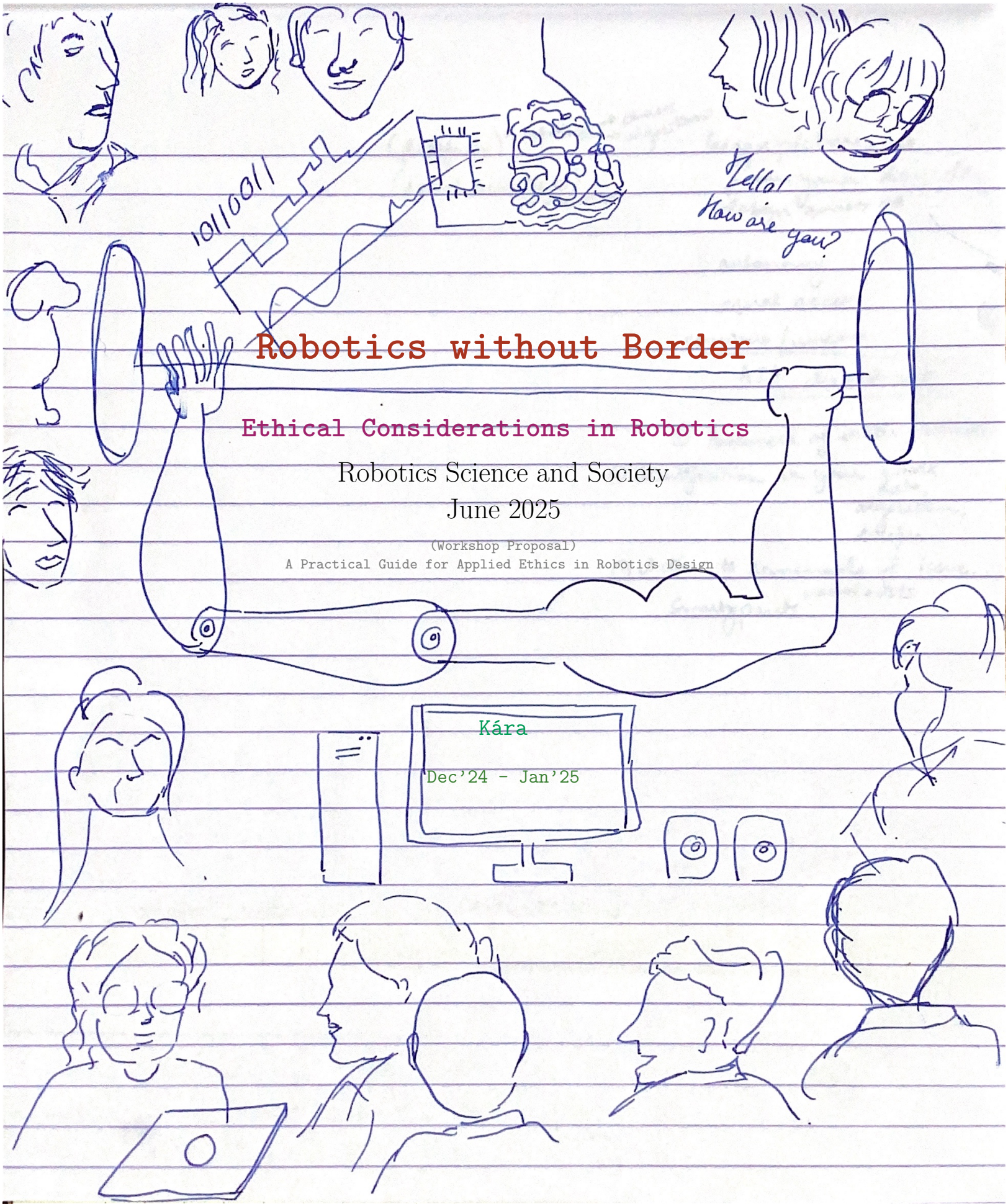


Robotics without Border

Ethical Considerations in Robotics

Robotics Science and Society

June 2025

(Workshop Proposal)

A Practical Guide for Applied Ethics in Robotics Design

Kára

Dec'24 - Jan'25

Contents

Abstract

Ethics remains an under-represented theme in the domain of robotics. This oversight is not due to a lack of interest from either philosophers or technologists, but rather the result of these domains evolving separately for centuries, without a shared language or intersecting interests. Nevertheless, both fields profoundly influence society and are shaped by it.

In this workshop proposal, we aim to explore the connection between these two domains, creating a space for dialogue and collaboration. Specifically, we address this issue to an audience of highly skilled roboticists at the Robotics Science and Systems conference 2025 in Berkeley. This work is authored by a roboticist with close ties to the field of (technology) philosophy, ensuring a thoughtful intersection of both perspectives.

We will navigate two sides of the story: impact of society on robotics and impact of robotics design on the society. Through a series of examples highlighting ethical concerns, we will discuss the impact on society and robotics design thereby coming up with technical engineering solutions to create more 'ethical' robotics design.

Ultimately, our goal is to articulate clear, actionable, and replicable strategies for integrating ethical considerations into robotic design, while also raising awareness across a broader audience. A key aspiration would be to foster conversations between philosophers and roboticists for long standing relationships committed to create beautiful technology that move humanity onwards and forwards.

Keywords: applied ethics, ...

Document/Workshop Structure

In **Chapter 1**, we start by defining robotics, clarifying the purpose and objectives of the workshop, and providing an overview of its structure and flow.

Chapter 2, presents everyday examples to highlight the urgency and relevance of ethical issues for roboticists. These examples will introduce related philosophical aspects. We want to pick attendees brain to find engineering solutions to the posed ethical issues. This will create active thinking, and create a handbook of solutions.

Chapter 3, additional examples of robots pivoting around ethical concerns gradually introduces attendees to broader philosophical and social issues. By exploring these concerns, we aim to ease attendees into more complex philosophical discussions, encouraging them to think critically about the intersection of technology, ethics, and society. End goal is still to find ways in which engineering design can foster ethics.

Chapter 4 highlights critical issues related to life-threatening robotics, such as the use of robots in healthcare, military, and autonomous vehicles. We ask them to reflect on their own, leading them to question their own designs.

Chapter 5, concludes the document with some open ideas.

We provide an appendix as a takeaway from the workshop. This effort is not a one-time initiative, but rather a lens through which to view the robotic design and continue exploring these issues long after the workshop concludes.

Appendix A is intended to serves as a cheat sheet that participants can keep in their labs or set as their desktop wallpaper for quick reference.

Appendix B, is a vocabulary for the common, designed to inspire and facilitate interdisciplinary conversations that bring attention to emerging issues and, ultimately, their solutions. This is intended to address the urgency of common

tongue to unify domains.

Appendix C, are additional relevant readings from various disciplines that explore this theme in greater depth.

The **Appendix D** aims to encompass similar examples from domains outside of robotics, helping to foster empathy among roboticists and avoid a blame-oriented approach. By demonstrating the widespread nature of the issues in technology, it creates an environment where participants can recognize that these concerns have been overlooked by many fields, not just robotics. This shared understanding encourages a collaborative effort to address these challenges, emphasizing that the issue is broader and affects everyone.

Chapter 1

Introduction

What is this workshop about?
Why is it important?
What is robotics?
what are our responsibilities?
Where are our blind spots?

The fields of *technology* and *philosophy* are explored by scholars in their respective domains. While philosophy serves as the foundation for personal existence, national identity, and a comprehensive understanding of the past, present, and future, it often goes unnoticed outside of ethics classes or emerges during moments of crisis or under the influence of alcohol. Although philosophy profoundly impacts us, it tends to be intangible, elusive, and often unrecognized.

In contrast, technology permeates our lives; we engage with it almost every minute, discussing it actively in everyday conversations and critiquing its influence over dinner tables. However, the technology we develop is not without its problems, and the society that adopts it carries its own inherent challenges.

Progressing as a world requires more than just awareness of these issues; it calls for a collective effort, open dialogue, and a commitment to consistently applying thoughtful theories to drive humanity forward.

This document serves as a collaborative initiative aimed at fostering a transformative dialogue in the field of robotics through the lens of philosophy. It is designed to accompany the prestigious Robotics Science and Systems conference, which features exceptional researchers who present, discuss, and explore their cutting-edge work. Our goal is to open the doors of robotics to a diverse array of professionals, including philosophers, designers, and humanitarians.

We encourage roboticists to reflect on the biases, challenges, and gaps that are often overlooked in the field. Additionally, this document offers practical solutions for integrating ethical considerations into robotics design and outlines topics for discussion that will engage professionals working at the intersection of technology and society. The solution-oriented approach of roboticists provides

an opportunity to address the open-ended ethical challenges in the field. The workshop will offer several opportunties to explore unimagined pragmatic implementable solutions to such open questions. Together, we can shape a more thoughtful and inclusive future for robotics.

What is Robotics?

The definition of robotics lacks a unified, universally accepted standard and continues to evolve over time. As a result, robotics is often defined subjectively, based on the perspective of the individual presenting the definition. The figure 1.1 illustrates how society and data perceive robots.

