NTNU

Knowledge for a better world

Sosiale roboter i kommunale helsetjenester – fra hype til reell verdi

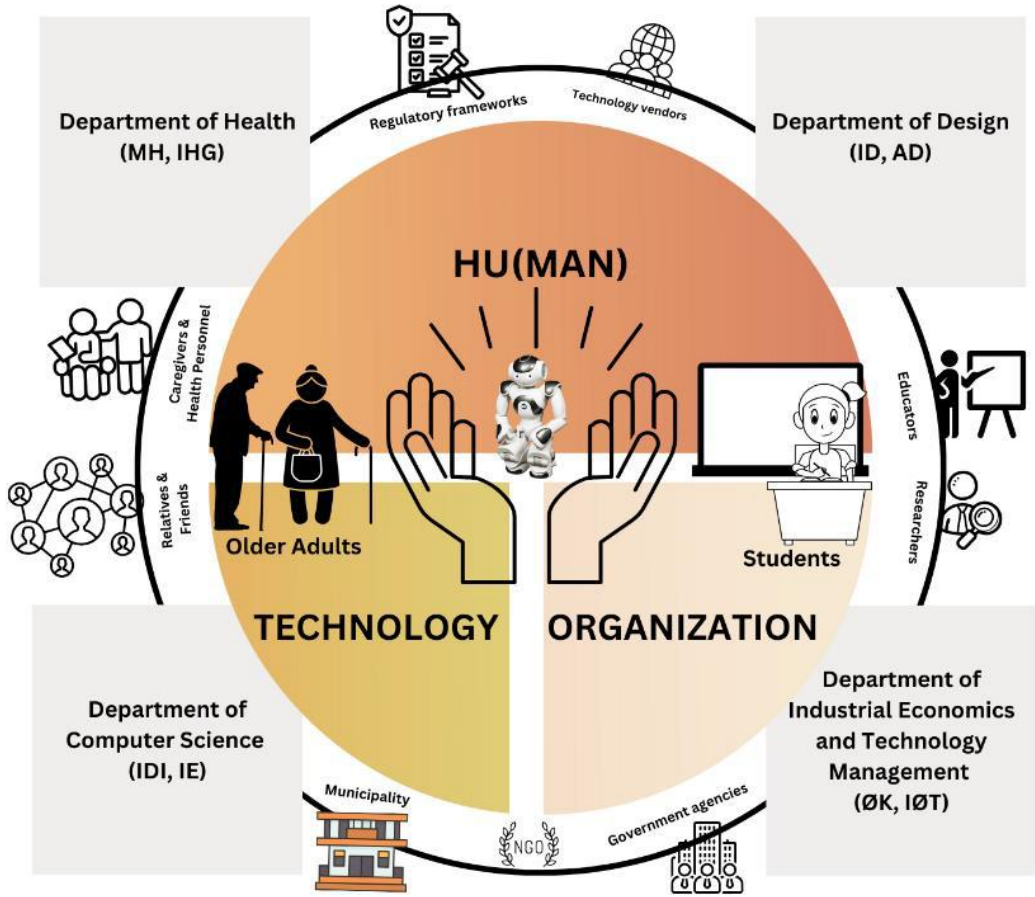
23 September 2025, Trondheim

Associate Professor Solveig Beyza Evenstad, NTNU, Institutt for industriell økonomi og teknologiledelse, **Gjøvik**

Solveig Beyza Narli Evenstad

- **MULTIDISCIPLINARY BACKGROUND:**
  - 1 year - Social sciences (METU, Ankara, Turkey, 1980-1981)
  - BA in Management (Boğaziçi University, Istanbul, 1981-1985)
  - BSc Informatics – Systems Analysis (UiO, Oslo, 1985-1988)
  - Master in Management – Organizations and Leadership (NTNU, Trondheim, 2008-2011)
  - PhD, Communication and Media Studies (Université Côte d'Azur, Nice, 2012-2016)
- **ACADEMIC SINCE 2012**
  - Assoc. Professor in Organizations and Leadership at INN University, Lillehammer (2017-2020)
  - Associate Professor at NTNU Gjøvik since August 2023, Organizations and Management, Org. psychology and management, Quality management, Qualitative method, Sustainable organization and management of innovation
- **20 YEARS OF INDUSTRY EXPERIENCE BEFORE ACADEMIA**
  - Hydro (aluminium, oil, fertilizers, petrochemicals, ICT); IBM, Cytec (now Solvay, chemical industry), TINE, the Norwegian Food Safety Authority, Navico (electronics);
  - Worked abroad in Belgium, Switzerland, France.
  - Managed teams in Mexico, New Zealand, USA; worked in Nordic and UK teams.

NTNU Social Robots for Support Team is part of «Team Active Aging» under the TSO Community, a strategic focus area for NTNU



- **Human** (Prof. Aud Obstfelder, Associate Prof. Mari Bjerck)
- **Technology** (Prof. Deepti Mishra, Associate Prof. Akshara Pande)
- **Organization** (Associate Prof. Solveig Evenstad – project coordinator)

We have got some of NTNU's best social robot experts with us

forskning.no Kultur Helse Miljø Samfunn Teknologi Naturviten Podcast Nyhetsbrev

Det kan være en trygghet for eldre som bor alene og som er litt skrøpelige.

