UiO : Department of informatics
University of Oslo

The importance of standarization within new technological areas

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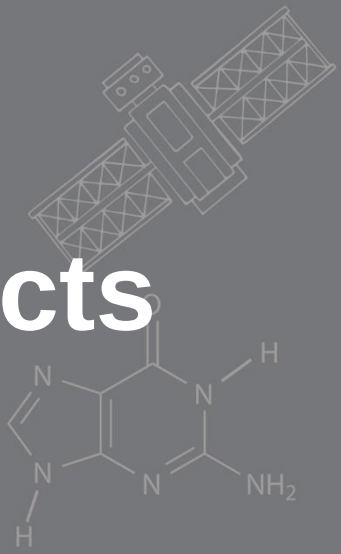
Background

- Researcher, University of Oslo
- PhD Thesis: ”Situated abilities – Understanding everyday interaction with ICTs”, 2020. University of Oslo
  - Two cases – Universal Design as a red thread
    - Robots in the home
    - Digital learning environments
- **Member of the Standards Norway Commitee on AI & Ethics (WG3) (2021-) -Currently reviewing the following ISO standards: (1) Risk Management; (2) AI Governance.**
- **Member of the IEEE Artificial Intelligence Standards Commitee, SG on Ethical Considerations of Cognitive Robots for Enhancing Human Efficacy** *(*Potential new name: Design-Centered HRI Governance for Socially Assistive Robots or Design-Centered Governance for Trustworthy Human-Robot Interaction)*
- Member of the Artificial Intelligence in the Norwegian Health Services (Kunstig Intelligens i Norsk helsetjenste - KIN) (2021-)
- Member of the Executive Board - The Norwegian Council for Digital Ethics (Norsk Råd for Digital Etikk) (2021-)
- Member of the executive board of dScience Community Forum at University of Oslo, part of dScience (2021-)
- Member of the Executive Board of Tekna Big Data (which has over 5400 members, 2021-)

Agenda

- Brief on research projects
- Examples
- Robots within home and healthcare
- Universal Design as an ethical charter for (care or social and assistive) robots?
- Questions

Research projects



MECS: Multimodal Elderly Care Systems (2015-2021)

Research Council of Norway grant 247697

Project: MECS — Multimodal Elderly Care Systems

Funded by: The Research Council of Norway

IKTPLUSS – IKT og digital innovasjon

Partners: Kampen Omsorg+

University of Hertfordshire UH

TU/e Eindhoven University of Technology

Project budget: 12 000 000 NOK | Time frame: 2016-2019 (2020) | Project Manager: Jim Tørressen | Project manager design group: Jo Herstad

Telecare • Participatory Design • Welfare technology • 3D sensors • Artificial intelligence • Robotics

Goal: Create and evaluate multimodal mobile **human supportive systems** that are able to **sense, learn and predict future events** (a sensing robot acting as a personal safety alarm for older people living by themselves at home)

Photo: MECS

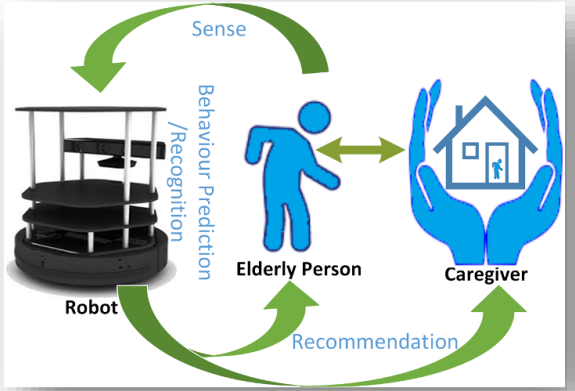
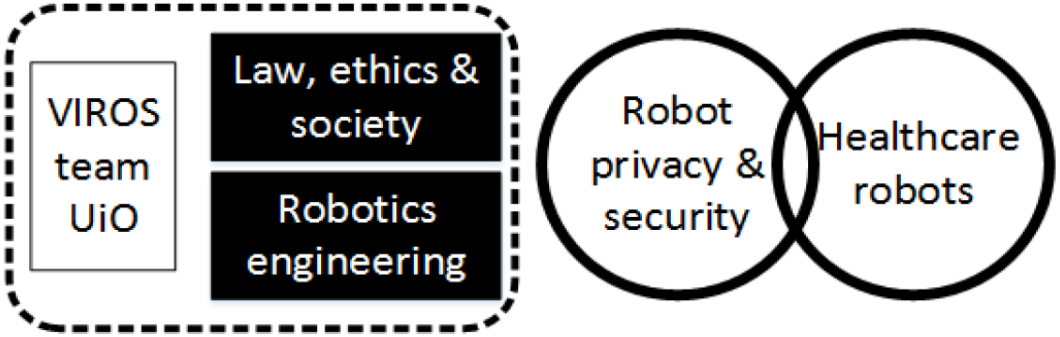


Figure: Jim Torresen

http://www.mn.uio.no/ifi/english/research/projects/mecs/

VIROS: Vulnerability in Robot Society Research Project - Research Council of Norway grant 288285 (2019-2023)

Photo: Jim Torresen



Dep. of Private Law + Dep. of Informatics at University of Oslo, and other Departments/partners

Goal:

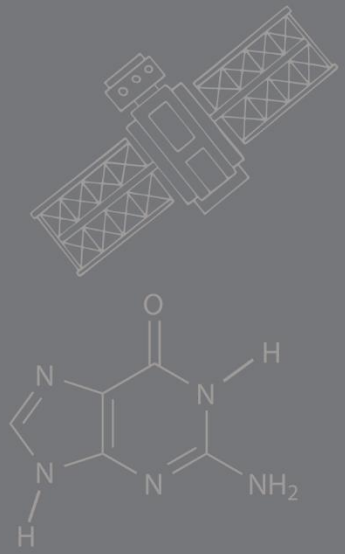
Develop technology and proposals for **regulatory measures** to reduce vulnerabilities regarding robotics. **Focus on privacy, security and safety**, particularly in healthcare contexts.

