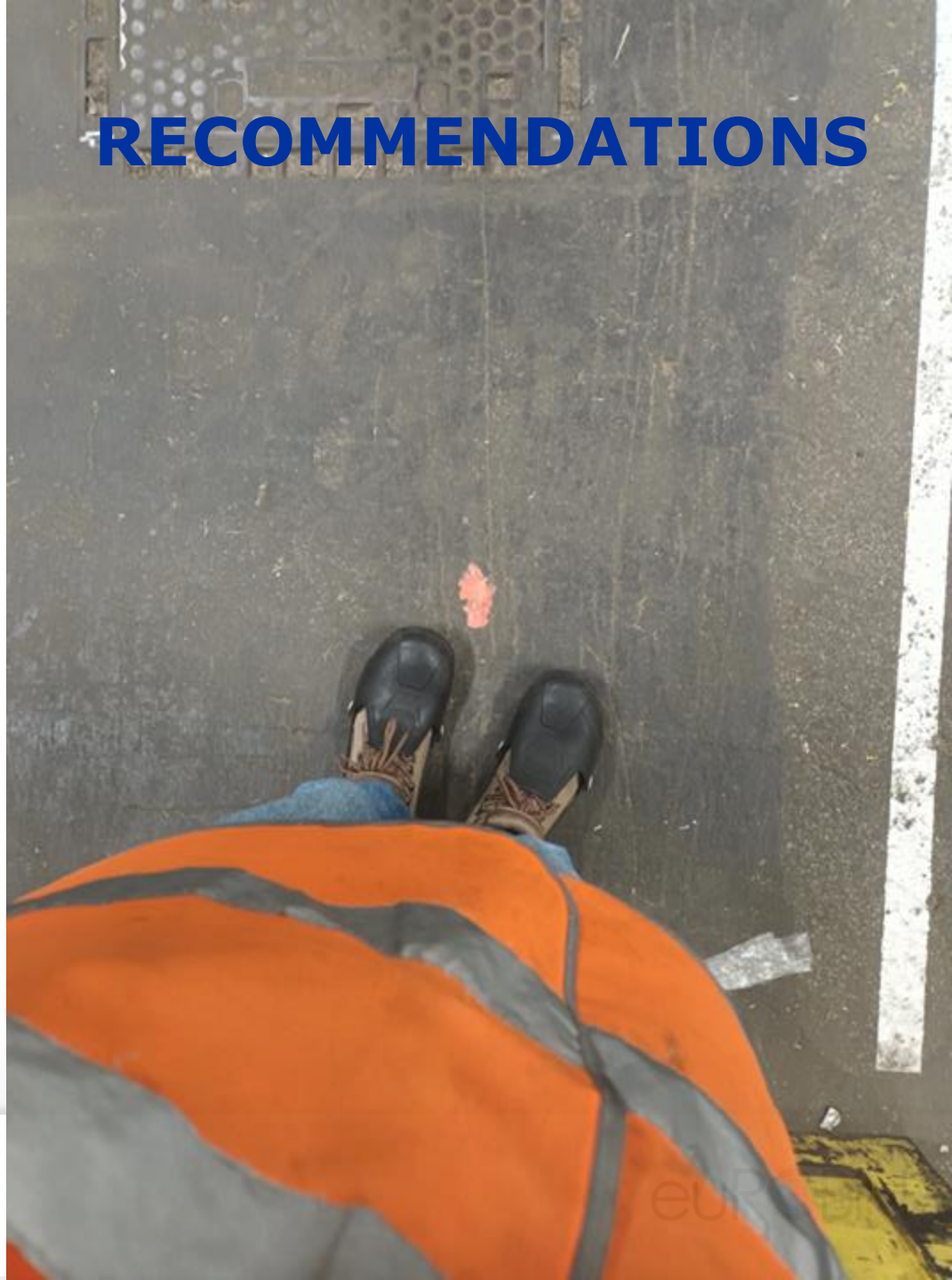
LESSONS LEARNED

1. Observation and **field work necessary** for the context
2. **Survey was not always straightforward** to participants
3. Busy environment requires **flexibility**
4. Clear **communication with workers was missing**
5. **Technical delays** had an impact on the research
6. **Outsourcing** the data collection added to the **limitations**



RECOMMENDATIONS

1. Start **early** on
2. Be **flexible** and make and **adaptable** research design
3. Keep a **research diary**
4. Use a **mixed method approach**
5. **Adapt the research tools** towards the workers
6. Be ready for **traditional** procedures
7. Count **on technical delays** during development
8. **Be in touch with the development team** as much as possible
9. **Maximise your presence when you can**



How do you design such a such a study to assess the future HRI in the wild ?

We have a 3 step approach to tackle this

HOW ? LIVING LAB : ITERATIVE – REAL LIFE – PARTICIPATION OF MULTI-ACTORS

Exploring
current health/work context

Envisioning
future health/work context

Evaluating
new health/work context

HOW ? LIVING LAB APPROACH

GOAL LIVING LAB : ITERATIVE – REAL LIFE – PARTICIPATION OF USERS

EXPLORING THE CURRENT WORK CONTEXT

Observations - interviews - surveys

- robots always in cages
- due to experience with caged robots:
  - fear of job loss
  - less social contact
  - experience with workload reduction