Blomsterpotten Tessa

En annen robot er designet som en blomsterpotte med øyne. Den har navnet Tessa. Hvordan i all verden kan en blomsterpotte bidra i eldreomsorg?

Tessa er en fysisk avatar for et hjemmesensorsystem og er laget for personer med demens som bor alene.

Roboten kan for eksempel lære seg å kjenne igjen vanene til den som den deler hus med. Via sensorer i kjøleskapet kan den blant annet lære seg at personen vanligvis åpner kjøleskapsdøra og spiser frokost klokka 9 hver dag. Hvis kjøleskapsdøra ikke åpnes til vanlig tid, kan den minne personen på at er nå det på tide å spise frokost.

For demente som glemmer og surrer med tidspunkter kan dette være nyttig å bli minnet på.

Forsker Roger A. Søraa (Foto: NTNU)

Roboten Tessa er utviklet i Nederland. (Foto: Jan-Willelm Heeg / Tinybots.nl)

Jin Kristian Hurum
Vit.ass
Institutt for tverrfaglige kulturstudier
jin.k.hurum@ntnu.no
Dragvoll 1, Bygg 1 - 6 Dragvoll, Trondheim

Gemini.no
Forskningsnytt fra NTNU og SINTEF
Nyhetsbrev

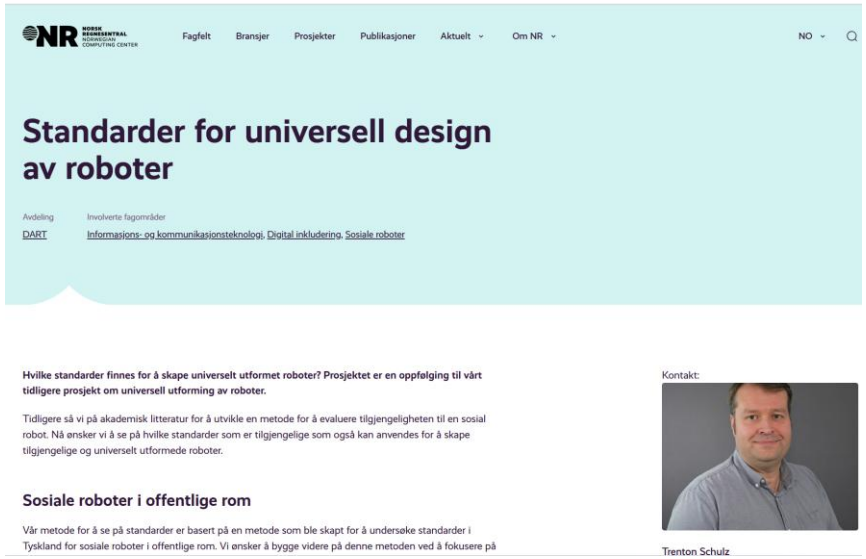
Professor Deepti Mishra ved Laboratorium for læringsteknologi ved Institutt for datateknologi og informatikk, NTNU i Gjøvik. (Foto: Privat)

Førsteamanuensis Akshara Pande ved Laboratorium for læringsteknologi ved Institutt for datateknologi og informatikk, NTNU i Gjøvik. Foto: Privat

kan også være utfordrende, og unge og lærer kan snakke med ulik tydelighet. En løsning her er å vise lærernes tale i skriftlig tekstform på Peppers nettbrett. Dette kan skje gjennom integrering av tekst-til-tale-verktøyet Whisper med Pepper.

