

## **Ethical Theme Definitions:**

### **Human Rights**

In recent years, human rights has become more engaged with the development of robotics. For example, privacy is heavily impacted throughout our cyber life. Robots with artificial intelligence can monitor the users' data and personalize commercials. Other outdoor robots like drones can invade human's privacy as well. The liberty can be challenged with the development of caring robots, as some encourage caregivers to stay at home for safety. Thus protecting human rights is a significant topic when designing robots. When it comes to a robot interacting with humans, we need to think about whether the robot's behavior might potentially invade human rights before endowing it ability.

### **Government**

Governments play a crucial role in ensuring human rights, preventing robots from physically hurting humans and other potential issues. The government should establish a sound law and regulate not just robot companies but also the owner of robots. Besides, the military robot is a particular subfield that the government fully controls. The restriction of military robots is also a problem that governments need to think about. Internationally, all governments should sign robot consents and reach a consensus as well.

### **Accountability**

The accountability of robotics can be divided into three essential stages across the lifecycle of robots: design (pre-deployment), monitoring (during deployment), and redress (after harm has occurred) (Fjeld, 2020). It can be challenging to decide whether the harm is caused by terrible robot design (robots companies), misuse of robots (users), or both. Creating proper accountability is an indispensable topic within the development of robotics, as it could efficiently teach people their responsibility and obey the rules.

Fjeld, Jessica, Nele Achten, Hannah Hilligoss, Adam Nagy, and Madhulika Srikumar. (2020). "Principled Artificial Intelligence: Mapping Consensus in Ethical and Rights-based Approaches to Principles for AI." Berkman Klein Center for Internet & Society. Retrieved Nov 17, 2020 from [https://dash.harvard.edu/bitstream/handle/1/42160420/HLS%20White%20Paper%20Final\\_v3.pdf?sequence=1&isAllowed=y](https://dash.harvard.edu/bitstream/handle/1/42160420/HLS%20White%20Paper%20Final_v3.pdf?sequence=1&isAllowed=y)

## **Fairness and Non-Discrimination**

In any case where a robot might directly or indirectly be in contact with humans, it is important that it treats all equally. This may seem like something that would be 'natural' for something that is not programmed to have any inherent predisposition to different groups of people, however this is not always the case. Functions that a robot relies on, such as facial detection, or algorithms for decision making, can have inherent biases, either intentional or unintentional. These biases may be the result of poor data sets or algorithm training, or just bias on the behalf of the programmers of these functions. It is important to try and catch these errors when possible to ensure that robots are equitable in their interactions with humans.

## **Identity**

Sense of identity is something that can be challenged by robotics, particularly when robots are capable of doing more and more 'human' things. Identity can be discussed by either how robotics affects the identity of individuals or groups, as in how they see themselves and how that has changed due to robotics. Identity might be affected by industrial robotics for example, in the sense that someone's job can be a part of their identity, and it is therefore impacted by the automation of their work. On a larger scale, the identity of humans as a whole might eventually be affected in such a way.

## **Anthropomorphization**

Anthropomorphization is the application of human-like qualities to something that is not human, such as describing an object as 'breathing' even though it cannot. Robots that interact with humans, do things that people do, or even just ones that people like or find cute can often be subjected to anthropomorphization. Giving a robot a name is one such example, as many bomb disposal robots in military use are named and sometimes even given funerals when they are 'retired'. Anthropomorphization may change how people view robots, or how they view other humans, and as such it is important to consider when a robot should be anthropomorphized, and when it shouldn't. This can be dictated by the use case for the robot, such as anthropomorphized for companion robots, and non anthropomorphized for industrial robots.

## **Human Control of Technology**

As technology progresses user interfaces with technology are constantly evolving. For instance, when it comes to communication one of the first user interfaces was a single button

to send morse code, then it changed to rotaries and individual buttons, and now most cell phones have a touch screen. Many evolutions in how we change how we control technology is to make it easier for the individual to use the full capabilities of the device. As we make it easier for us to control robotics, they become more intertwined with our everyday actions and have a larger effect on the world around us.

### **Professional Responsibility**

In order for progression to be made in any field, leading specialists conduct research in the interest of the general public to find the extents of their field. It is up to these professionals to guide these investigations with caution and awareness of the implications and effects of the knowledge they pursue. More so, professionals stand as the translators of their findings to the public to explain the uses, possibilities, and dangers of their findings. By conducting research and educating others leading specialists grow their field and keep an informed public as to how their findings will affect their lives.

### **Promotion of Human Values/ Public Interest**

As advances are made in various fields we as a society have influence just by having public discussions on said fields. News outlets many times act as general voices giving basic information or common opinions people can use to build their own view on the subject. While social media has made it easier than ever for individual people to voice and discuss their perspectives on any given topic. Since people can get their own voice out so easily, the public can easily encourage or restrict topics of research or fields. This can be done through events, petitions, protests, fundraisers, and even legal matters. With so many ways to affect and be heard by large amounts of people it has never been easier for the public to influence progression and research.

### **Safety & Security**

With robotic technology becoming further integrated into our lives, people interact with an increasing number of data collecting devices on a daily basis. Despite efforts to make technology secure, every technology faces the risk of cyberattacks (Rehberger 2020, 1). A cyberattack in the form of a data breach can risk the privacy of citizens and often results in identity theft ("How Data" 2021). Robots can also be hacked giving the attacker control of the robotic device. This can be a risk to safety if the attacker uses the robot to perform harmful

acts. For example, if hacked, an autonomous vehicle could crash, a surgical robot could malfunction during surgery, and a military robot could become deadly in an unintended way. It is crucial to have a “well-rounded prevention, detection, and response program” for dealing with cyber attacks for any technology (Rehberger 2020, 1).

How Data Breaches Happen. (2021, January 13). Retrieved March 16, 2021, from <https://www.kaspersky.com/resource-center/definitions/data-breach>

Rehberger, J. (2020). *Cybersecurity Attacks – Red Team Strategies* (1st ed.). Packt Publishing.

### **Transparency & Explainability**

It is important for companies to maintain the explainability of their technologies and to be transparent with the public. Explainability refers to the ability to provide reasons for a decision or in the context of technology, being able to explain how and why a technology works a specific way (Coeckelbergh 2020, 2052). This is a critical aspect of holding people or “moral agents” responsible for a technology’s impact on the environment and individuals it interacts with (ibid.). Transparency builds on explainability as the process of disclosing information about the technology to users (Turilli 2009, 106). This is crucial for obtaining informed consent and allowing users to evaluate the ethics of a company's practices. Transparency must also balance information privacy; a company should not disclose information that sacrifices the information privacy of users (ibid.).

