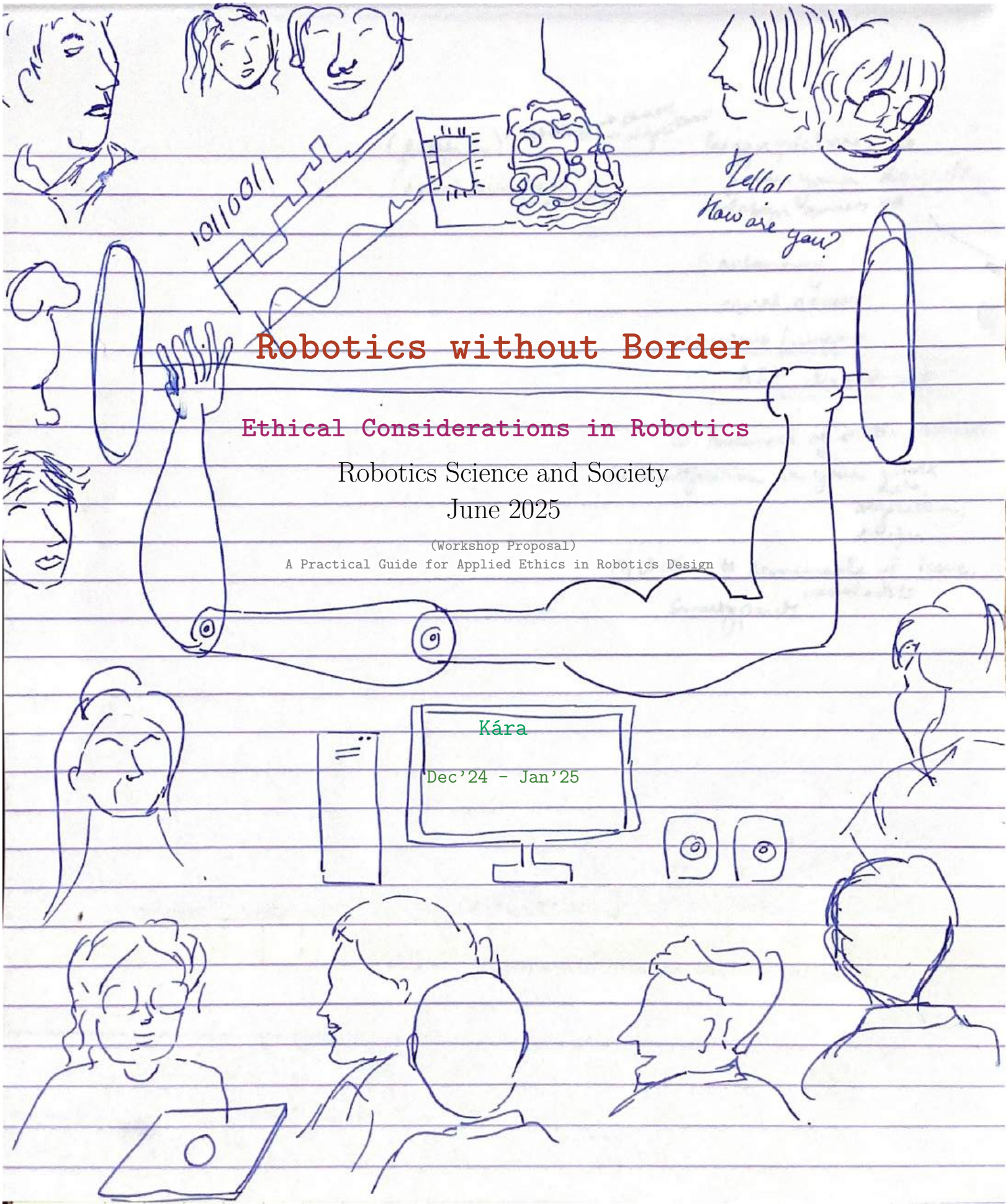


Robotics without Border

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 generic solutions.

We provide 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.

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.

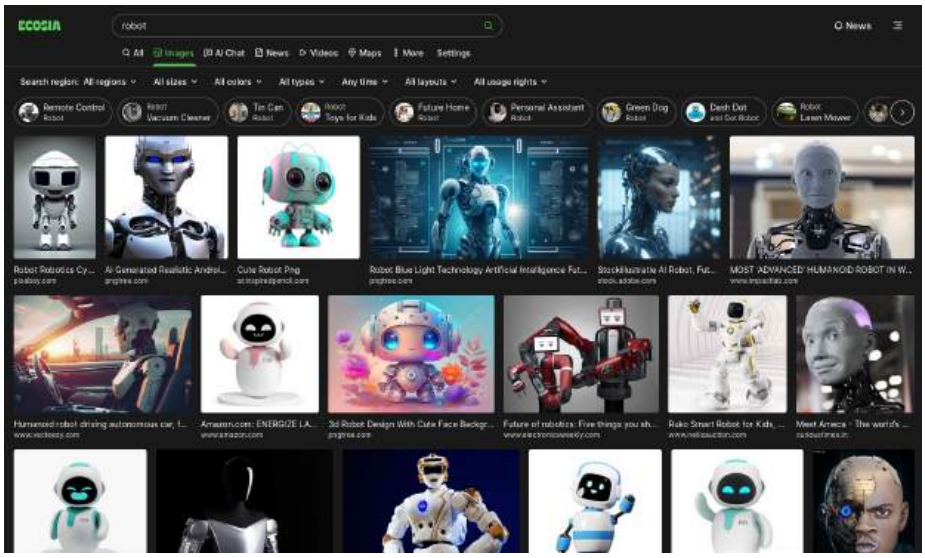


Figure 1.1: Common perception of robots in society and search engines

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

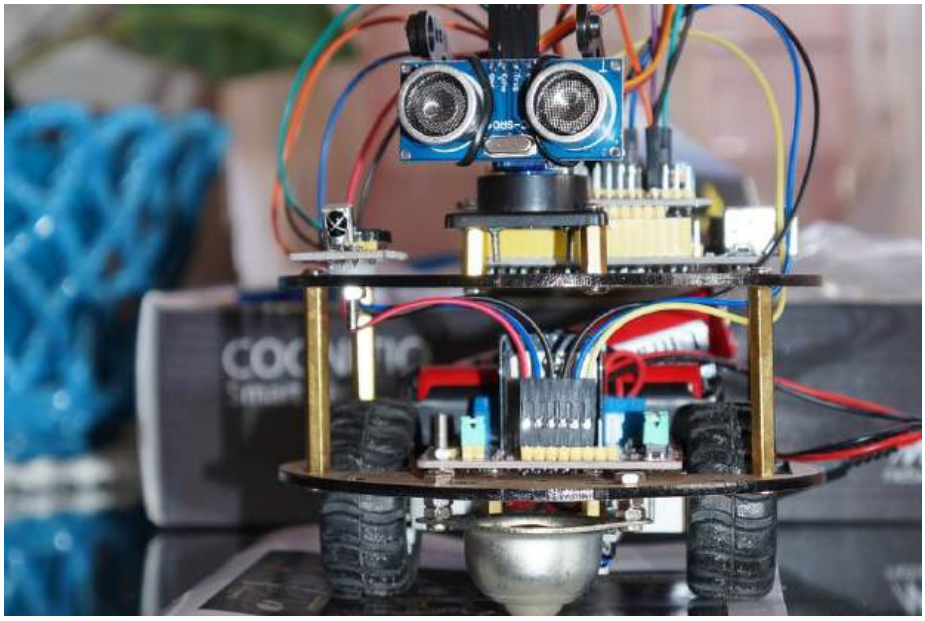
Evolving from the visions of sci-fi cinema, a declining global economy and changing job market dynamics have led many to view robotics with skepticism. Often depicted as fearsome transformers or iron-clad warriors, these machines are seen as a looming threat capable of wreaking havoc on the Earth, invading 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? :'(

Moving from Robot Ethics to humanities

Isaac Asimov's "Three Laws of Robotics":
A robot may not injure a human being or, through inaction, allow a human being to come to harm. A robot must obey orders given it by human beings except where such orders would conflict with the First Law. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.
`https://webhome.auburn.edu/~vestmon/robotics.html#:~:text=A%20robot%20may%20not%20injure,the%20First%20or%20Second%20Law.`

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:

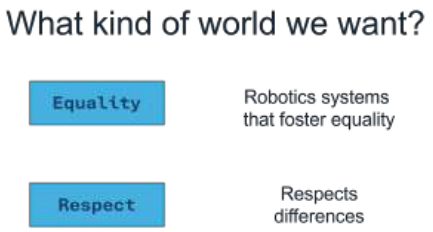
What kind of world do we aspire to create?

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.

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,

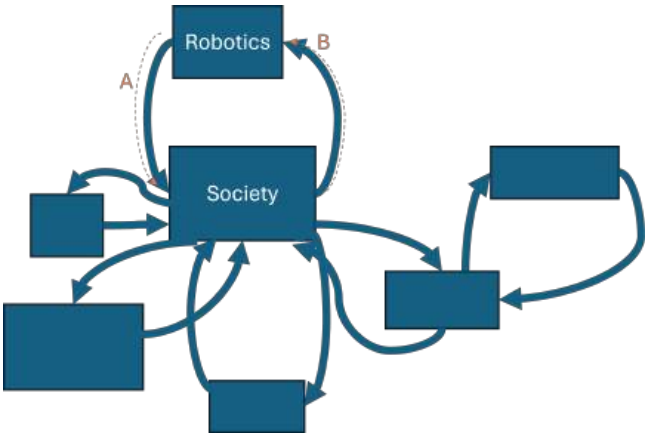


Figure 1.2: Robotics affecting and being affected by society; we will study arrow A and Arrow B in this workshop

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

domain applications in robotics that use face recognition: Control, planning, manipulation, field robotics, HRI, Grasping, imitation learning, perception and navigation, locomotion and manipulation, perception, navigation, robot learning foundation models, robot design, planning.

Types of Robots that use Facial Recognition: social robots, autonomous vehicles, gesture detection

Examples of robots that use facial recognition in their workflow

Robots using facial recognition	
Social Robots using facial recognition	
"Telenoid" Robots for Elderly Care Robotic Assistants in Airports (e.g., Aldebaran's Nao Robot) Sophia by Hanson Robotics Pepper by SoftBank Robotics	
Autonomous Robots	
Tesla's Autopilot System K5 Security Robot by Knightscope	

Table 2.1: Examples of robots using facial 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

In 2015, Google faced backlash when its photo app mistakenly labeled African American people as "gorillas." This issue was linked to the use of biased training data in the system's image recognition algorithms. While Google apologized and removed the categorization feature, this incident highlighted the risks of AI systems inheriting discriminatory patterns from unrepresentative or poorly curated datasets.

Figure 2.2: Google photos controversy; Source picture: `https://ichef.bbci.co.uk/ace/standard/624/cpsprodpb/BC13/production/_83974184_29ba8607-9446-4298-9d9e-d33514811487.jpg.webp`

In 2018, the Gender Shades project by Joy Buolamwini at the MIT Media Lab demonstrated that commercial face recognition systems from companies like IBM and Microsoft had much higher error rates in identifying the gender of darker-skinned and female faces compared to lighter-skinned and male faces. This was attributed to the fact that the training datasets used for these systems were predominantly composed of lighter-skinned individuals, leading to bias in performance.

Autonomous Vehicles: A study from the Proceedings of the National Academy of Sciences in 2019 revealed that AI systems used in autonomous vehicles had difficulty distinguishing darker skin tones from the background, which could lead to more accidents involving Black pedestrians.

Some robots or drones used in policing or surveillance systems have raised con-

Figure 2.3: Google photos controversy; Source picture: `https://ichef.bbci.co.uk/ace/standard/624/cpsprodpb/BC13/production/_83974184_29ba8607-9446-4298-9d9e-d33514811487.jpg.webp`

cerns about racial bias, particularly in the context of predictive policing. These systems often rely on historical crime data that may reflect biases against communities of color, leading to disproportionate targeting and surveillance of those populations.

The use of predictive policing algorithms, such as those used by the Chicago Police Department's "Heat List," often results in over-policing of Black and Latino communities, based on biased historical arrest data and profiling practices.