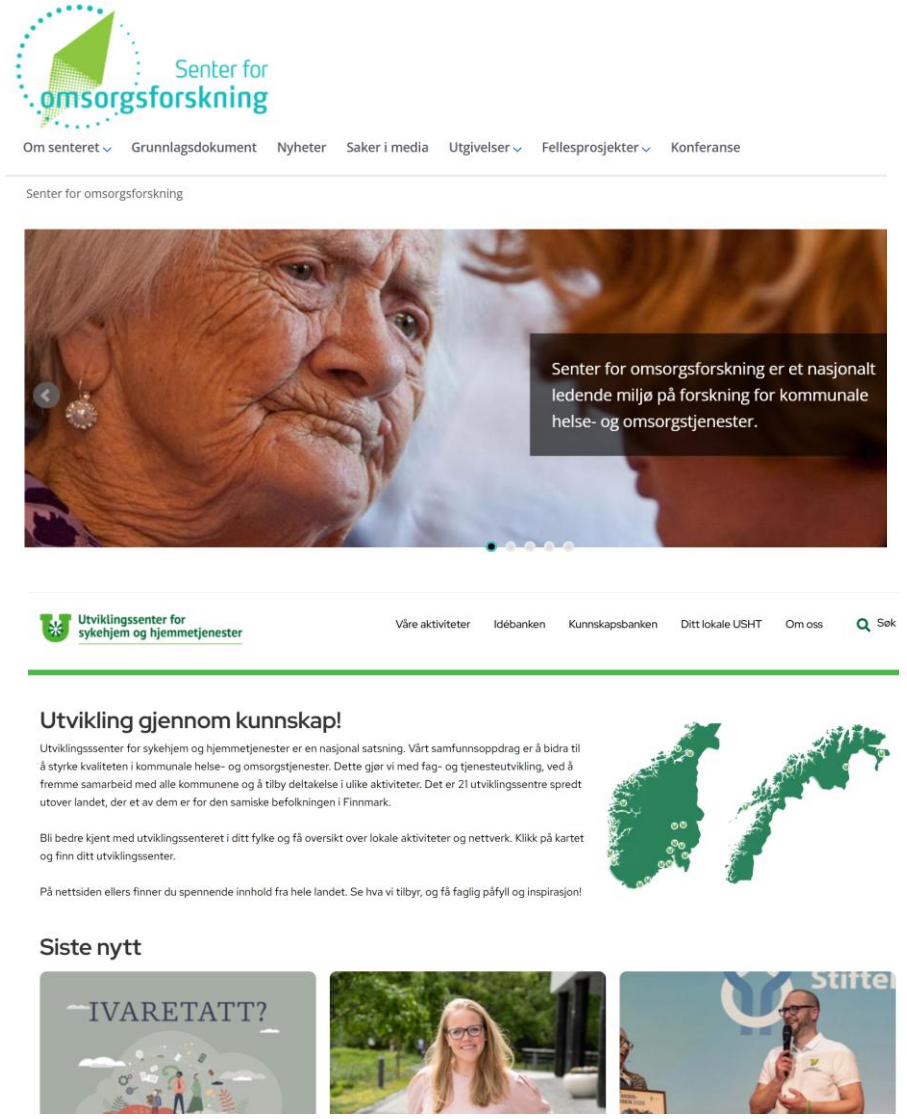
Pepper tar opp og lagrer all lyd. Det betyr at studentene kan lytte til forelesningsopptak sammen med taleutskrift. Dette kan være nyttig når eleven har lesevansker eller redusert hørsel. På bildet masterstudenter i Laboratorium for læringsteknologi ved NTNU Gjøvik. Foto: Geir Mogen, NTNU