Turilli, M., Floridi, L. (2009) The ethics of information transparency. *Ethics Inf Technol* 11, 105–112. <https://doi-org.ezpxy-web-p-u01.wpi.edu/10.1007/s10676-009-9187-9>

Coeckelbergh, M. (2020). Artificial Intelligence, Responsibility Attribution, and a Relational Justification of Explainability. *Science and Engineering Ethics*, 26(4), 2051–2068. <https://doi.org/10.1007/s11948-019-00146-8>

## Robotic Domains:

### Surgical Robotics



#### Story:

Year 2075

Sarah has been noticing pain in her chest the past couple weeks and it has been getting more severe the last few days. She finally decides to go see a doctor and her doctor tells her that she has plaque in her arteries and is at high risk for a stroke. She will need a coronary artery bypass as soon as possible. The doctor informs her of a surgical robot at his hospital that is capable of completing a coronary artery bypass entirely by itself, without the need for a human surgeon. He says the robot is worth \$2 million and is more precise than humans.

Sarah is very nervous about the procedure because she has a rare pre-existing condition that puts her at higher risk for complications and she is unsure if she is willing to trust a robot to do the procedure. She brings up her concerns with the doctor and he assures her that the robot has successfully completed the operation many times. He also tells her that if she wants the procedure to be done by a human surgeon she will have to wait at least 2 months. The hospital has been hiring less human surgeons now that robots can do many of the common surgical procedures. Consequently, their schedules fill up far in advance and prioritize operations that cannot be done by surgical robots.

Since Sarah does not want to wait to get the operation done and her doctor has convinced her that robotic surgery is actually safer than human surgery, she agrees to schedule the surgery with a robot. She calls the hospital's Financial and Billing Assistance Center to make sure her insurance will cover the cost of the procedure. She is put on hold for about 30 minutes then a woman picks up the phone and says "Unfortunately robotic surgery is not covered by public insurance policies". Sarah had been diligently saving money for the last couple years so she could afford the out of pocket cost if absolutely necessary, but it does not seem right that such a common and vitally important operation would not be covered by insurance. She decides to call other hospitals to explore her options.

## **Introduction:**

Surgical robots are becoming increasingly advanced and common in the healthcare industry. These robotic systems can be controlled by surgeons' direct actions, automatic and programmed before the operation, or semi-automatic constraining the surgeons movements [6]. Surgical robots are especially useful for minimally invasive procedures where it can reduce patient recovery time and possibly increase accuracy and precision [7]. Surgical robots can also be helpful for neurological procedures that require very fine, delicate movements that are difficult for surgeons to perform without robotic assistance [7].

## **Themes:**

(Primary) Professional Responsibility, Transparency & Explainability, Fairness & Non-discrimination, Safety & Security, Accountability

(Secondary) Human Rights, Privacy

## **Ethical Questions:**

- Does Sarah fully understand the risks involved with robotic surgery? Has Sarah discussed the risks enough with her doctor to be able to give informed consent? [1,6,9]
  - a. “Family verbal or written informed consent should be obtained, with patient assent if appropriate, with emphasis on the innovative nature of the device or procedure” [1]
  - b. “Patients present with a wide variety of educational and cultural backgrounds, which should be considered during the informed consent discussion. Perhaps due to the aggressive marketing of robotic surgery or patients’ desire for the latest technology, patients generally seem enamored with robotic surgery.”[1]
- Why might the doctor be motivated to recommend robotic surgery over human surgery? [5,6]
  - a. “Hospital staff may try to persuade patients to accept the robotic procedure in order to pay off the costs of buying and installing the system” [5]
- Has the hospital unnecessarily spent money on expensive surgical robots to appear more “innovative” when human surgeons may be a safer and less expensive option? [1,3,6]
  - a. “But a common optimism bias among surgeons and institutions creates a tendency to overestimate the positive effects of the new.” [6]
- What would people who cannot afford robotic surgery do when there are no human surgeons available? [3]
  - a. “As the cost of new technologies is expected to be high and in various health care systems may not be covered or only partially covered by the public insurance, many patients may not be able to afford robotic treatment and the benefits of the new technology” [3]

- Does the robot have experience operating on people with Sarah’s pre-existing condition? How might a lack of training data for pre-existing conditions and minority groups create unintended bias in robotic surgery? [5]
  - a. “A robot might, for example, be subtly slower or a bit less precise given situations that were rare in its training set, and the effects of these small differences may be hard to detect on a case-by-case basis, while still contributing to biased outcomes when analyzed at the population/subpopulation level” [5]
- Will less human surgeons be entering the medical field when so many jobs are being taken over by surgical robots? [8,9]
  - a. “who cares if the surgeon is denied a chance to become excellent at surgery if the machine that replaced her provided a better outcome?” [9]
  - b. “ if the systems became more autonomous and allowed the surgeon to become deskilled, then professionalism and excellence would be diminished and with it the ethical value of the work done” [9]
- Who would be held accountable if there were complications in Sarah’s surgery— the hospital, the robot company, the doctor, the technician? [3,4,8]
  - a. “As in surgical practice, the grounds for liability with robotic surgery include damage to patients, causality, illegality and guilt. Nevertheless, litigation with the use of robotic surgery may be complex.” [3]
- Will people begin to lose trust in the healthcare industry if surgical robots are unreliable? [6,8,9]
  - a. “ surgical innovation can potentially cause increased mortality and morbidity compared to standard techniques. Surgery in itself is not benign and there are risks from infection, anesthesia and longer hospital stays. But there are also possible financial and psychological harms as well as loss of trust in the 4 medical professions.” [6]
- How will Sarah’s information and privacy be protected after the robot has access to all of her medical records? [8]
  - a. “Robotics research and use of robots in healthcare raise questions about which data are collected, how they are stored, who has access to them, who owns them, what happens to them, and so on.”[8]

**Resources:**

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## Distributed Robotic Systems



### Story:

Year 2050

On a winter morning, Tim wakes up to the smell of toast cooking in his *LifeBot* smart toaster. His *LifeBot* virtual AI assistant, Charlie, greets him: “Good Morning Tim! Today it is 35 degrees and cloudy. You have a meeting at 9am and there are currently seven parking spaces available outside your office building.” Tim drags himself out of bed and gets ready for work.

