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**The attainability and repercussions
of making gendered and genderless
robots**

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Abstract

When robots are becoming increasingly important in society, it's important to investigate each design choice we make about them intensively. And since gender plays such a large role in human society, this is certainly an aspect of a robot's design that we can't disregard. However, it appears that the gender of some social agents is already being chosen based on gender stereotypes. This thesis investigates the issues in both human and robot gender with the help of Simone de Beauvoir's *The Second Sex*, as well as recent literature on how robots of different genders are perceived. Additionally, it discusses the feasibility of genderless robots, concluding that due to many factors, it may be very challenging to make a robot that is perceived as genderless. Finally, it proposes some ways of designing robot gender in a way that is less harmful and that could potentially lead to progress in society's perception of gender.

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Chapter 1

Introduction

Imagine this: it's the year 2050 and you're going to the store to buy a robot. When you walk in, one of them catches your attention. In cursive pink lettering, the box reads *MaidMachine 3000*, and inside is a female-looking robot with a short dress and red lipstick. The other text on the box describes not only her cleaning skills but also her warm and kind personality. You're not sure if this is what you were looking for, so you decide to browse a little further. You have a look at the next box over. The *MaidMachine 3000X*. When you look closer at it, you realize that it's the same robot, except she is wearing a lingerie set instead of a dress. Wanting to look for something else, you wander over to the home security section of the store. Here, you find an array of masculine and muscular robots with frowns on their faces. The *SecurityStud 3000*.

Maybe we don't need to look this far into the future to find the impacts of gender stereotyping and inequality in the field of AI. After all, all the most used virtual assistants make use of female voices: *Siri*, *Alexa*, and *Cortana*. Some have worried that this might affect the way we interact with other people; if we are used to commandeering an entity with a female voice, what might this do to our other social interactions[1]? AI is starting to have a more and more prominent role in our day-to-day lives: not only virtual assistants, but also service robots in restaurants and hotels, social robots used in health- and social care, and so on. Because of this, the sale of robots has been increasing drastically and there is no sign of this stopping in the near future[2]. In this thesis, I want to examine what happens when we gender the robots that we interact with; how do we do it, why do we do it, and what effect does it have?

In section 2 I will describe what types of AI and robots the thesis is discussing, and how these agents are given a gender by the designers that make them. It is important to understand what is being discussed before delving deeper into the topic.

Then, I will introduce Simone de Beauvoir's writing on gender that she re-

leased in her book *The Second Sex*[3], and how this may apply to robotics. Her book explores the theme of the woman as the Other, which I believe applies to robots that are designed to be female in many ways. I will take examples from research regarding this topic and relate this to de Beauvoir's writing. Presently there is a lot of research regarding the effects of a robot's gender on humans, but not quite as much literature that delves into what these differences might mean for both the interaction between humans and robots as well as the way humans interact among themselves. This will be the core of this thesis, as this will be where I outline what the problem is about how robot gender is currently being designed and how this may be perpetuating preexisting negative social dynamics that exist in humans. I will also briefly explore identities that exist outside of the gender binary, and why it may be important to take these into account when designing a robot or virtual assistant. After this, I will explore the topic of genderless robots, and explore why it may prove to be very difficult to make something like that, also making use of the topics discussed in *The Second Sex* in my explanation.

Last but not least, I will propose ways to improve the way we design robot gender. First, I will explain how robots of each gender could be spread across different sectors in order to make a difference in the way people see gender. Additionally, I will propose different ways of "non-binary" robots; robots that are not male or female. This will both avoid reinforcing harmful gender stereotypes and also help normalize non-binary gender identities.

Chapter 2

Background

To fully understand and delve into the topic of robot gender and what issues it brings with it, I will first introduce a few core concepts and give background information on them. First I will briefly introduce the topic of robotics and the types of robots that are relevant to my thesis, and then I will narrow it down to some more specific topics.