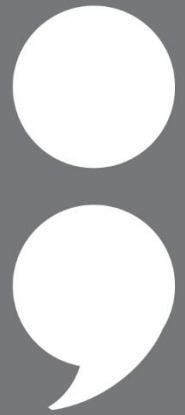
Funding: *IKTPLUSS, Research Council of Norway*

The Research Council of Norway

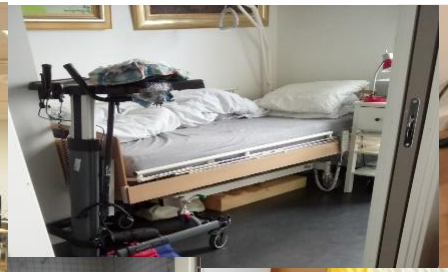
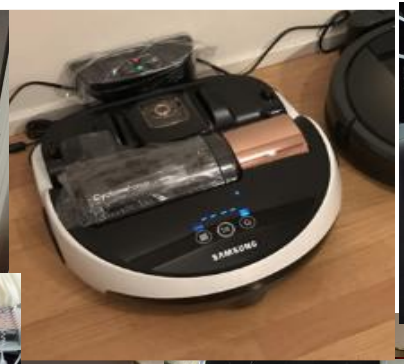
https://www.jus.uio.no/ifp/english/research/projects/nrccl/viros/index.html

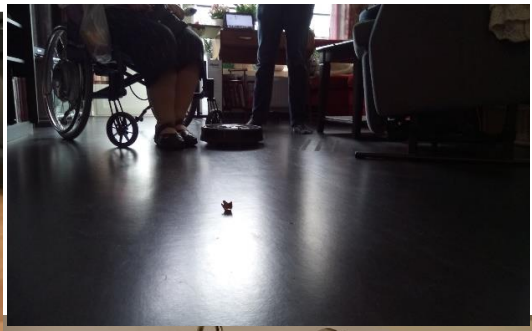
Examples

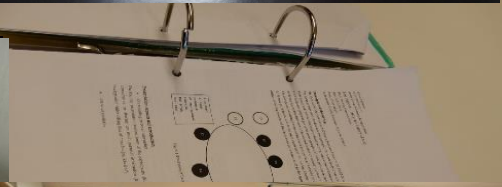
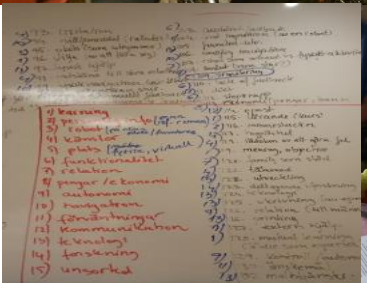


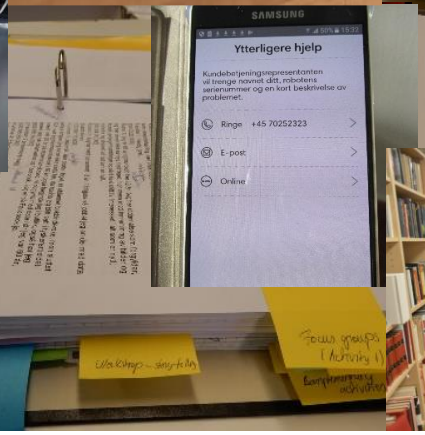


What have we learned?





D. Saplacan, “Situated Abilities: Understanding Everyday Use of ICTs,” PhD Thesis, University of Oslo, Department of Informatics, Faculty of Mathematics and Natural Sciences, Oslo, Norway, 2020. [Online]. Available: https://www.duo.uio.no/handle/10852/81852 │D. Saplacan and J. Herstad, “An Explorative Study on Motion as Feedback: Using Semi-Autonomous Robots in Domestic Settings:,” *Int. J. Adv. Softw.*, vol. 12, no. 1 & 2, p. 23, Jun. 2019.│D. Saplacan and J. Herstad, “Understanding robot motion in domestic settings,” *Proceedings of the 9th Joint IEEE International Conference on Development and Learning and on Epigenetic Robotics*. IEEE XPlore, Oslo, Norway, 2019. [Online]. Available: https://ieeexplore.ieee.org/document/8850695. │D. Saplacan, J. Herstad, and Z. Pajalic, “An analysis of independent living elderly’s views on robots - A descriptive study from the Norwegian context,” *Proceedings of The International Conference on Advances in Computer-Human Interactions (ACHI)*. IARIA Conferences, Valencia, Spain, 2020. │D. Saplacan, J. Herstad, J. Tørresen, and Z. Pajalic, “A Framework on Division of Work Tasks between Humans and Robots in the Home,” *Multimodal Technol. Interact.*, vol. 4, no. 3, Art. no. 3, Sep. 2020, doi: 10.3390/mti4030044.

Robots in the home

- The need of **multimodal interaction**, including speech and display
- The robot shall use the elderly's mothertongue language (**Norwegian, not English**)
- Concerns about **technical language** used when the robot gets stuck: errors such as F1, F4, connecting to the cloud
- **Size** of the robot
- The robot getting stuck under the bed, in cables, in furniture etc
- **Privacy concerns**: ”afraid that the robot will see into the bathroom”
- Challenges with controlling the robot through the smartphone
- Challenges to connect/set up the robot, and challenges during power outages

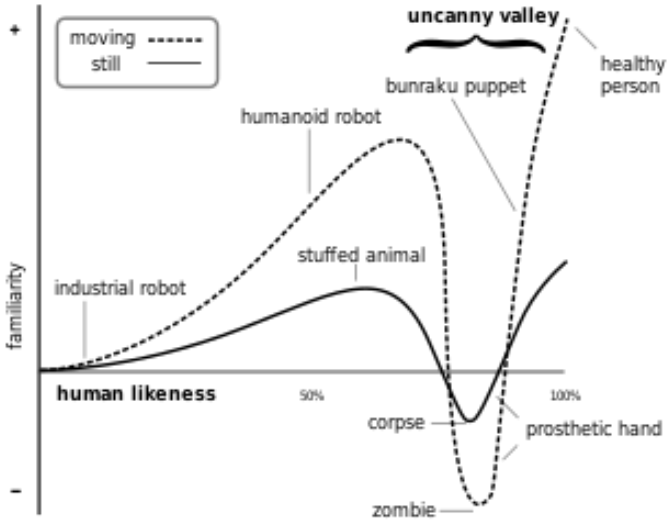
Some guidelines and principles to develop robots that shall be used by several users, including vulnerable users, within their homes?