Social robots research



Several EU potential partners were interested

Health care research



Innovation networks

HelseINN

DigiViken
Løfter Viken inn i en digital framtid

Health2B

DIGITAL INNLANDET

Municipalities

Østre Toten kommune

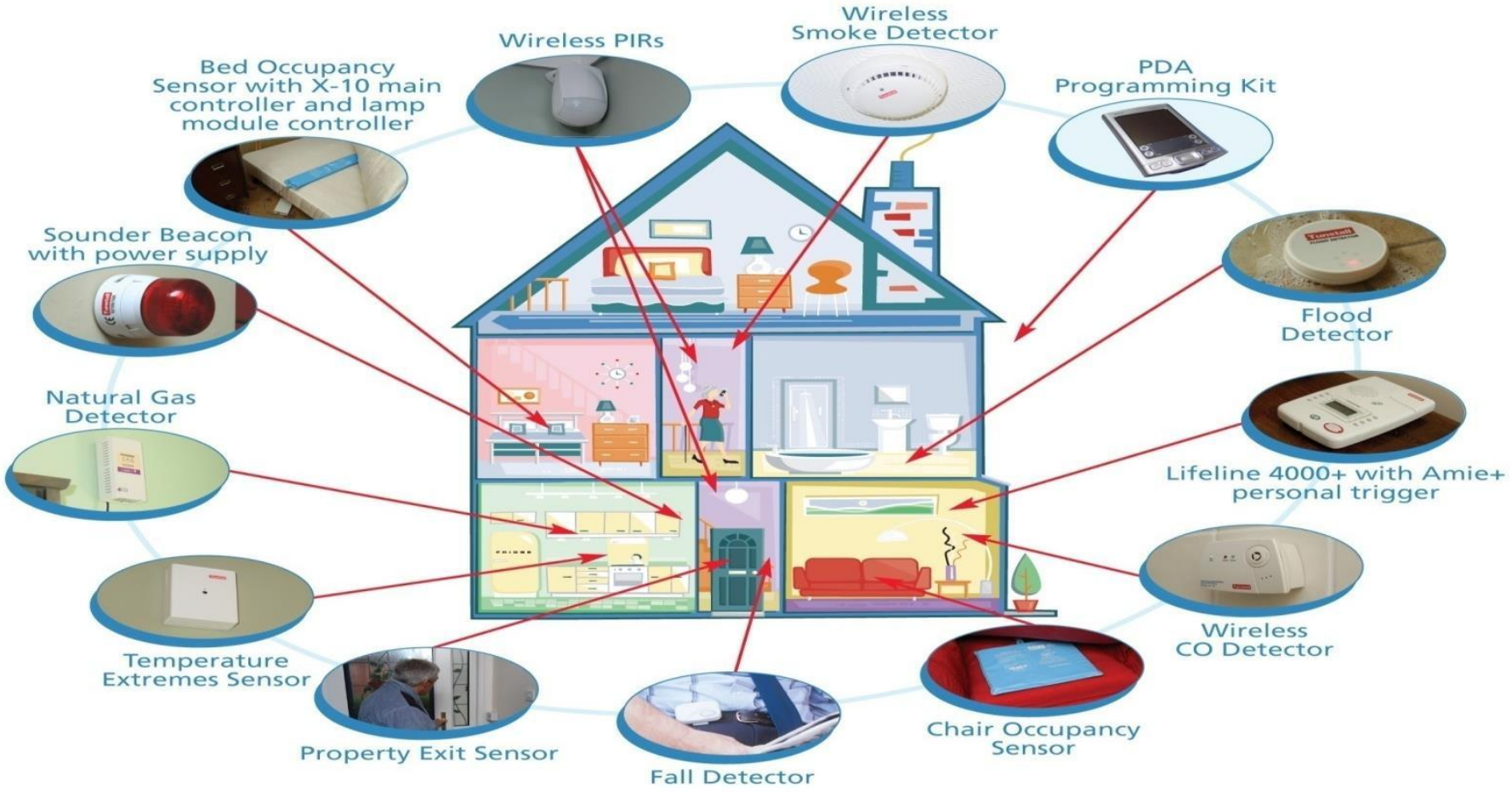

GJESP
KLIKK
SPJOING

Social Robots in Municipal Healthcare

Norwegian municipalities face a growing elderly population, staff shortages, and rising loneliness. And the state wants people to live at home as long as possible.

- Could social robots be part of the solution for supporting the elderly and cover their (unmet) needs?
- How can social robots contribute to optimize task division / reallocation in carework?
- How can social robots be integrated in municipal healthcare in an ethical, responsible and sustainable way (trippel bunnlinje)?
- How can municipal decision makers build up the necessary competence to make the good procurement and implementation decisions of this new technology?

Welfare technologies – the optimal home environment for "living at home longer"(?) What place do social robots have in this environment? What (unfilled) need can they meet for brukere? Hvordan kan de støtte helse-omsorgsarbeidere i eldreomsorg?



Social robots – some definitions

- Robots in care environments are often categorized as either **service robots** which perform physical tasks such as **cleaning, lifting, or guiding** or **social robots**, which interact with humans through social behaviors and communication (Dautenhahn, 2007).
- **Socially assistive robots (SARs)** are a subcategory of social robots defined as “robots that assist through social rather than physical interaction” (Feil-Seifer & Mataric, 2005). SARs provide **cognitive support, motivation, and companionship** in domains like eldercare, rehabilitation, and special education.
- A **personal assistant robot** may offer **physical help and social companionship** simultaneously (Broekens et al., 2009; Naneva et al., 2020; Salichs et al., 2020)

Social robots are robots that are able to interact with humans and display social behaviors such as speech, gestures, and emotional expressions to facilitate social interaction (Dautenhahn, 2007)

ASIMO: A humanoid robot developed by Honda.

Pepper: A semi-humanoid robot developed by SoftBank Robotics that can understand and respond to human emotions.

Jibo: A home assistant robot that can interact with users through voice and visual displays.

Moxi: An animated household robot designed for children.

Kaspar: A robot designed by the University of Hertfordshire to help children with autism.

PARO: A therapeutic robot baby harp seal that is used in care institutions, especially for dementia patients.

hitchBOT: A social robot that attempted to hitchhike across the United States.

Kismet: A robotic head that demonstrates emotion recognition and expression.

Tico: A robot designed to improve children's motivation in the classroom.

NAO: A humanoid robot used in educational settings and healthcare.

Care-O-Bot: A robot designed to help with care tasks in healthcare.

A.L.O.: A robotic butler used in hotels and shopping malls to provide customer service.

Cozmo: An entertainment robot designed by Anki.

Animal-inspired Robots

Human-inspired Robots

Study: A Novel Implementation of a Social Robot for Sustainable Human Engagement in Homecare Services for Ageing Populations. Image Credit: Stock-Asso/Shutterstock.com

Social Robots in Elderly Care

- Challenges of an aging population and caregiver shortages (Martinez-Martin et al., 2020).
- **SARs can provide psychosocial benefits for older adults**, **such as reducing loneliness and depression and improving cognitive functioning and overall well-being** (Abdollahi et al., 2017; Di Napoli et al., 2023; Góngora Alonso et al., 2019; Sawik et al., 2023).
- Salichs et al. (2020) identified four application areas where social robots can benefit the elderly and their caregivers using cognitive and mental tasks: **safety, entertainment, personal assistance, and stimulation.**
- **Many existing eldercare robots do not yet fully meet users' needs or expectations**, and real-world impacts on quality of care remain limited (Sawik et al., 2023).
- No reductions in staffing needs were observed in earlier studies, meaning the robots supplemented rather than replaced human care (Fracasso et al., 2022).
- The need for long-term, real-world studies that consider not just the robot's performance but also organizational and contextual factors that affect success (Koh et al., 2021)
- **High costs and fragmented solutions** (Sawik et al., 2023).

Social Robots for Children with Special Needs

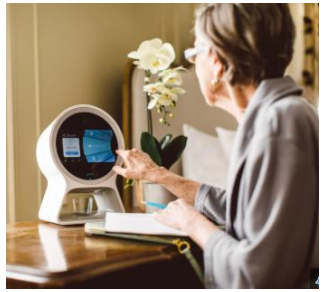
- Many children with **autism spectrum disorder (ASD)** respond positively to robot-assisted interventions (Martinez-Martin et al., 2020)
- Long-term integration of a humanoid robot into autism therapy promote **sustained engagement, increased eye contact, and positive emotional responses in children with ASD**, particularly when sessions are personalized and repetitive (Rakhymbayeva et al., 2021)
- **SARs in special education improve therapy engagement and social outcomes for learners with developmental disorders** (Papakostas et al. 2021)
- Many children with autism appear to prefer simpler, less human-like robot designs, for instance, devices with bright colors, cartoonish faces, or animal features over highly realistic humanoid robots (Robins et al., 2006).