Water taps that made use of sensors, which did not recognise black-skin coloured hands, but only white ones. `https://metro.co.uk/2017/07/13/racist-soap-dispensers-dont-work-for-black-people-6775909/`

Identification

keyword: racial discrimination,

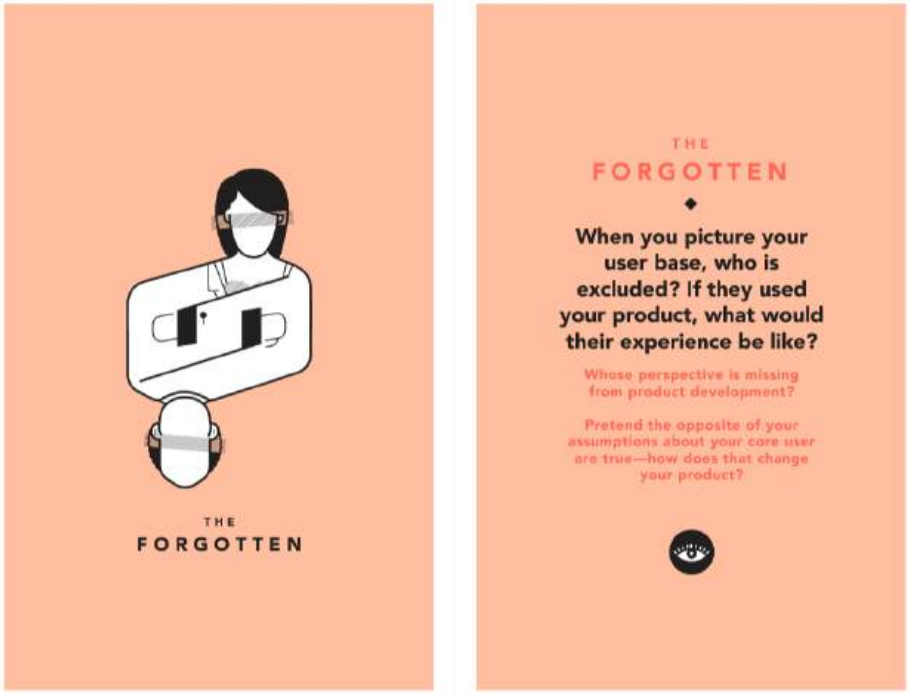


Figure 2.4: Tarot Cards; `https://tarotcardsoftech.artefactgroup.com/` by Rob Girling

Action

Keywords: Biased Training Data, Algorithmic Bias, Lack of Diversity in Development
We are in the habit of reusing library. We are inheriting social issues with the existing data bias in the society. Thereby introducing more exclusion, discrimination and bias with our technology.

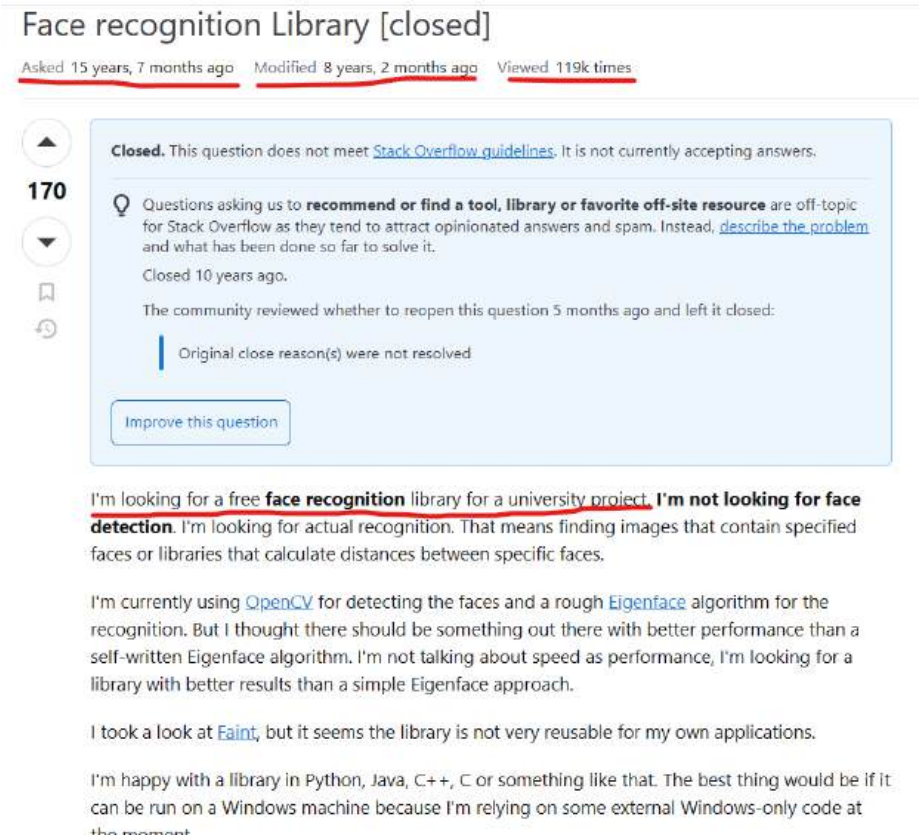


Figure 2.5: Picture Souce: `https://stackoverflow.com/questions/953714/face-recognition-library`

Facial Recognition is used in Social robots, by medical robots, psychological robots. It is used in various domains of robot design: Learning, Planning and Optimization, Simulation and Sensing. We do not have perfect data, nor perfect facial recognition algorithm.... what do we do?

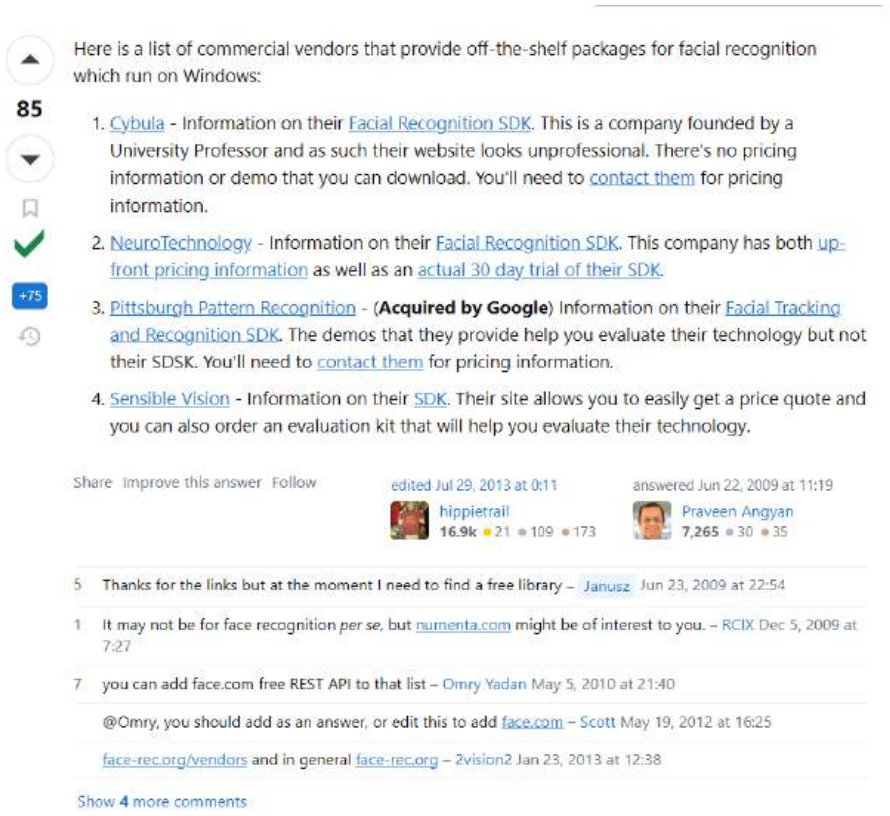


Figure 2.6: Picture Source: `https://stackoverflow.com/questions/953714/face-recognition-library`

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.

What can we fix?

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...

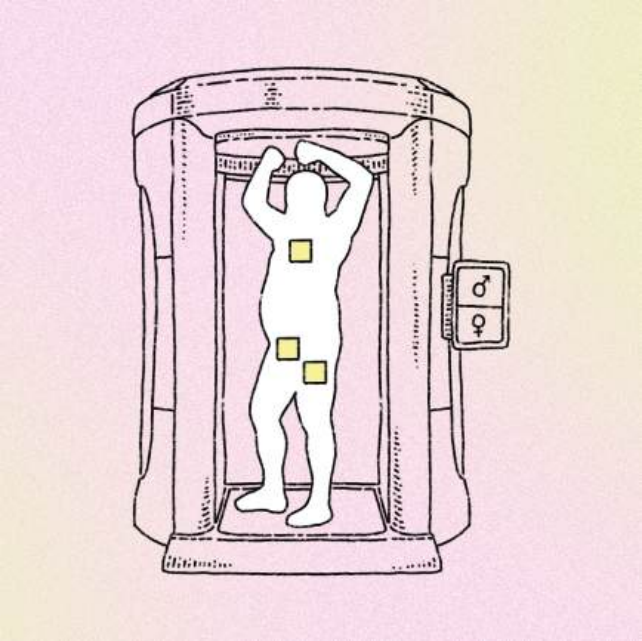


Figure 2.7: travelling as a trans; `https://www.folxhealth.com/library/tips-for-flying-while-trans-the-transgender-and-non-binary-travel-guide-you-didnt-know-you-needed`

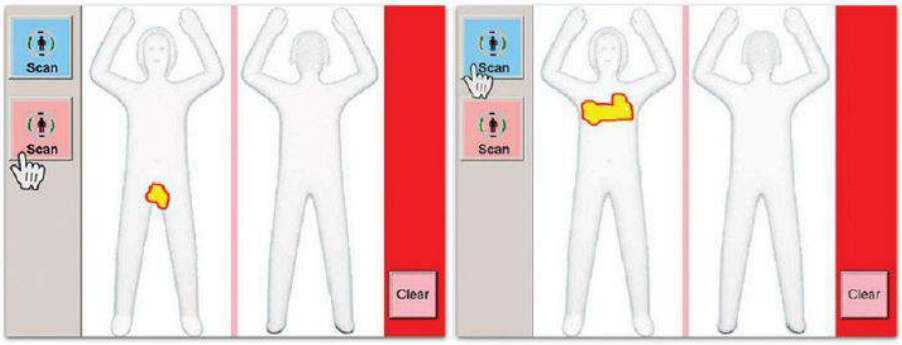


Figure 0.1 "Anomalies" highlighted in millimeter wave scanner interface. *Source:* Costello 2016.

Figure 2.8: ref: Travelling as a Trans, Steffen Steinart Doc

Figure 2.9: Gendered Airports Picture Source: `https://edition.cnn.com/travel/article/tsa-body-scanners-transgender-travelers/index.html`

Identification

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

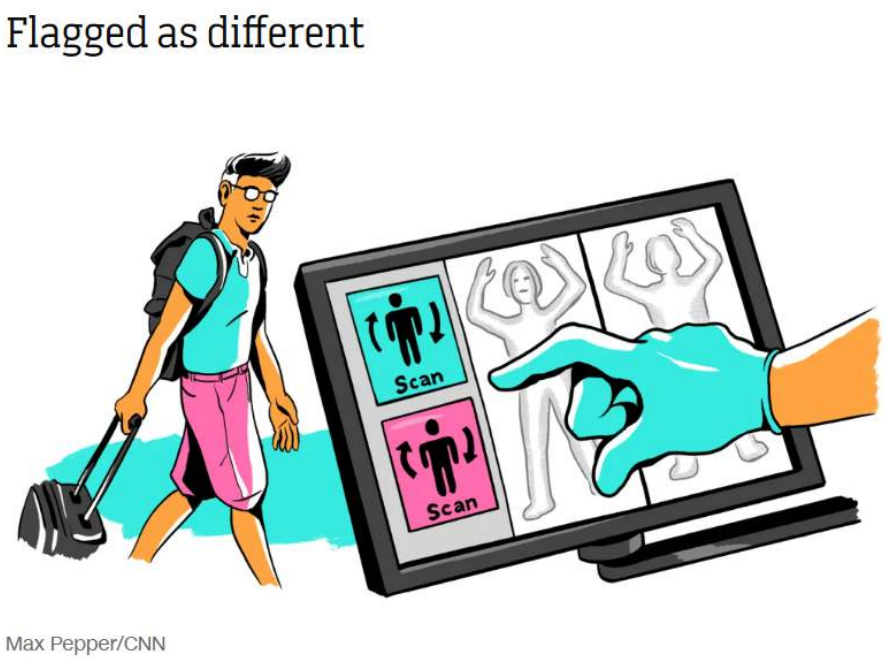


Figure 2.10: flagged as different Picture Source: `https://edition.cnn.com/travel/article/tsa-body-scanners-transgender-travelers/index.html`

The society discriminates on basis on gender and sex. In Figure 2.10, the discrimination started from the machine. We automated it in times when we only recognised two gendered. Now all the metal detectors in the world recognise only two genders. What shame! Can we fix it?

What technology is used in metal detectors? Have we reused the algorithms and design in other technological applications? Which ones? Is it too late?

Figure 2.11: Tarot Cards; `https://tarotcardsoftech.artefactgroup.com/` by Rob Girling

Action

The aforementioned gender discrimination occurs because of many reasons, our concern is limited to engineering design changes. We can fix such discriminations by acknowledging that data biases arise from our societies perspective and our personal biases.