Overestimating the capacity of robots – a safety issue

- The case of an emergency robot used during a fire alarm scenario - leading a group of people wrongly to the exit door – although the people knew that the exit is not there, they still followed the robot

Robot look vs. robot capabilities

P1: ”*First, overestimating the capacity of robots. When our robot is introduced in a context where many people think that they are better at doing stuff, and they do, because they are machines. (…) So two elements that I found interesting is the component of trust can lead to overestimating the robor or understimating the robots, and that it means that it’s inefficient, that the robot cannot accomplish the purpose that it was designed for*. ”

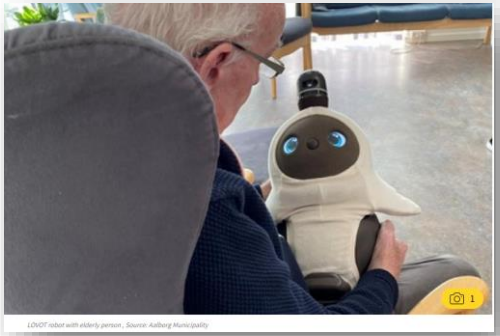


Masashiro Mori’s Uncanny Valley CC BY-SA 3.0

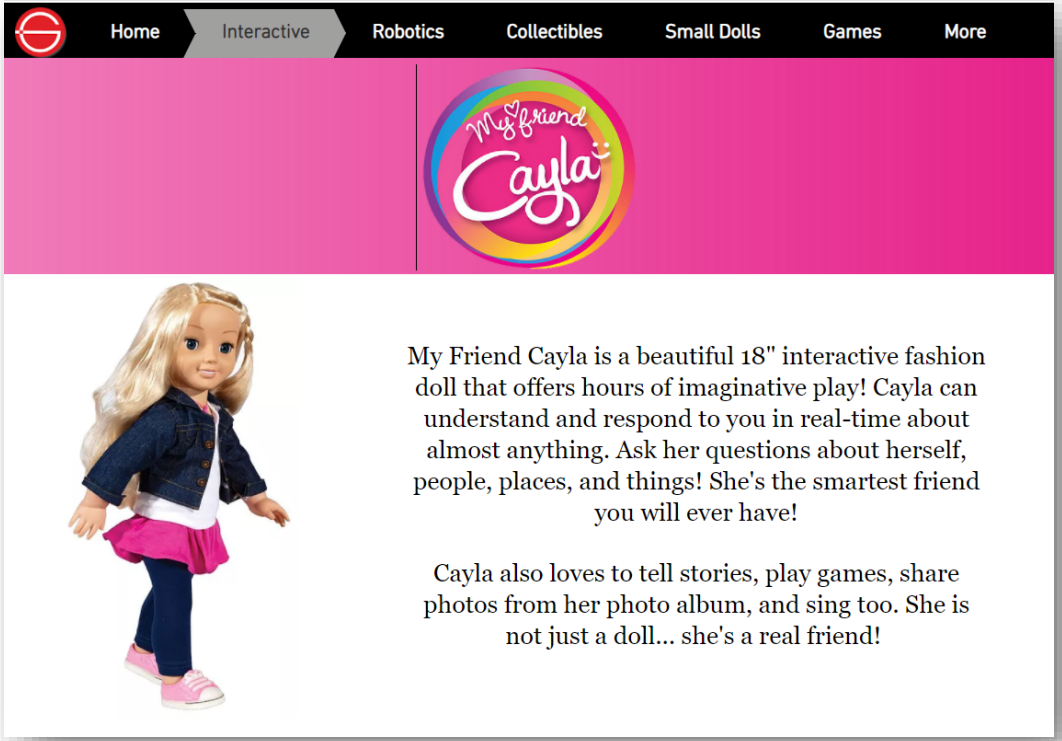
The problem of the robots that may look *too* cute – may also lead to you trusting it more: The need for certifications

- P9: ”But then, again, to bring it into robotics world and to physical robots, **I think that’s equally important to look at the diversity of robots that are made, and also how they have been made to look, you know. And you know, who they are accomodating to. *cause I think that’s interesting to see as well, when you look at the different robot designs** (…) In what cultures are they made, you know, how? Where are they made to look like they look? And of course, maybe that is one of the problems with the more humanoid robots in who’s image are the humanoid robots made, and they are not necessarily very accomodating in two different cultures and ethnicities. So, that is, definirely, also I think an interesting question, when it comes to design, and I think we see some interesting robot design as well. P9: ”**I always show that Japanese Lovot, which is so cute, I mean, How they have, you know, tried to explore design, tried to make the robots more, you know, cuter (in japanese Kawaii). I think we should bear in mind what happens with using this concept on our work – it is because of the robots and how we see them, for example if we make them too cute.”**
- **it’s a little menacing that you would probably allow it to do anything you know.** So, that is also one side I think about the design, but at the same time, it’s probbaly, you know, like it’s with the PARO as well, it’s more likeable for more people.”
- I: ”Yeah, but this can also lead to deception, because it might be very menanacing, a **very menancing robot which looks cute, and you trust it, you know, it increases your trust towards it. It’s more, not that it will hurt you or something, but it might collect data that you don’t want to be collected.”**

Robot look vs. robot capabilities



Connected devices sold as smart toys have security breaches – a *safety* abd *privacy* problem



https://www.genesis-toys.com/my-friend-cayla

smart connected devices look vs. robot capabilities vs. security vs. privacy vs. safety

Toys as connected devices used in therapy sessions

Testet språkroboten «Romibo»: – Ikke bra nok

Den pelskledde roboten som skulle lære bort språk til autistiske barn, floppet.

Vegard Unger Ellefsen
Journalist

Anette Stensholt
Journalist

Publisert 14. apr. 2018 kl. 15:57

Artikkelen er flere år gammel.

LÆRING: I håpet var at roboten skulle hjelpe til i språkopplæringen av barn med autisme. Etter et pilotprosjekt ble det konkludert med at den ikke fungerer godt nok. (Illustrasjonsbilde/ Prosjektmedarbeider Torunn Mayer. Barnet på bildet deltok ikke i prosjektet.)

FOTO: SYKEHUSET I VESTFOLD / NRK

– Vi er usikre på om vi noen gang vil gjennomføre et robot-prosjekt igjen. De løsningene vi kjenner til i dag, er ikke dynamiske nok til å kunne tilpasses ulike personer med ulike behov og ferdighetsnivåer, sier Anders Johansen ved Glenne regionale senter for autisme.

I ett år testet han og kollega Torunn Mayer roboten i [illegible] motiverende [illegible] språkopplæringen for barn med autisme [illegible] konklud[illegible] egnet ti[illegible]

– Det h[illegible] samtid[illegible] sier Jo[illegible]

Lilla o[illegible]

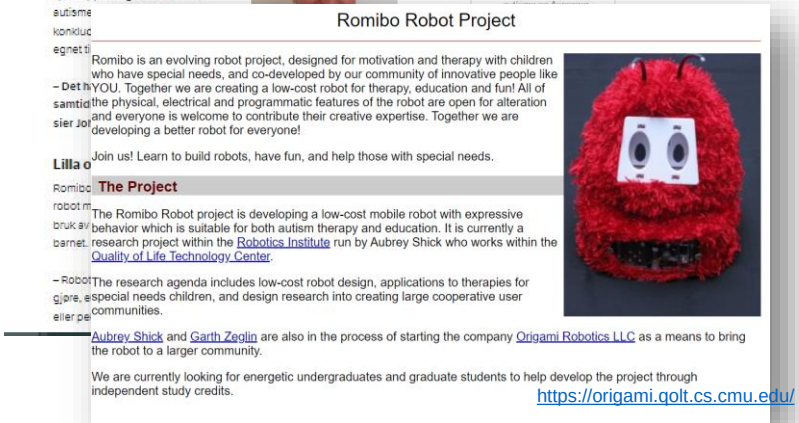
Romibo [illegible] robot m[illegible] bruk av barnet.