HOW ? LIVING LAB APPROACH

GOAL LIVING LAB : ITERATIVE – REAL LIFE – PARTICIPATION OF USERS

ENVISIONING THE FUTURE WORK CONTEXT

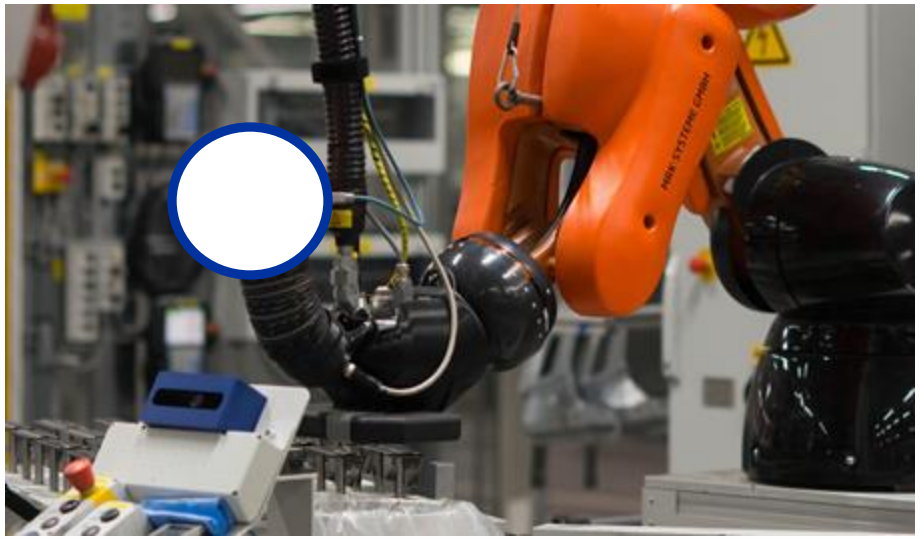
Wizard of Oz experiments - interviews - co- creations

- more humanlike features are enjoyable & are more accepted
- mapping preference of gesture types

HOW ? LIVING LAB APPROACH

GOAL LIVING LAB : ITERATIVE – REAL LIFE – PARTICIPATION OF USERS

EVALUATING NEW WORK CONTEXT



Probing - observations - interviews

- workers would like a cobot
that supports heavier tasks & works faster

- robot is part of the team:
  - colleagues make fun of it • talk about it
  - feel safe around it

- working with latest technology (i.e the cobot) evokes a sense of pride

PRODUCT ECOLOGY APPROACH - FORLIZZI

People use technology in a **specific context or environment**

- A specific **place,**

but also a **space** with a specific meaning

- With norms, values, rules

•while using other tools

•while doing other tasks, and activities

•With other people : collaborating, disturbing, …

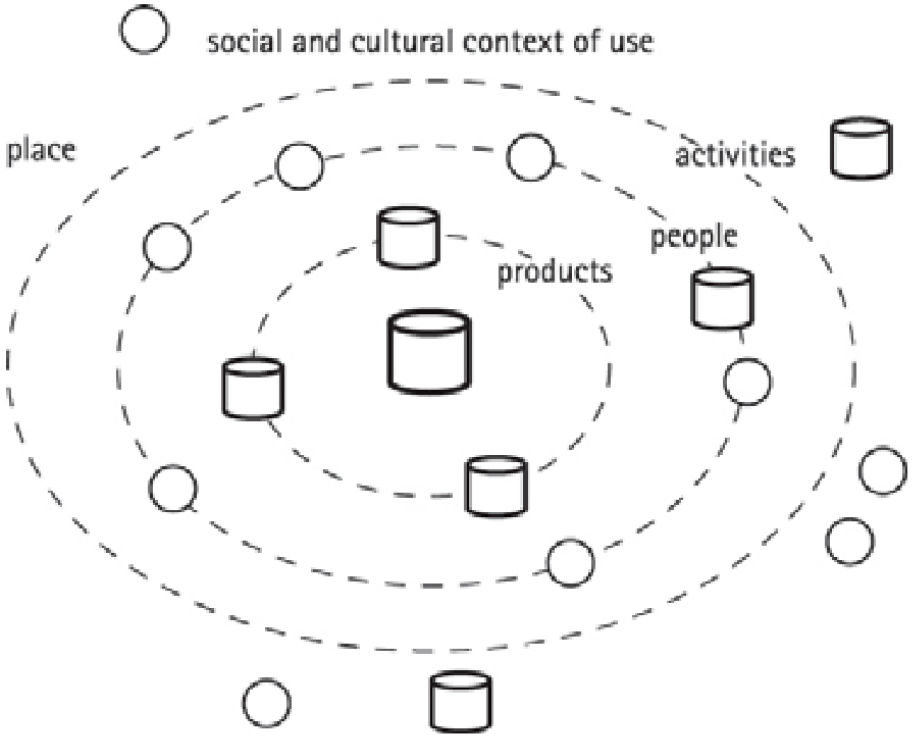


Figure 2. Schematic diagram of the home as an ecology, containing people, products, activities, and interactions within a bounded environment.

Forlizzi (2006)

DIFFERENT PRODUCT ECOLOGIES

WITH OR WITHOUT INTERVENTION

CURRENT PRODUCT ECOLOGY?

AS IS

Without robot

AS IS

With robot

TO BE: add robot or new features with robot

EMBODIED EXPERIENCE WITH ROBOT

DATA COLLECTION TECHNIQUES

ACTIVATION &

PARTICIPATION TECHNIQUES

OBSERVATION

With and without WIZARD of OZ

DEPTH-INTERVIEW

Ethnographic approach

IN DEPTH INTERVIEW

Prepare

Execute

Process

ASKING QUESTIONS, REGISTER INFORMATION RIGH ANSWERS ('HEARING DATA')

POSITION OF INTERVIEWER (KVALE, 1996)