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

C: Rescue Robots

Awareness

We design robots to fulfil human needs. We ignore the other half of the living. We do not consider animals for instance. In this section we will discuss instances of where we ignore animals and how we can include animals in our robotics design.

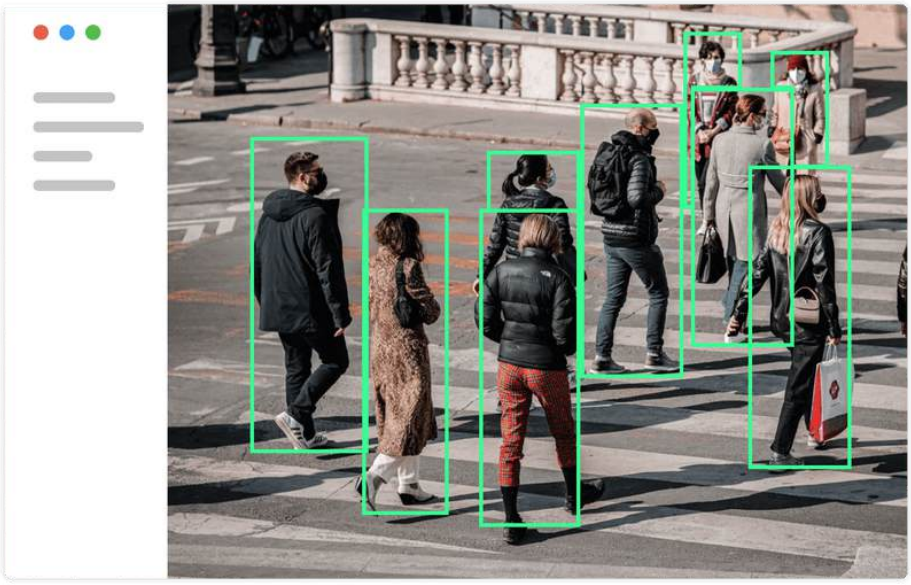


Figure 2.12: Computer Vision landmarks; Picture Source: `https://visailabs.com/top-3-techniques-to-improve-people-human-detection-accuracy/`

Figure 2.13: Dog in rubble; Source credit: `https://news.sky.com/video/china-dog-rescued-after-more-than-30-hours-under-earthquake-rubble-13036897`

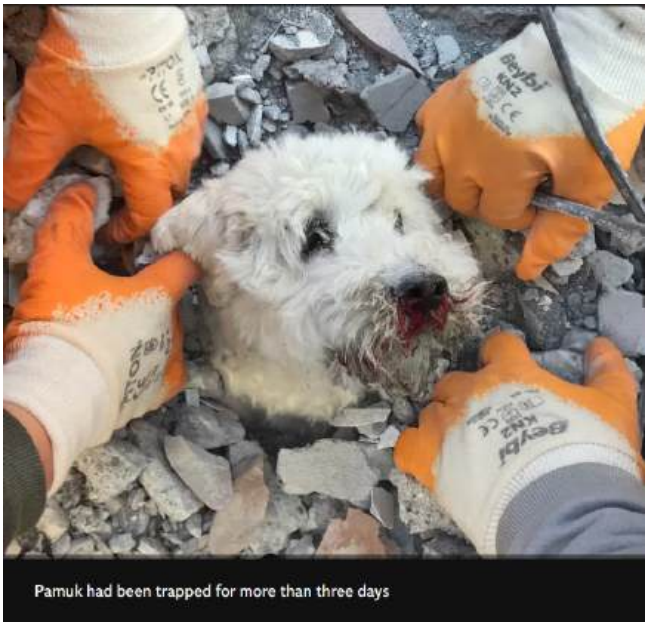


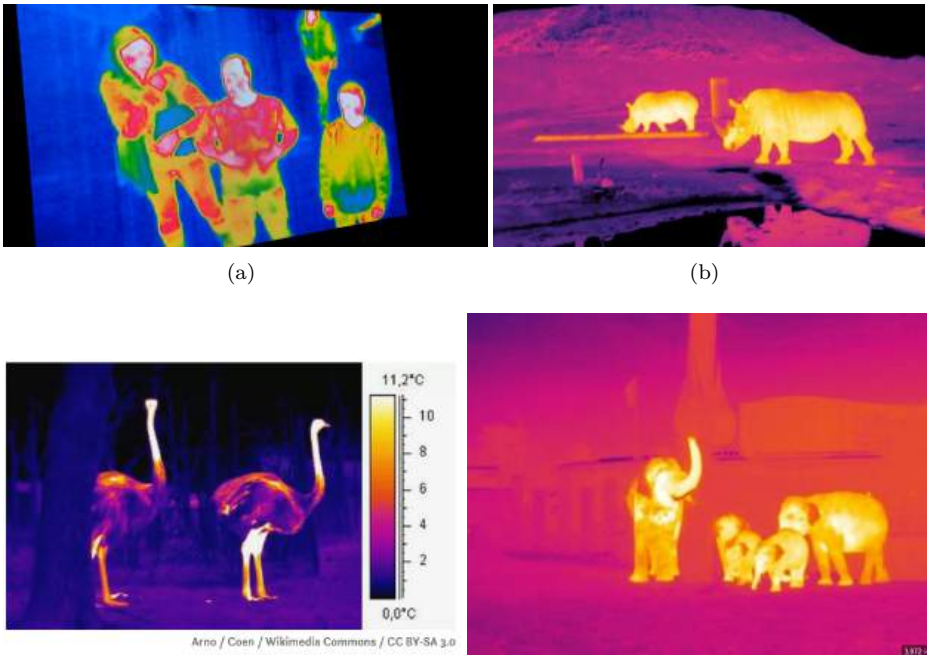
Figure 2.14: `https://www.independent.co.uk/news/world/europe/turkey-earthquake-dog-rescue-pamuk-b2279942.html`

Identification

Figure 2.15: Tarot Cards; `https://tarotcardsoftech.artefactgroup.com/` by Rob Girling

Action

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



(a) (b)

(c) (d)

Figure 2.16: Being more inclusive with choice of sensors

Picture credits: https://www.treehugger.com/hot-and-wild-thermal-images-of-animals-4868612, https://www.zdnet.com/article/as-animal-collisions-soar-thermal-cams-offer-hope/, https://www.nationalgeographic.com/science/article/thermal-infrared-cameras-drones-poaching-conservation-animals-spd, https://www.campussafetymagazine.com/news/thermal-sensors-surveillance/65799/

Careful Inclusive Choice of Sensors

D: Recommender System

Awareness

Social Robots and Interaction Recommendations

Identification

Figure 2.17: Tarot Cards; `https://tarotcardsoftech.artefactgroup.com/` by Rob Girling

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..)...
intersectionality

Awareness

Da vinci SUrgical System
the prevalence of sexist and racial/ethnic microaggressions in the medical field can impact how technology is used and who benefits from it.
Additionally, the high cost of the da Vinci system may limit its accessibility to certain institutions, potentially exacerbating existing healthcare disparities.`https://en.wikipedia.org/wiki/Da_Vinci_Surgical_System`

Identification

Action

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

F: Autonomous Vehicles

Awareness

Data used to train autonomous vehicles, such as images from cameras or historical driving data, could reflect societal biases. These biases could lead to unfair or discriminatory treatment of different groups, such as pedestrians or other drivers based on race, gender, age, or socio-economic status.

Case Study 1:
In March 2018, Uber self-driving car struck and killed a woman named Elaine Herzberg as she walked her bicycle across a road in Tempe, Arizona[1].

Case Study 2:
In 2018, an Audi self-driving car failed to recognize a black man crossing the street during a demonstration in California. The car's sensors detected the man but failed to classify him as a pedestrian, and instead continued its journey without stopping.

Autonomous vehicles, particularly in early testing, have been shown to struggle with accurately identifying dark-skinned pedestrians or individuals wearing certain clothing, like dark coats.

Case Study 3:
Waymo[2] cars struggled in highly complex environments that included pedestrians, cyclists, and mixed traffic in low-income, racially diverse neighborhoods.

These concerns highlight potential discriminatory outcomes where AV companies could unintentionally prioritize more affluent, predominantly white neighborhoods for testing or deployment, leaving marginalized communities underserved.

Case Study 4:
This highlights that autonomous vehicles must be designed with careful consideration of local infrastructure and community needs, ensuring they do not exacerbate existing problems like traffic congestion or inefficient resource distribution in areas where public transportation might already be lacking.

[1] `https://www.wired.com/story/ubers-fatal-self-driving-car-crash-saga-over-operator-avoids-prison/`

[2] the self-driving car division of Alphabet (Google's parent company)

Identification

Racial Bias, economic biases in Decision-Making while overlooking local traffic rules, diverse vehicles, and not trained on animals.

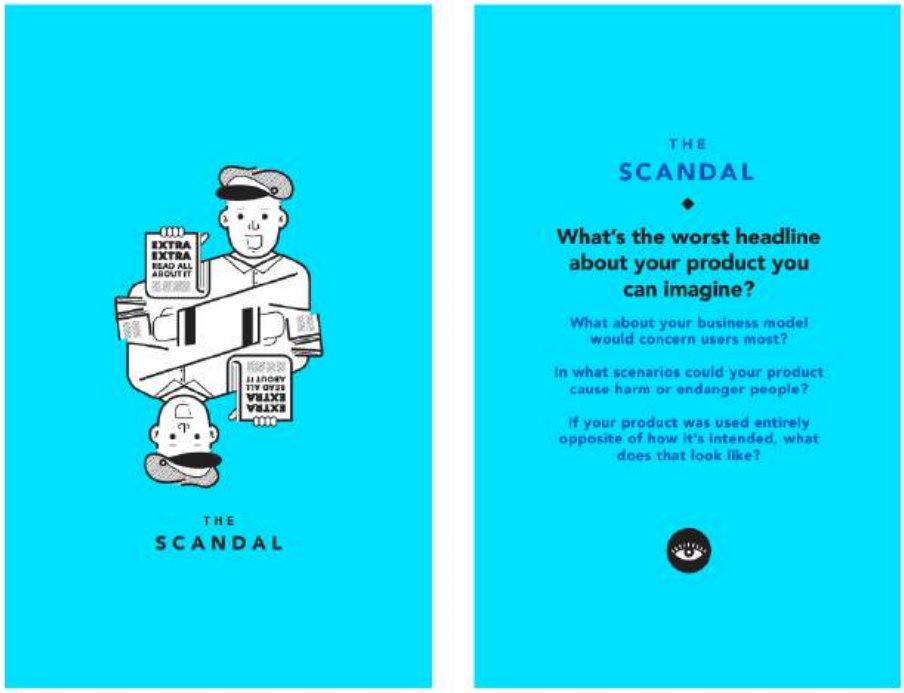


Figure 2.18: Tarot Cards; `https://tarotcardsoftech.artefactgroup.com/` by Rob Girling

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.

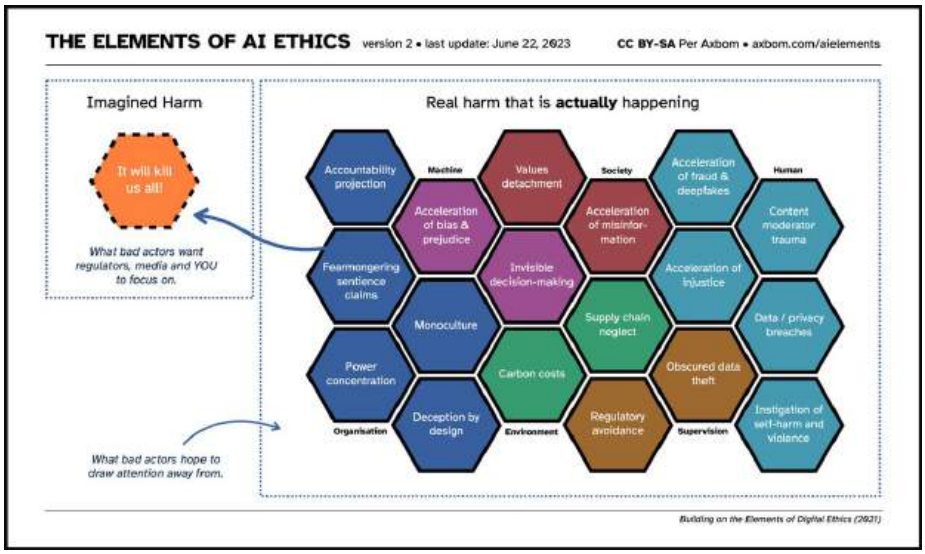


Figure 3.1: This is intended to particularly showcase AI, but very well articulated. Digital ethics.

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

G: Inaccessible Design

Awareness

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.