2.1 Robotics

As robotics is a rather large field that different people might define in different ways, it may be helpful to start by outlining what “robotics” will be referring to henceforth in this thesis. While the term “robotics” formally concerns itself with anything that can be considered a robot, which is any machine that can execute actions automatically, not every type of robot is relevant here. There are all sorts of robots that are built for applications in fields like construction and medicine, and even things like nanobots, but for the purposes of this thesis, we’ll have to leave these types of robots out of our consideration. Robots that are used as practical tools rather than social tools or companions will be left outside of the scope of this thesis.

The robots that are of interest here are ones that humans interact with and that are usually used to provide companionship or another type of service to people. These types of robots are usually humanoid (this could mean that they have a human shape, human voice, play a human role, etc.) but can also take a shape reminiscent of an animal[4]. The reason for which we will be limiting ourselves to this subset of robots is that in this thesis the interaction between robotics and societal phenomena will be discussed. While it might be interesting to discuss the indirect effects of the design of robots that are used as tools in society, in the interest of keeping the scope feasible this will be left out of consideration.

Some of the social agents that will be discussed in this thesis will also fall outside of most people’s conception of what is considered a robot, for instance,

some of the research used concerns the use of AI assistants or companions that are interacted with through the use of audio, like Apple's *Siri* virtual assistant. While this is not strictly considered a robot, as it is technically not a machine as much as it is a piece of software that runs on a smartphone, we will still consider such AI that uses only audio at times, as it adds to the discussion about gendered AI in day-to-day life.

2.2 Human-robot interaction

This more narrow subsection of robotics brings us to the field of human-robot interaction, which studies interactions between humans and robots. Robots are used in numerous contexts to aid and accompany people during their everyday lives, take for instance a self-driving car or a virtual assistant on a cellphone. Applications in the service sector are also becoming increasingly more common, with robots taking on the roles of servers in restaurants and room-service clerks in hotels.

Social robots are also often used in more specialized medical contexts like elderly care and companionship[5] or helping people with autism understand social cues[6]. Implementing robotics in the medical field, specifically in applications that concern social care, may turn out to be very beneficial for many reasons. In recent years it has become more and more clear that there are oftentimes too few people working in the social care field for the amount of demand for this kind of care[7]. Work in this field is also very demanding and causes more stress for workers than comparable occupations[8]. Both of these problems can be aided, or even solved, by the involvement of robotics. By taking over part of the workload, robotics could alleviate some of the pressure that is on social care workers. Since it may be cheaper to produce robots than to educate someone up to the point that they are competent enough to work in the industry, robotics could also make it a lot easier to meet the demand for social work.

When designing a robot for interaction with humans, there are of course a great number of things to keep into account. Every aspect of the robot that is perceived by a person can be assumed to have some sort of an effect of the person, so the design of each of these things must be very deliberate. For instance, if a robot is designed to be much taller than the average person, this might make people uncomfortable. This would be highly undesirable for a social robot, and thus this has to be considered when designing one.

2.2.1 Gender in humans and robots

To initiate the conversation about gender in robotics, it may be important to establish why this is an important topic to think about and discuss. It is undeniable that gender plays a very large role in our society. This ranges

from the systemic impact of gender to the day-to-day interpersonal impact of gender, such as the way it impacts what personality traits we infer about a person when we first meet them[9].

It is also a fact that humans have a big tendency to anthropomorphize, meaning that we, often involuntarily and subconsciously, assign human characteristics to things that are inanimate or otherwise not human[10]. This tendency to anthropomorphize is also very much present when we interact with a robot[11], especially since robots are often *designed* with human features and with the intention to evoke human emotions. Thus, we can infer that if something like gender plays such a big role in how people perceive each other, of course, this must be taken into consideration when designing a robot. So far, there has been a wide range of design decisions that people have taken to make their robots appear as a certain gender. An example of a visual indicator that can be used to gender a robot is its waist-to-hip ratio[12]. But there are also things aside from visuals that may make a robot appear as a certain gender to its user, such as its voice[13], its given name[14] or its behavior.