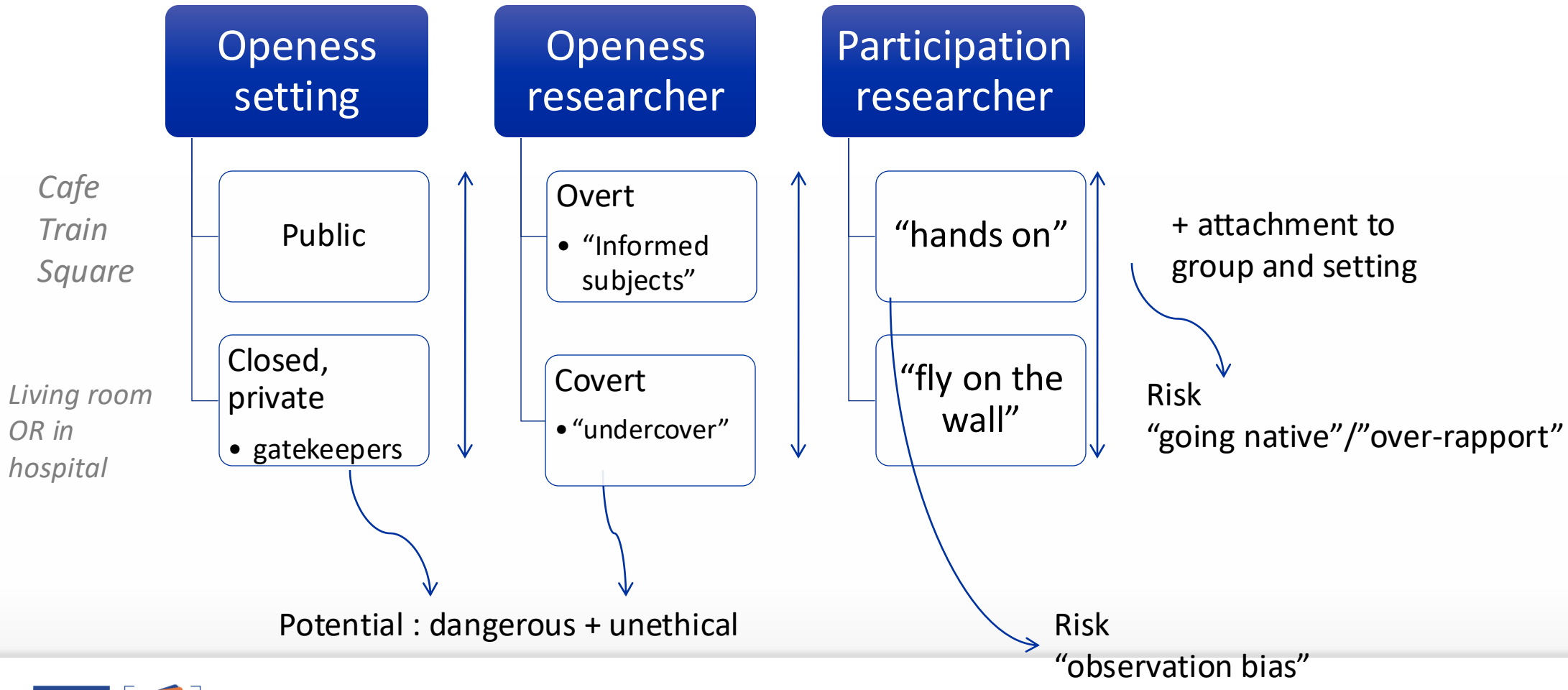
- **"miner"** (post-postivistic school) :

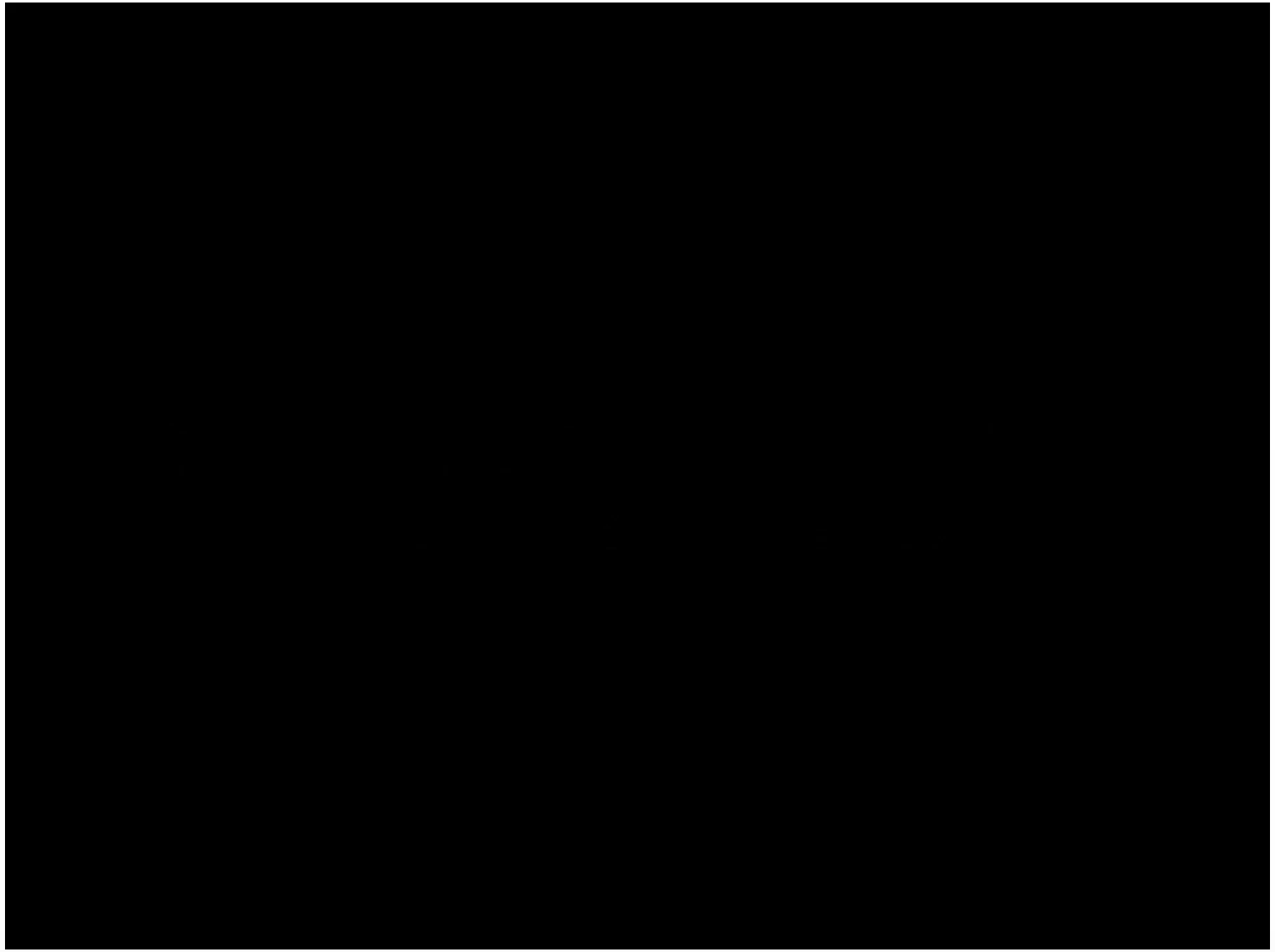
all info exist in the head of the interviewee