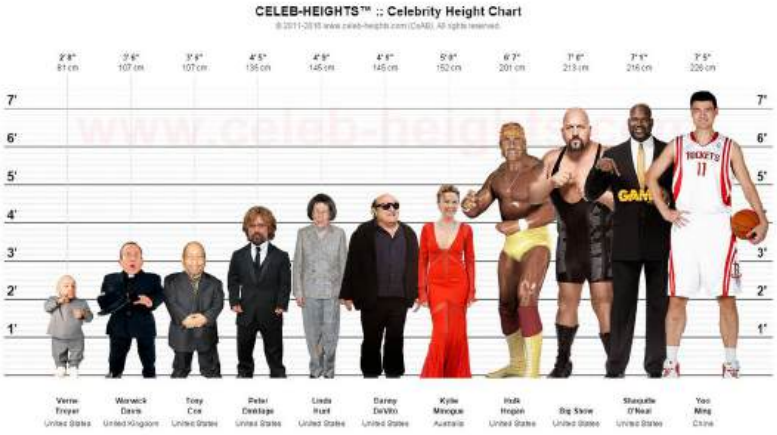


Figure 3.2: Height differences

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

Figure 3.3: Caption

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 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,

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

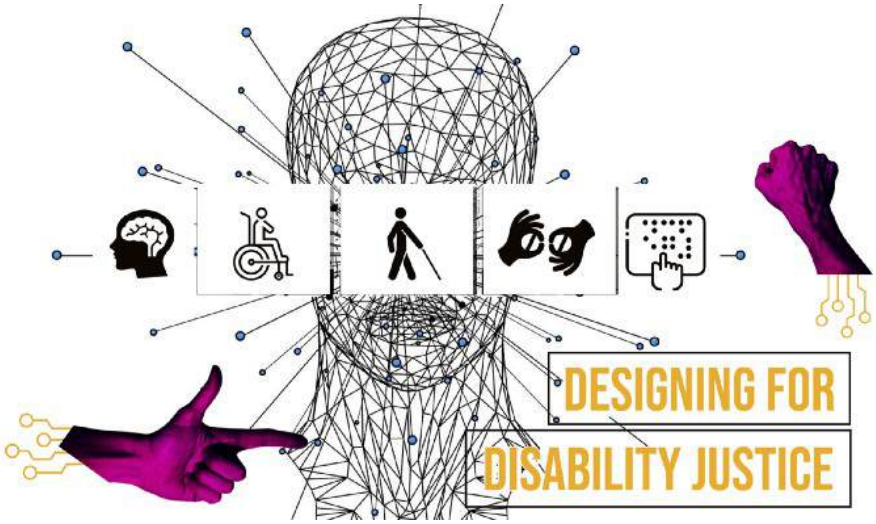


Figure 3.5: Caption `https://sbmediashowcase.com/640/stories/including-people-with-disabilities-in-the-process-of-tech-development-starts-by-addressing-technoableism/`

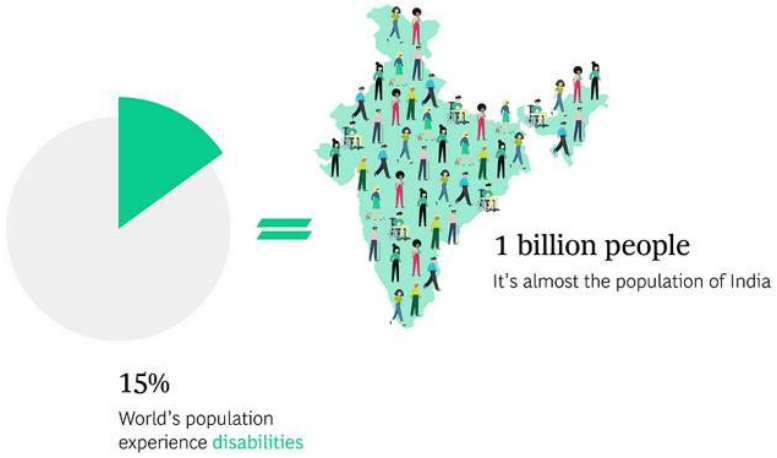


Figure 3.6: `https://uxdesign.cc/an-accessible-guide-to-inclusive-design-chapter-2-a1cc8c6fa4b4`, `https://www.worldbank.org/en/topic/disability`

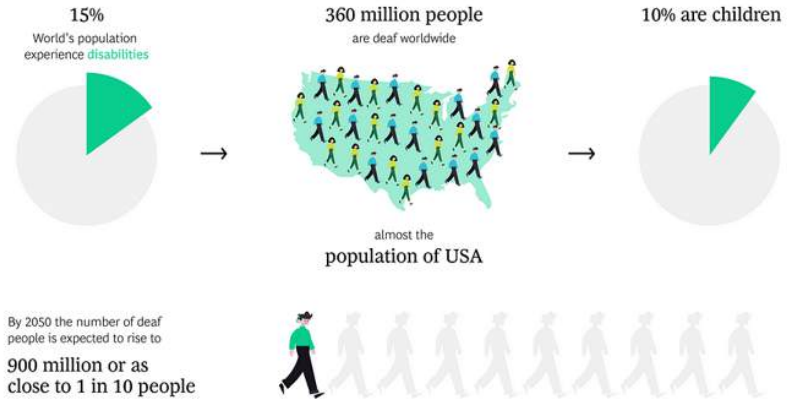


Figure 3.7: `https://uxdesign.cc/the-hidden-value-of-inclusive-design-for-business-and-innovation-6663e17c43a2`

such as those who require assistive technologies integrated into the limb or those with more severe limb loss.

up for discussion

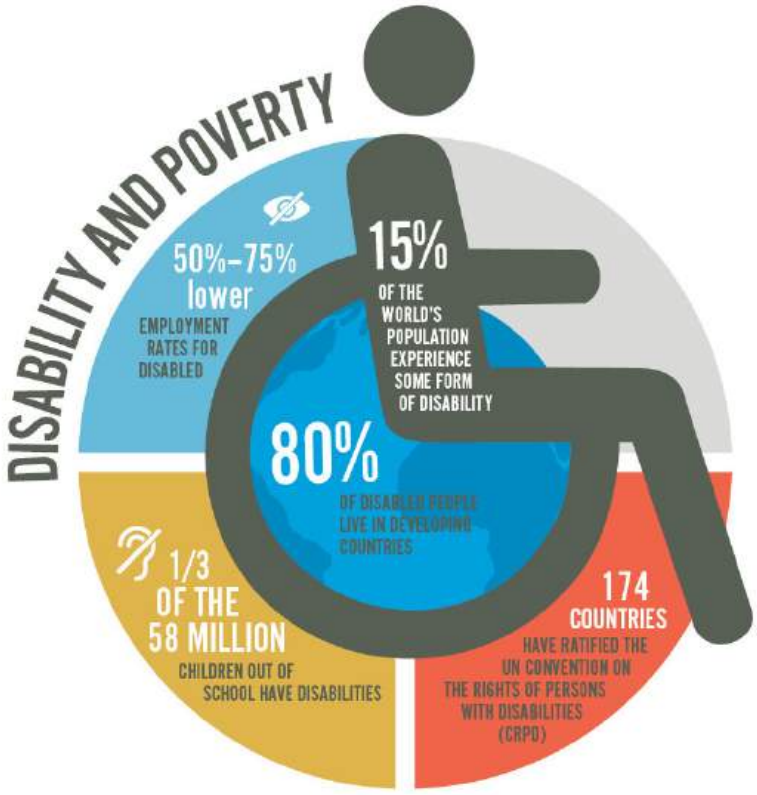
One would argue: I am just creating a prototype, if it becomes successful, then I will think about how to make it more accessible. But that never happens! In public spaces, robots designed to provide assistance (e.g., delivery robots or information kiosks), can not be accessed by visually impaired or 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 3.8: 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



Identification

Identify aspects in your design that have potential to not be inclusive to all. Would you have ideas to circumvent around those issues?

Action

Modularity over Customisation

For exoskeleton, look into materials that adjustable in size. Invite designers to make chassis of the exoskeleton adjustable and flexible to sizes of people. Instead of tailored made clothes or customised Tesla, Invent modular wheels that can accommodate multiple shapes and sizes.

Disability Language Guide, Written by Labib Rahman and Reviewed by the Stanford Disability Initiative Board https://disability2022.sites.stanford.edu/sites/g/files/sbiybj26391/files/media/file/disability-language-guide-stanford_1.pdf

(a)

(b)

(c)

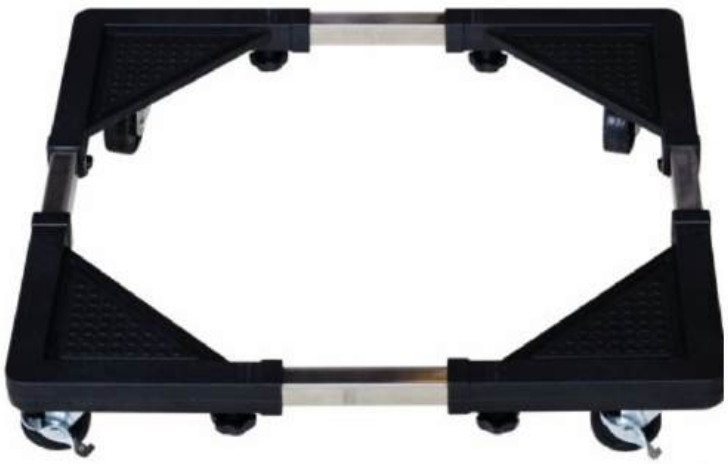


Figure 3.9: Adjustable Trolley board Picture: https://www.mediamarkt.nl/nl/product/_scanpart-verrijdbaar-onderstel-1382609.html?utm_source=google&utm_medium=cpc&utm_campaign=Shopping&utm_term=&utm_content=1382609&gad_source=1&gclid=EAIaIQobChMImubH0-3kigMViJKDBx2w-iyMEAQYESABEgJm0fD_BwE

Accessibility Access

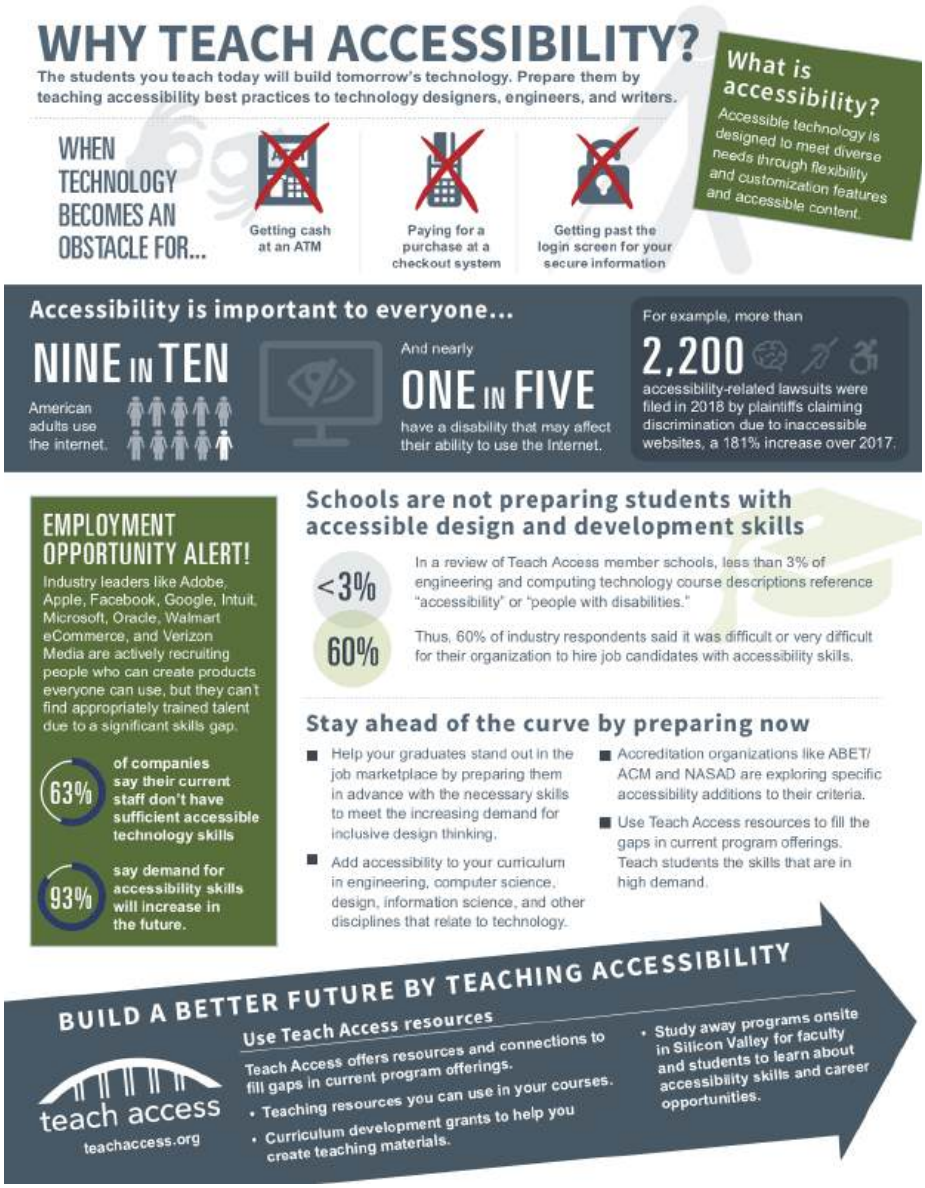


Figure 3.10: ref: `https://teachaccess.org/resources/fact-sheet-why-teach-accessibility/`