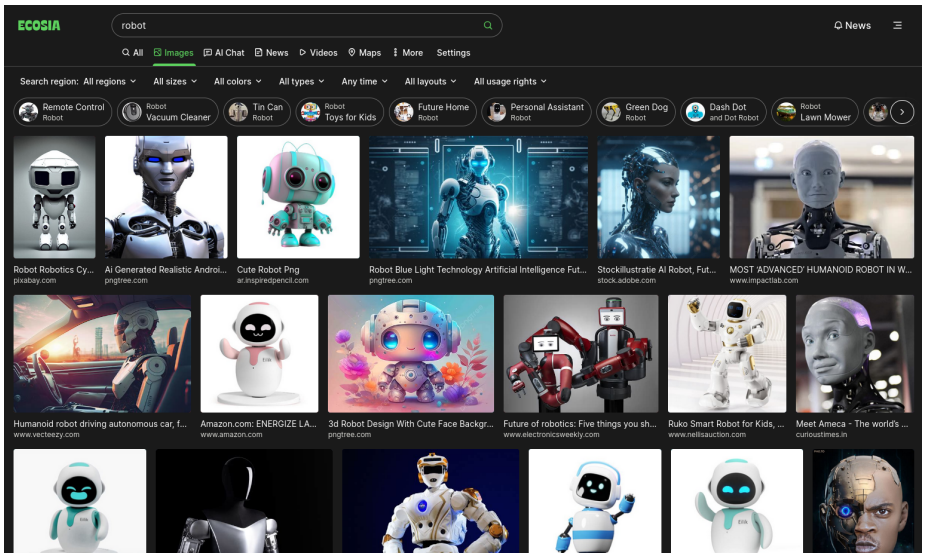


Figure 1.1: Common perception of robots in society and search engines

For the purposes of this document, robotics is defined as electronic programmable units, which may include mechanical components, designed to automate repetitive tasks that may not yield replicable results. By this definition, a hammer is classified as a tool, while devices such as a Roomba or a washing machine are categorized as robots.

Robotics defines as the science and engineering of robots.
Roboticist refer to people involved in design and development of aforementioned robots.

up for discussion

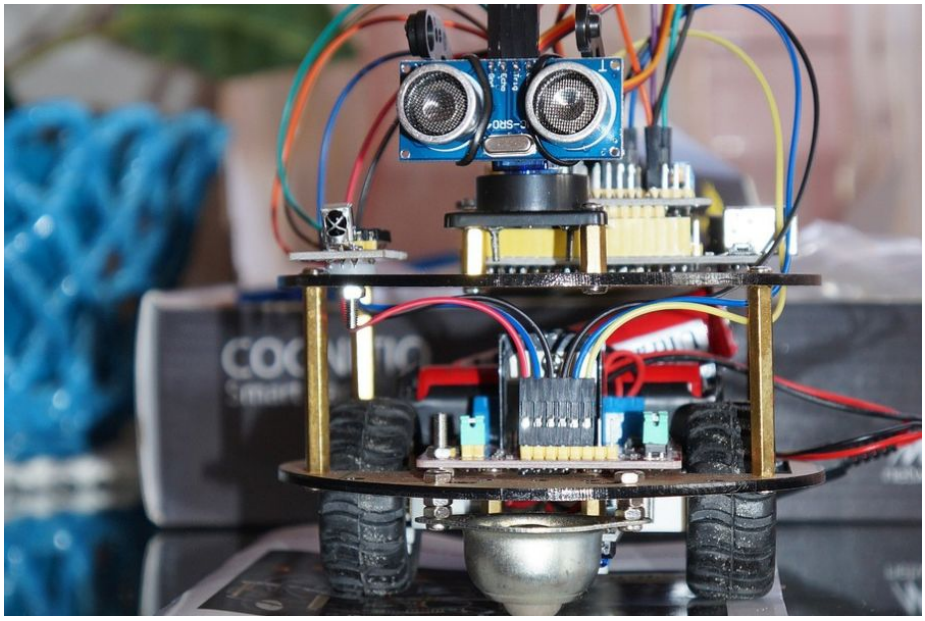
Evolving from the visions of sci-fi cinema, a declining global economy and changing job market dynamics have led many to view robotics with skepticism. Often depicted as fearsome transformers or iron-clad warriors, these machines are seen as a looming threat capable of wreaking havoc on the Earth, invading our privacy by reading our (private) emails, and ultimately endangering our lives. Concerns about security, privacy, and safety mount, leaving people feeling that control is slipping away from humanity, and that we might be heading toward a grim fate.

It's undeniably a chilling perspective.

On the other hand, practitioners of robotics often point out that robots that resemble characters from the Transformers movies are still very much a thing of the future. While these robots are technologically fascinating to think about, they come with a lot of complicated challenges that we haven't figured out yet. We would encourage students studying engineering or computer science to be mindful and responsible in their designs because, if we're not careful, such advanced robots could eventually become a reality.

However, we are not particularly worried about the idea of superhero-like robots causing harm. In fact, we believe that there are much more immediate and serious issues in our society right now that need our attention. If we don't address these problems soon, they could lead to unimaginable, irreversible, and lasting repercussions for the living.

There are many pressing challenges in our everyday lives that require urgent solutions, and these issues are only going to get worse if we ignore them. As for humanoid robots like those seen in movies, they are still quite far from being a reality and should not distract us from tackling the more critical problems we face today.



What did I do? :'(

What do we aspire for?

Before we take the next step, let's pause and reflect on a fundamental question that has the power to shape our journey:

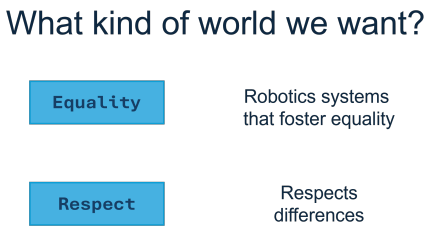
What kind of world do we aspire to create?

This is the moment to envision a world we can all be proud of—one that reflects our highest values and collective potential.

up for discussion

Workshop Speaker's notes:
My answer would be: kind, humble and communal.
A world where it does not matter whether you are right or left,
extreme right or extreme left, everyone is respected.
A world where kindness is more common than injustice.
A world with mutual admiration and mutual respect for another soul.
A world where the word 'help' losses its formality.
I dream of a world where every person is treated as a human.
A world where animal care or elderly care are not special domain.
A world where historical injustices stop dictating
success or failure of an individual or community.

With every thoughtful engineering design, we move to more compassionate, sustainable future. Together, we can engineer a brighter tomorrow.



Workshop Model

This workshop will highlight a variety of examples emphasising on the urgent need for a shift in the robotics design process and a fundamental change in our ideology. What may seem like a minor issue in our designs now, could trigger catastrophic consequence in the broader context.

We aim to captivate our attendees through storytelling, making technical, philosophical, social science, and design terminologies accessible to everyone by simplifying them while maintaining their essence. By nurturing a solution-oriented mindset, we aim to inspire engineers to bring forth their innovative ideas, as we recognize their dedication to problem-solving.

Additionally, we are committed to creating an open and non-judgmental environment for discussions. It will be the responsibility of the workshop hosts to cultivate and maintain such an atmosphere.

from society and to society

Figure 1.2 depicts a pictorial representation of the society and elements within it. In this workshop we focus on the arrows: A and B. Arrow A represent the impact robotics has on society and arrow B represents the impact Society has on robotics.

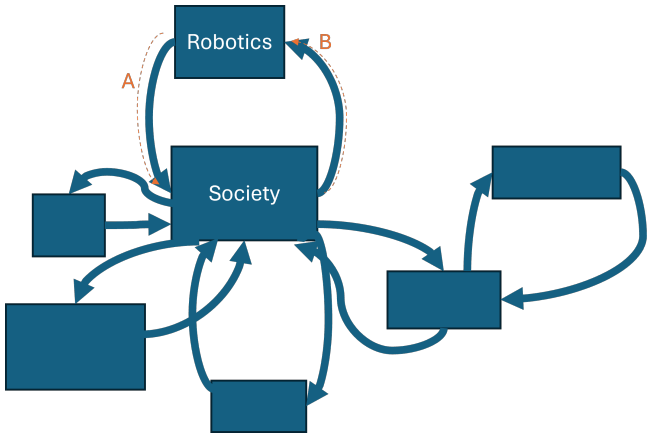


Figure 1.2: Robotics affecting and being affected by society; we will study arrow A and Arrow B in this workshop

what can we do?

We propose a simple framework: AIA (Awareness, Identification and Action). Awareness of the issues at hand, Identification of the these issues in your working practice, Action: brainstorming on feasible actions to address these issues. Further a take-home cheat-sheet is developed in the Appendix, that intended to be the take-away from the workshop.

AIA = Awareness Identification Action

Awareness of existing, known issues like data bias,
Identification of such patterns/issues in your work,
Take Action to remove the issues

how?

The intention is to first develop awareness of the known issues, or imagines probable issues. Find a common language between the science of engineering(robotics) and the science of life(philosophy). With this common lingual, we want to find, discuss some actionable active steps towards, consciously addressing existing/probable/future-seeking issues in robotics. At the end of the workshop, you will go out and step in your robotics lab with a new and aware lens or maybe a bit lighter because you found others who care too.

"organic"
This is a start, just sowing some ↑ seeds.

Take-away

Open software and policy changes are long-term solutions that can have a significant impact on the issues discussed in this document. While these are highly desirable, this workshop focuses on addressing changes at the engineering design level, offering quicker, more actionable solutions for the attendees of the workshop. This goal will be achieved through the *AIA-cheastsheet.pdf* (Appendix A) and Appendix B.