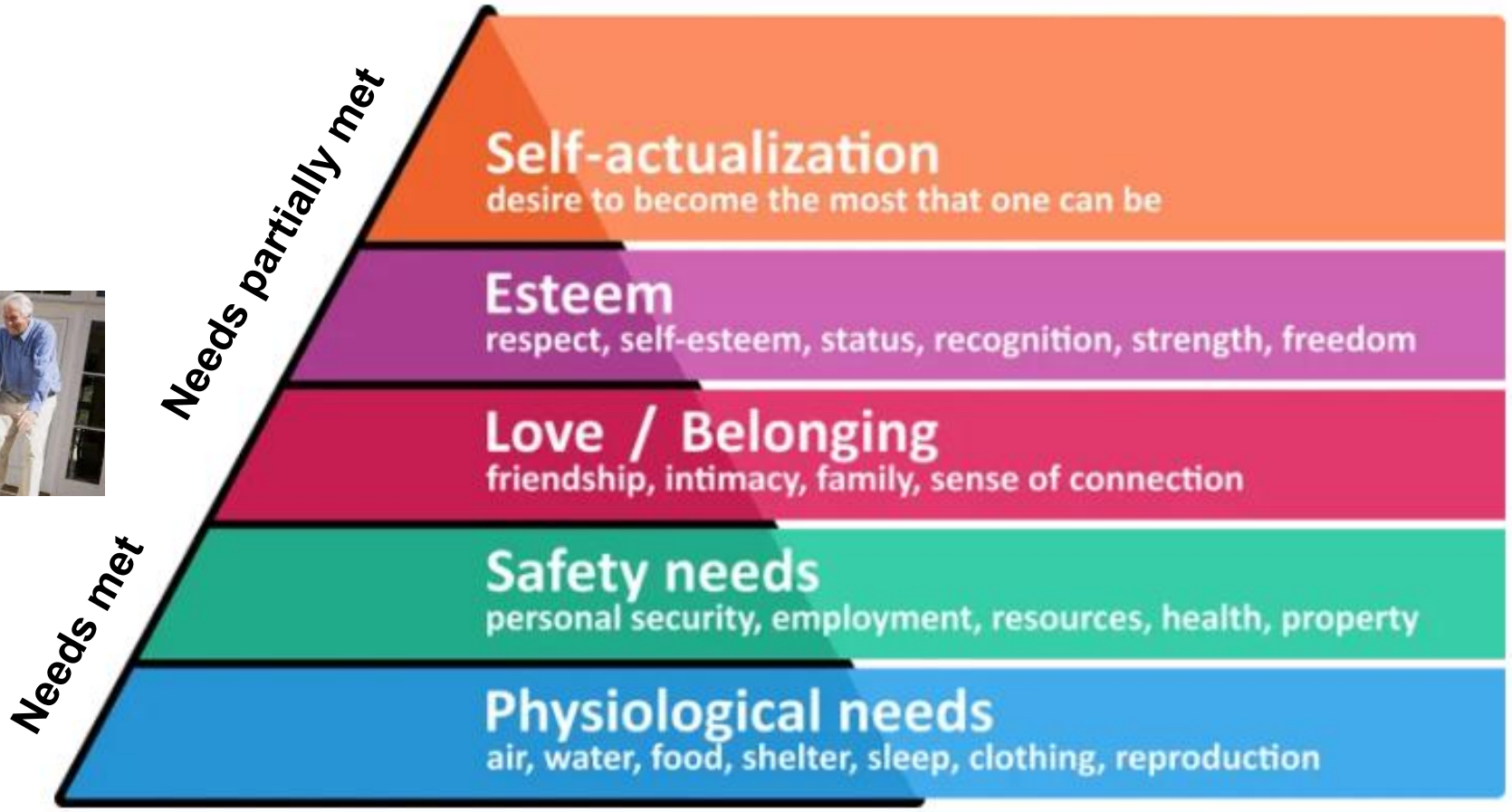
Needs are not «one-size-fits-all»

- Mrs. Hansen: Lives alone, needs safety checks and reminders
- Mr. Ali: In facility, craves meaningful interaction
- Solution must adapt to individual and evolving needs

Human needs as design foundation in social robotics in elderly care

Study: A Novel Implementation of a Social Robot for Sustainable Human Engagement in Homecare Services for Ageing Populations. Image Credit: Stock-Asso/Shutterstock.com





NTNU

Maslow → Users needs and social robot mapping

Maslow Level	User Need	Robot Feature	Existing Welfare Technology
Physiological	Daily routine support	Medication & hydration prompts	Pill dispensers with alarms
Safety	Feeling secure	Emergency alerts	Personal safety alarms, GPS trackers, fall detectors
Belonging	Social connection	Conversation, pet robot behaviors	Video call platforms, digital photo frames
Esteem	Sense of purpose	Positive feedback, shared tasks	Digital reminiscence tools, activity planning apps
Self-actualization	Mental challenge	Games, storytelling, memory cues	Brain training apps, interactive tablets

Impact on caregivers and their needs

Healthcare professionals should engage, because social robots can support them in their work (Bemelmans et al., 2013).