`https://bookish.press/tac/CS1#header-38`

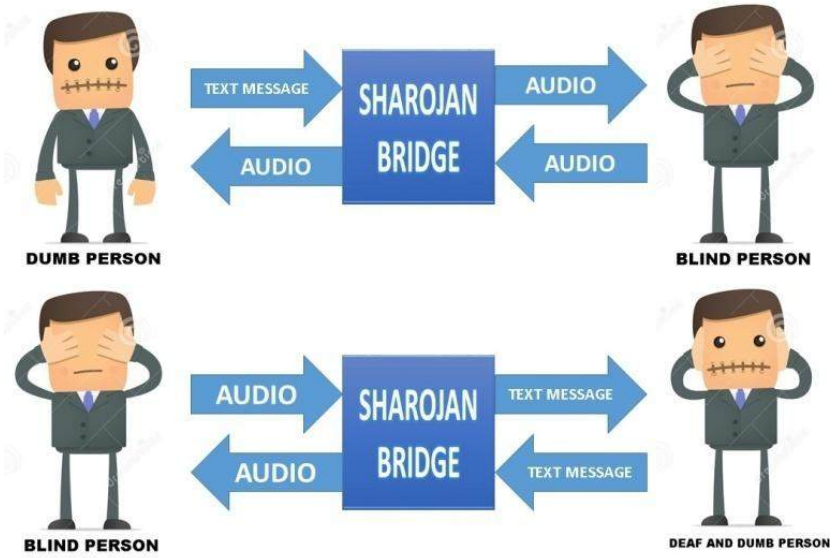


Figure 3.11: A Novel Approach for Communication among Blind, Deaf and Dumb People, Rohit Rastogi, `https://www.researchgate.net/publication/283507754_A_Novel_Approach_for_Communication_among_Blind_Deaf_and_Dumb_People`

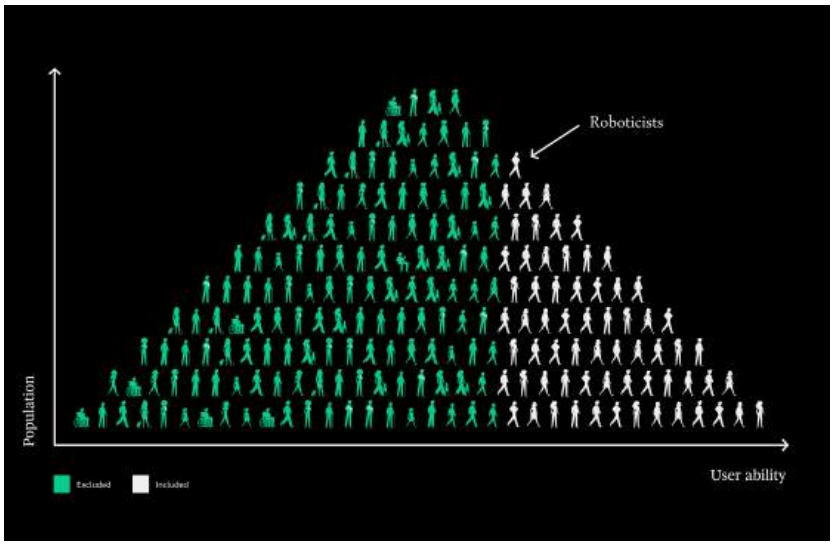


Figure 3.12: `https://uxdesign.cc/an-accessible-guide-to-inclusive-design-chapter-2-a1cc8c6fa4b4`– > changed original picture

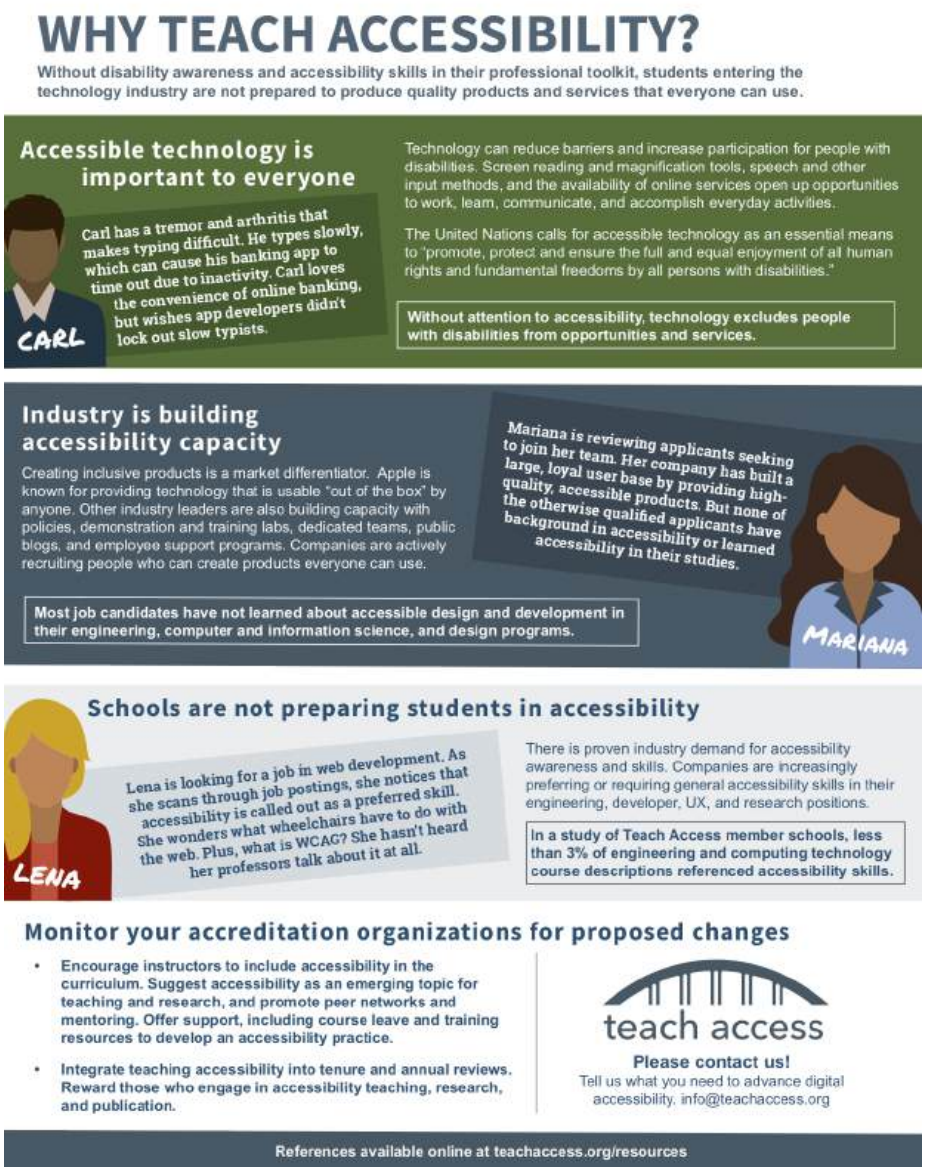


Figure 3.13: ref: `https://teachaccess.org/resources/fact-sheet-why-teach-accessibility/`

Use case exoskeleton
Fixed sized exoskeleton;

variable length exoskeleton.

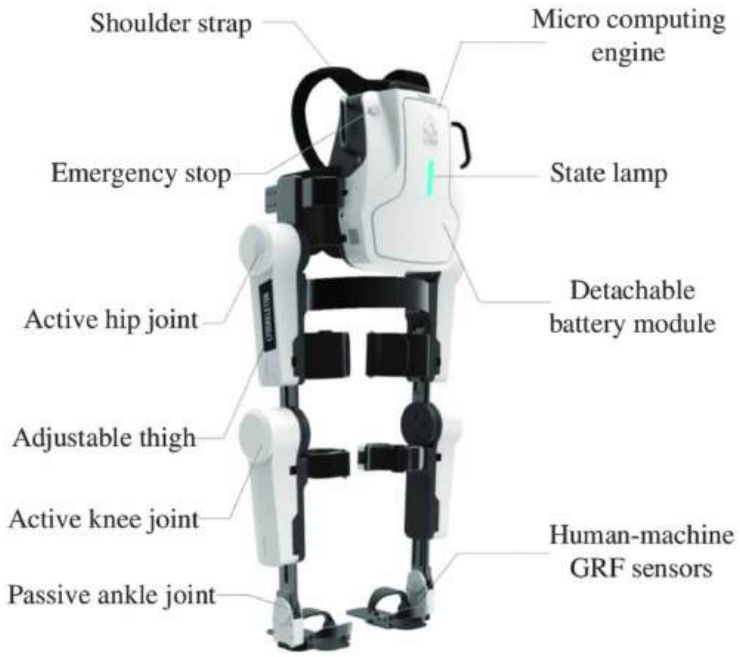


Figure 3.14: source picture: https://exoskeletonreport.com/product/ugo210/

Function Over Form

Instead of designing robots based on human-like forms or behaviours, focus on their intended functions in the ecosystem or environment.

design knees and leave the length of legs growable.

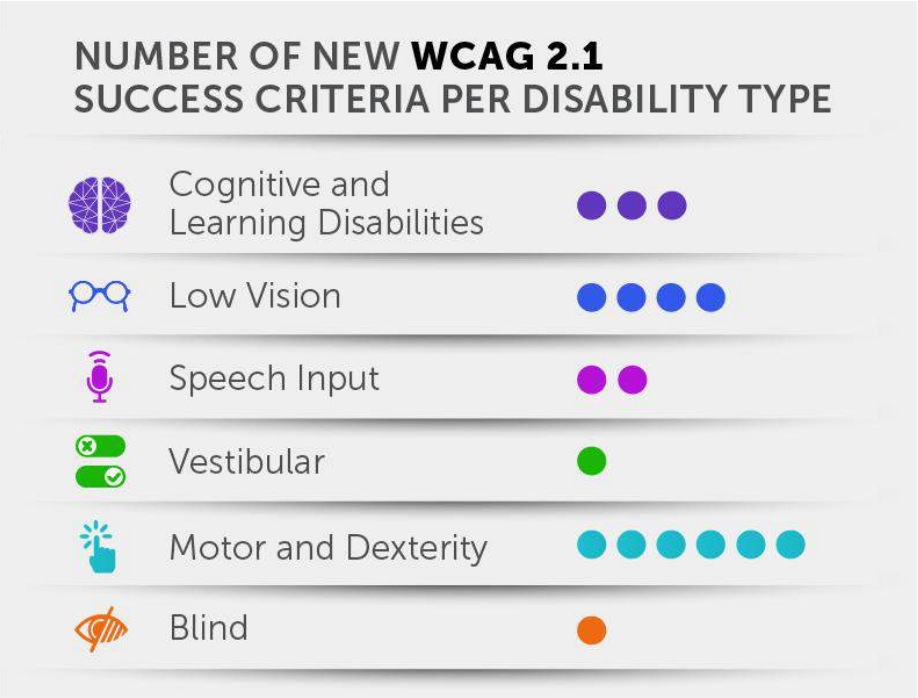


Figure 3.15: Accessibility Guidelines for Websites; WCAG 2.0 Guidelines;
Picture Source: https://www.levelaccess.com/blog/wcag-2-1-exploring-new-success-criteria/

WCGA guideliens accessibility
https://www.w3.org/TR/WCAG20/
Time for Guidelines for Robotics? https://www.mdpi.com/2079-9292/10/5/561