*LifeBot* is a massive tech company which rapidly gained popularity over the last 3 years for its vast line of connected IoT devices that can perform a multitude of everyday tasks. *LifeBot* has three major product lines for businesses, households, and smart cities. Tim lives in a *LifeBot* operated smart city and smart home. He loves how well his home devices integrate with the smart city.

Running late for his meeting, Tim rushes out to his self-driving car to head for work. The car is already running and has picked its destination for the closest available parking spot to the entrance of Tim’s work building. The car takes him on a different route to work today and he assumes it must be avoiding an accident or other traffic along the normal route. When Tim gets to the office, no one is at their desks. He goes to the break room and finds everyone watching the news and frantically checking their phones. “What’s going on?” he asks his co-worker. She replies, “*LifeBot* had a data breach this morning. I heard it only affected the business management devices but this could mean that our personal data was breached as well. Either way, we can’t do much work today until it all gets sorted out.” Realizing how much personal data *LifeBot* technology has collected on him, Tim’s stomach drops.

### Introduction:

Distributed robotic systems are systems of robots linked through a network, such as the web, for data sharing and cooperative learning and working [4]. Distributed robotic systems can be multi-robot systems in which self-organizing robot teams work in coordination to perform specific tasks [4]. These

systems can also include networked intelligence systems such as the smart city described in the story above. Smart cities can have a mixture of networked devices such as weather monitoring systems and robotic systems such as robotic police officers. With robots becoming increasingly advanced, smart cities will likely integrate more robotic technologies in the future.

Distributed robotic systems are becoming further integrated into society as the market for Internet of Things technology, such as Amazon's Alexa or Google Home, grows and Web speeds improve [4]. This is a popular field of research because there are many benefits to using a system of many robots working together. Multi-robot systems are more adaptable because they are not designed for one specific task. They are also more reliable because if one robot becomes damaged, the rest of the system remains intact. They are also very useful for large scale applications because they have a wider field of view. While an individual robot can only gather information from its immediate surroundings, robots that are part of a system can access information from its own surroundings as well as the surroundings of other robots in the system. An example of this is military microdrones which communicate with each other on intelligence gathering missions.

### **Themes:**

(Primary) Privacy, Safety & Security, Public interest, Government, Fairness & Non-discrimination

(Secondary) Identity, Transparency & Explainability

### **Ethical Questions:**

- Is Tim aware of what data *LifeBot* is collecting about him?
  - “Notice and consent—considered the cornerstone of data and privacy protection—are significantly weakened within smart city technologies and in data/urban science becoming an empty exercise or being entirely absent. Individuals interact with a number of smart city technologies on a daily basis, each of which is generating data about them.” [2]
- Is any personally identifiable information being collected on Tim? How is anonymity maintained? [2]
  - “One of the key strategies for ensuring individual privacy is anonymization, either through the use of pseudonyms, aggregation or other strategies. The generation of big data and new computational techniques, however, can make the re-identification of data relatively straightforward in many cases” [2]
- Could *LifeBot* be selling Tim's data for purposes such as custom advertising and has Tim consented to the use of his data in this way? [5]
  - “By loading the banner ad, a cookie is placed on the web user's computer. In this way, online advertising companies are also able to track (part of) a user's movements on the web.” [5]
- How does custom advertising limit free choice or shape the culture and values of society?
- Could the government get access to data collected from *LifeBot* technologies? Could mass

surveillance of the people by the government be a threat to democracy or civil liberties? [1]

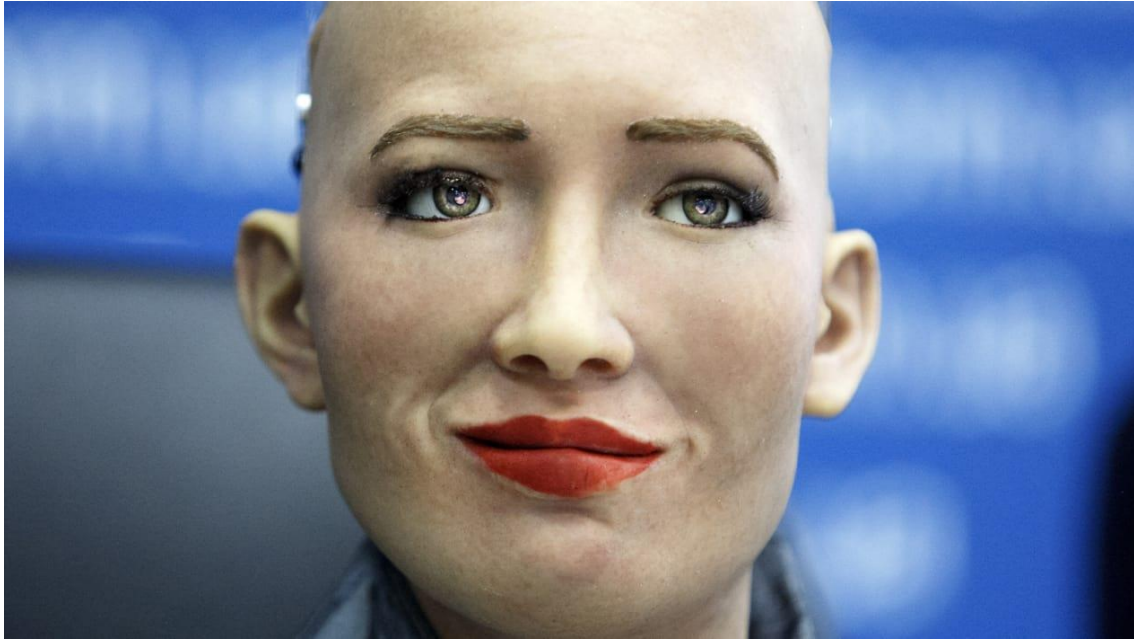
- “On the other hand, human rights organizations are legitimately concerned about mass surveillance as a threat to civil liberties. A corrupt government can get to know your every move, habit, medical problem, and other private detail.”[1]
- What laws should there be to protect Tim’s privacy and rights?
- How do smart technologies in cities and homes improve the quality of life for the citizens currently and how will they in the future? To what extent is it worth sacrificing personal data privacy for convenience? [3]
  - “People who live in smart cities or who are visiting smart cities have the immediate benefit of being connected to the governing body for information and services. The quality of their lives can be improved with better traffic management, waste removal, snow removal, and more.” [3]
- How could a data breach or cyber attack impact the people? How secure is the data being collected? [1,4]
  - “for instance, the increasing dependability of primary services from complex systems, and the unpredictability of robot team behavior.”[4]
  - “Some government systems are simply corrupt to the point they cannot guarantee decent protection of their citizens’ personal data.”[1]
- How does mass data collection lead to deindividualization when people are constantly grouped into categories based on their data? [5]
  - “When group profiles are used as a basis for decision-making and formulating policies, or if profiles somehow become public knowledge, the individuality of people is threatened. People will be judged and treated as group members rather than individuals.” [5]
- Smart cities are beginning to integrate roboticized police forces. What human biases are present in roboticized policing, considering that the machine learning algorithms used for profiling were trained using data from an already biased law enforcement system? [1]
  - “In 2016, a coalition of US civil rights organizations picked predictive policing apart with a joint statement describing the technology as “biased against communities of color.”[1]