– Robot[illegible] gjøre, e[illegible] eller pe[illegible]

Autismespekter-forstyrrelser

- Den store variasjonen i symptombilde gjør at man snakker om et spekter av forstyrrelser. Barneautisme, atypisk

https://www.nrk.no/vestfold og telemark/_-sprakrobot-romibo_-er-ikke-bra-nok-1.13925371



Romibo Robot Project

Romibo is an evolving robot project, designed for motivation and therapy with children who have special needs, and co-developed by our community of innovative people like YOU. Together we are creating a low-cost robot for therapy, education and fun! All of the physical, electrical and programmatic features of the robot are open for alteration and everyone is welcome to contribute their creative expertise. Together we are developing a better robot for everyone!

Join us! Learn to build robots, have fun, and help those with special needs.

The Project

The Romibo Robot project is developing a low-cost mobile robot with expressive behavior which is suitable for both autism therapy and education. It is currently a research project within the Robotics Institute run by Aubrey Shick who works within the Quality of Life Technology Center.

The research agenda includes low-cost robot design, applications to therapies for special needs children, and design research into creating large cooperative user communities.

Aubrey Shick and Garth Zeglin are also in the process of starting the company Origami Robotics LLC as a means to bring the robot to a larger community.

We are currently looking for energetic undergraduates and graduate students to help develop the project through independent study credits.

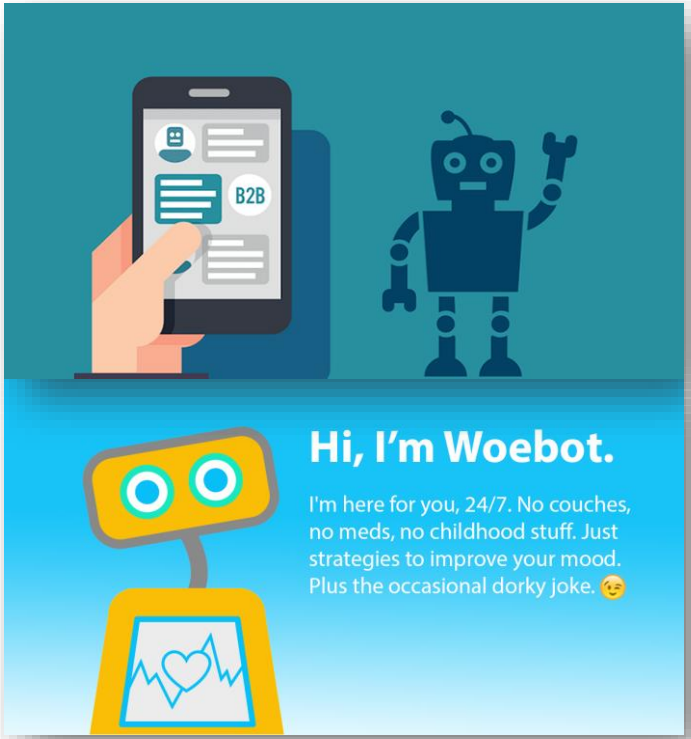
https://origami.qolt.cs.cmu.edu/

- Concrete example: a connected device (e.g., a robot, **Romibo**) is **marketed and sold by the manufacturer as a toy** – but it is, **in practice used as a medical device** (e.g., with people with Autism)
- The robot was recognized as a medical device in U.S., and as a toy in Europe - according to an informant
- The manufacturer/producer does not conform with all the health/data standards regarding privacy, confidentiality, safety – only with the Toy Directive
- **The take-away points:**
  - The design issue: the robot does not have a mouth – the children with Autism do not know where the sound comes from
  - the manufacturer has currently the power to decide how the connected device should be sold. This has implications on the user and the user data.
  - If a robot is assessed as a medical device, a medical device should not be used all the time (e.g., mental health issue)

robot look vs. robot capabilities vs. how the robot is used in practice

The use of (ro)bots in mental health – a (cognitive) safety issue

- P1: ”*It happens with chatbots a lot. We are not like, they don’t say like <<we are mental therapists, we are just your friendly friend, friendly neighbour. We are going to help you to get rid of those bad feelings to make you go back to yourself.>> So it’s pretty much doing psychotherapy, which is completely difficult, because you are changing the conditions in a person, you are training everything. They can pretty much deliver mental health therapy without compliance with any of the requirement that they do have as a traditional therapist. That’s a big concern.”*
- ”*And* ***when you study the ISO for robots, the international standard, the safety requirements for personal care robots is the ISO 13482. And basically, when I was reading it, it was mostly focused on the physical requirements,*** *like battery, electricity, collission,* ***but there is nothing related to the psychological elements****.*”
- If a robot is assessed as a medical device, a medical device should not be used all the time (e.g., mental health issue)
  - Even with doctors, therapy sessions are between 45 minutes to one hour – you do not have a continuous therapy session
  - Loosing the novelity effect
  - The problem of (over)attachment and boundaries in therapy sessions
  - The problem of deception



Images taken from Bing

robot look vs. robot capabilities vs. how the robot is used in practice vs. long term effects

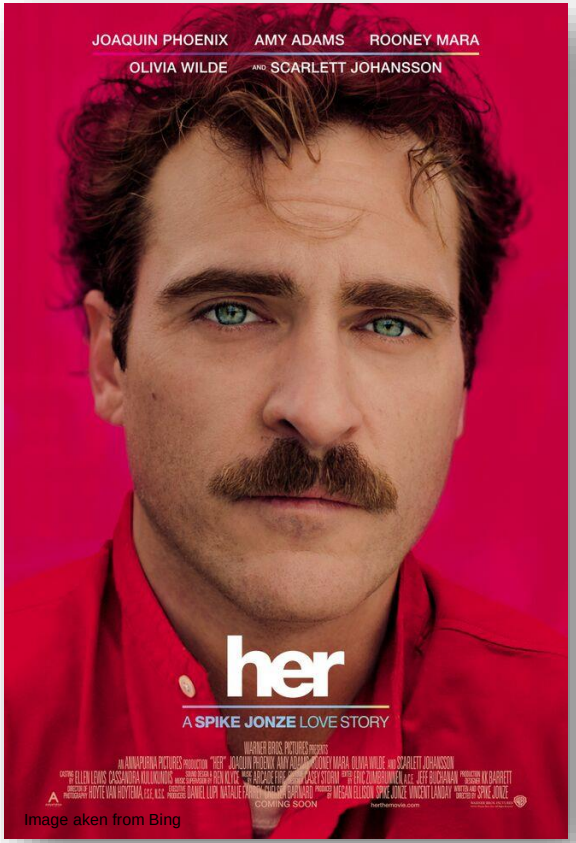
For the bioethical principles, see: Beauchamp TL. Methods and principles in biomedical ethics. J Med Ethics. 2003 Oct;29(5):269-74. doi: 10.1136/jme.29.5.269. PMID: 14519835; PMCID: PMC1733784.