Royakkers and Van Est (2015) advocate for a **value sensitive design** in which developers and researchers **take into account wishes and needs** of **caregivers and care recipients**.

The design of the social robots would be influenced by **acceptance and preference of users to work with social robots**. (Frennert & Östlund, 2014).

Social robots can **relieve healthcare professionals** from their workload (Royakkers & Van Est, 2015).

Key questions when embarking upon social robotics projects

What do older adults actually **want and need**?

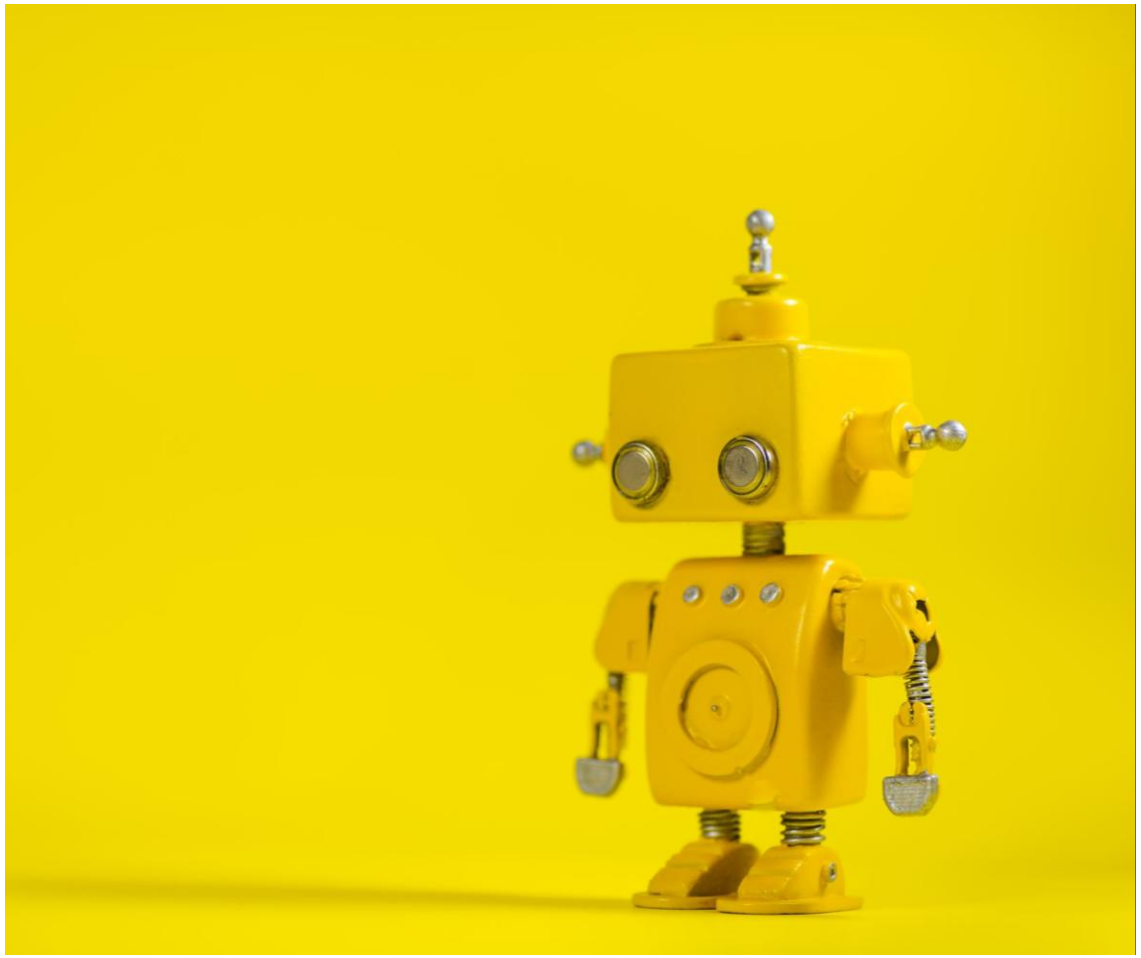
How do we include **users and caregivers** in design decisions?

How can social robots help **preserve dignity and autonomy**?

What are the **risks**, and how do we build **trust**?

“*A good social robot is not the most advanced—it's the one that meets real unmet human needs*.”

— Dr. Solveig Beyza Evenstad



What are the needs, impact and challenges?

Needs
Emotional Support
Social Connection
Mental Stimulation
Self-Worth & Purpose
Practical Assistance

Impact on Caregivers
Increased Workload
Collaboration with robot
Decreased workload
Time and Task Management
Trust and Acceptance
Organizational Impact
Technical Implications
Financial Implications

Challenges
Cultural & Social Resistance
Trust & Understanding
Technostress
Privacy & Security
Organizational challenges
Competence & Learning
Policy and regulations
Technological Challenges
Cost & Accessibility

A workshop on social robots among researchers from different disciplines at NTNU, USHT, NR with own old or deceased parents as reference point (CAREBOT project, NTNU& partners).