**Resources:**

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## Humanoid Robot



[11]

### Story:

Year 2045

Jennifer has a daughter who is seven years old. Jennifer is busy at work, and she can not spare much time for her daughter. Jennifer's friend Ashley recently bought a humanoid robot to take care of her child. This robot is designed by a company that targets parents who can not look after their children during the daytime. Lots of parents chose to buy humanoid robots to take care of their children instead.

After one month, Ashley was so satisfied with the humanoid's overall performance on child care service that she suggested Jennifer purchase the same robot, so that she does not have to be concerned about her daughter's well-being while she is at work. Based on Ashley's shared experience, the robot performs outstanding communication skills and provides excellent entertainment services while caring for her child. She further emphasized that the childcare robot has identical features and external appearance to a human, which helped her child better communicate with the humanoid robot.

Nonetheless, Jennifer has her own thoughts. On one hand, she needs someone to help her take care of her daughter, and it seems like the robot's companionship could be beneficial for both the physical and mental health of her child. On the other hand, Jennifer has a lot of worries about those human-looking machines. In the end, she still decides to bring it home.

At first, Jennifer has difficulty introducing the robot to her daughter because she does not know whether she should introduce the robot as a friend or a machine. A robot's human-like appearance sometimes can be confusing, especially to a child whose cognition is still developing. Once Jennifer's daughter was crying at home about arguments with friends at school. The robot was not able to show

feelings or compassion, instead it just said some common phrases pre-programmed to comfort kids. However, after hearing those words, Jennifer's daughter became more upset because she felt that the robot did not understand her situation. After a few months, Jennifer found that her daughter was always giving other people orders because she got used to talking to robots, which influenced her social skills. Her friends at school stopped hanging out with her because of her authoritative behavior. Then, she started to imitate the robot's behavior, from speaking to facial expression, making Jennifer worried. Jennifer's daughter learned to hide her emotion and became not as expressive as other kids her age. Jennifer thinks this humanoid robot is gradually undermining her daughter's mental health. In the future, if her daughter has some emotional disorder such as alienation, depression, etc, who should take full responsibility for that?

### **Introduction:**

A Humanoid Robot is a robot whose body shape and face resemble the human appearance. Most humanoid robots can interact with humans. Building a robot that looks like a human has generated heated discussions on moral and ethical issues, as humanoid robots' appearance is controversial. This unique feature can make it easier for humans to build emotional connections compared to other robot types. The professional responsibility in this field is to think about the necessity and applications of anthropomorphization with the potential risks of co-existing with robots. Preventing discrimination between the human species and humanoid robots can also be a challenge we need to think about.

### **Themes:**

(Primary) Promotion of Human Values, Anthropomorphization, Fairness and Non-discrimination, Identity, Social meaning of Humanoid Robots,

(Secondary) Human Control of Technology, Human Right, Safety and Security, Accountability, Professional responsibility, Government

### **Ethical Questions:**

- Can people accept the external appearance of a humanoid robot? How will robot's human traits influence the way people treat them?[1][2]
  - "When things go wrong with robots in Sci-Fi, they almost always take human form. Beyond the "robots out of control" trope, there's the psychological factors that come to play as we can't decide how to treat them, or how they should treat us." [1]
- What do the children's social and moral relationships with a humanoid robot look like? How do children perceive humanoid robots?[3]
  - "The interview data showed that the majority of children believed that Robovie had mental states (e.g., was intelligent and had feelings) and was a social being (e.g., could be a friend, offer comfort, and be trusted with secrets)." [3]

- Should we introduce humanoid robots to young children? If so, would it affect the child's interaction with other people based on their lack of ability to differentiate between humanoids and human beings? How can machines affect children's behavior and interaction based on their age and cognition level?
  - “In terms of Robovie's moral standing, children believed that Robovie deserved fair treatment and should not be harmed psychologically but did not believe that Robovie was entitled to its own liberty (Robovie could be bought and sold) or civil rights (in terms of voting rights and deserving compensation for work performed).”[3]
- Since the humanoid robots only work for profit, will their involvement undermine society's trust?[4]
  - “Cooperation is a key feature of our species, essential for social life. And trust and generosity are crucial in differentiating successful groups from unsuccessful ones. If everyone pitches in and sacrifices in order to help the group, everyone should benefit. When this behavior breaks down, however, the very notion of a public good disappears, and everyone suffers. The fact that AI might meaningfully reduce our ability to work together is extremely concerning.”[4]
- Should we program humanoid robots to have emotion? If so, would they deserve to be treated humanely? Should they possess rights and accountabilities?[5]
  - “If we did want to build a robot with real sensations, how should we proceed? When I ask my students this question, they often respond with “Why would anyone want to do that?” That’s a good question that reflects an understanding that robots, as we usually think of them, don’t feel anything, and so can’t suffer. That’s why we think they’re ideal for jobs that would be dangerous to people, like fixing damaged nuclear facilities.”[5]
- How could humanoid robots make some humans believe that they do have feelings even if it is not true? What can be the potential impact that some people believe humanoid robots have feelings when they actually do not?
  - “The results revealed that the developed robot has a positive effect on the teacher's impression about reliability and sympathy.”[6]
- Can humanoid robots be moral without sensations? If not, how can people stay in control of the fast-developing complex artificial intelligence? How can people protect themselves against unintended consequences caused by humanoid robots? Who should take the responsibility if it happens?
  - “The conceptions of morality and creativity interplay with linguistic human beings instead of non-linguistic humanoid robots, as humanoid robots are indeed docile automata that cannot be responsible for their actions.”[7]