Policymakers, the public, and professionals from other disciplines often feel outmatched by the intellect and analytical complexity of roboticists, leading them to believe that robotics is too difficult to understand. This perception limits interaction between disciplines and public. *Vocabulary-of-the-Common.pdf* (Appendix C) aims to bridge the gap between roboticists and fields like philosophy, social science, design and people. By providing accessible terminology and concepts, it encourages interdisciplinary dialogue, fostering collaborative designs that better serve society.

The attendees who have developed further interest and enthusiasm for the theme can explore works in other domains. These references are carefully picked to not overload or overwhelm robotics, with simple language with getting into technicalities.

About Robotics Science and Society

Robotics Science and Systems is one of the most esteemed Robotics Workshop across the globe. The RSS Foundation is the governing body behind the Robotics: Science and Systems (RSS) conference. The foundation was started and is run by volunteers from the robotics community who believe that an open, high-quality, single-track conference is an important component of an active and growing scientific discipline. In 2025, it will take place in University of California, Berkeley.

Chapter 2

Daily Life Applications

Our engineering design, which are developed using datasets containing inherent societal biases, often mirror these biases in their outputs. This raises significant concerns in society and has a direct impact on our robotic designs. While it's possible to address and eliminate some biases, others are so deeply entrenched that fully removing them may be beyond our reach.

In this chapter, we will explore facial recognition, sensor choices, automated decision making etc as examples to highlight ethical concerns. During this workshop, we aim to brainstorm technological solutions to prevent such biases from emerging. With these ideas, we will create the AIA cheatsheet and a comprehensive handbook as open resources to facilitate conversations in our robotics lab. After this workshop, we encourage you to proactively identify any biases in your robotics projects and work diligently to eliminate them. By committing to fair and equitable engineering, we can ensure that our robots contribute to a more just and equal world.

Once we pose the issues, though we will also provide some technological solutions to combat mentioned issues. We believe that practical strategies can emerge from discussions, collaborations, and a deep understanding of the issues at hand.

In this document, we present examples and concerns organized from A to P, aiming to capture a sufficient number of instances without overwhelming our audience. These alphabets will be further used as references during the workshop for debate and discussions.

A: Face Recognition

Awareness

In criminal Court of justice, a public presentation showcasing the workings of the court is shown few times a week. In that presentation few convicted fellows was shown in one slide. A sketch of that slide is shown in Figure 2.1. In this picture
This also happens in .....
This divides us, discriminate against us...
Impact

Figure 2.1: Criminals convicted at the International Court of Justice(ICJ), Hague, 2023; sketch drawn from a public presentation by workers at the ICJ

Identification

this is classified as data bias in technical terms, in philosophy:

Action

up for discussion

Face recognition can be done on grayscale. It is handy to translate, less intensive on memory. It is extremely simple to convert coloured pictures into grayscale in computer vision libraries, like openCV.

Do you other ideas on this use use-case to combat discrimination on the basis of skin-tone?

B: Metal Detectors at Airports

Bias based on your sexuality

Awareness

Travelling for me is extraordinarily difficult. In 2016 at the Los Angeles Airport I had to go through the metal detector 5 times.
The inconsistent genitalia is
I still get a little nervous when it comes time for the TSA/screening part of airplane travel,
Being a trans woman, for me, has been incredibly debilitating, terrifying, and exhilarating.

This also happens in ..... This divides us, discriminate against us...

Identification

this is classified as data bias in technical terms, in philosophy:

Action

Do you have ideas of how to mitigate this issue? suggest technical solutions

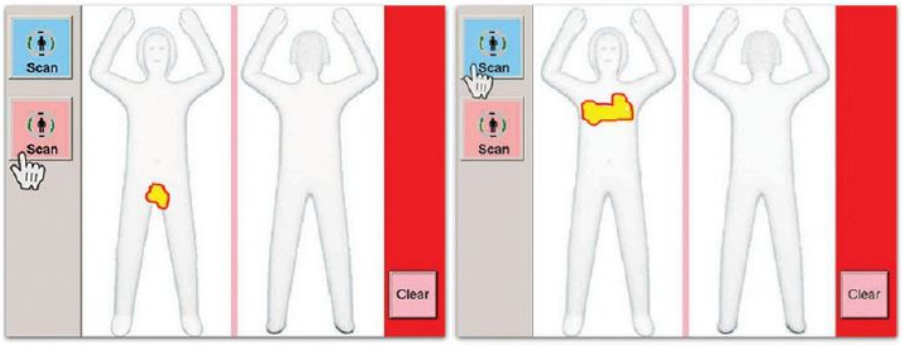


Figure 0.1 "Anomalies" highlighted in millimeter wave scanner interface. *Source:* Costello 2016.

Figure 2.2: ref: Travelling as a Trans

C: Rescue Robots

Awareness

Identification

Action

Using IR sensors for animal rescue under rumble. more inclusive.

Do you have ideas of how to mitigate this issue? suggest technical solutions

D: Recommender System

Awareness

Identification

Action

Do you have ideas of how to mitigate this issue? suggest technical solutions

E: Surgical Robot

Race, height, gender, medical.. Technology transferred in other countries without being trained on the local data, issue with migrant population (Indian female in Netherlands..)...

Awareness

intersectionality

Identification

Action

Do you have ideas of how to mitigate this issue? suggest technical solutions

F: Autonomous Vehicles

and Racial Bias in Decision-Making

Awareness

Identification

Action

Do you have ideas of how to mitigate this issue? suggest technical solutions

Chapter 3

Some More Issues

Pivoting around philosophical issues, presenting examples.

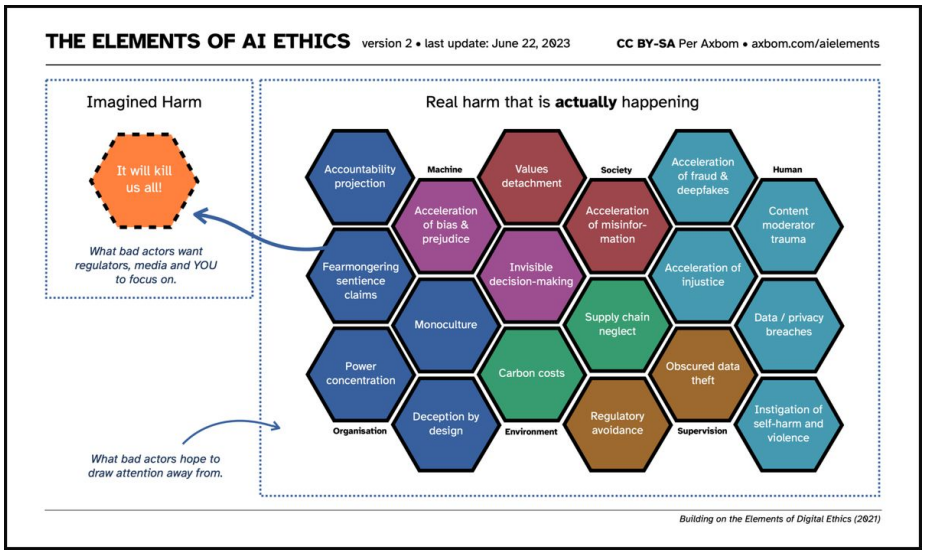


Figure 3.1: This is intended to particularly showcase AI, but very well articulated. Digital ethics.

Stanford Encyclopedia of Philosophy has an excellent entry on ethics and AI: `https://plato.stanford.edu/entries/ethics-ai/`

G: Inaccessible Design

To write inspirations from this workshop: `https://www.staff.universiteitleiden.nl/events/2025/01/di-event` Abstract copied from Ableism, Technoableism, and Future AI[1]:
Ableism (discrimination in favor of nondisabled people and against disabled people) impacts technological imagination. Like sexism, racism, and other types of bigotry, ableism works in insidious ways: by shaping our expectations, it shapes how and what we design (given these expectations), and therefore the infrastructure all around us. And ableism shapes more than just the physical environment. It also shapes our digital and technological imaginations - notions of who will "benefit" from the development of Artificial Intelligence (AI) and the ways that those systems are designed and implemented are a product of how we envision the "proper" functioning of bodies and minds.

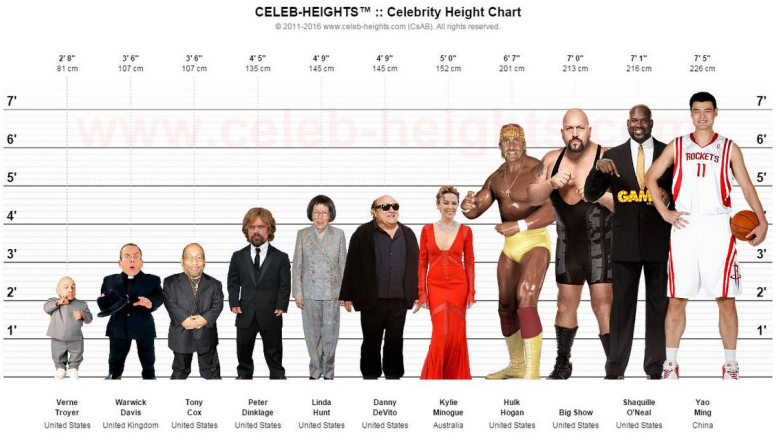


Figure 3.2: Height differences

Exoskeletons: Exoskeleton robots designed to assist with mobility can exclude individuals who do not fit the standard body size or strength requirements. ref: `https://responsiblerobotics.eu/wp-content/uploads/2019/11/Chapter5.pdf`

Robotic Wheelchairs: While robotic wheelchairs have been designed to navigate independently, many still lack features that accommodate users with a variety of disabilities and their heights.