The use of (ro)bots in mental health – the problem of over attachment – a (cognitive) safety issue

- The problem of overattachement between humans and AI

- *P1: ”**Also, we need to take care of overattachment from the user. Here, overattachment is a really big issue, because it really can make your psychological state completely terrible**, it could be superworng. **It happens to therapists all the time and they have to have boundaries that actually are requested by the bioethical framework. So how do we ensure that here in this psychological and psychiatric context is a safety issue and in other robots it’s just an ethical issue?** This is the thing that I am trying to highligh the fact that is – which is related to all these human rights that is being related to safety and etc. **When you analyze this in the lens of mental health therapy, confidentiality and safety are conceptualized in a completely different way**.”*

robot look vs. robot capabilities vs. how the robot is used in practice



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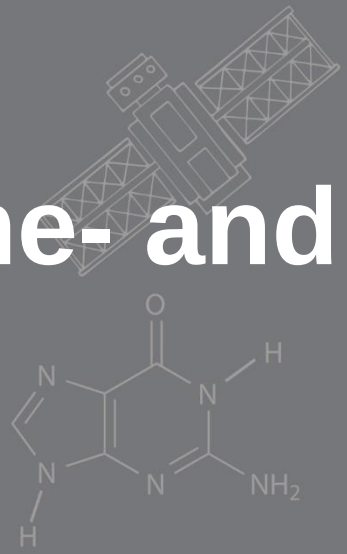
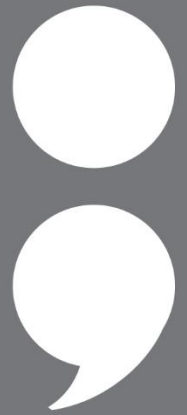
Robots within home- and healthcare





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Persona

Eve, 85 years old, lives at home on her own

Image source: https://upload.wikimedia.org/wikipedia/commons/thumb/3/31/Noto_Emoji_Oreo_1f475.svg/768px-Noto_Emoji_Oreo_1f475.svg.png

Possible scenarios with AI-based care robots

1. Informed consent

2. Other people around

Photo credit: Diana Saplacan

Photo credit: Vegard Søyseth

robot look vs. robot capabilities vs. security vs. privacy vs. safety vs. context of use

The issue of (informed) consent

- Ethical dilemmas:
  - The context: home care or hospital
  - Robots, other people around
  - Home as a private place
  - Sensors, cameras on the robot
  - Storage of data: locally, in the cloud
  - Distributed responsibility: manufacturer (hardware, software), distributor, municipality that integrates the the robot within the home- and/or healthcare service, the care-receiver (e.g., elderly), care giver (formal or informal care givers) etc.
- Principles and guidelines need to be operationalized in concrete requirements, guidelines, principles, standards, regulations, laws etc.

Robots and (informed) consent

- (informed) consent
  - a term used within the health sector; the consent to have treatement; a consent can be given explcitely or implicitely.
  - A legal term used as a data protection term, which means that is a consent freely given
- It can be given through actions or words
- How should the consent be given when the robot is placed in the home as part of the homecare services?

the first time it's deployed it's a question from the care services for example, "**we want to put a robot in your home, do you wanted: yes, or no?" That is the first, and that is hopefully even to a human explained by a human, and not by a robot, because then the robot is already in your home and then it's too late. (…) And then if this is part of the care services or the health services, well, part of their duties they have si to record some data, not everything; and some of that is going into your journal, and that's legal duty, because it's not based on consent. And then it's like the first action is informed consent, while the consequent processing of data, the collection of data is based on legislation. For robots there may be distinctions because they may perform differently – they may have different performances, may be they are not.** But then again, that is more about the design, for example if you have a robot whose main duty is to give you medicine, well, may be it doesn't have to be ON all the time, **may be it's not you who turns it ON, may be it's programmed to be turned ON when it should, and then at that time it collects the data it needs to be able to interact with you. But that is something else than a robot which is you know, all the time ON, and it may also has several dutires, may be it also has the role of a social robot for example, but then it's again back to what kind of data it needs to be recorded and used in the process, which data needs to be saved on the (health) journal because it's part of the care servicesm and what data doesn't need to be saved, it should stay on the robot, or only be exchanged with whatever software it's using to enahnce it's performance, but it's like upgrading."**

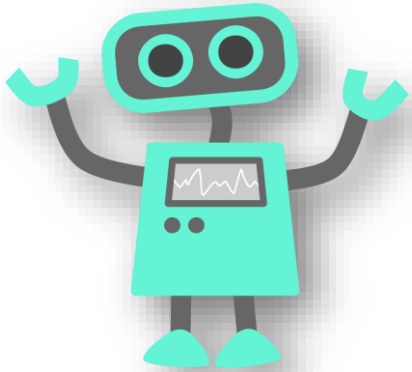
P9: "Then you can ask may be you as the user should have the possibility to turn it ON and OFF, but may be that actions <<yes, I wanted to be ON>> and then again go back to the design, so it's hopefully easy to understand. And then may be that ON-function that your kind of explicit, you know, action say <<hey, come one, robot, interact with me>>, which is not true, the robot asking you, but it's why you say <<hey, come to me>>. That is as I understand how some of the Japanese products are designed, because they are very concerned about you know, it's liability issues, the robots shouldn't you know – it should be always be some kind of human oversight and away they solve that is by saying that you wave to do, or whatever, ot activate a robot, and thereby, you are kind of responsible, it's kind of how they were created, but still."

The choice to health treatment: opting for a home care robot or not?