- Do people hold a humanoid robot morally accountable for the harm it causes? Who should take more responsibility if the humanoid robots cause harm?[8]
  - “Sixty-five percent of the participants attributed some level of moral accountability to Robovie. Statistically, participants held Robovie less accountable than they would a human, but more accountable than they would a vending machine.”[8]
- What considerations do we need to make when maintaining a society where humans coexist with humanoid robots? Should humanoid robots be fairly treated like humans?[10]
  - “Do robots have moral and legal rights – the right not to be tortured, the right to consent to sex (can you consent to your own programming)? As Jinks points out, if robots are indistinguishable from humans but have restrictions placed upon their behaviour and movement, “aren’t we legislating discrimination?””[10]

### Resources:

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## Companion Robot



[3]

### Story:

Year 2035

Due to the pressure of the aging society in Japan, companion robots became a popular trend, especially in elder care. Kazuki is a 70-year-old man who lives by himself. His children are worried about him since they live in different cities. To better take care of Kazuki, his children decide to buy a companion robot. This senior care robot's job mainly is to take care of older people, and if an emergency happens, it will report to the families and doctors. Also, communicating with companion robots might be able to decrease the risk of depression and dementia since it can help the care recipients to relax and maintain a good mood.

However, Kazuki is not that happy with this change. His children visit him less after having this robot as they assume that it will fulfill their father's every necessary need, including emotional and physical support. Furthermore, Kazuki feels an absence of privacy as the humanoid robot monitors him 24-7 even when he goes to the bathroom or takes a shower. Kazuki also feels he is monitored and imprisoned. For instance, the robot is programmed to peer around Kazuki, and his children can view his location as the robot updates his location by real-time streaming service. His children can even interfere with Kazuki's life by ordering the robot to encourage and guide him back to the designated area.

Moreover, Kazuki is not comfortable communicating with the robot because he does not feel any sincerity behind the robot's words, especially when it uses emotional expressions. The first reason is that he feels embarrassed talking to a machine, especially in front of other people. Kazuki complains to his children, 'Only kids talk and make friends with a doll.' Another reason is that he is aware that robots only mimic human behaviors and do not resonate with the meaning behind the words. Kazuki doubts

that the companion robots positively affect care recipients' mental health, as the commercial said. Because of the reduced visit from Kazuki's family and superficial communications provided by the companion robot, Kazuki feels more lonely than he did before he had this robot.

### **Introduction:**

A Companion Robot is a robot designed to provide companionship towards human beings, especially patients, children, or seniors. The formats of the companion robots are not all the same. Some look cute and imitate animals' appearances with fur, which can provide more emotional support. The care recipients can interact with them by touching them and talking to them. Some can only understand simple orders and connect with hospitals for healthcare services. Currently, the elder care robot is a companion robot that is primarily used in care homes, and, as such, it is seen as a solution to the needs of an aging society. However, there are uncertainties that to what extent companion robots can replace human caregivers with the consideration of potential harms.

### **Themes:**

(Primary) Human Right, Safety and Security, Human Control of Technology, Promotion of Human Values

(Secondary) Professional Responsibility, Anthropomorphization, Identity, Fairness and Non-discrimination, Accountability

### **Ethical Questions:**

- What are some social issues behind substituting a robot for human care or companionship?[4][8]
  - “This population problem is already very real in countries like Japan, where there will be an estimated shortage of 1 million caregivers by 2025. The U.S. is facing a similar dilemma — as the percentage of people aged 65 or older is expected to rise to roughly 26% by 2050.”[4]
- Can companion robots be physically and psychologically beneficial to care recipients in ways that are more effective than human caregivers?[1][3]
  - “Content analysis identified 3 key benefits of and 3 barriers to the use of PARO. Main benefits include: reducing negative emotion and behavioral symptoms, improving social engagement, and promoting positive mood and quality of care experience. Key barriers are: cost and workload, infection concerns, and stigma and ethical issues.”[1]
- How well are Companion Robots accepted by elderly people?[5]

- “The acceptance of care robots has so far been rather poor, despite the potential benefits they are meant to provide.”[5]
- When receiving care from companion robots, would care recipients receive less care from humans? Would care recipients face psychological effects from interacting more with humanoid robots than humans?[2][5]
  - “The worry is that the use of robots in elder care for tasks such as lifting, carrying, or even cleaning, might result in a reduction in the amount of human social contact that an elderly person experiences.”[2]
- How will the Companion Robot affect human rights, especially privacy?[2]
  - “Our second concern is that there is a risk that monitoring could infringe on the right to privacy. The privacy of people in general should be respected”[2]
- Will people feel embarrassed and uncomfortable when interacting with companion robots, since they are talking to a machine? How could we prevent it?[1][6]
  - “Some cases described individuals as appearing embarrassed about interacting with PARO especially in front of others, and this might have influenced their reactions.”[1]
- Would people feel they lose control since their life is getting ‘arranged’ by care robots? Will people feel they lose their dignity and independence? Which one is better compared to taken care of by human caregivers?
  - “Such robots could make elderly people feel that they had even less control over their lives than when they are dependent on human nursing care.”[2]
- Is it deception to have emotional connections with companion robots? Can companion robots give true caring if emotional connections are based on deceptions?[2][6]
  - “For an individual to benefit significantly from ownership of a robot pet they must systematically delude themselves regarding the real nature of their relation with the animal.”[2]
- Who should control Companion Robots? Doctors, families, or users?[2]
  - “Robot technology that was under the control of an elderly person could empower them and increase their independence.”[2]

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## Biomechatronics:



### Story:

Year 2025

Jacob's best friend Noah is an amputee that lost his left arm in an accident. Noah was having a hard time adjusting to normal life without his arm and basic prosthetics didn't have enough control for him to comfortably complete everyday tasks like driving and cooking. In an effort to help eliminate his disability and be able to function like he did before the accident Noah got a biomechatronic left arm surgically implanted. The implant responds to his thoughts as if it were the arm he was born with, but comes with the added benefits of being stronger and having different attachments and tools, such as a peeler and knife to help with cooking, various tools like screwdrivers and wrenches, it even replaces his cell phone allowing him to send messages and take calls. In addition to this the arm keeps track of Noah's health and notifies him when to see a doctor. Noah and Jacob now joke about how Noah has become a real life cyborg.

Out of curiosity of his friends' new arm, Jacob decides to do some research on biomechatronics to learn more about the field. In his research he finds there are many different types of biomechatronics, but they serve two main purposes, to eliminate disability and to improve functions of the human body. He had no idea that people without a medical need for biomechatronics could still get implants. At first he's taken aback, why would people put robotic parts into their body if they don't need it, but then he remembered all of the features of Noah's new arm. It did much more than his arm ever could. And so he started looking at biomechatronics that might interest him.