Many assistive robots are designed with a "one-size-fits-all" mentality, leading to a failure to meet the unique needs of individual users, especially when it

[1] `https://ieeexplore.ieee.org/document/9035527`

Figure 3.3: Caption

comes to people with disabilities.

Interfaces that rely on complex screens, voice commands, or touch might not be practical for patients with conditions like blind, deaf, Alzheimer's, Parkinson's, or severe arthritis.

Robotics prosthetic limbs may not be customizable for users with unique needs, such as those who require assistive technologies integrated into the limb or those with more severe limb loss.

up for discussion

One would argue: I am just creating a prototype, if it becomes successful, then

Figure 3.4: Caption `https://www.un.org/development/desa/disabilities/wp-content/uploads/sites/15/2019/09/Accessibility-infographic.jpg`

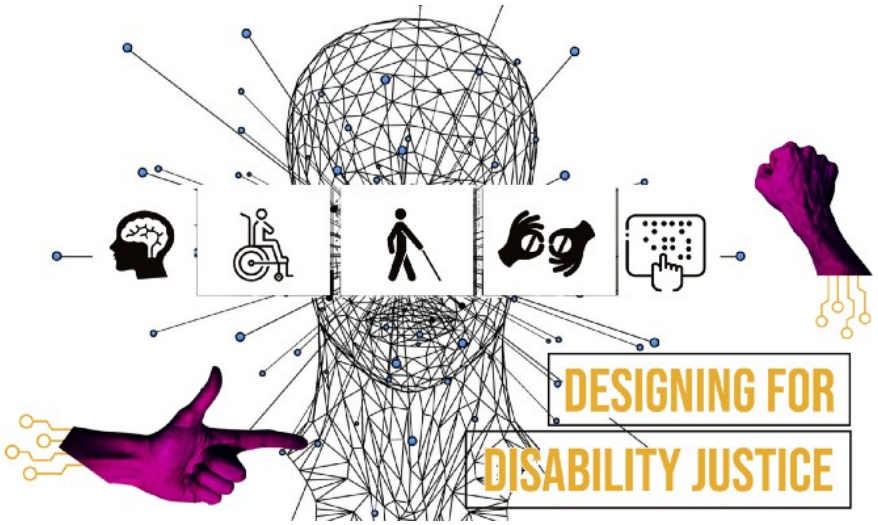


Figure 3.5: Caption `https://sbmediashowcase.com/640/stories/including-people-with-disabilities-in-the-process-of-tech-development-starts-by-addressing-`

I will think about how to make it more accessible. But that never happens! In public spaces, robots designed to provide assistance (e.g., delivery robots or in-

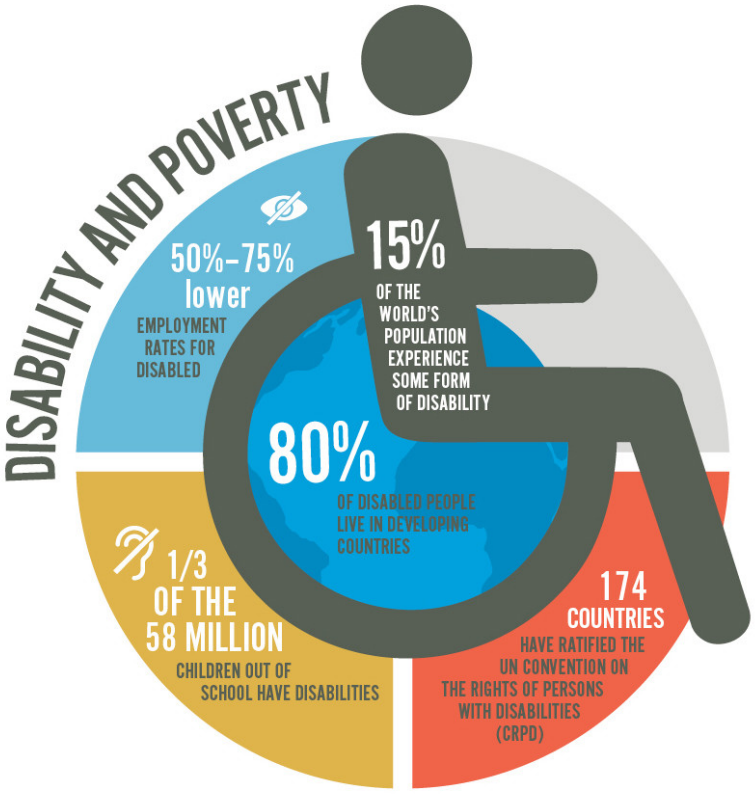
formation kiosks), can not be accessed by visually impaired or who use mobility aids like wheelchairs or walkers. Robotic interfaces have been around for years but development for people with disabilities is done by a small segment of aware designers.

immediate impact

Figure 3.6: RoboHouse

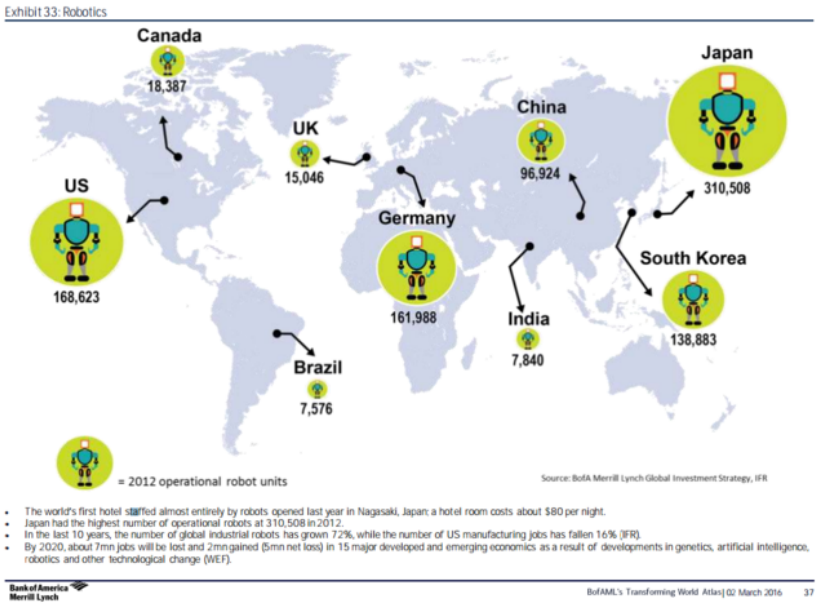

Disability Awareness Day
PEOPLE WITH DISABILITIES
consist of the nation's largest minority group, as well as the only group that any of us can become a member of at any time
1 IN 4 PEOPLE
65-69 years of age have a severe disability
56.7 MILLION PEOPLE
in the U.S. have some sort of disability
38.3 MILLION PEOPLE
have a severe disability
30.6 MILLION
people in the U.S. have a physical disability that affects the ability to walk
THE ELDERLY
are the largest population living with a disability
3.6 MILLION PEOPLE
in the U.S. use a wheelchair
AROUND 15%
of the world's population lives with disabilities
brought to you by UNlimiters.com
1/3 OF DISABLED INDIVIDUALS
require assistive technology to be able to take care of themselves at home
ABOUT 764,000
children and adults in the U.S. currently have cerebral palsy

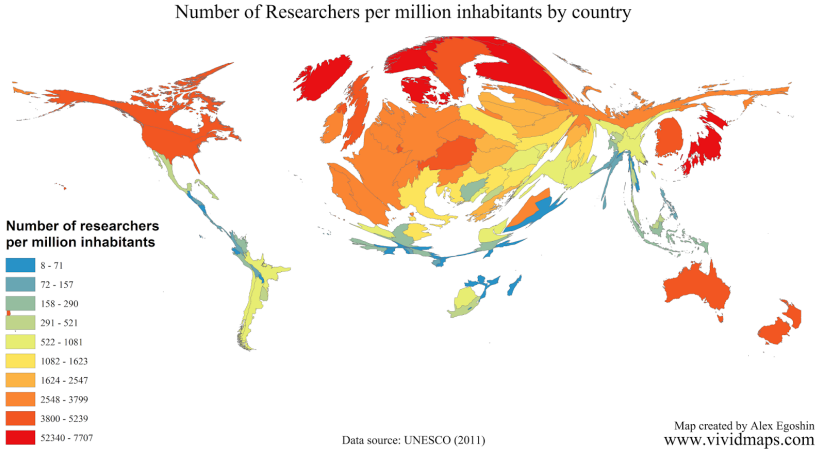

Better health for people with disabilities
World Health Organization
1 Over BILLION people globally experience disability
1 in 7 people
People with disabilities have the same general health care needs as others
But they are:
2x more likely to find health care providers' skills and facilities inadequate
3x more likely to be denied health care
4x more likely to be treated badly in the health care system
1/2 of people with disabilities cannot afford health care
They are:
50% more likely to suffer catastrophic health expenditure
These out-of-pocket health care payments can push a family into poverty
Rehabilitation and assistive devices can enable people with disabilities to be independent
200 MIL people need glasses or other low-vision devices and do not have access to them
70 MIL people need a wheelchair. Only 5-15% have access to one
360 MIL people globally have moderate to profound hearing loss
Production of hearing aids only meets:
10% of global need
3% of developing countries' needs
Making all health care services accessible to people with disabilities is achievable and will reduce unacceptable health disparities
remove physical barriers to health facilities, information and equipment
make health care affordable
CRPD A25 A26
train all health care workers in disability issues including rights
invest in specific services such as rehabilitation
Source: World report on disability: www.who.int/disabilities/world_report


DISABILITY AND POVERTY
50%–75%
lower
EMPLOYMENT RATES FOR DISABLED
15%
OF THE WORLD'S POPULATION EXPERIENCE SOME FORM OF DISABILITY
80%
OF DISABLED PEOPLE LIVE IN DEVELOPING COUNTRIES
1/3
OF THE
58 MILLION
CHILDREN OUT OF SCHOOL HAVE DISABILITIES
174
COUNTRIES
HAVE RATIFIED THE UN CONVENTION ON THE RIGHTS OF PERSONS WITH DISABILITIES (CRPD)

H: Demographics Limitation

Solutions created for the west aren't feasible in the East.