- **"traveler"** (constructivist school) :

data is result of interactive construction between the two parties

OBSERVATION: SOME FUNDAMENTAL CHOICES





Changing attention points during observation

Place : physical place(s)

Actor : people present/involved

Object : material things around

Actie: single something someone does

Activity : series of connected actions of people

Event : series of connected activities

Time: sequence of time over something

Goal: what people try to attain with actions

Emotions: feelings people express

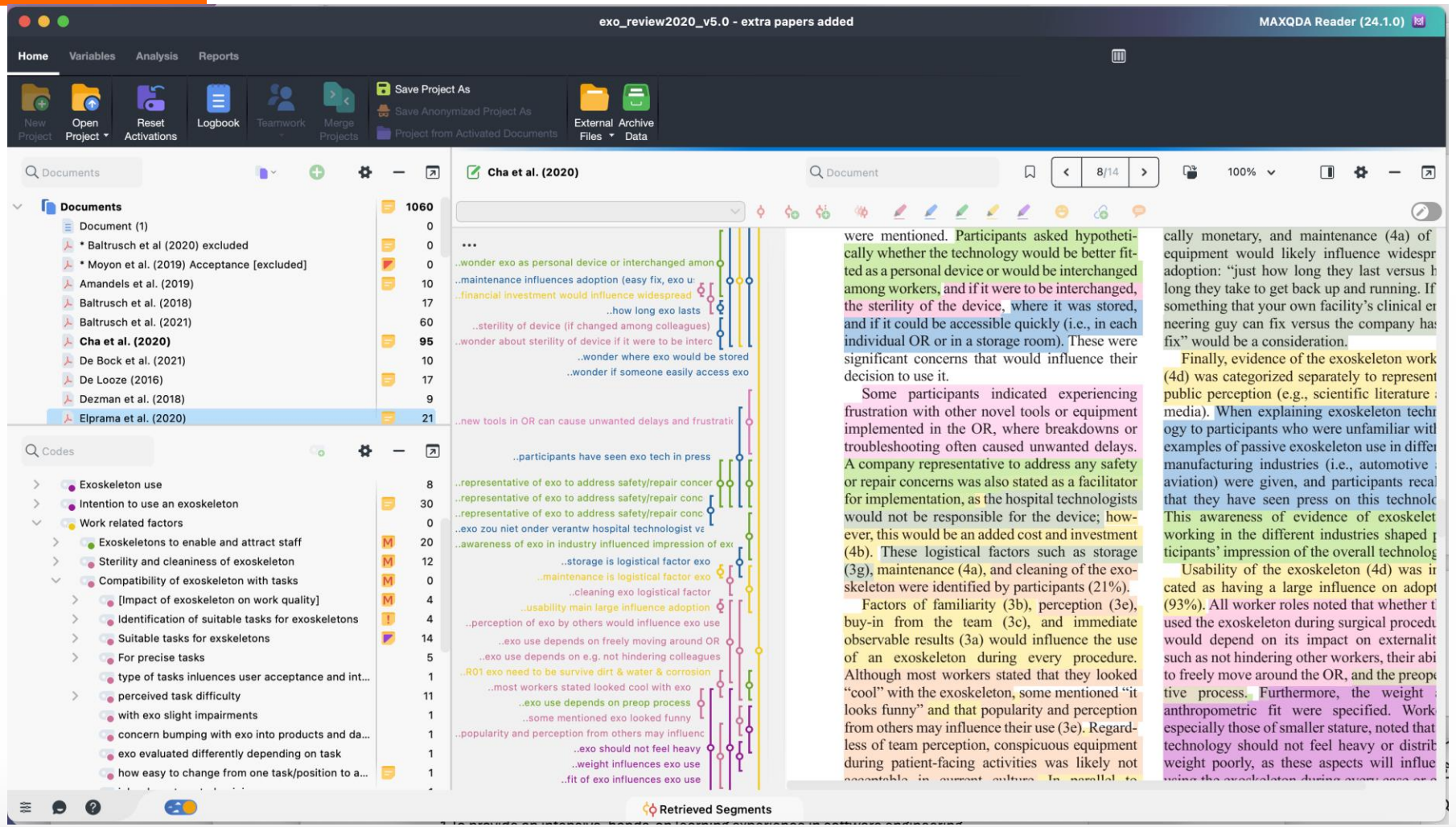
Source:
Spradley 2008 in Mortelmans, 2009

FROM DATA TO INSIGHT

"Coding" to find new patterns in data over different observations, interviews and activities

= hearing data

Looking from the point of view of the "users"