Fast Forward 10 Years

The year is 2035, Jacob and Noah are getting lunch at a diner. Once they finished their meals and paid they made their way to the exit. Before Noah can reach for the door Jason holds out his arm as his hand extends forward from the wrist revealing his newest addition to his body's biomechatronics.

"Another one? How many do you need to get before you're not human?" Noah asks concerned. Ever since Noah got his new arm Jacob has been getting more biomechatronics. Jacob now has an implant that indicates true north, a visual implant to refine his sight, and a RFID chip. None are visible, but Noah worries his friend will never be satisfied with the implants he gets and will always want more.

Jacob is aware of Noah's concern, but he doesn't see a problem, what's wrong with improving one's senses and functions to live a better life. Isn't that what the technology was created for? He replies to Noah nonselauntly walking out the diner door, "If being a cyborg is wrong, I don't want to be right."

### **Introduction:**

Biomechatronics is the integration of mechanical and electrical technology with biological organisms in an effort to improve and/or expand biological functions. The growing field currently has two main objectives: to use robotics in order to eliminate a disability and to expand the capabilities of the human body. Biomechatronics designed to eliminate disabilities include devices to help people who are paralysed or have cerebral palsy be able to move around, as well as high grade prosthetics. On the other hand biomechatronics have been developed that allow people to see in multiple spectrums, detect atmospheric pressure, and even gauge radiation levels.

### **Themes:**

Primary: Identity, Human Rights, Human Control of Technology, Fairness and Non-discrimination, Government

Secondary: Accountability, Safety and Security, Professional Responsibility, Transparency/ Explainability

### **Ethical Questions:**

1. Will the government have to regulate biomechatronics like the FDA regulates food and drugs?  
[4] [15]
  - a. "In 2016 together with electronic civil rights and civil liberties researcher and activist Rich MacKinnon, a list of Cyborg Civil Rights were proposed at SXSW. The rights exposed the redefinition and defence of cyborg civil liberties and the sanctity of cyborg bodies. It also foresaw a battle for the ownership, licensing, and control of augmented, alternative, and synthetic anatomies; the communication, data and telemetry produced by them; and the very definition of what it means to be human." [4]
  - b. "Next week," Herr said, "I'm going to present to the Centers for Medicare & Medicaid Services, and I'm going to try to convince CMS to grant the appropriate code language and pricing so that this technology can be made available to the patients who need it." [15]
2. Should Noah's new arm be covered by insurance?
  - a. "The BiOM is one of the costlier prosthetics on the market – until January of this year insurance companies reimbursed physicians anywhere from \$50,000 to \$150,000 for the devices, according to BiOM. Although the device is covered by the U.S. Defense Dept., the Veterans Affairs Dept., and various private worker's compensation plans, the device

remains in reimbursement limbo at the Centers for Medicare & Medicaid Services (CMS).” [15]

3. Is there such a thing as going ‘too far’ with a biomechatronic implant? [22]
  - a. “I feel like a lot of robotics is developing systems because we can, not because we should. With the biomechatronics, it’s a great application because we are satisfying that interest and that need to build these systems, but it’s definitely for a good purpose, to end disability.” [22]
4. As more people get biomecatronic implants could a new form of discrimination appear? [24]
  - a. “After a long battle with the UK authorities, Harbisson's passport now carries a photo of him wearing his eyeborg, making him the world's first government-recognised cyborg.” [24]
5. How will Noah having biomechatronics affect his opportunities? For example, will he be allowed to play competitive sports?
  - a. “Herr is in no doubt that this is where the technology is heading and his ambitions for it are huge. He says: "I envisage a world in which the technology is so advanced and the human/machine interaction so profound that we can rid the world of disability... and that's the goal: an end to disability." [10]
6. Would having many biomechatronic implants make Jacob a different type of human or even another species? [10] [18] [23]
  - a. “All of these advances derive, claims Herr, from a concentrated effort to understand the human body better and to emulate it. He says: "Building a bionic limb that has the profound versatility of the human limb is incredibly hard. Right now when you open up your closet, you see lots of shoes. When I open up my closet, I see lots of legs. I have a leg for running, I have a leg for climbing – I have about eight pairs. It's a challenge to build all that capability into a single limb. The human leg is so adaptable and versatile.” [10]
  - b. “Pau Prats is a cyborg-artist from Barcelona, and he can perceive ultraviolet radiation. What initially began as basic research for his final year of high school, has become an artistic journey into the frontiers of future human evolution. The 18 year old Catalan is a member of Transpecies Society, an interdisciplinary collective and social project that explores new senses and organs while advocating for non-human identities. It is through their guidance that Prats became a cyborg.” [18]
7. How will biomechatronics change how we interact with technology? [3] [8]



- a. “Unfortunately, technological progress means my chip is already relatively behind the current technology and it will take a surgical procedure to upgrade it, albeit minor.” [3]
  - b. “UA medical student Ben Conner is part of a team that studies the use of robotic exoskeletons. Kids with the disorder wear a wireless control system around their waists and the exoskeleton works with muscles in the legs to propel the body forward and create a more normal walking pattern.” [8]
8. Should biomechatronics be something that everyone learns about? [17]
- a. “Biomechatronics offers many opportunities for our students at Markham Woods that will appeal to many of our families. Because Biomechatronics combines biology, mechanics, and electronics, it gives us a way to provide students with skills and knowledge that can be used many different ways.” [17]

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**Industrial Robots**



**Story:**

Year 2030

Sam is working as a cigar roller in Florida, A job that she has had for the past few years and is good at, though these skills are not easily directly transferable to another job. In the past, Torcedors (cigar rollers), were predominantly female, and this has stayed true to this day, as most of Sam's coworkers are also female. Up until recently, hand rolled cigars were revered for the high level of quality they exhibited, however, as automation becomes increasingly adept at achieving the same results, the value of hand rolling lessens to the point where many Torcedors working with Sam begin being laid off, and their work has been automated.

Sam notices that, even considering the smaller number to begin with, her male coworkers have been replaced far less frequently than her female coworkers, on top of the fact that most of the non cigar-rolling jobs at her workplace already are male occupied. After a year, she ends up being laid off as well, alongside a number of coworkers. Many of Torcedors, Sam included, are part of a group chat that they continue to use even though they are no longer coworkers, and a number of them express frustration after losing their job.