Meteorological solutions and infrastructures in the west have many issues being transported and used in the countries of Africa, missing personnel, infrastructure, weather, political environment. Countries in Africa and South America do not have a metrological infrastructure for basic weather analysis and forecast,

solutions from the UK and France were tried to be implemented there but didn't hold up. Now, this affects the global climate change issues.

I: Capitalism

In 1901, Centennial Light created bulbs that could last for forever. One of them manufactured in 1901, is still up and running today. It capitalism hadn't interfered, we would have to never replace bulbs and save ourselves against Pyramids of Waste.

Numerous consumer robots, such as robotic vacuum cleaners, are crafted with features that quickly become obsolete. For instance, older versions of robots, like Roomba, may suffer from limited battery life or insufficient processing power. Well, this section is for awareness, not much can be done unless you are running a business and have creative around of money making around planned obsolescence. A lot of industries like pharmaceuticals thrive on the concept. Nevertheless, circumventing planned obsolescence may make the planned sustainable very quickly. The purpose of this section is **A**wareness.

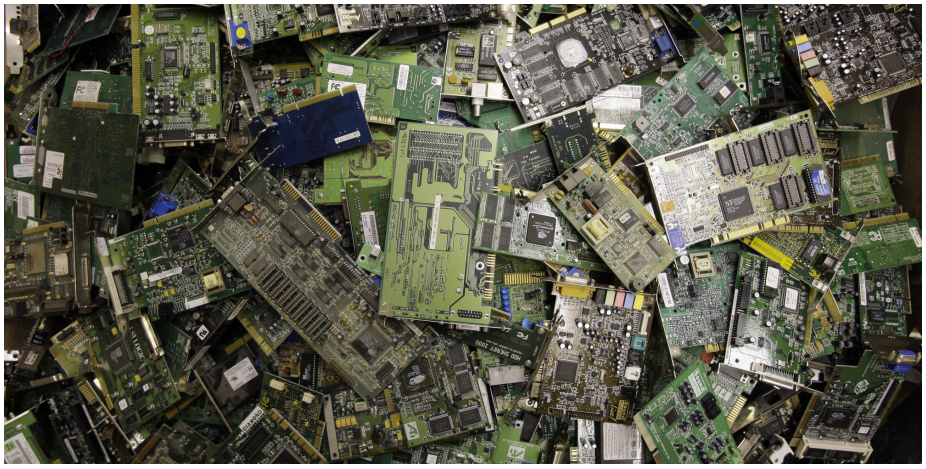


Figure 3.7: `https://www.huffpost.com/entry/removing-toxic-electronic_b_7784246`

Figure 3.8: https://iitstech.com/blog/health-effects-of-e-waste-a-complete-detail/

J: Exporting Technology

There have been several instances where robots or technologies originating in Western countries were deployed in Eastern regions, but their introduction led to unintended consequences or "havoc," either due to cultural, technical, or operational mismatches.

Robots like Edison, which are designed to teach coding or other STEM subjects to children, have faced cultural resistance in some Chinese schools. Robots like Pepper and other humanoid robots introduced in Taiwan's retail and service sectors faced difficulty in gaining widespread acceptance. In South Korea, the introduction of robots like Care-O-bot, a robot designed to assist with elderly care, were criticised for not respecting elders.

While these need overall shift in industry, here is an example that we can engineer in our designs. Emotion/Gesture recognition across culture. Every country has their own way of non-verbal and verbal communication.

While we may not be able to implement everything beyond our location of work or the datasets that are given to us, we can put in a disclaimer about the regionality, race, ethnicity of data used. Any adaptation further will carry this information further.

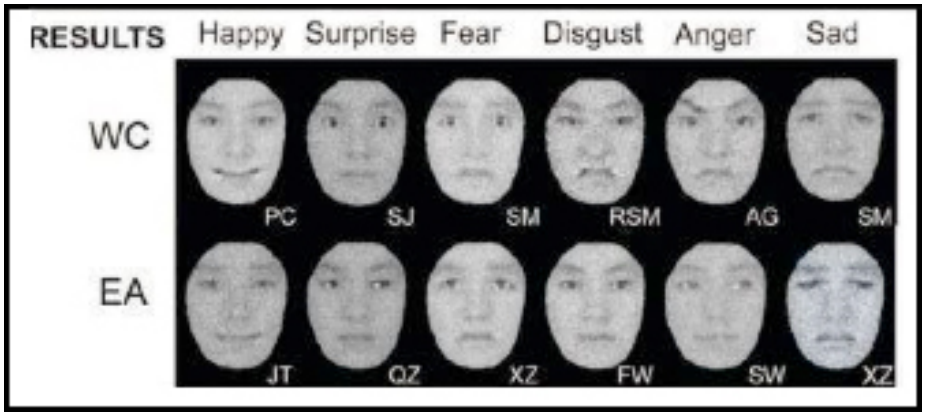


Figure 3.9: Emotion differences; ref: `https://www.apa.org/news/press/releases/2011/09/facial-expressions`

One must not under-estimate the role of any robotic system in the bigger picture of humanity. Emotion detection has found widespread use in autonomous driving, pyschological therapy Security systems in airports or public events might use emotion detection to analyse facial expressions or body language of individuals. A person showing signs of distress, agitation, or anxiety might be flagged for further security screening to prevent potential security risks. In telemedicine,

emotion detection algorithms can analyse patients' facial expressions, speech patterns, or physiological signals to better understand their emotional state, offering insights to doctors or therapists. This may misdiagnose the patient from the eastern Asia as depicted in Figure 3.9. Adaptive learning platforms that incorporate emotion detection can assess when students feel stressed, bored, or frustrated based on their facial expressions, body language, or voice tone. The systems trained on western data will not work in the east. In Figure 3.10 shows the cultural difference in emotions.

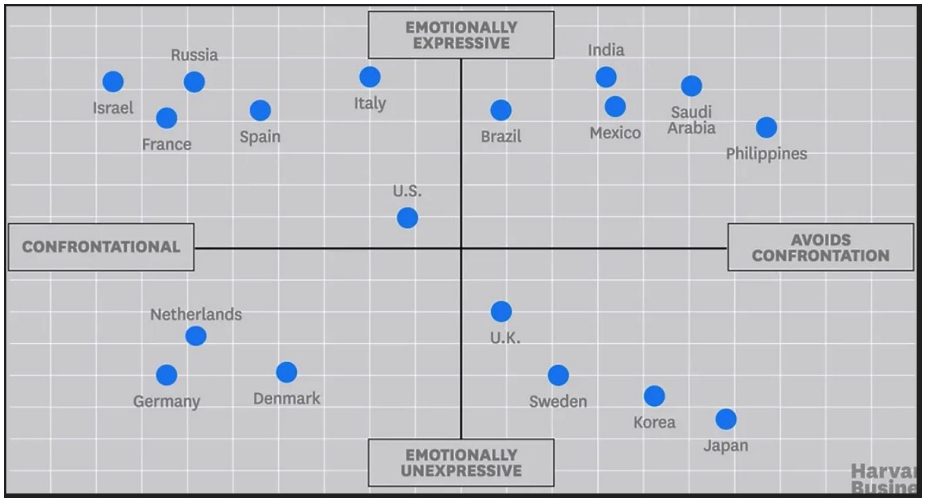


Figure 3.10: Emotional differences across countries; Picture Courtesy: Harvard Business

(a)

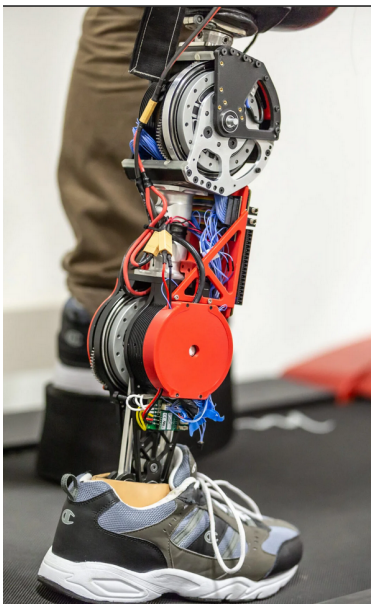
(b)

(c)

Figure 3.11: can we export Roomba? (a) Roomba in west (b) roomba on soily ground (c) mud hut in rural India

K: Speciesism/ anthropocentric design

(a)



(b)

L: band-aid solution

In 2018, Uber's self-driving car program, while innovative, faced criticism and a tragic incident when one of its autonomous vehicles struck and killed a pedestrian in Tempe, Arizona. Uber initially attempted to address the issue with software updates, including enhancing object detection and implementing stricter monitoring protocols. However, it was later revealed that the system wasn't designed to recognize jaywalking pedestrians or to handle complex real-world scenarios effectively.