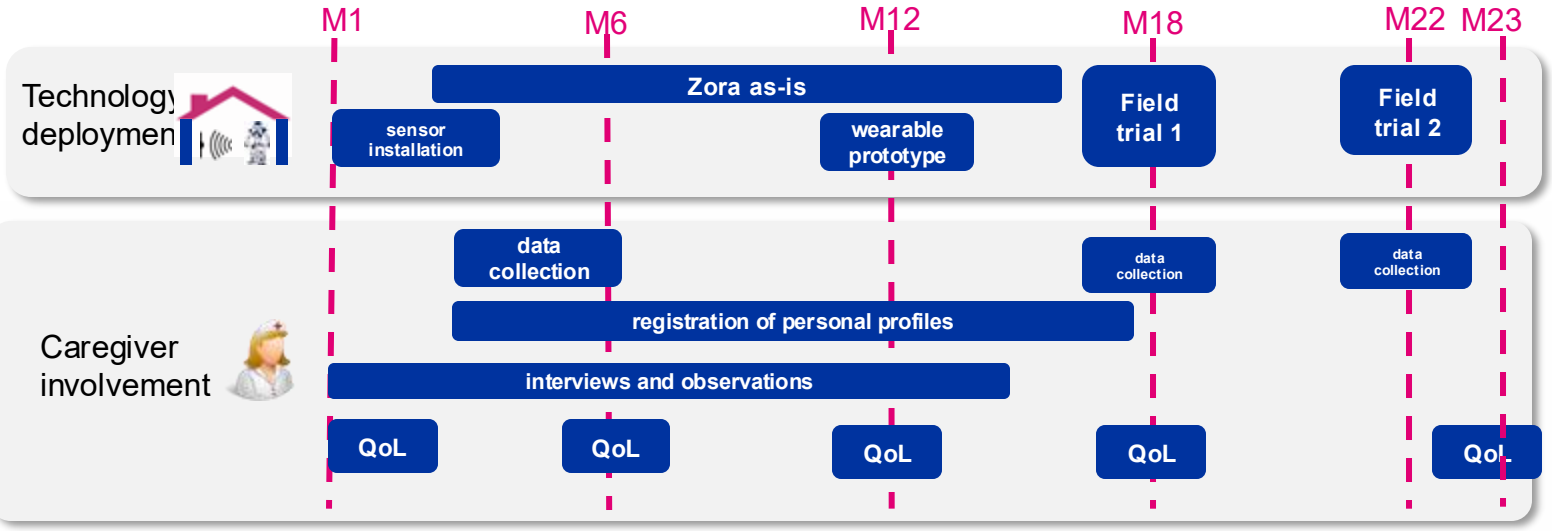


We now know the basic methods, and then ?

…and so we first focus on the current context

How to improve service cobots?

iMinds ICON project *WONDER* (2015-2017)



QBMT

Xetal

Tight involvement of care stakeholders (caregivers, residents, family)
Field trials in real-life environments

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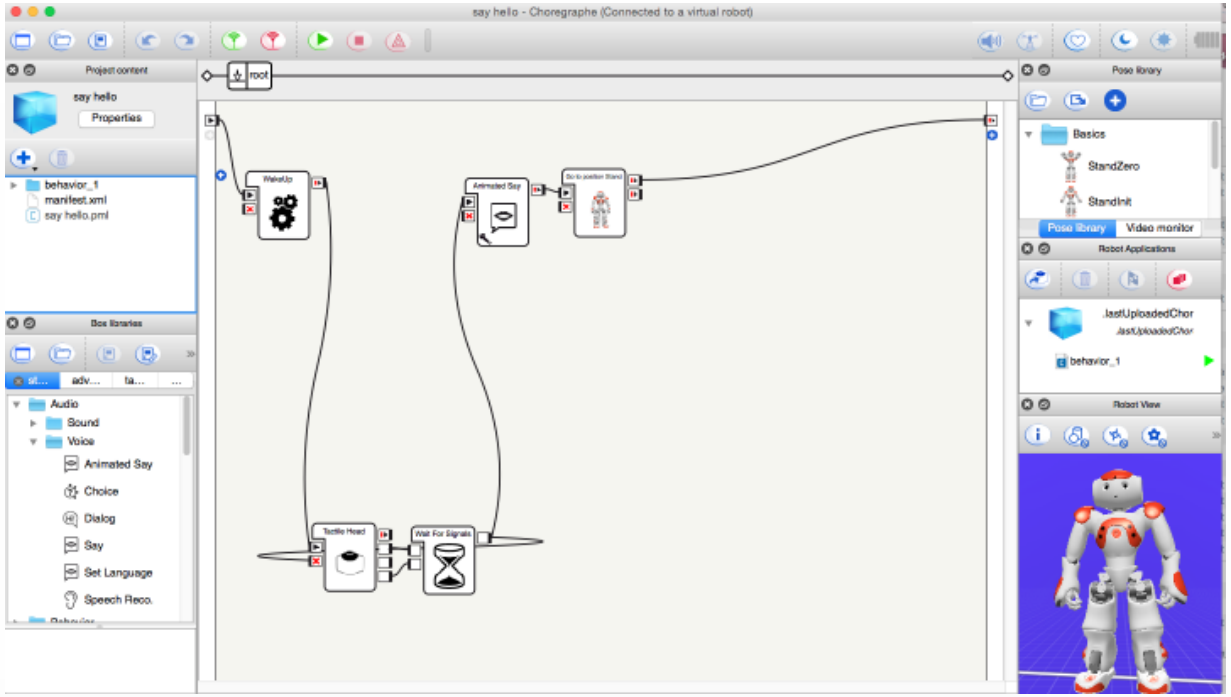
VUB
SMIT
WOON- EN ZORGCENTRA DE FOYER
OCMW GENT
euROBIN