"How is this even legal? It's ridiculous..."

"Not only legal but it might as well be encouraged. Have you even seen how much automation is incentivized?"

"Well that's what happens when legislation is decades behind. God forbid the government is proactive with protecting our livelihood"

"I guess we all just need to get robot handling jobs instead, since we 'unskilled laborers' are all capable of doing so"

"Well that worked just fine for Jim and Victor"

"Yeah I wonder why, lol"

Sam's feelings mirror that of her coworkers, and she often finds she needs to ignore the chat to avoid getting angry when the topic is brought up. Knowing that the difficulty she, as well as others, are going through at the moment is avoidable only makes it more annoying, and she finds herself wishing that she were able to help prevent this from happening to others. Though she knows it will be difficult, she decides that she would like to campaign for more worker friendly policies in the face of automation.

### **Introduction:**

Industrial Robots are, in general, any type of robot that is used in manufacturing. Their form is typically suited to exactly the kind of motions and workload they are expected to handle in regular operation. These robots are typically employed to do tasks that have a high degree of repeatability or 'routineness'[1], such as picking and placing objects, or aiding in the assembly of parts. Industrial robots have the potential to increase efficiency and quality, while on the downside 'taking' jobs that would otherwise go to people. While industrial robots do displace work, they also create work in the form of

designing, working with, or maintaining these robots, which can help lessen the negative impact of job displacement.

**Themes:** Government, Fairness/Nondiscrimination, Human Rights, Safety/Security, Identity

**Ethical Questions:**

- Will automation on its own be able to counterbalance the amount of jobs that it displaces with an equal, or greater number of new jobs?[5][6]
  - “In the 19th century, as automation of some tasks was ongoing, other technological developments generated employment opportunities in new occupations. These included jobs for line workers, engineers, machinists, repairmen, conductors, managers, and financiers”[6]
- If automation will not result in more jobs, will there be a feasible way to implement policy, or some other incentives to ensure that there is not a net loss in jobs?
  - “These interventions might include removing incentives for excessive automation (such as the preferential treatment of capital equipment) and implementing new policies designed to rebalance the direction of technological change”[6]
- For workers displaced by automation who are also able to get one of the new jobs that is afforded or created by automation, will this process be quick enough that they would be able to get right back to work, or would they still be displaced for a considerable amount of time?
- In the time period between the automation being implemented, and the additional jobs that arise from that automation, should the workers that have been displaced have some sort of financial compensation to ensure they stay on their feet until they are able to get one of the new jobs?
  - This, along with many of the following questions has the potential to be solved with the right kind of automation policy by the government in order to ensure those displaced by automation are not too adversely affected.
    - i. Alternatively, should employers be incentivized to provide job training to workers who are going to be displaced? For example, someone who will lose their job to a technology is able to receive job training to be able to maintain that technology, and therefore is able to keep their job at that company.
    - ii. As we get more and more capable of automating complex tasks that were previously considered unfit to be done by robots, and the realm of jobs that are untouched by automation dwindles, would something like a universal basic income be necessary? Would an idealistic financial world even be feasible?

- iii. For people who are privileged enough to make more money than they need to, should there be a societal obligation to accept a lower salary in order to allow for the possibility of more workers, ideally those who have been displaced by industrial robots?
- Automation, like in the case of the story, can disproportionately displace groups that already face disadvantages in the workplace[1]. How will we ensure that, for all people who are displaced by automation, we are able to provide an equal opportunity for work elsewhere, as well as ensure that already disadvantaged groups aren't being displaced more rapidly than others?
  - Some jobs with higher numbers of female workers are "more insulated from displacement by technology"[1], meaning there is the potential for this to naturally offset disproportionate displacement elsewhere.
- In some cases, the work that a human does might be very harsh on their body, or have other severe consequences to their health. If this process is able to be automated, is it better that they have the opportunity to work a job that will harm them, or is it better that they are put out of work, and are able to better maintain their health?

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**Military Robots**



## **Story:**

Year 2040

Darius works as a government researcher in Maryland, specializing in military robotics. While Darius used to have more control over what research he was able to conduct, his higher ups have been consistently pushing him more towards the inevitability of looking into robotic solutions that might be used in battle. While Darius is made uncomfortable by the idea, it would be very difficult for him to find another job at the moment, and he thinks that he may be able to either dissuade his superiors from pushing him in this direction, or be able to come up with some solution that is potentially.

Understanding that Darius is concerned about the direction of his work, one of his higher ups attempts to help convince him that this work is not inherently bad: "Automation could even help prevent loss of life, a robotic system will be far less prone to error; When soldiers are stressed or tired, they are more likely to miss, incorrectly evaluate a situation, or even friendly fire. For reasons like these, a robotic solution may be capable of reducing the amount of casualties, while at the same time potentially being more effective." While Darius understands that reducing the number of casualties is a good thing, and can even further prevent loss of life by lowering the potential for further insurgents to enter the fight, he is still against working on an automated system that can take someone's life.

Previously Darius had only worked on automated systems that either prevented loss of life, such as bomb defusal robots, or were simply used as tools by soldiers, such as recon robots. His increasing discomfort in straying any further from these applications leaves him with a difficult decision to make: He either continues to work, and aids in creating something he does not want to exist, or he quits his job and is forced to find work elsewhere, which would put him in a dangerous position with the current economy. Additionally, Darius could go one step further and actively protest against the creation of such automated implements, which would most likely result in him being fired, but would also make it even more difficult for him to get a new job, as he has seen how difficult it is for whistleblowers and the like to do just that.

## **Introduction:**

Military robots are autonomous platforms used by the military for a variety of roles. Currently, military robots take non-lethal roles, such as disposing of live explosives or being used as reconnaissance tools by soldiers. Automated defense systems such as the Samsung SGR-1 do now exist though, and are capable of autonomously firing a weapon, though the SGR-1 in particular is stationary. Aerial drones are currently used as well, though they do not operate entirely autonomously. Some missile systems for example also have an autonomous portion of their usage, i.e. a missile package that is capable of splitting up and seeking out individual targets. [2][3]