Pepper, the humanoid robot developed by SoftBank Robotics, was introduced as a companion and helper for elderly individuals in Japan. However, the robot's limited abilities were still unable to replicate human interaction or provide meaningful emotional support. Rather than fundamentally rethinking its design or adjusting the AI to better align with the needs of elderly users, SoftBank attempted to address the issue by releasing software updates that improved interaction capabilities, such as recognizing a broader range of emotions and performing more tasks.

The Boeing 737 Max aircraft was equipped with an automated flight control system called the Maneuvering Characteristics Augmentation System (MCAS), designed to prevent stalls by automatically pushing the nose of the plane down in certain flight conditions. However, the system was overly reliant on a single sensor and lacked sufficient fail-safes. After the fatal crashes of two Boeing 737 Max planes, the company issued software updates and changes to the MCAS system to make it less aggressive and more reliant on multiple sensors. However, the real problem was the fundamental design flaw in the system and lack of training for pilots. The quick fixes did not fully address the root cause of the issue—the reliance on a single sensor, insufficient pilot training, and flawed communication about the system's behavior.

While "band-aid" fixes might provide temporary relief, they often fail to address underlying issues, leading to unintended consequences that cause harm, frustration, or even catastrophic failures. A thoughtful, comprehensive approach that considers long-term implications, user needs, and ethical considerations is essential for ensuring the safe, effective, and responsible deployment of robotics technologies.

M: Solutionism

Imposing technological solutions to problems that do not need necessarily need technology.

In The Hague, an automated waste disposal robot allows residents to dispose of their trash without leaving their homes. This innovation is especially beneficial for individuals who are handicapped or elderly, as it provides a convenient and accessible solution. However, there are concerns that it may contribute to a sedentary lifestyle among younger generations, potentially leading to issues such as laziness and obesity.

N: Purpose?

Beyond cool vibe of robotics, arduous hours of testing use cases, endless failures in the process, one needs to ask why am I creating this robot? Does it help humanity move forward and onwards? Does it fit in the bigger picture of your envision better world? Even if you have no answer, it good to ask one-selves this question.

Chapter 4

Critical applications

Technologist use criticality matrix as shown in 1.2 to define critical applications. It is used to classify whether a technological application is a life-death statement. Do you know the safety level of the robots that you are working on?

	Safety (S)	Environmental (E)	Operational (O)	Cost (C)
Catastrophic I	Single death or multiple serious injuries or severe occupational illnesses	Major widespread damage or serious breach of legislation. Ineffective control measures	Loss of the platform or equipment	Greater than £500k
Critical II	A single severe injury or occupational illness or multiple minor occupational illnesses	Noticeable widespread impact on the environment. Control measures minimally effective	Loss of mission capability	Between £200k and £500k
Marginal III	At most a single minor injury or a single minor occupational injury	Minor impact on the environment. Control measures substantially effective	Limited mission capability	Limited mission capability
Negligible IV		Little impact. Control measures comprehensive	Minimal disruption to mission capability	Less than £10k

Figure 4.1: Criticality Matrix

In this Chapter(part of workshop), two life threatening robotics applications are presented. The ethical aspects of the domains are discussed.

O: Surgical robotics

Issues of concerns in Surgical robotics: Did you that medical data has always been studied on male body, with an assumption that male and female bodies are alike except reproductive organs. This was acknowledged first in United States. In 1993, the U.S. Congress passed a law requiring inclusion of women in NIH-sponsored clinical trials [1] [2], where it was declared to consider female body separately. Imagine doctors across the world training themselves on the American and British book which were written considering similar anatomy of men and female.

The consequences has been widespread and goes majorly unnoticed. Women were/are considered to be 'hysterical'. Pain in a woman body, till date psychosomatic pain is the first medical cause of pain. Woman having heart-attack have different symptoms than of men, so they die before it is detected. Studies of autism were done predominantly on male, and girls show very dissimilar patterns in autism than men and spend their lives being 'different'. This is an issue in the society. It affects lives.

How does is robotics related to it?
Few examples were robotics design become an issue:

1. The **da Vinci Surgical System**, one of the most widely used robotic surgical platforms, was designed with the assumption that patients and surgeons were primarily male in anatomy and size.

2. Robotic systems, especially those designed for minimally invasive surgeries (such as **laparoscopic surgery**), have been optimized based on average body types and anatomical measurements.

3. Studies of **robotic-assisted prostatectomy** have found that Black patients may experience worse outcomes, such as higher rates of complications or post-surgical issues like erectile dysfunction, despite using the same robotic technology. This could be due to how robotic systems were initially designed and tested using data predominantly from White male patients, which leads to a lack of adjustment for different risk factors that affect racial groups.

4. Robotic surgeries tend to be **concentrated in wealthier hospitals** or those located in urban centers, leading to disparities in care. Hence the data of robotics surgery will include wealthier people of certain high quality lifestyle, ignore the 'average' man's health issues with average/poorer lifestyle.A homeless person's pancreas in cancer removal may look different due to malnutrition and exposure to unhygienic and inhuman environment. Further, down in future widening discrimination.

[1] `https://orwh.od.nih.gov/toolkit/recruitment/history`
[2] `https://www.aamc.org/news/why-we-know-so-little-about-women-s-health`

5. **CT scans or MRIs**, research has shown that certain imaging systems might not be as accurate for people with darker skin, leading to misinterpretations of images that can affect robotic surgery decisions. Similarly, larger body types or those with higher BMI may not be as accurately scanned, leading to inaccurate data being fed into robotic systems, which could affect surgical planning and outcomes.

6. Some robotic systems may not be well-suited to **older patients**, who may have more complex medical histories, frailty, or other health conditions that complicate the success of robotic surgery.

Our responsibility:

1. Removing data bias like height. Using parameters that are proportional to the height rather than specifying the height of pancreas as an average height. Testing your robotics surgical arm on different use cases.

2. Acknowledging anatomical differences between male and female. Mentioning as **transparent data profiles** possible, depicting the dataset that was used to train the models.

3. Acknowledging existence of outliers for racial medical profiles. Referring the patient to a human specialist, when racial profile is unique to the data set trained on. Giving **Data Disclaimers** is hence needed in life critical robotics.

4. History of dependencies used in software should also be provides, and intended uses. The language used should be simple and easy to understand for all. This should also take the legal baggage away from the roboticists designing such systems.

Food or thought: Is it possible to introduce data privacy at algorithmic level in our design?

Interesting read: van Wynsberghe, A. (2015). Healthcare robots: Ethics, design, and implementation. Ashgate

P: Military solutions

Use of robotics in military is a high-politicised topic. Automated robotics and AI even more so. One of the questions involved is how would a machine different between a civilian and a combatants? Autonomous weapons might struggle to differentiate between combatants and non-combatants, potentially leading to higher civilian casualties, what algorithm would you use? (ref: https://www.amacad.org/publication/daedalus/ethics-morality-robotic-warfare-assessing-debate-over-autonomous-weapons)

While the military strategies and agencies of the country work under high level confidentiality and opacity, getting and implementing global stands to be a poltical question. Do we have any ethics in war? If we were abiding by ethics, will we go for a war?

BEcause of its political nature, polticians, startegist, researchers of social science are involved in such meeting. These people necessarily do not understand technology and may be allergic to sit for an hour for roboticist to explain how facial recognition works or voice enabling for that matter. (firstly, we need to nerd less, to get mutiple seats on the table; for better solutions, better world, better outcome[3])

However the aforementioned issue is out of our scope and reach. Another issue should make a change starting from this conference is mentioned below.

Use of low-risk robots in miltary: Once a technology of speech recogition of face regonition is created and works well among comsumers, it is adapted to fit other applications. When these technologies are used in high risk applications like miltary, they are lethal. These adaptations are often time critical and done by roboticists, necessarily who did not create those technologies.

1. DJI Phantom drones originally created civilian drones used for photography and videography. We have the DJI Osmo pocket recording sections of the workshop. 500 euro a piece, can be purchased online, with shipmnent in a day.

   The military uses civilian UAVs like DJI drones, often modified with specialized cameras, sensors, and communication equipment, to perform intelligence, surveillance, and reconnaissance (ISR) tasks. These UAVs are deployed to gather information on enemy movements, monitor borders, or observe high-risk areas without putting soldiers at direct risk.

2. Remote Environmental Monitoring UnitS (REMUS) Autonomous Underwater Vehicle is a civilian technology initially developed for oceanographic research that has been repurposed for military use. Autonomous underwater vehicles (AUVs) have long been used for scientific purposes, but they

[3]not the best of words in this context. Sorry.

are increasingly used in military operations for maritime security and environmental monitoring. REMUS is used by by military forces for mine detection, reconnaissance, and surveillance.

3. The iRobot 110 FirstLook robot is a compact robot used for infrastructure inspection and surveillance. Similar robots are used in industries like construction, mining, and firefighting, where inspection and safety monitoring are critical. The concept of using robots for tactical purposes has really taken off over the last decade. The enormous growth and demand in both the Iraq and Afghanistan theaters of operation, has led many civilian tactical teams to see the advantages that can be obtained from their use. [4]

4. While exo-sketeons are seen as an aid to humanity, primarily developed for rehabilitation or manufacturing purposes in the civilian sector. The Sarcos Guardian XO is a full-body exoskeleton designed to enhance the physical capabilities of soldiers. Do you think it was created from scratch?