ZORA
care robot

Impact on work processes



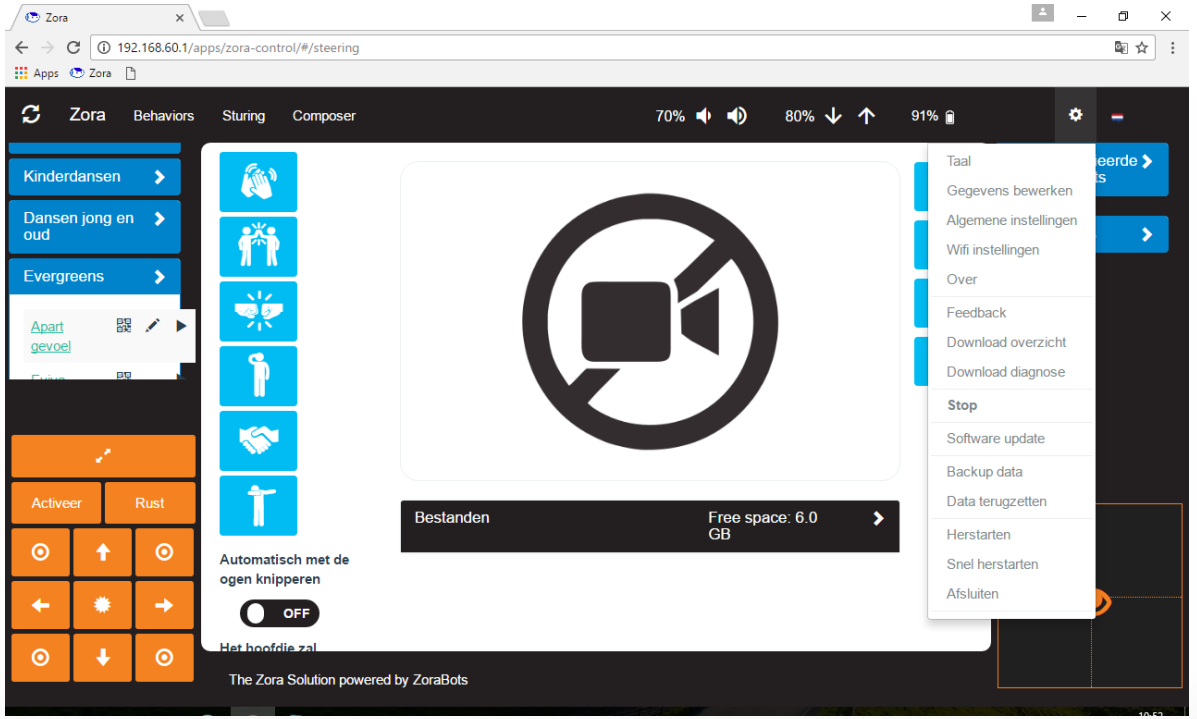
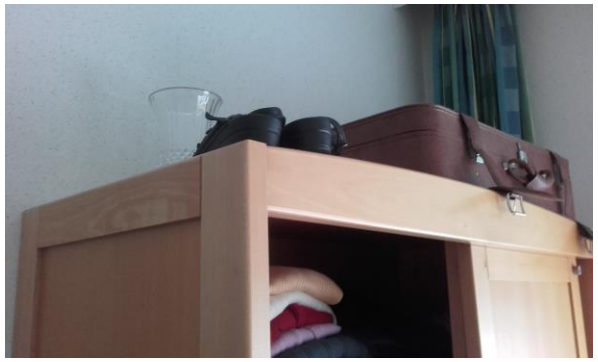
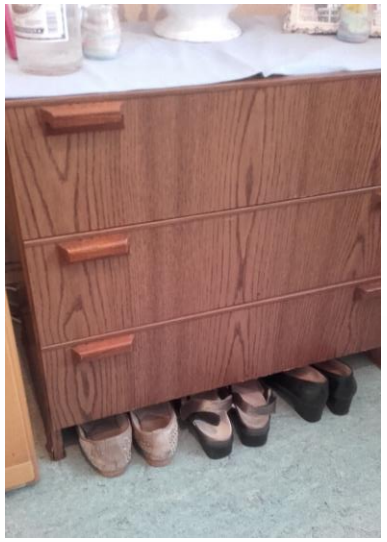


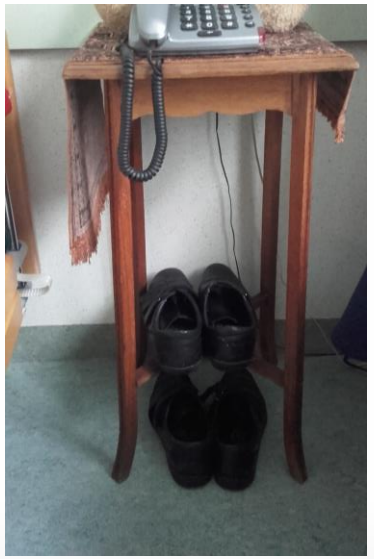
Fig. 1. Choreographe Operating Interface

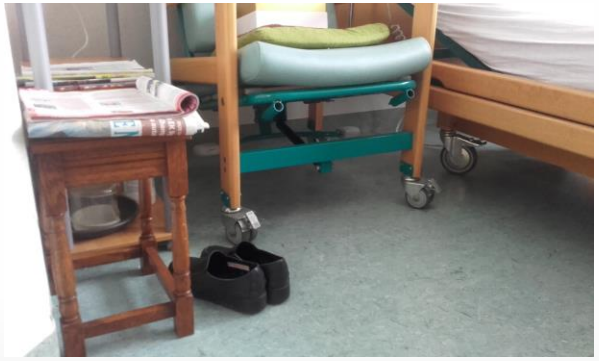

MARIE JOSE

OPPORTUNITY FOR SENSOR IN SHOE ? STUDYING SHOE PRACTICES









Ok so we explored the current practices, and then?

… we start cocreating and envisioning the future

COCREATION strategies to alleviate wandering behavior with healthcare professionals ?