**Themes:** Government, Safety and Security, Fairness/Nondiscrimination, Identity, Anthropomorphization

## **Ethical Questions:**

1. Should an autonomous system have the ability to take a human life without any human intervention? If so, how might this affect legal and ethical concerns in other domains or robotics where loss of life is accidental? Additionally, to what degree of certainty must the system reach before it is allowed to 'take the shot', or whatever it may be?
  - a. One possible opinion is that autonomous weaponry of this type should not exist whatsoever, and this opinion has been urged upon the UN[11]
2. Military equipment that is already in use, such as a land mine[2], has the potential to kill without human intervention, and it has no knowledge of who triggers it. It can be argued that the land mine has some form of agency, do we treat robots the same way? How can it be acceptable for a land mine to kill someone, but not acceptable for a robot to?
  - a. "However, in general, traditional weapons have a very low autonomous power compared to the new generation of military robots." [2]
3. If the actions of the robot result in a wrongful death, who is responsible for this? If this responsibility is shared, how much is each associated party responsible?[2][6][9]
  - a. Responsibility for cases such as this can be defined as a 'chain of responsibility', wherein any member associated with the decision that lead to the incident holds some amount of responsibility. Politicians may be responsible at a higher level, military commanders at a level below that, soldiers at a level lower still, and the robot itself at the lowest level.[2]
4. These robots will need to use what data they can gather from the environment in order to make decisions, including who it is they are attacking. Biases, particularly racial biases or others based on physical appearance, are already common, how much would this affect these robots and their decisions?
  - a. Facial recognition can become increasingly inaccurate when identifying people of specific minorities[21]. Mistakes that come from such an inaccuracy could potentially involve the loss of life of a completely unrelated party.
5. The ease of use of these robotic systems may make it even easier to carry out terror attacks. Should governments ensure that these systems do not become accessible to independent individuals and groups? [4]
6. It is possible that a robot of this manner may be produced with some vulnerability in programming, and is then able to be hacked by someone. If there is loss of life related to this incident, is it the fault of the manufacturer? [4]
7. Does the lack of human error[19] justify the use of automated soldiers, if they prove to be better at preventing the deaths of noncombatants?

- a. Precision can be an important factor when it comes to war; “needlessly harming innocents can turn the populace against the counterinsurgency”[22], reducing these needless casualties can in turn prevent further deaths in the future.

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## Domestic Robots



### Story:

Year 2070

For the past three years Marissa's family has been the proud owners of a HouseMaster+ robot, Billy. This household robot won't only clean your house but also orders groceries, cooks, and does your scheduling, everything to help make your home life smooth and relaxing. Billy made Marissa's homelife much smoother, helping to prepare meals, taking care of the kids, and even suggested the best Christmas presents; he became part of the family.

The big story on the news today is that the company that produces the HouseMaster series robots, BetterLyfe, has been storing all the information the HouseMaster robots have been collecting in order to better market items and services from other BetterLyfe franchises to the robots' owners.

The public seems to have two reactions: outrage at that the company collected and used the customers private information for monetary gain, or others believe that as long as the information wasn't distributed to other companies and organizations the breach of privacy was somewhat minor. Seeing this unfold Marissa's family doesn't know how to react, but they don't like the idea of being monitored. For now they shut down Billy until they make a decision. Her 2 year old, having spent most of their life playing and bonding with Billy, cries as the robot is placed in the garage lifeless.

The coming week is filled with unforeseen obstacles for Marissa's family. Marissa herself is noticing how little time there is in the day having to cook, clean, and keep track of everything alone. She is only barely able to finish the kid's lunches before school the first few days, and is late to a meeting because she lost track of time cleaning the house. Needless to say it seems Marissa and her family have grown dependent on Billy over the last few years. The family now goes forward trying to decide if they will continue to use Billy, or shop around for other similar domestic robots on the market.

### Introduction:

Domestic, or household, robots are autonomous robots used to make homelife run smoother by completing chores and other mundane tasks. Current domestic robots, like Roombas, are specialized to complete a specific task and are confined by factors like movement, size, and the current complexity of automated technology. As the field develops we will likely start to see more domestic robots like Honda's Asimo robot, a humanoid generalized robot that can interact with owners as well as complete almost any household chore.

**Themes:**

Primary: Accountability, Safety and Security

Secondary: Transparency/ Explainability, Anthropomorphization

**Ethical Questions:**

1. What are the moral implications of the privacy breach committed by BetterLyfe? [1] [6]
  - a. "The need for such considerations is clear: future robots in the home could introduce new or amplify existing security and privacy risks for homeowners and other occupants. In many cases it may not be obvious how to overcome these security and privacy risks." [1]
  - b. "We may not know much about how domestic robots of the future will be designed, but one thing is certain: security, safety, and privacy will not be thrown in as afterthoughts." [6]
2. Will people form emotional connections with domestic robots like Marrison's youngest child? [5] [8]
  - a. "The acceptability of robotic devices in home settings... does not depend only on the practical benefits they can provide, but on complex relationships between the cognitive, affective and emotional components of people's images of robots" [5]
  - b. "We propose that users will perceive domestic robots as a new kind of entity." [8]
3. What will happen as humans become increasingly reliant on robots to do what we consider to be easy and essential tasks?
  - a. "Many Americans are not equipped to earn their living in a future society where all the routine tasks are automated. That's going to be a big, big problem. But it is ultimately solvable by raising our educational standards." [14]
4. How will our privacy be affected as domestic robots become more complex? [4]
  - a. "The idea of a smart watch that lets you keep an eye on your children might sound like something a security-conscious parent would like: a smart watch that can be hacked to

track children, listen in on their surroundings, and even fool them into thinking a call is coming from their parents is the stuff of nightmares.” [4]

5. If a domestic robot like Billy were to malfunction and injure someone, who would be held responsible? [13]
  - a. “Such claims may arise from tort law or from special laws like road traffic acts, product liability regulation, or anti-discrimination laws, if the AI application derives discriminatory consequences from the data it uses. In addition, liability can of course also be the result of the contractual relations between the injured party and one of the other parties involved.” [13]
6. Should domestic robots ever be allowed to care for children unsupervised or otherwise? [11] [12]
  - a. “Robot-Assisted Therapy (RAT) has successfully been used to improve social skills in children with autism spectrum disorders (ASD) through remote control of the robot in so-called Wizard of Oz (WoZ) paradigms.” [11]
  - b. “...it has become increasingly apparent that social and interactive skills are necessary requirements in many application areas and contexts where robots need to interact and collaborate with other robots or humans.” [12]
7. How will domestic robots change how we interact with and control technology? [8]
  - a. “The TPB model points to the importance of perceived behavioral control in forming opinions about technology such as users believing they can control when and how technology operates, how adopting such a technology affect their social status, and all other factors of concern. TAM narrows these criteria and places emphasis on the perceived ease of use.” [8]

Want to ask a question about net neutrality

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