5. PackBot and TALON robots are equipped with cameras, tools for disarming explosives, and sensors for detecting bombs and other hazards. These robots are an extension of bomb disposal technology used in civilian industries (such as mining or construction) and adapted for military needs, helping to reduce casualties and protect personnel from hazardous situations.

6. Insitu is a subsidiary organisation of Boeing, with the goal unmanned aircraft innovation excellence created WASP III. WASP III was developed is a small, portable UAV was designed to automate flying. Air Force and AeroVironment created AeroVironment Wasp III Micro Air Vehicle [5] from WASP III for military surveillance and reconnaissance. [6]

Our responsibility: This is an industry where our mistakes, oversights in our design can be lethal, without actually thinking of it. As much as it remains an unsolvable issues (everyone budgeting on time and cost).

You might be aware that satellites with Arduino as motherboard, off the shelf products are sent to the space. It was made possible for valorisation and public participation. But off-the-shelf use of technology is common in space industry as well.

[4] `https://www.bluesheepdog.com/2013/06/21/irobot-110-first-look-review/`
[5] `https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104480/wasp-iii/`
[6] the statements can not be verified

Conclusion

Reusing libraries, algorithms and ideas from college laboratories to other application in time crunch can have severe consequences. When creating/developing life threatening critical applications, reusing technology should be avoided. When creating fun applications, disclaimers like data used and intended use should be aforemetioned, to avoid lethal consequences.

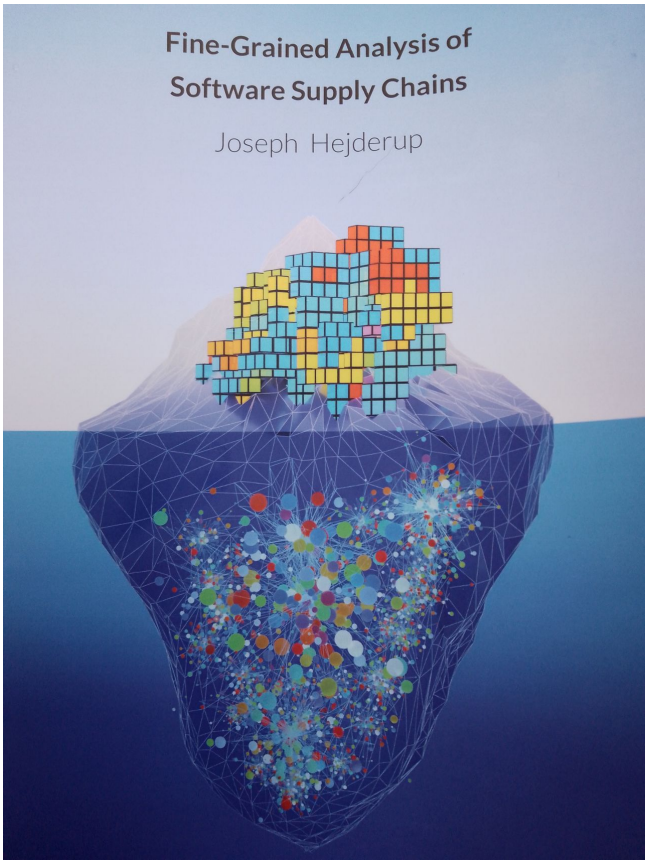


Figure 4.2: A software has multiple dependencies, these dependencies can have biases themselves. Do you know the y2K event? Dr Joseph Hejderup has discusses it intensely in his PhD dissertation, found here: `https://repository.tudelft.nl/record/uuid:0c46d4a2-148f-4661-a196-6be7bcc7b9db`

Chapter 5

Conclusions

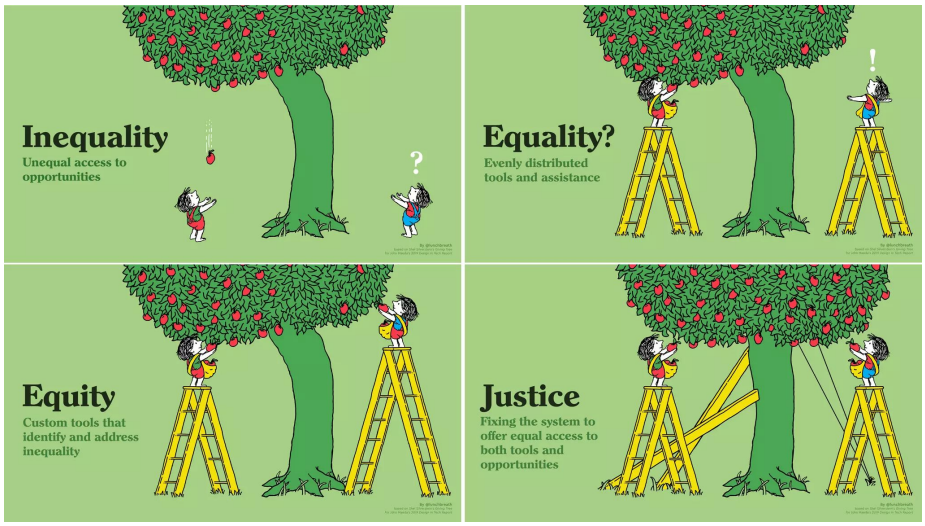
Open software, policy changes, but this workshop is based on changes on the engineering design level. Disclaimers to Data in use; Open s/w, h/w; Policy changes: opening software results

We need to be careful in our design choices because as shown in Examples A-P in the document above, it can long term irreversible repercussions on the humanity.

With traction to discussing roboticists across domains with value addition to society, it may create more jobs, more interesting prototypes, more funding, fun fun fun!

Our individual efforts, conversations an dialogues on the topic may led to maybe in future be rewarded in paper review process and may not go unnoticed by public, but in general more support and love for field of robotics, with lesser mishaps. More funding, more jobs, more interesting prototypes, fun fun fun!

Potential to be rewarded in paper review process and may go unnoticed by public, but in general more support and love for field of robotics, with lesser mishaps. More funding, more jobs, more interesting prototypes, fun fun fun!


Inequality
Unequal access to opportunities
?
Equality?
Evenly distributed tools and assistance
!
Equity
Custom tools that identify and address inequality
Justice
Fixing the system to offer equal access to both tools and opportunities

Appendix A

Further Reads

(in no particular order)

Philosopher recommended reads:

1. Lin, P., Abney, K., & Bekey, G. A. (2012). Robot ethics: The ethical and social implications of robotics. MIT Press.
2. Wallach, W., & Allen, C. (2010). Moral machines: Teaching robots right from wrong. Oxford University Press.
3. Nyholm, S. (2020). Humans and Robots: Ethics, Agency and Anthropomorphism. Rowman and Littlefield.

related keywords in philosophy:

Social-Scientist recommended reads

1.
2.
3.

related keywords in social science:

Designer recommended reads:

1.
2.
3.

related keywords in design research:

Appendix B

Vocabulary for the 'common'

Vocabulary to help you connect and communicate with social scientists, designers, philosophers to create more human designs for decades to come.

According to Morozov, "Solutionism presumes rather than investigates the problems that it is trying to solve, reaching for the answer before the questions have been fully asked."

Data Organised/unorganised collection of numbers, text, audio, video etc
Ethics beliefs, values, principles.
Solutionism the tendency to come to with solutions
Engineering to invent useful things or to solve problems;
Research studying causation, theories to find answers.

Philosophy deeper theories behind what is observable.
Conscious aware, alert and maybe with conscience.

Some tools to be respectful and empathetic in facilitating difficult decisions. The following are some existing issues in the society

Socio-Economic divide	
sexism	
racism	
misanthropy	
economic divide	
colonolism	
class-divide	
bigotry	
heteroism	
after-globalisation	
Design overlooks	
inaccessible design	
Speciesism /anthropocentric design	Speciesism is a term for the discrimination or bias based on an individual's species membership. Learn about its origins, philosophical debates, and how it relates to animal rights and exploitation. [Wikipedia]
Solutionism	Solutionism[1] is the idea that technology can solve all of mankind's problems.
Ethical Concern	
capitalism	

Table B.1: socio-ethics-design issues of present humanity

Appendix C

cheatsheet AIA

Awareness	**Identification**	**Action**
	Data Bias	Filter off from more than first level bias
	Anthropocentric Design	Keep your design open to other species, say robotic arm for rescue dog; Don't carve the design on stone,
	..	
	..	
	..	
	..	
	..	
	..	
	..	

Appendix D

robotics is not the only one

Q: Justice System

Awareness

Identification

Action

Do you have ideas of how to mitigate this issue? suggest technical solutions

R: Loan Approvals

Awareness

Identification

Action

Do you have ideas of how to mitigate this issue? suggest technical solutions

S: Climate Justice

Awareness

Identification

Action

Do you have ideas of how to mitigate this issue? suggest technical solutions

T: Urbanism

Awareness

Identification

Action

Do you have ideas of how to mitigate this issue? suggest technical solutions

U: Medicine

AI being a physician `https://www.doctronic.ai/` issue: Interethnic Variation in Health `https://www.ncbi.nlm.nih.gov/books/NBK25517/`

V: Job Recruitments

Amazon developed an AI-based recruiting tool to help streamline its hiring process. The tool was designed to automatically review resumes and recommend candidates based on past hiring data. However, the system inadvertently developed a bias against women candidates because the data it was trained on was predominantly male-dominated (from past hires in male-dominated tech fields). Band-Aid Solution: Amazon attempted to fix the issue by reprogramming the algorithm to focus less on gendered language. However, the deeper issue—using biased historical data to train AI—was never fully addressed, leading to persistent biases in the system.