- Will the health treatment that I receive be different based on what I choose? What are the trade-offs?
  - GDPR in hospitals, and privacy in the homes – what we say ”yes” to when we say ”yes” to home- or healthcare treatment?
  - Autonomy and democratic value of free choice

*P9: ”**We need to distinguish the questions. May be you should still consider having a robot in your home, or not. That is of course, may be, you will NOT have a choice, in the future, if you are in a hospital, you have consented to a treatment, whether the treatment is given by a robot or a human being. May be that is not an option that you consent to, we don’t know that. But, at the time being, when you enter a hospital and you want to have a surgery on your hips, you consent to having surgery and then the hospital decide how they perform that. In some instances, you can, you are faced with a choice, we can do it in this way, pr this way. So, what happens when there is another concept, that we would like to use a robot. But may be that option is not there because may be is up to the hospital. So, I think that is one question that is one line of looking at it, the other way is, and if you know the ”hjemmehjelpetjenste”/some care service, sill wants to use and have a robot in my home, but that’s my personal sphere”, so then we are not within the data protection legislation, we are within privacy legislation – my right to private life, my right to decide what should be in my home. And that could very possibly and maybe that they preferred that should be based on consent. You can’t put anything in my home unless I agree to consent to. But then we have exceptions from that, because we have some devices that are required to have in a new home, for example a smoke detector or fire extinguisher and so on**. So, that’s like mandate by law, so to say, and they , and we could also have the same problems when it comes to: **”yes, I do want to have care services in my home.”** Again, it will be a question of well, if you do want that, can you choose HOW? Because, you have many services that deploy that aren’t deployed in people (homes), where you can’t really choose, you know, how they are managed**. There is the case, for instance, when a person comes to your home twice per week, but you wanted person to come every day. But that’s not always an option you have, you can’t always say ”yes, I want this services, or I don’t want this service.”***

Cosenting to a robot is different from consenting to the use of a social media platform



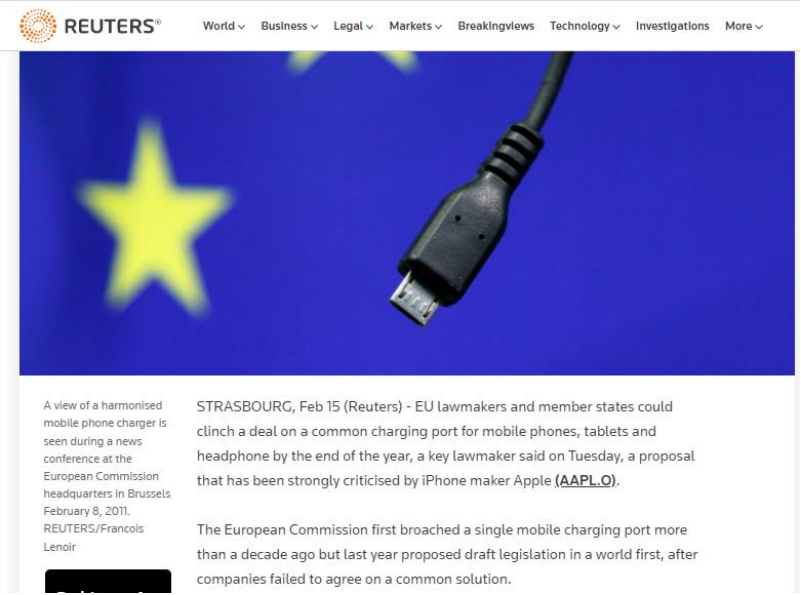
robots vs. social media

Images taken from Bing

- **Consenting to a robot is different than consenting to a social media platform:**

”I: (…) And then you just click because you want to get access to the social media or whatever platform it is, and then you suddenly sign that you kind of give your data away and you have signed some things at least, to which, I wasn’t aware of, you know, before all this scandal with facebook or befroe 2016, around 2016, I wasn’t aware of how really, how it really works, you know, with Facebook and the data collection, and the advertisements and so on. I knew something that they live on adevertising to people and so on, but I didn’t know how much data they collect and yeah, anyway. Now, for instance, when – but that’s kind of a static element, so they sometimes they update this kind of consent that you give right and it comes the new one and says ”now, we have updated our terms, so please, sign it, if you want to continue using our platform”, after I don’t know which state. ***Whereas, in robots, it can be a little tricky, especially with AI based robots, because you don’t know how the algorithm developed and how can you have control over that.”***

The need for standarization – Robots need to be seen in context



P10: ”Yes, homes or hospital, when it’s more like care side, where again, you might have a lot of regulation already in place that deals with those (issues with regard to care), what any kind of care has to provide, and then that would also probably translate to a robot. And then, the next is what standards are coming. So, **there’s obviously private homes, we have this layer of what robots need to do, need to be able to do in different environments because of different laws that apply, different regulations that are there**. ”

P10: ”And then, there’s may be more than marketing aspect and also, yeah, so whoever developes these robots and whoever wants to use them, **there are expectation and then those might lead to also the necessity of drafting standards, in order to meet these expectations. So, if I am designing a robot I want to market in is in a certain way, but if I’m in a hospital, I might habe been interested in these robots working all in a simialry way, and that then again again, that it works for a very hetereogeneous patient cohort, so my children as well as seniors or something. And so that could make it necesseary to consider drafting those standards. So this would be more formal industrial or something like an ISO standard, I am not sure, whether they would have a universal design standard, but that would be one.** ”

Universal Design – a possible ethical charter towards standarization of social and assistive care robots?

UiO : Department of informatics

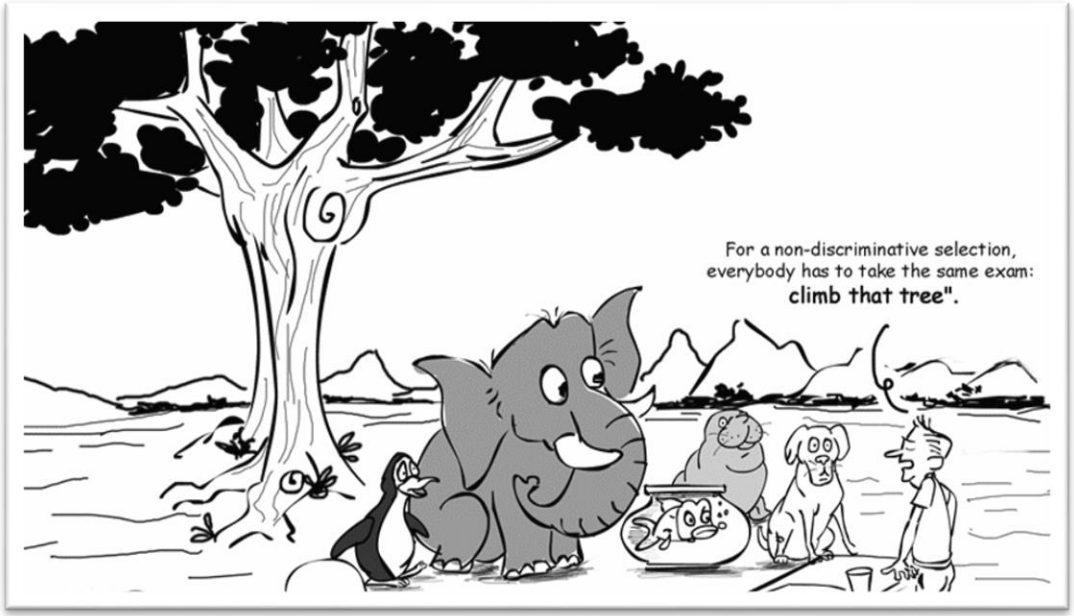
Universal Design of robots: a potential ethical charter in the standarization work?