Current known limitations for social robots

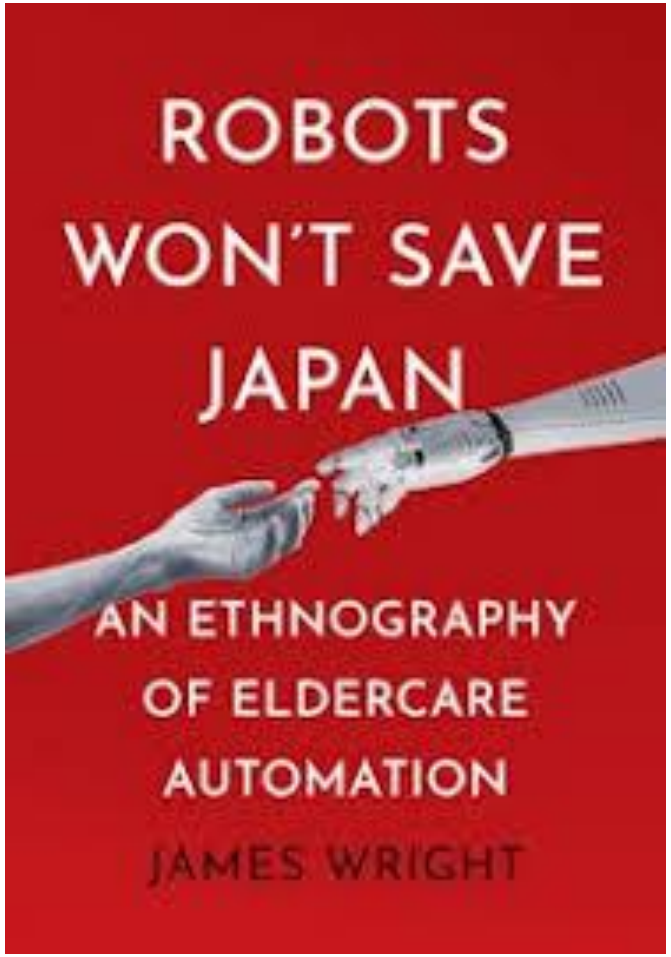
- High acquisition costs
- Narrow functionality (Fracasso et al., 2022)
- Technical challenges such as battery capacity (Deshmukh et al., 2018)
- Mixed user acceptance (Sawik et al., 2023)
- Organizational resistance (Koh et al., 2021)

A large-scale review (Naneva et al., 2020) found that general attitudes towards social robots in education and healthcare tend to be positive, but **acceptance is highly dependent on the robot's behavior and the context**.

Digital security and privacy are important (Lutz et al. (2019).

Experiences from Japan

- Experiences with ***Hug***, a lifting robot; ***Paro*****,** a robotic seal; and ***Pepper***, a humanoid robot.
- *Hug* was meant to prevent care workers from having to manually lift residents,
- *Paro* offered a robotic form of animal therapy (while also acting as a distraction aid for some people with dementia who made repeated demands of staff throughout the day), and
- *Pepper* ran recreational exercise sessions so that staff would be freed for other duties.



Paro and Pepper in the nursing home Sakura

"*Paro was received more favorably by staff and residents alike. Shaped like a fluffy, soft toy seal, it can make noises, move its head, and wiggle its tail when users pet and talk to it. At first, care workers were quite happy with the robot. However, difficulties soon emerged. One resident kept trying to "skin" Paro by removing its outer layer of synthetic fur, while another developed a very close attachment, refusing to eat meals or go to bed without having it by her side. Staff ended up having to keep a close eye on Paro's interactions with residents, and it didn't seem to reduce the repetitive behavior patterns of those with severe dementia.*"

Social robots like Paro and Pepper were introduced precisely to address such psychosocial and cognitive needs in Japan. However, the outcomes were mixed; robots sometimes provided comfort but often introduced complications or failed to sustain engagement. Wright observed:

Paro and Pepper in the nursing home Sakura

Pepper was not a huge success either. Wright observed: "…*But care workers quickly realized that to get residents to participate in the exercise routine, they had to stand next to the robot, copying its movements and echoing its instructions. Since there was a relatively small set of songs and exercise routines, boredom also started to set in after a few weeks, and they ended up using Pepper less often.*"

Hug robot for lifting in the nursing home

Wright observed that social robots often do not reduce caregiver burden. Robots add work through maintenance, training, troubleshooting, and supervision. "*Staff stopped using Hug after only a few days, saying it was cumbersome and time consuming to wheel from room to room—cutting into the time they had to interact with the residents. And only a small number of them could be lifted comfortably using the machine*."

Conversations with Tokyo Science, AIST, Shibaura Inst. of Technology in Japan (5th September 2025)

- The talks indicate there are upsides and downsides with the experiences.
- The industry is fueling more research and innovation and there is literature that shows opportunities and challenges.
- In Japan there is a political agenda to support to technology development, with national policy, strategy and investments in social robotics.
- Robots are still too expensive and have too narrow functionalities.
- Human-centric design focused on needs and ethical, responsible, thrustworthy approach can lead to good results.
- More interdisciplinary research and development needed. Today most projects are technology dominated, with technologists who develop what they think people need, rather than involving them in the development from the start (participatory design).