- What should robot do when approaching person?
- What should robot do in interaction with person?
- Added value for health professionals

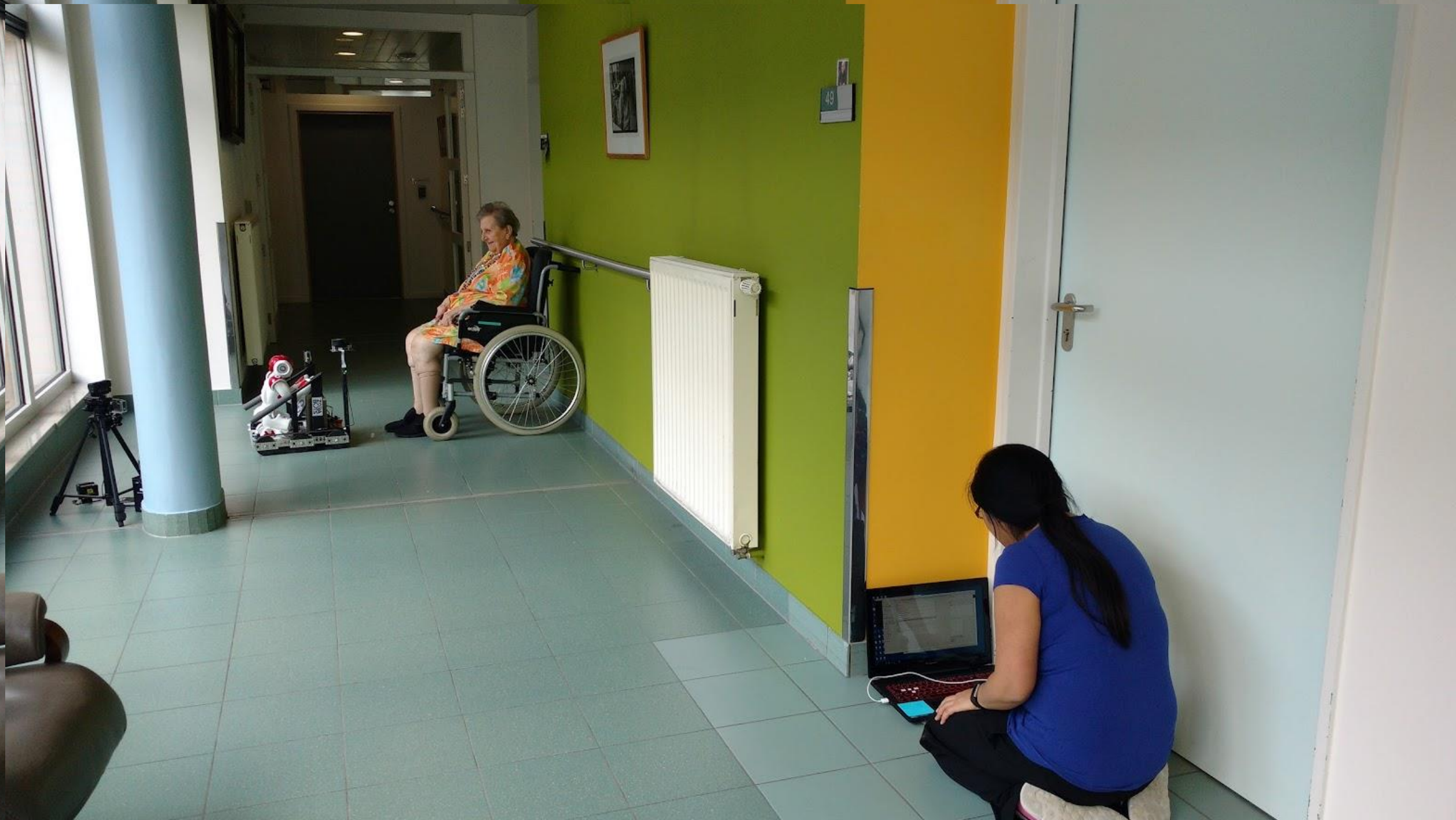
Example strategies to alleviate wandering with & without robots

Resident behavior	Cause	Current staff intervention	Robot intervention
Excessive wandering	Exhaustion, hunger, thirst	Encourage resident to rest & replenish with food or drink	Encourage resident to rest (don't give food or a drink)
Attempting to elope / lingering around exit	Dangerous for wanderer	Distracting resident with a conversation	Distract resident with conversation, song or dance
Trespassing (e.g. entering rooms of other residents)	Dangerous for wanderer; upsetting other residents	Remind resident of forbidden areas; guiding them further	Remind resident of forbidden areas; invite resident to follow robot to other nursing home activities.

S.A. Elprama, K. Kilpi, C. Jewell, F. Ongenae, F. De Backere, F. De Turck, P. Simoens, A. Jacobs.
Opportunities to use robots to alleviate behavioral disturbances of nursing home residents. *Gerontechnology 2016;15*

So together with the multidisciplinary team this inspired to create a POC ?

… yes and we try to evaluate that as well in real life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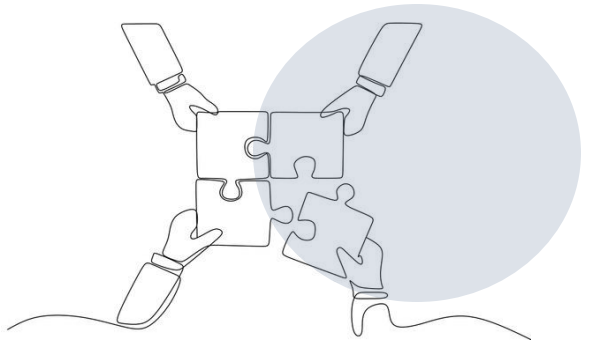
NATIONAL GEOGRAPHIC

EU PROJECTS



Our expertise – social sciences:

- Acceptance & ethics
- Human oversight
- Explainable AI
- Living Labs
- User involvement
- Robots, cobots, exoskeletons
- Peri-menopause

- Interested in:
  - HORIZON-CL4-INDUSTRY-2025-01-TWIN-TRANSITION-02: **Physical and cognitive augmentation in advanced manufacturing**
  - HORIZON-CL4-2025-03-DIGITAL-EMERGING-07: **Robust and Trustworthy Generative AI for Robotics and Industrial Automation**
  - HORIZON-CL4-2025-03-HUMAN-15: **Generative AI for Virtual Worlds - Immersive and inclusive experiences**
  - … and other calls

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Thank you, time for questions!