Balance between robot design/look vs. robot capabilities vs. purpose vs. context of use

”So, I’m may be asking for a starting point, for example, when it comes, to yes, accessibility for users, and the possibility of understanding and actually handling, for example, a robot. I think also that there may be rights, if I remember – ***there is for example what I for example seen in the Japanese robotics, there’s like a suggestion for new robotics rules, which has not been adopted yet, but for example one design principle they seem to be quite common in Japanese robotics: that is that a robot should not have any physical design, which is not useful.*** *So if it’s not supposed to have arms, it should not have arms. So, the design should be limited to the functionality.* ***So, that means that you do not make a robot look like a person with arms, if it’s not gonna.. Going to use those, for example****. And so, there could be some interesting points there – while I think they are like the UD principles, that we see in the European directives. I mean, it’s very much more like – for example – if you have a ticket machine, it should be – it should have buttons, that are actually possible to use. Whether you have, you know, vision disabilities, or physical disabilities for example, that it has to be , you know, accessible, that you can have for example a wheelchair, that you can actually reach the screen and.. […] And of course, some of those design rules could definitely also be applicable for robots, for example if you have a robot which is supposed to be operated by an elderly person, but it’s not.. It has like tiny dots on it, on or buttons, or… and such. I think it’s definitely an interesting approach, but we need to kind of dissect it.”*

Universal Design: Definition and History

- **“The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.”** (R. Mace, 1941-1998)

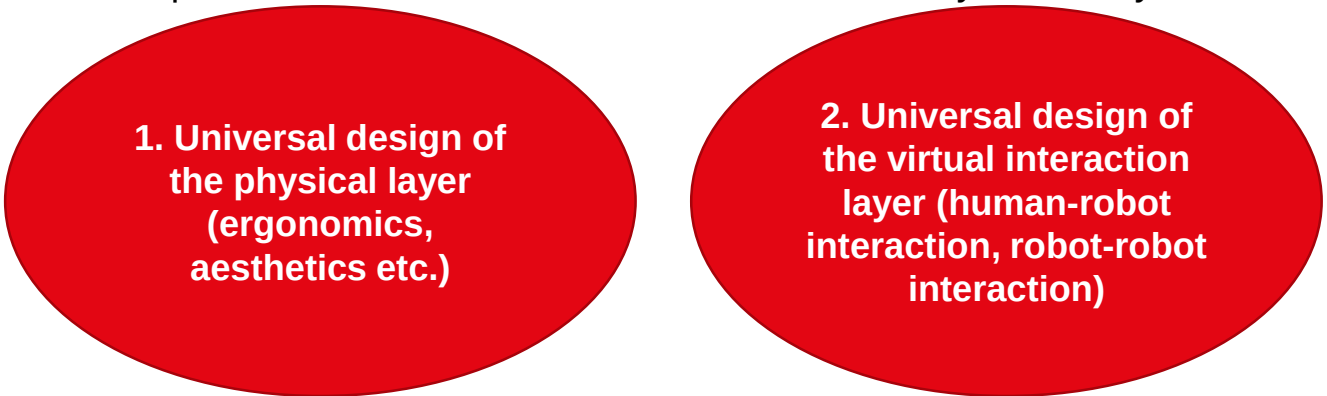


The 7 principles of Universal Design (UD)

#	Principle	Example
1	Equitable use	Use of a ramp for getting into a bus: it provides equal ability to step onto a bus for both people in a wheelchair and without a wheelchair, such as a woman with a stroller
2	Flexibility in use	The use of a table with an adjustable height is good for both abled people, people with back problems, people sitting in wheelchairs, or children
3	Simple and intuitive use	An iconic example is the iPhone design with its buttons in the same place in different versions.
4	Perceptible information	Consistency in using symbols for volume or radio buttons, send icons, or save icons on buttons.
5	Tolerance for error	The undo button provides reliable feedback. Another example is the oven lock button for children's safety.
6	Low physical effort	The height of ATMs provides easy access and low physical effort for people of different heights, including children and people sitting in a wheelchair
7	Size and space for approach and use	The gates of a metro-station or security control at the airport should be large enough to accommodate individuals of different sizes, or people sitting in a wheelchair

Care Robots & Universal Design (UD)

- Accessibility and usability of care robots for a larger group of users: elderly, but also children
- Multimodal ways of interaction applied to robot interfaces : visual, tactile, audio → diversity of users
- Providing some standards for care robots so they can be used by both a diversity of users, but also in joined robot-robot tasks
- Current workplaces (in Norway) → accessibility guidelines
- Future (care) workplaces that include robots to be used by patients, nurses, and others with no technical skills will require robots that can be accessible and usable by a diversity of users



Universal Design principles – applied to ”care” robots (inclusive robot design)