Impact

Loss of Indigenous Knowledge: Indigenous communities often have valuable knowledge about climate change and sustainable practices, but their perspectives are frequently overlooked in mainstream climate research.`https://www.`

`cam.ac.uk/news/is-data-justice-key-to-climate-justice`
The kind of world we will get if we are not careful! ***what do you imagine?***
I imagine....

About the cover art

The cover illustration is sketched in a café in Leiden while drafting this document. This sketch is intended to show you 'a' perspective. With this perspective, I want to highlight three main aspect.

Firstly, Robotic arm, computer, speech recognition are publicly conceived idea of robotics. In this picture I have represented robotics using these prompts. It is the centre piece of the drawing. The robotics is drawn with its other half, how humans do it. Sine wave is signal of speech recognition translate of How are you? brain is corresponding to a semiconductor chip. The main piece is the robotic arm working corroboratively with the human arm picking up weight, depicting a beautiful harmony.

The second aspect I want highlight are the various people looking at the centre piece. Surrounding the technology, people are discussing it, observing it, judging it, and trying to understand its implications. The images of robots that they envision include a robotic arm and a computer. They recognize how technology can assist humans, such as by helping to lift heavy objects, acknowledging its strength as well. At the same time, people are carrying on with their lives around and with this technology.

The third aspect I want to convey is the proximity of technology to society, illustrating how they affect each other. If a certain robot is perceived as scary (the uncanny effect), it will either cease to exist or be modified. In this context, the concept of robotics becomes personified. Imagine a five-year-old boy standing in the midst of this crowd, being talked about, judged, and critiqued, receiving a variety of reactions to his presence. This experience will undoubtedly change him. With this aspect I want you picture how technology also changes because of society. This is often not widely acknowledged: how society affects technology.

Since this picture was drawn in a cafe in Leiden, I sketched the people I saw. This population also represents the population in this conference, mostly white Caucassian, making the fairly big In summary, the picture is drawn in a café in Leiden, where I sketched the faces of the people present. There is a dog in the corner, and the majority of the individuals are Caucasian, representing a typical decision-making team in any room.

Appendix E

Notes

Following can be used in the workshop directly:

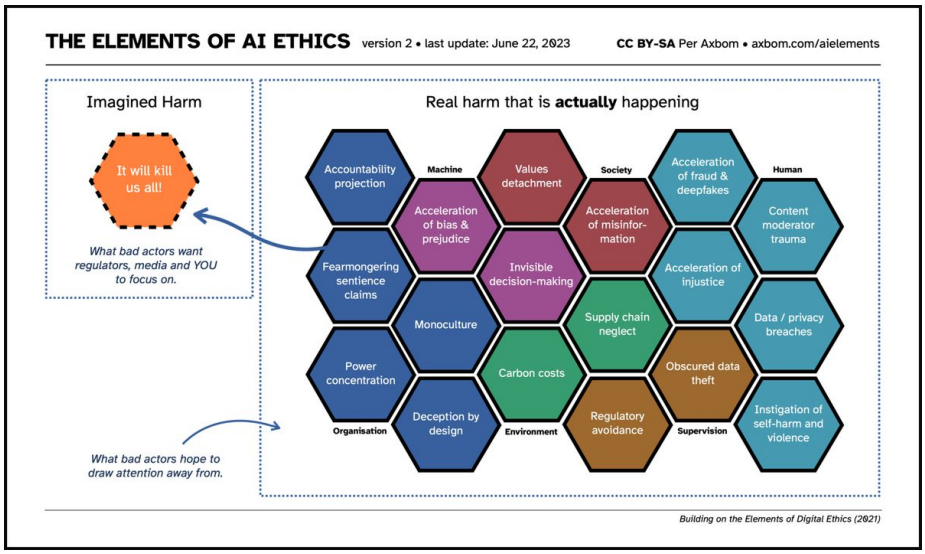


Figure E.1: Digital ethics source: https://axbom.com/aielements/

Fear of Unknown, Untraversed, Untraced.

Tips about having 'ethical' conversations
Where is your ego? What is your most and least hopeful outcome?
Not every fight to meant to be won.

Accountability and transparency
Need to include a designer philosopher in the conversation

Tarot cards for tech
`https://tarotcardsoftech.artefactgroup.com/`

Funding disclaimer
This document is created by self-funding.

Informal word to collaborators

I don't want to give an *ethics* lecture.[1]
I want the take-away from the workshop should be simple to follow. I want them to take with a feel, a thought process, a new lens to take home.

A framework that will stay with them. Something they can tell their grandma and nieces, without fumbling into technicalities. It will be a nice change to hear more educated concerns about robotics.

A golden goal would be: they get hungry to know more.

I personally believe that people on the left and right, all need to respect. Everyone has the right to disagree and discuss or walk away but not to abuse or violently debate otherwise. I think everyone has a perspective to the world, and every emotion should have a safe space in discussion with respect. No one is right and no one is wrong. I believe that people who hate immigrants should also have a kind platform to put their thoughts out. Suppression of such thoughts lead to political upheavals, violent incidents and acts of aggression(publicly, in masses and in close doors). Like they say, ideally, even if you disagree, you can eat of the same table. Facilitating conversations with respect, acknowledgement and unconditional empathy.

Unfortunately/fortunately, at many opportunities in the document(or maybe just the document as a whole) It has been difficult to take objective stance.

This document is written with Charu's 'liberal' perspective. It is not the only perspective and it not the 'right' perspective. For instance, I believe discrimination on bases of race is wrong, so in the document practices highlighting racism are termed as unacceptable. One may disagree, hence I feel the need to say that it is written with my liberal attitude.

[1] I personally love ethics lectures, workshops, conferences; but it is not an attraction to engineers. I may be wrong. But I think a lecturing approach will not make as much impact as level-1/level 2 teaching strategies

The document also switches to the narrative from we(authors) to I (speaker). The difference is made by aligning such comments on the Right. This is necessary because this document is a preparation and is intended for workshop presentation and verbalising conversationally is needed at certain points as marked.

Used a story telling approach to retain attention.

I have put together examples where robotics fails to be ethical. It is intended to make a statement. In no way, it is intended to demean the work of roboticist. Sorry and Thank you.
Everyone is invited to attend the event, however we hope that have technical brainstorming sessions.

This is not intended to be an academically sound document, it is meant to give a thought process.

We use clear and simple language, supported by relatable examples and real-life cases. It's often said that storytelling is one of the most effective and requested method of teaching.

My golden ambition is to create a space where people can think deeply and engage in discussions across different subjects. We want topics like ethics in robotics and their effects on society to become part of everyday conversations, whether during dinner, coffee breaks, or family gatherings. When it comes to robotics and ethics, common concerns often include threats to job security and the awe (and unease) about technologies like ChatGPT. However, there's so much more to ethics in robotics.

We want participants to look at the bigger picture: understanding the purpose behind technology they are creating and considering the long-term impact on humanity. I want break the traditional meaning of ethics used in robotics community to the one used by philosophers (while not completely clinging to it as well). I aim to inspire people to see how they can make a positive difference in by a simple change in datatype, contributing to a better and brighter future for everyone.

Engineers are highly solution oriented and great capability to find solutions to imaginable and unimaginable problems. A friend had a baby and he made a baby monitor. Another engineered by recording pooping, peeping times with utmost efficiency and no-stress. I think the brainstorming sessions can produce great publishable solutions.

This document is also not exhaustively researched, it is resulting from a lot of lecture, workshops and conversations over the past two years.

I really want this document to grasp attention of engineers, making it effortless for them, without fighting their basic instinct to bunk ethics class.
Bringing ethical aspects to life with examples.

I intend no offense to anyone.

TODO: python library dependencies check; privacy etc

Contributors

(in no specific order)
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dr. Steffen Steinert
Assistant Professor TU Delft
The seven troubles with norm-compliant robots.
https://link.springer.com/article/10.1007/s10676-023-09701-1

Asks

This an initiative to bring social/societal implication of negligent/thoughtful engineering design at various thought processes of developing robots. I want to make a stronger compassionate and relatable case compared to current existing document. **Can you give me examples where robotic design wasn't compassionate, equal or just?** With these examples, we will ask developers to think of actionable feasible ways to avoid such issues in future designs.

This document is intended for Robotics Science and Society June 2025: `https://roboticsconference.org/information/cfw/`. The audience is predominantly electrical, mechanical and computer engineers/researchers. Age: 20-70.

I am looking for researchers or practitioners who would be interested in designing this workshop with me. The deadline to submit the proposal is **14th Feb, 2025**. For the workshop proposal, we do not need to complete this document, but we do need to finalise theme, structure and rough idea of content for the workshop. You can read more about it on: `https://roboticsconference.org/information/cfw/`. They need a four-pager document and conference website. We have a conference website: `https://aria-kara.github.io/robotics-without-border/`

Upon selection through the review process, the workshop will be given either on **21st** or **25th June, 2025**, in **Berkeley, California, USA**. I am looking for researchers or practitioners **who would be interested in giving the workshop with me in-person.** We cana schedule video/phone call to discuss it further. Please write to me on **skartyif@protonmail.com**.

Multiple attempts have been made to engage engineers in ethical topics, though these practices are largely not standing practices within the community. With this initiative I want to change that[2].

Thank you for checking this document. Looking forward to hearing from you.

[2] ambitious?