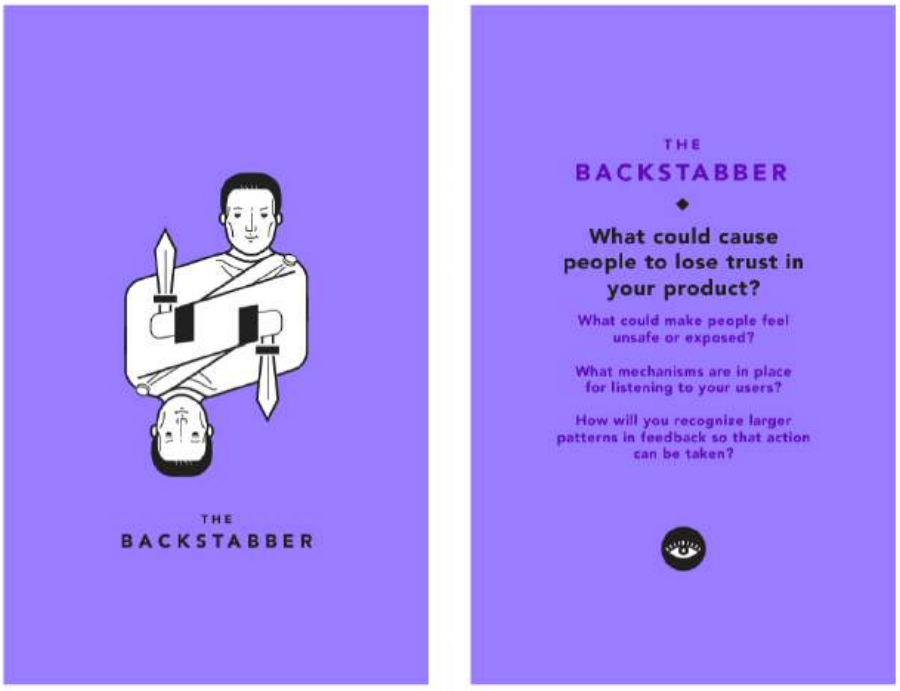
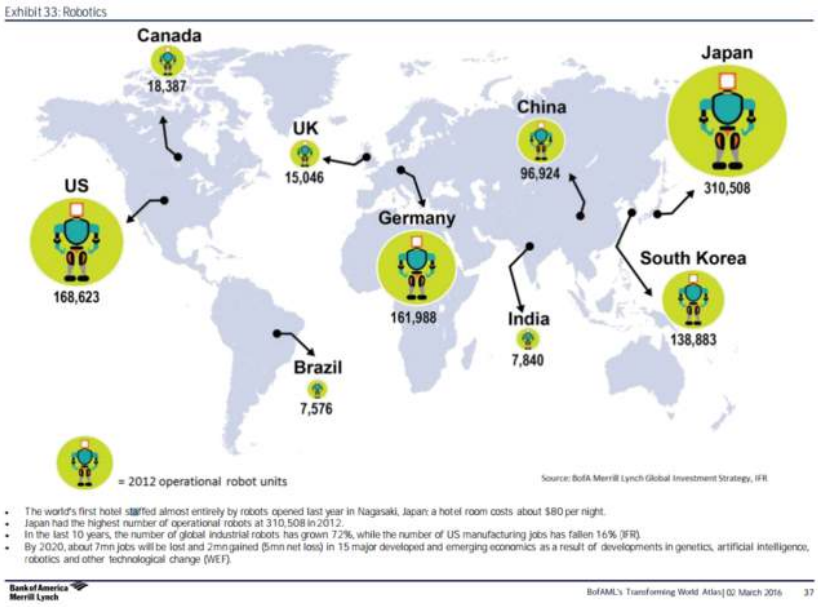
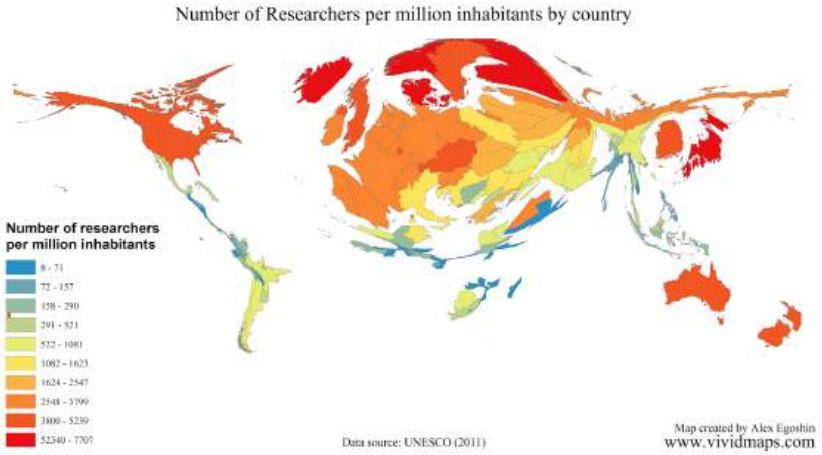


Figure 3.16: Tarot Cards; `https://tarotcardsoftech.artefactgroup.com/` by Rob Girling

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.

Speech Recognition

Awareness

Accent Destroying rare and language from developing cultures, also destroying the culture/cultural records hence.

Action

Opacity in the process of development,
Putting clear data disclaimers on the product and documentations.

Computer Vision

Awareness

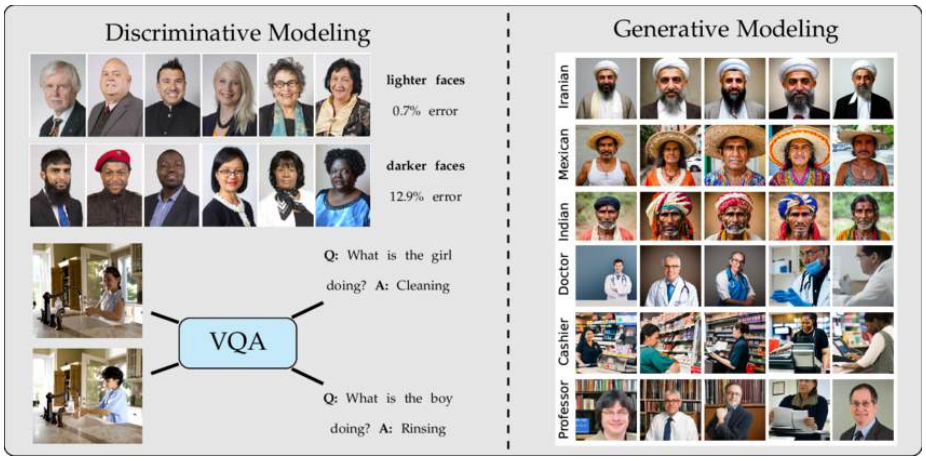
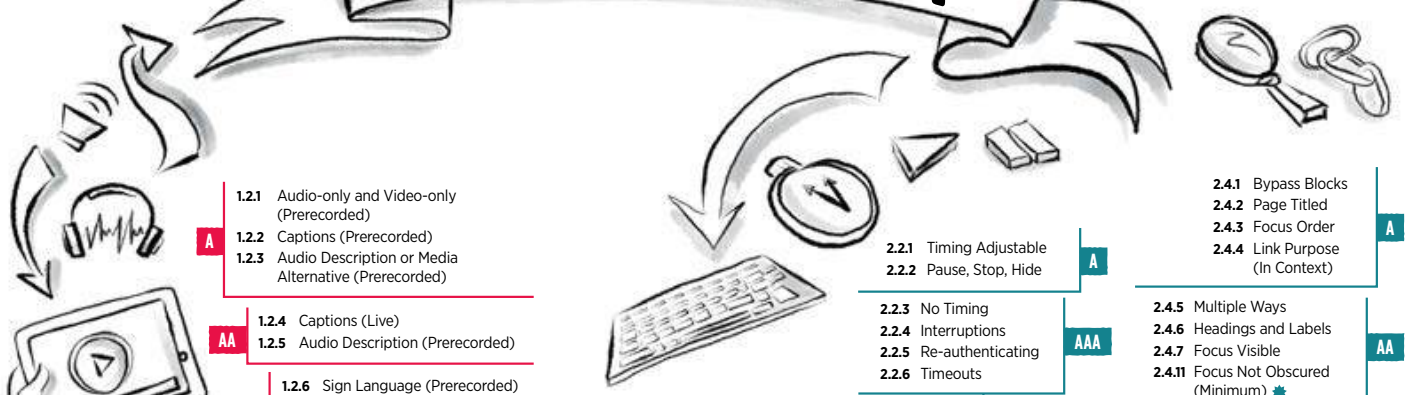


Figure 3.17: Dehdashtian, Sepehr & He, Ruozhen & Li, Yi & Balakrishnan, Guha & Vasconcelos, Nuno & Ordonez, Vicente & Boddeti, Vishnu. (2024). Fairness and Bias Mitigation in Computer Vision: A Survey. 10.48550/arXiv.2408.02464. `https://www.researchgate.net/figure/Examples-of-Bias-and-Unfairness-in-discriminative-and-generative-computer-vision-systems_fig1_382885634`

Inclusivity in Generative AI Should Be an Attribute, Not an Add-On
`-https://ssir.org/articles/entry/inclusive-generative-artificial-intelligence`

WCAG 2.2 Map



Perceivable

Information and user interface components must be presentable to users in ways they can perceive.

1.1 Text Alternatives

- A 1.1.1 Non-text Content

1.2 Time-based Media

- A 1.2.1 Audio-only and Video-only (Prerecorded)
- A 1.2.2 Captions (Prerecorded)
- A 1.2.3 Audio Description or Media Alternative (Prerecorded)
- AA 1.2.4 Captions (Live)
- AA 1.2.5 Audio Description (Prerecorded)
- AAA 1.2.6 Sign Language (Prerecorded)
- AAA 1.2.7 Extended Audio Description (Prerecorded)
- AAA 1.2.8 Media Alternative (Prerecorded)
- AAA 1.2.9 Audio-only (Live)

1.3 Adaptable

- A 1.3.1 Info and Relationships
- A 1.3.2 Meaningful Sequence
- A 1.3.3 Sensory Characteristics
- AA 1.3.4 Orientation
- AA 1.3.5 Identify Input Purpose
- AAA 1.3.6 Identify Purpose

1.4 Distinguishable

- A 1.4.1 Use of Color
- A 1.4.2 Audio Control
- AA 1.4.3 Contrast (Minimum)
- AA 1.4.4 Resize Text
- AA 1.4.5 Images of Text
- AA 1.4.10 Reflow
- AA 1.4.11 Non-text Contrast
- AA 1.4.12 Text Spacing
- AA 1.4.13 Content on Hover or Focus
- AAA 1.4.6 Contrast (Enhanced)
- AAA 1.4.7 Low or No Background Audio
- AAA 1.4.8 Visual Presentation
- AAA 1.4.9 Images of Text (No Exception)

Operable

User interface components and navigation must be operable.

2.1 Keyboard Accessible

- A 2.1.1 Keyboard
- A 2.1.2 No Keyboard Trap
- A 2.1.4 Character Key Shortcuts
- AAA 2.1.3 Keyboard (No Exception)

2.2 Enough Time

- A 2.2.1 Timing Adjustable
- A 2.2.2 Pause, Stop, Hide
- AAA 2.2.3 No Timing
- AAA 2.2.4 Interruptions
- AAA 2.2.5 Re-authenticating
- AAA 2.2.6 Timeouts

2.3 Seizures and Physical Reactions

- A 2.3.1 Three Flashes or Below Threshold
- AAA 2.3.2 Three Flashes
- AAA 2.3.3 Animation from Interactions

2.4 Navigable

- A 2.4.1 Bypass Blocks
- A 2.4.2 Page Titled
- A 2.4.3 Focus Order
- A 2.4.4 Link Purpose (In Context)
- AA 2.4.5 Multiple Ways
- AA 2.4.6 Headings and Labels
- AA 2.4.7 Focus Visible
- AA 2.4.11 Focus Not Obscured (Minimum) ✸
- AAA 2.4.8 Location
- AAA 2.4.9 Link Purpose (Link Only)
- AAA 2.4.10 Section Headings
- AAA 2.4.12 Focus Not Obscured (Enhanced) ✸
- AAA 2.4.13 Focus Appearance ✸

2.5 Input Modalities

- A 2.5.1 Pointer Gestures
- A 2.5.2 Pointer Cancellation
- A 2.5.3 Label in Name
- A 2.5.4 Motion Actuation
- AA 2.5.7 Dragging Movements ✸
- AA 2.5.8 Target Size (Minimum) ✸
- AAA 2.5.5 Target Size (Enhanced)
- AAA 2.5.6 Concurrent Input Mechanisms

Understandable

Information and the operation of user interface must be understandable.

3.1 Readable

- A 3.1.1 Language of Page
- AA 3.1.2 Language of Parts
- AAA 3.1.3 Unusual Words
- AAA 3.1.4 Abbreviations
- AAA 3.1.5 Reading Level
- AAA 3.1.6 Pronunciation

3.2 Predictable

- A 3.2.1 On Focus
- A 3.2.2 On Input
- AA 3.2.6 Consistent Help ✸
- AA 3.2.3 Consistent Navigation
- AA 3.2.4 Consistent Identification
- AAA 3.2.5 Change on Request

3.3 Input Assistance

- A 3.3.1 Error Identification
- A 3.3.2 Labels or Instructions
- A 3.3.7 Redundant Entry ✸
- AA 3.3.3 Error Suggestion
- AA 3.3.4 Error Prevention (Legal, Financial, Data)
- AA 3.3.8 Accessible Authentication (Minimum) ✸
- AAA 3.3.5 Help
- AAA 3.3.6 Error Prevention (All)
- AAA 3.3.9 Accessible Authentication (Enhanced) ✸

Robust

Content must be robust enough that it can be interpreted reliably by a wide variety of user agents, including assistive technologies.