Experiences from Norway

Research by
Odd Ruud, Digi Viken
Jin Kristian Hurum/Roger Søraa, NTNU

Norwegian social robots experience summary

Robot	Municipality	Application	Target group	Experiences	Comment
PARO (robot seal)	Trondheim, Baerum	Sensory stimulation and calming; dementia care	Elderly with dementia	Calming effect and increased safety. The staff reports calming effect among users with anxiety. Requires close follow-up.	Well documented. CE marked medical equipment. Used in many countries.
Zora (NAO platform)	Bodo, Skien, Drammen	Activity and entertainment (exercise, dancing, singing)	Nursing home residents	Used for exercise, dancing, singing. Creates joy and engagement. The experiences vary – must have employees who follow up.	Experienced as useful, but vulnerable to lack of follow-up and technical limitations.
Pepper	Horten, Sandefjord	Meeting host, information, screen content	Elderly, employees, relatives	Used to demonstrate technology, interlocutor, information, music and videos via screen. Somewhat challenging in real caregiving role.	Often used for show/demo. Requires a lot of technical and social facilitation.
AV1 (No Isolation)	Fredrikstad, Oslo, Stavanger, Bergen and others.	Remote controlled school - and social participation	Children with long-term illness	Used to participate in classroom, social contact and professional follow-up. Very positive effect on children's attachment to class.	One of the most successful examples. Supported by the Norwegian Directorate of Education and NAV.
Tessa	Kristiansand	Voice assistant for reminders and dialogue	Homestay older	Provides support in everyday life, reminders of medications and agreements. Low user threshold and useful support.	Part of welfare technology programs. Experiences indicate high benefits and a low barrier.
ElliQ	Under evaluation in Norway	Conversations, reminders, cognitive support	Homestay older	Being tested in Sweden and the Netherlands. Norwegian assessment ongoing via several welfare technology environments.	Evaluated by KS and more municipalities. Gets attention in international research.

AV1 and Tessa: Connection and Reminders

AV1 (No Isolation): Remote school and social participation for long-term sick children in **Fredrikstad, Oslo, Stavanger, Bergen**. Very positive effect on children's attachment.

Tessa: Voice assistant for reminders and dialogue for elderly people living at home in **Kristiansand**. Low user threshold and useful support in everyday life.

Tessa in Norway

- A robot system connected to sensors in the home
- Learns the user's daily routines
- Helps maintain routines by giving reminders, e.g., to eat
- Notifies relatives of abnormal behavior (e.g., frequent toilet visits, walking outside at night)

Source: Jin Kristian Hurum/Roger Søraa, NTNU

ELSEVIER
Technological Forecasting and Social Change
Volume 167, June 2021, 120678

The social dimension of domesticating technology: Interactions between older adults, caregivers, and robots in the home

Roger Andre Søraa [a, b], Pernille Nyvoll [b], Gunhild Tøndel [c], Eduard Fosch-Villaronga [d], J. Artur Serrano [b]

Norwegian experiences

Opportunities

- Helps older adults with mild cognitive decline maintain daily routines via spoken reminders.
- Acts as a communication bridge between older adults and informal caregivers.
- Symbolizes companionship, reducing loneliness for some users.

Challenges

- Some users expected two-way communication, leading to disappointment.
- Voice clarity, dialect mismatch, and technical bugs affected comprehension and trust.
- Less effective for users with advanced dementia or little motivation for self-care tasks.

Source: Jin Kristian Hurum/Roger Søraa, NTNU

Existing pilots in Norway lacked personalization and contextualization

- **Personalize:** It is important to identify **real unmet needs** and program a layer of functionalities that will serve the needs of the elderly and be a support for the caregivers.
- **Contextualize** through integrating the robot to **the built environment in a Norwegian elderly home** which can have already a robot pill dispenser, fall sensor, electronic lock. The functionalities should not duplicate and create en environment of gadgets with contant reminders, which will “infantilize” and irritate the elderly, jeopardizing adoption. Furthermore, all IoTs need to talk together and connect to municipal nursing & IT. Can we integrate the robot to the welfare technology environment of a typical home? What cybersecurity risks are there?
- **Urgent municipal need for guidelines** and competency to handle the pressure from a very dynamic social robot market.

Lessons learned from EU projects in a EU-Japan cooperation, which we in CAREBOT follow and recommend:

- Importance of user-centric participatory design
- Fight ageism: older people are not ‘all the same’
- Need for trust and security
- Ensure interoperability of systems in the built environment
- Sustainability and accessibility
- Embrace personalization
- Multidisciplinary approach
- Educational programs and support

Implications for design & implementation: Employ Maslow's framework as a design roadmap for personalization and contextualization.

Start with human needs (of both users/patients and caregivers), not features.

Prioritize **basic needs** first (safety, routines) but avoid duplication among the welfare technologies in the built environment.

Build up towards **psychological and self-fulfillment** domains for the elderly with TRUST as key.

Use modular designs to customize robots for different needs of different personas (one size doesn't fit all).

Think integrated healthcare, avoid fragmented, narrow solutions. Be courageous to test and build competence.

Thank you for your attention!
Questions?

solveig.b.evenstad@ntnu.no
m.40319156