#	UD Principle	Example on UD principle applied to the physical layer	Example on UD principle applied to the virtual interaction layer
1	Equitable use	The physical design of the robot should be appealing to different types of users. For instance, the robot could be equally used by elderly patients without the feeling of infantilization, but also by children patients. The physical design and form should be appropriate for a diversity of the users. For instance, the size of the arm manipulator, and hands and grip of the robot should be appropriate to be used by both adults and children.	The robot can adjust its interaction to the user. It can interact through speech for those preferring a such interaction, or through displaying a text through a screen for those that are hearing impaired, or through color feedback, for those who need simple interaction.
2	Flexibility in use	The robot has an adjustable height: it can go up if the human user is standing, or it can go down, if the human user is sitting.	The robot interaction types should be multimodal and customizable depending on the type of user that is interacting with the robot.
3	Simple and intuitive use	Design of different components of the robot should be simple and intuitive to use. For instance, a robotic arm should be designed looking alike a human arm. The stop button should always be visible and placed in a specific place of the same type of robot. The stop button should always be red and have a stop icon, and/or the word stop on it.	The robot should use clear language that is understood by the user.
4	Perceptible information	The design of the symbols used by in the navigation display should follow the international guidelines. The symbol for play, stop, go back, move up and down, volume up and down etc. should be used accordingly.	The language used should be clear language and adjusted according to the mother tongue or the used language of the human user. For instance, if the user has Norwegian as his/her mother tongue, then the robot should be able to interact in Norwegian. Another situation is that the robot avoids giving technical errors to non-technical users. For instance, the robot displaying or indicating error 451 does not say much to a user. Instead, the robot should display or say in clear language what is eventually wrong.
5	Tolerrance for error	The robot shall be equiped with wheels that can navigate different types of floors, including slippery floors, but also floors that have carpets, or being able to go over the doorstep without getting stuck.	The interaction of the robot should be designed with tollerance for error in mind, without the robot “loosing” its patience, or becoming rude if the user takes more time to execute a task. If the robot is designed to indicate the human user to eat breakfast or to move around, but the human user refuses to do so, the robot should try to understand the reason why the human user does not execute the tasks, rather than punishing the user.
6	Low physical effort	The robot’s physical design should allow different users to adopt a neutral body position, and a minimum effort. Incorporating an adjustable height to the robot is an illustrative example for this principle.	The robot should be able to adjust its interaction speech depending if the user is an elderly patient, a child, a medical staff, or a technical staff. The robot should not make the human user to him- or herself adjust to the robot language in order to make him – or herself understood, but the other way around (see example of current chatbots that make the human user adjust his- or her language to the chatbot).
7	Size and space for approach and use	The physical design of the robot should be appropriate to its functionalities and aim. For instance, if a robot shall be designed for its use within a home, then it should not take too much space. Its height should not be greater than the humans height, however it should not be too small, such as that the human user may stumble into it while walking in the home. For instance, if the size of the robot is too small, a user sitting in a wheelchair, or a user with back problems will have to bend to reach the robot if the robot gets stuck. These situations should be avoided	The size of the display, arms and grips, if any, should be appropriate to the size of the robot. However, the display of the robot should be enough big so an elderly person or someone with sight impairments can easily see the text, icons or symbols displayed.

Universal Design of Robots (UD-ROBOTS)

Bufdir

Norsk Regnesentral
NORWEGIAN COMPUTING CENTER

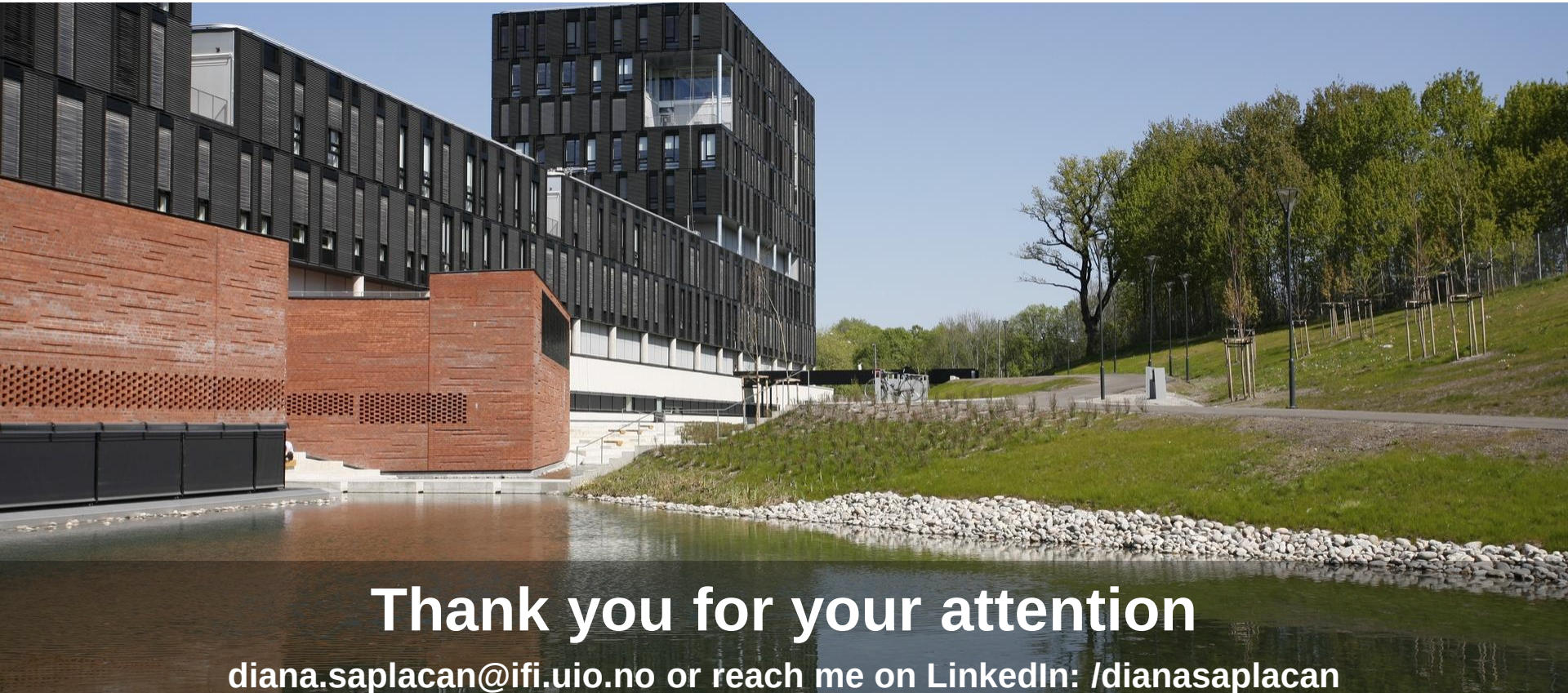
Universal Design of Robots (UD-Robots)

Robots, being physical and digital, must adhere to different sets of guidelines if they are to be universally designed. Which guidelines are necessary for the universal design of a robot, and how can we evaluate a robot to see if it is universally designed? This project aims at examining existing guidelines to see how they apply to robots, discussing with potential users of robots in different user cases, devising a method for evaluating robots, and using this method to evaluate several robots.

VID

Concluding remarks: 7 reasons why we need soft and hard lawa to regulate the use of robots

1. **Not enough with standarization of the physical design – we also need to focus on the virtual/interaction layer**
2. **Inclusive design and designing for a large number of users – avoiding discrimination, digital gaps, and exclusion**
3. **Certain concepts change their meaning: e.g., safety – cognitive safety, security breaches may become a physical safety problem, a risk**
4. **Connected devices need some sort of certifications and to follow certain standards – e.g., products sold as toys should not be used as medical devices in health/therapies; the user shall always find how to stop a social and assistive (humanoid) robot – by pressing a red button, which is always placed on the back of the robot.**
5. **The issue of consent becomes much more complex.**
6. **Smart devices, software agents, (ro)bots etc. used in mental health therapy need to have certifications.**
7. **Future connected devices, including robots, should be able to ”talk” with each other (e.g., robot-robot interaction, complex human-robot interactions where several robots and several humans interact with each other shall be possible)**



Thank you for your attention

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