4.1 Compatible

- A 4.1.1 Parsing (Removed in 2.2)
- A 4.1.2 Name, Role, Value
- AA 4.1.3 Status Messages

intopia

intopia.digital

Key: ✸ New in WCAG 2.2 | AA Success Criteria Level

Visual map of Web Content Accessibility Guidelines 2.2 Based on World Wide Web Consortium documentation available at https://www.w3.org/TR/WCAG22

Robotic Applications: Security Surveillance..

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.

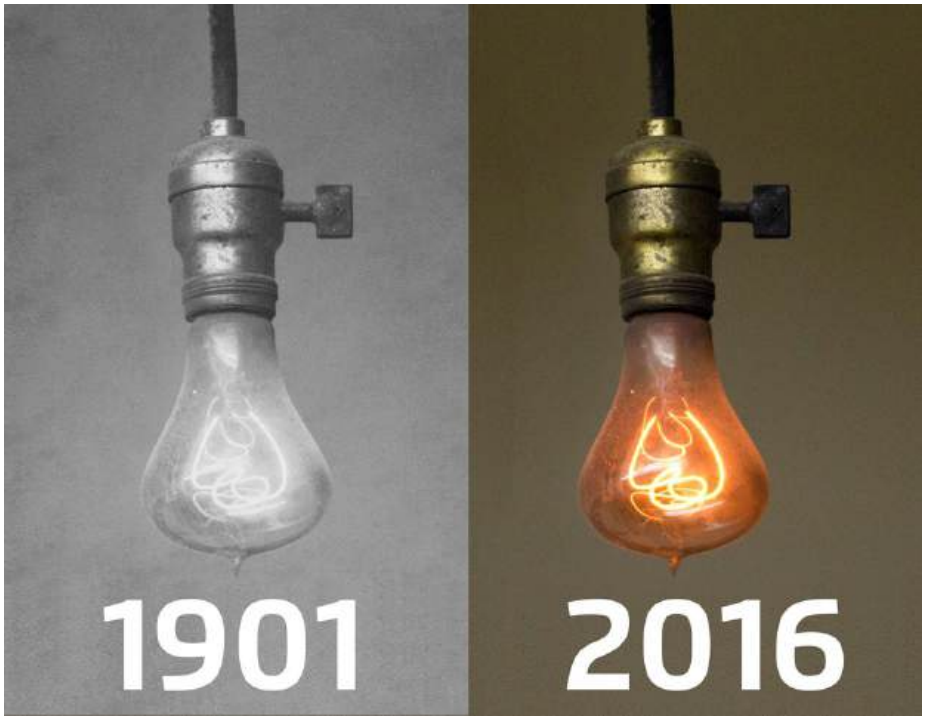


Figure 3.18: Centennial Light Source: `Lyskilderdirekte.dk`

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 3.19: https://www.huffpost.com/entry/removing-toxic-electronic_b_7784246

Figure 3.20: https://iitstech.com/blog/health-effects-of-e-waste-a-complete-detail/

Identification

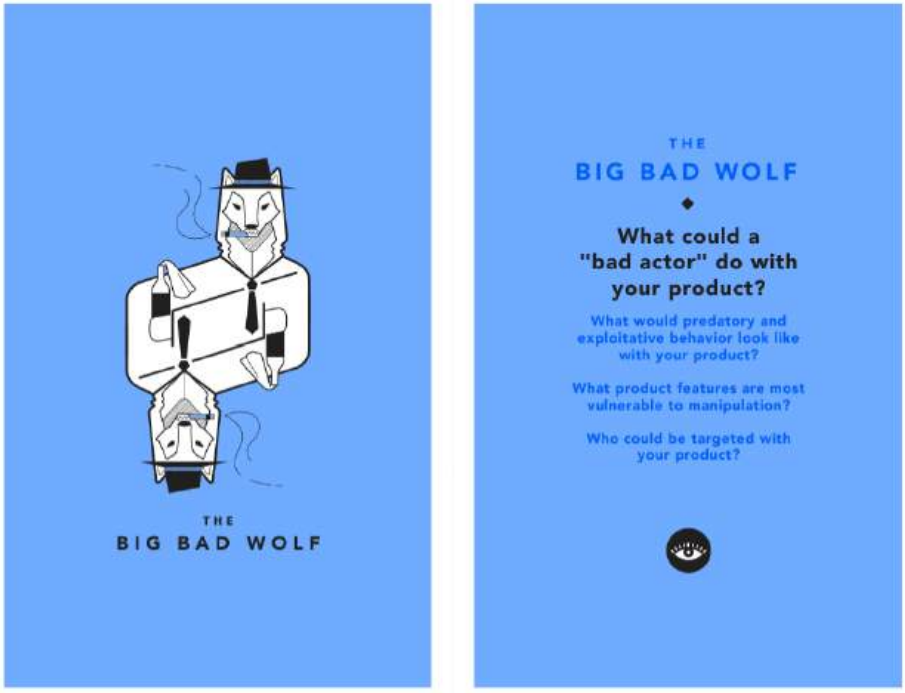


Figure 3.21: Tarot Cards; `https://tarotcardsoftech.artefactgroup.com/` by Rob Girling

Action

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.

(a)

(b)

(c)

Figure 3.22: can we export Roomba? (a) Roomba in west (b) roomba on soily ground (c) mud hut in rural India

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.

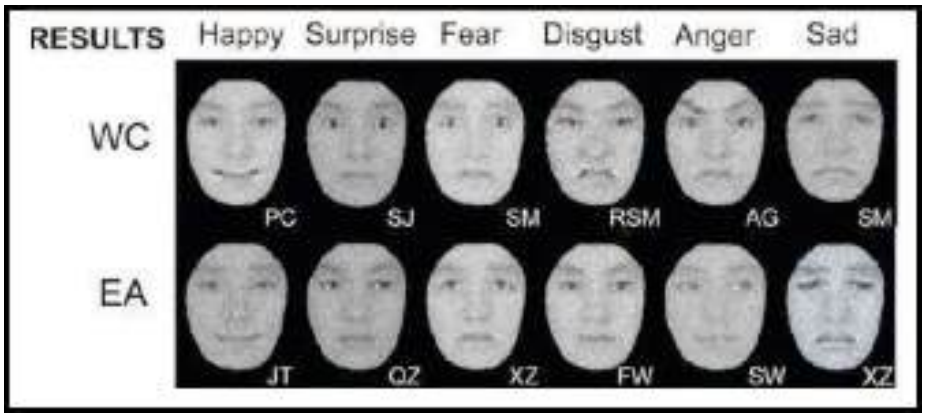


Figure 3.23: Emotion differences; ref: `https://www.apa.org/news/press/releases/2011/09/facial-expressions`

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 3.23. 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 3.24 shows

the cultural difference in emotions.

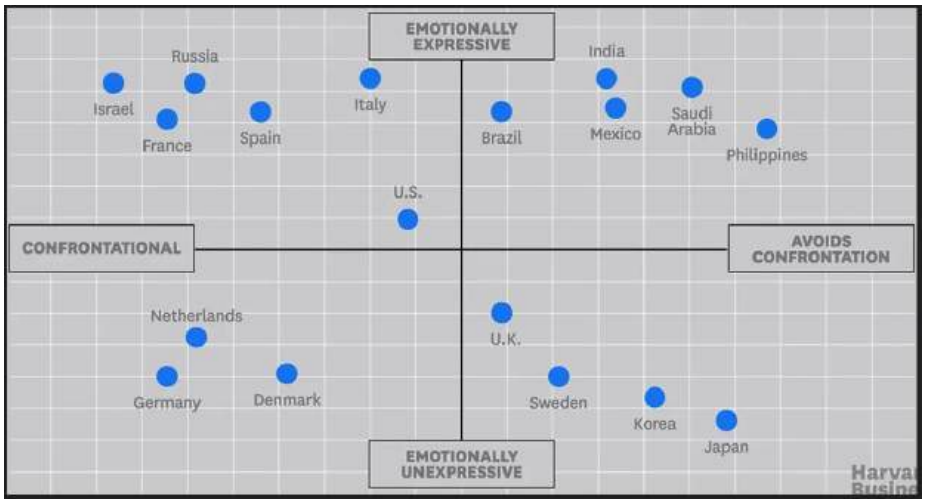


Figure 3.24: Emotional differences across countries; Picture Courtesy: Harvard Business

Farming robots:

Education Robots:

Social Robots:

Figure 3.25: Tarot Cards; `https://tarotcardsoftech.artefactgroup.com/` by Rob Girling

Western Surveillance Robots in Hong Kong Protests (2019) During the 2019 Hong Kong protests, the Chinese government, as well as local authorities, deployed various surveillance technologies, some of which included Western-made robotic systems intended for crowd monitoring and control. These Western surveillance robots were not well suited for the highly dynamic and unpredictable nature of the protests. The robots often malfunctioned or failed to adapt to the fast-moving, chaotic environment of the protests. Additionally, the deployment of these robots led to backlash due to concerns about privacy violations and the overreach of surveillance.

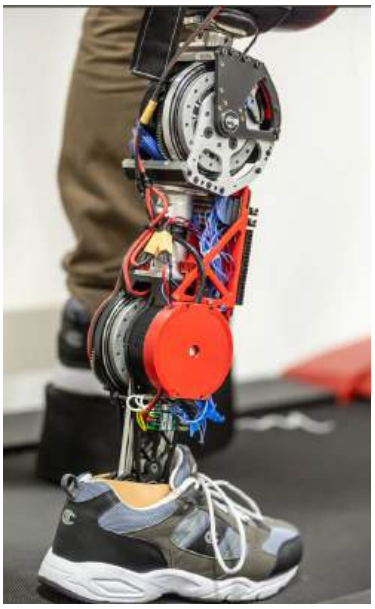
The use of these robots caused distrust among the public, as they were viewed as tools for government control rather than aid for public safety. The malfunctioning of the robots, combined with their controversial use, contributed to the overall havoc during the protests.

Western Security Robots in Singapore (2016): In 2016, the company Knightscope, based in the U.S., developed security robots that could patrol and monitor areas for potential security threats. The robots were designed for use in environments like malls, parking lots, and office buildings, and they were deployed in several locations around the world, including Singapore.

The robots faced several challenges in Singapore. While designed to be autonomous, they often struggled with environmental factors such as humidity and heat. Additionally, these robots did not account for the dense, diverse urban environment of Singapore, where the robots' sensors were frequently triggered by factors like crowds or unexpected changes in the environment. In one notable incident, a robot fell into a fountain while patrolling a mall, drawing negative attention to its capabilities.

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.

Figure 3.26: Tarot Cards; `https://tarotcardsoftech.artefactgroup.com/` by Rob Girling

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.

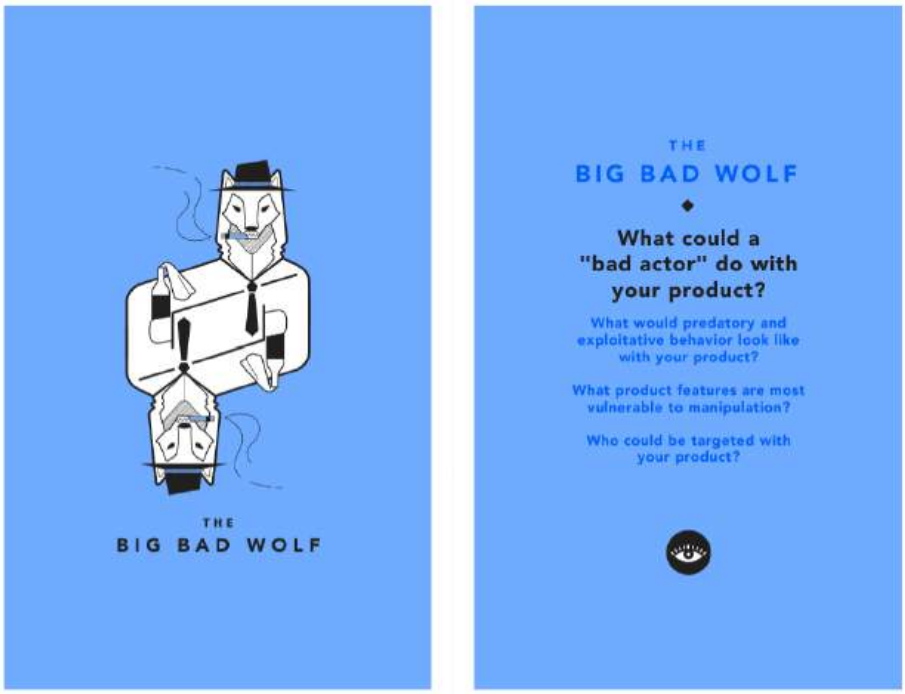


Figure 3.27: Tarot Cards; `https://tarotcardsoftech.artefactgroup.com/` by Rob Girling

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.