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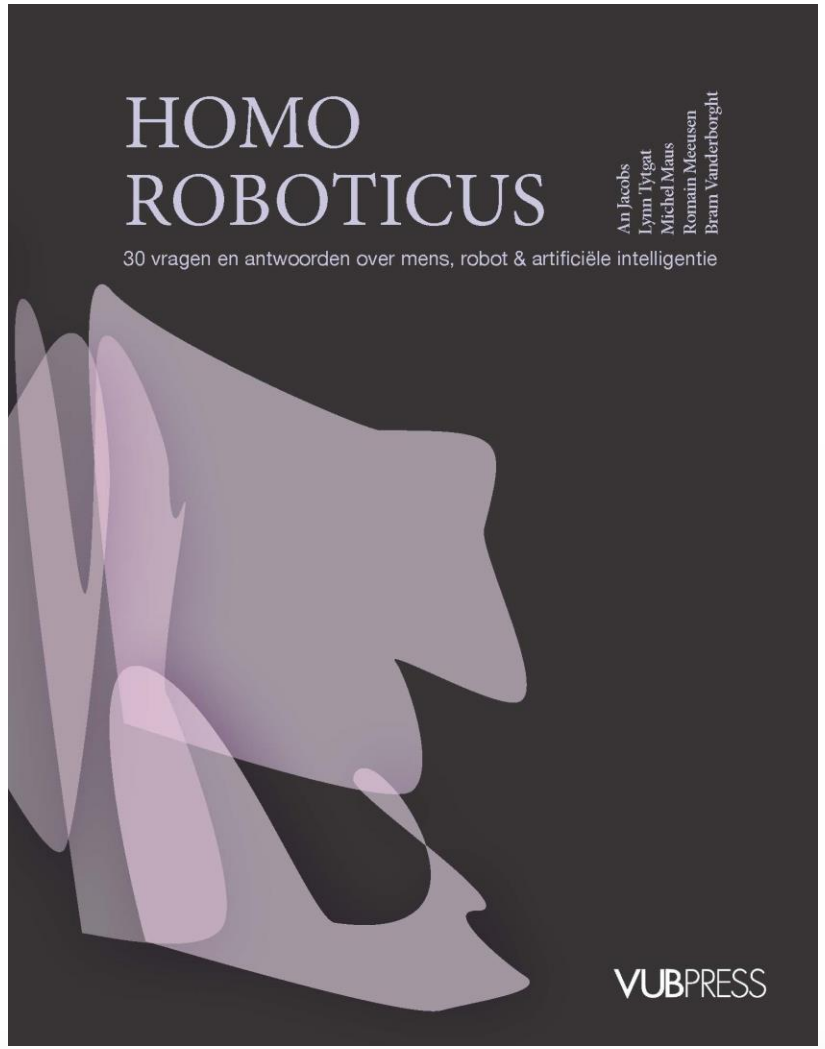
Shirley.Elprama@vub.be



"Jacobs, A., Elprama, S., Jewell, C. (2020). Evaluating Human-Robot Interaction with Ethnography. Pp. 257-268.In Human-Robot Interaction Evaluation Methods and Their Standardization, Springer"

PRACTICAL ASSIGNMENT

PREPARING FOR FIELD TESTING

1. Study overview
2. Stakeholders
3. Ethics and consent
4. Context
5. Equipment
6. Data collection
7. (Debriefing)

CASE STUDIES

DESCRIPTION

- Trustworthy information robot at a train station (Jesus)
- Trustworthy luggage carrying robot at a train station (Jesus)
- Mobile omnidirectional robot for safe interaction in a warehouse (Sahar)
- Ship simulator: helping the ship master to run the ship (steer, drive) in a safe way (robot as a helper) (Sahar)
- Robot handshake (Adnan)

1. STUDY OVERVIEW

PREPARING FOR FIELD TESTING

- What will the robot be used for?
- What will be tested?
- What the research question(s)?
  Pick one to focus on for this exercise.
- Which scenario(s) will be tested? Pick one to focus on for this exercise.
- Which methodology? (one or more)
  Observation, interview, experiment, questionnaires,…

2. STAKEHOLDERS

PREPARING FOR FIELD TESTING

- Who are the primary users?
  People affected by the system (Eason, 1989)
- Who are the secondary users?
  People who occasionally or indirectly use the system (Eason, 1989)
- Who are the non-users?
  Types of non-users excluded, resisters, rejecters, expelled, discontinuer (Wyatt et al, 2002; De Graaf et al., 2017) (can change over time)
- Who will be the participant(s) of the study?
- Who can you involve in setting up this field test? (look at the (non-)users you have already identified)

3. ETHICS AND CONSENT

PREPARING FOR FIELD TESTING

- **What are potential risks (physical, psychological, etc.) for the participant?**
- **How can you mitigate these risks?**

Risk	Mitigation

Checklist

- Who needs to provide informed consent?
- Is approval of an ethical committee (EC) needed?
- Where can you find out what approval is needed?
- Does the journal you intend to submit your work to require EC?
- Does your funding require EC?

4. CONTEXT

PREPARING FOR FIELD TESTING

- How can you create a situation that matches the real use case as close as possible? Try to match the participant's needs.
- Which part of the day will the test take place? (morning, afternoon, evening, night, etc.)? If any, what are the implications for your test?
- Where will the test be conducted? Be as specific as possible.
- What other context-related factors need to be considered? (e.g. dusty environments, environments with a little amount of light, with changing amounts of light,…)

5. EQUIPMENT

PREPARING FOR FIELD TESTING

- What equipment/tools are needed to conduct the study?
  (For example, wearable to measure EDA, camera to record videos, chargers, power banks, notebook, pencil, tablet, internet connection…)

Checklist

- How will the robot be transported to the context of study?
- Where will you store the robot (safely and securely) during the field test?
- Is there a (stable) internet connection in the field?
- Do you have internet access in the field?

6. DATA COLLECTION

PREPARING FOR FIELD TESTING

- What data will you collect?
- What are possible bottlenecks to bring this study into the wild?
- Which social scientist / HRI researcher can you consult and ask to do the field study?