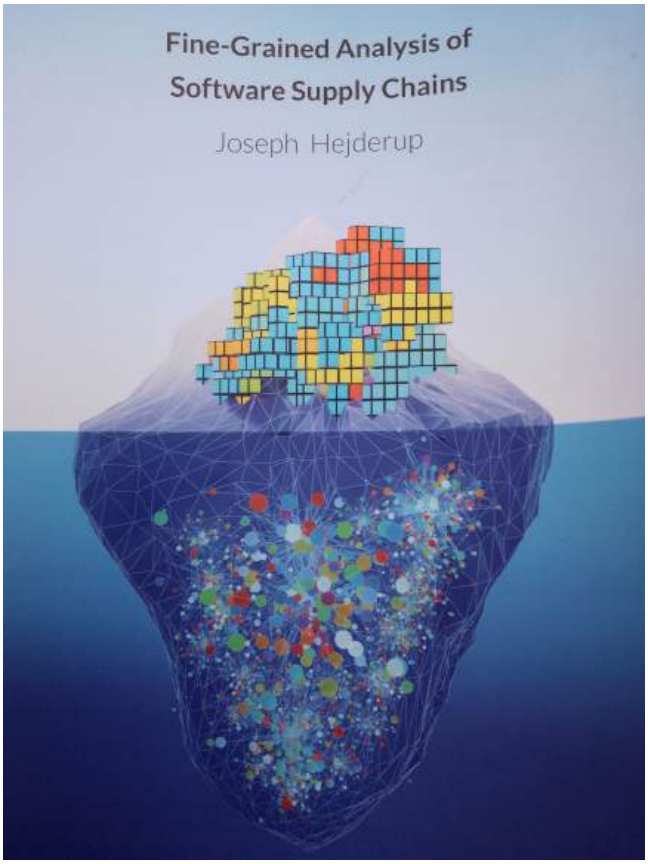


Figure 4.2: A software has multiple dependencies, these dependencies can have biases themselves. Do you know the y2K event? Dr Joseph Hejderup has discusses it intensely in his PhD dissertation, found here: `https://repository.tudelft.nl/record/uuid:0c46d4a2-148f-4661-a196-6be7bcc7b9db`

Chapter 5

Conclusions

Business or government level policy changes are definitely deemed to be impactful, quicker and large-scale effective to the issues described in this workshop. We vouch for it. However, the ambition of this workshop is designed to encourage the engineers to make changes in their engineering design, while provide an awareness of the theme, providing a shift in the mindset to engage outside the community for better production.
In this section we elaborate, and summarize some key aspects of making a shift towards more inclusive, respectful and equitable design.

5.1 Data Biases and Disclaimers

It is essential that you recognise and acknowledge that the data you have sourced and used in your design is an extremely small subset of the world population. It is essential that you acknowledge that your particular upbringing and surrounding introduce conscious and unconscious biases. Though no one can be blamed for it, these biases are not healthy for our global society. With the heavy use ChatGPT in the society and heavy reliance of it by the society, an proportional amount of work is rightfully dedicated to understanding these biases in Natural Language Processing(NLP). As a researcher/developer/designer, we encourage you to keep yourself updated and attuned with these research works.

Social robots use NLP. It is a domain of their research to understand the biases brought about by the AI biases researches. As a roboticist, you must interact with social roboticists to gauge the biases they deal with and further reflect on your own data.

Industrial designers are also very well versed with biases in data. They work to make designs more humane and closer and closer everyday to address the various shortcomings that excluded people. Partner with them, understand what they struggle with and how can you provide them engineering solutions that can

make their designs inclusive. Such collaborations are precious and deem high value for the future.

Design exoskeletons with designers.

Talk to local people from whom you are making the robots for. Introduce or consult with local roboticists/researchers/experts in your design and development through all phases of the process.

Encourage critical questioning from users, other researchers/developers. Will your grandmother like soft robotics hand or chatbot when she is lonely at elderly care? God forbid, but if you had an accident and lost a limb, will you be able to use the exoskeleton everyday- does it compensate or is useful enough? As an American, will you be able to trust surgical-bot or autonomous car designed in India?[1]

Reusing data from other disciplines to play with randomness.

When creating artificial/synthetic data- be careful of inherent biases.

Securing diverse data

5.2 Sustainability

Can you use a naturally occurring material to design your robots? The figure shown a beautiful example of wooden chassis for robot. It will be insulating to electric shocks, biodegradable, maybe create employments and collaborations but also extremely easy to mould, you can make anything out wood. With it's density lesser than water wood can be used for water robots. With wood's durability in out-door's environment, they can be used in framing robots, forestry robots etc. Well, think outside the box, look outside the window.

Natural materials bio-mimicry but also using existing materials from nature, chassis.

With such materials, will contribute Equitable Access to Technology. Robotics technology should be designed and deployed in ways that ensure broad accessibility and benefit, not just to those in wealthy, technologically advanced areas but also to underserved communities. (At-least not increasing the design.)

Work with designers, material engineers etc... the material with which robots are made is important, as it potential to add vast amount of waste that will not

[1] no offence intended :)

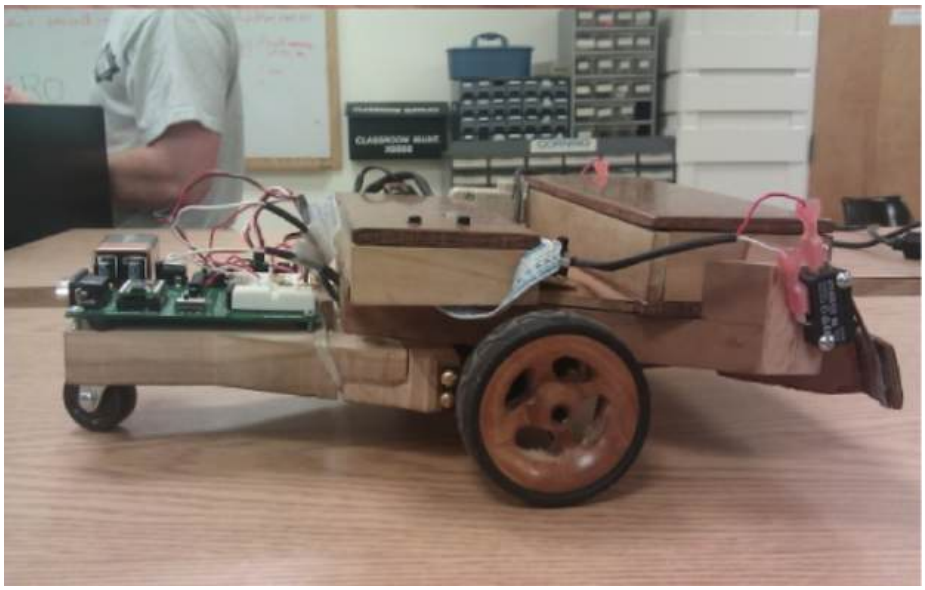


Figure 5.1: Wooden chassis robots; wood will be light an insulating. `http://glench.com/make/wooden-robot/`

be visible to you, as it is not dumped in your backyard.

Further, write modular code, updatable code, at-least keep the scope for it. DJI drones and software is amazing, but they change firmware every time, it is not backward compatible. It is bold, to rewrite everything, but also not considering environment. Replacing hardware every two years, with every update, not sustainable. Moore' law doesn't change that fast, does it?

5.3 Transparency

Open software and open hardware; open to critic,
Data disclaimers
Open Data sets
Opacity of process
Data disclaimers
Open Hardware and Open Software
`https://www.opensourceleg.org/`
to make this Open software and hardware, 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

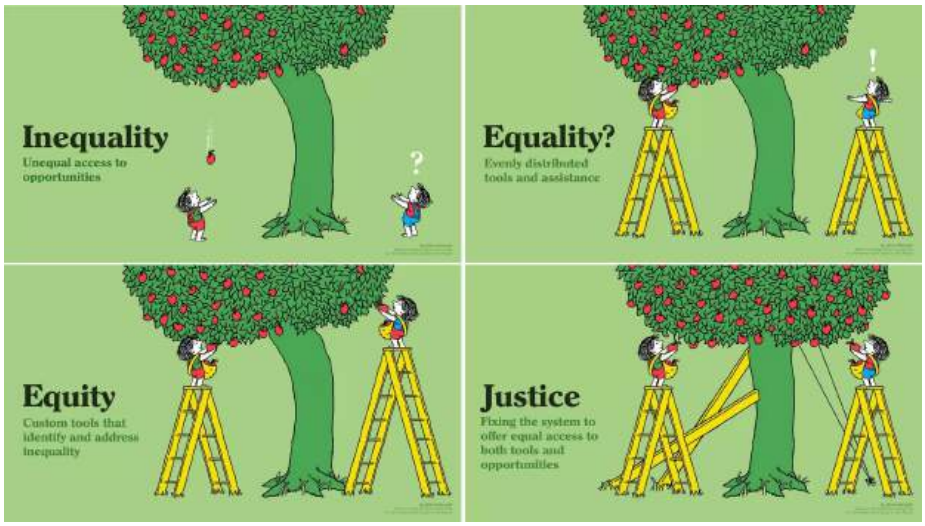


Figure 5.2: Picture reference: `https://www.linkedin.com/posts/kevinlbrown_are-you-using-the-correct-fundraising-language-activity-7282104006934503425-IRXd/?utm_source=share&utm_medium=member_desktop`

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!

5.4 Accessibility- inclusion

Working with designers,

5.5 Partnership with Global South

5.6 Partnership with humanity

Discussing with **Social Scientists** about social issues.
Attend lectures on **Technology Philosophy**, it may open gates and so..

5.7 Future prospects

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.

Transparency; thereby undertaking and offloading Accountability at the same time Providing data disclaimers.
Need to include a designer philosopher in the conversation

Why interdisciplinary conversations are important?

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

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.
4. Van de Poel, I., Frank, L. E., Hermann, J., Hopster, J., Lenzi, D., Nyholm, S,. Taebi, B., & Ziliotti, E. (2023). Ethics of Socially Disruptive Technologies: An Introduction. Open Book Publishers. Accesible via: `https://pure.tudelft.nl/ws/portalfiles/portal/176130437/obp.0366.pdf`.
5. `https://youtu.be/vwqi8C04Gsk`

related keywords in philosophy: vlause sensitive design,

Social-Scientist recommended reads

1. How We Became Sensorimotor: Movement, Measurement, Sensation; Dr Mark Paterson. Minneapolis, MN: University of Minnesota Press (2021).
2.
3.

related keywords in social science:

Designer recommended reads:

1. The Ethics of Drone Design; Dr Dylan Cawthrone, Published December 18, 2024 by Routledge https://www.routledge.com/The-Ethics-of-Drone-Design-How-Value-Sensitive-Design-Can-Create-Better-Technologies/Cawthorne/p/book/9781032445526.
2. What's next for design: Towards humanity-centered design: https://www.artefactgroup.com/ideas/towards-humanity-centered-design/
3. Best Practices for Accessibility for FIRST® Robotics Competition Events: https://www.firstinspires.org/sites/default/files/uploads/resource_library/frc/rpg/frc_best_practices_for_accessibility.pdf

related keywords in design research: humanity-centered design, accessible design

Human Rights:
https://www.sienna-project.eu/w/si/robotics/codes-and-guidelines/

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.
Anthrobotics : science of developing and studying robots that are either entirely or in some way human-like[1]. **Control**,
planning,
manipulation,
field robotics,
HRI,
Grasping,
imitation learning,
perception and navigation,
locomotion and manipulation,
perception,
navigation,

[1] Wikipedia defintion

robot learning foundation models,
robot design.

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[2] 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,
	..	
	..	
	..	
	..	
	..	
	..	
	..	

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.

TODO: python library dependencies check; privacy etc

Contributors

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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`

Mv. Marije Verkerk
PhD Utrecht University
Investigating existential well-being and meaningful education
Research themes: Religion in Contemporary Society;
Value-oriented Professionalisation

to add: Deborah Forster Madelaine Ley Karin Bogdanova Abhigyan Dylan Cawthorne

Collaborators

(in no specific order)

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Asks

Possible keynotes: **Data Discrimination bias: how to avoid, acknowledge fix.** and or **Algorithm biases in Robotics, and actions against it.**
How autonomous cars were adapted to real life situations: interdisciplinary approach, mix culture approach, dealing with uncertainity. **Anthropology of exporting and exclusive technology**
Sustainability ideas.
Value senstive Design?
Data biases 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 can 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[1].

What are the some fallacies that you see in robotics?
Would you like to elaborate on it through this anonymised google forum:
`https://forms.gle/mNDb5JX9G6D11s7SA`?

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

This document is self-funding initiative.

[1] ambitious?