Now that we know more about robots and the way they are gendered, we can delve into the issues that this gender assignment brings with it. The next chapter will discuss the treatment of women in society and what issues arise here, as well as how this is reflected in robots. The gender of a robot can have many repercussions for its interaction with human users, which will be discussed in section 3.2. Specifically, the many ways in which a robot can appear as either gender also have effects on the feasibility of making a robot that appears genderless. The causes and effects of that will also be discussed in section 3.4.

Chapter 3

The effects of (robot) gender

As we have learned, robots are like humans in several ways. They are often designed to replace or supplement humans in several workplaces. Social robots are designed not only to interact with humans but also often to look like humans, leading to them having many human features. This means that in many ways, we treat social robots the same way we do humans; we talk to them, listen to them, and interact with them similarly to the way we do with other humans. Likewise, the ways we interact with social robots may also impact the way we treat other humans. In this chapter, I will explore in what ways the gender dynamics among humans can also be seen when we interact with robots.

3.1 The Second Sex

Feminism has always been an important topic in philosophical anthropology, and one that is intertwined with the existentialist movement, as both of these movements concern themselves with the freedoms one should be able to experience in life. One who has read about existentialism may remember Simone de Beauvoir from this movement; her partner Jean-Paul Sartre was one of the leading voices in this movement, and while he was rather extreme in the notion that everyone has complete control over their own lives and must take responsibility accordingly, de Beauvoir brought some nuance into the frame when it came to women and sexism. In the context of existentialism, it was her point of view that while everyone must take responsibility for the freedoms they possess, women most certainly have fewer of these freedoms than men. However, not all of her writing concerning sexism was linked to the existentialist movement.

In her book *Le Deuxieme Sexe*, or *The Second Sex*, she explains how women are seen by society, in relation to men. Although the entirety of her writing in this book is highly interesting, for the purposes of this thesis I will summarize what de Beauvoir says about what exactly she means by “the second

sex”, as this is the part that is relevant to this thesis. After summarizing what she says about the relevant subjects, I will explain how this is relevant to the subject at hand, namely gender in the field of robotics.

Like the title might suggest, de Beauvoir argues that women are seen as secondary to men, or as she often puts it, they are seen as the Other. Otherization is a term that is often used when an individual or a group of people are excluded from the general population and seen as different from the norm. While women comprise roughly half of the population of humans, de Beauvoir still explains compellingly how they are otherized. Something that is often part of Otherization is that the otherized group is perceived to have less autonomy. This is certainly the case for the woman. An example named by de Beauvoir is marriage, in which the woman is given from one man to another, from father to husband. In primitive societies, marriage to a woman was often included in a trade deal. Nowadays it is not as extreme, but many ceremonies still include the bride’s father walking her to her soon-to-be husband. Aside from *how* she is otherized, Simone de Beauvoir also tries to establish the reasons as to *why* the woman is otherized.

Initially, de Beauvoir looks to biology for an explanation. After all, when one thing is treated as secondary to the other, the obvious explanation may be that the latter is physically hierarchically more important than the other. First, she explains what a female is in a biological sense, and concludes that this is not always as clear-cut as it may seem. Many organisms reproduce asexually, and several species of animals do not require both sexes to participate in reproduction to produce offspring, take for example the unfertilized eggs of the honey bee that produce the male(drone) bees. She also discusses that in many plants, one individual can possess the means to produce both gametes to reproduce, meaning the necessity of two different gametes does not necessarily imply the existence of two different genders. Thus, she says, “the division of a species into male and female is simply an irreducible fact or observation.”(page 35)

She then moves on to explain gametes in humans, thus: sperm cells and egg cells. In the past, many biologists have considered one as ”superior” to the other or stated that one plays the more “active” role(usually the gamete seen as more active was the sperm cell, which by some was even said to contain the entire person which would then grow and be nurtured by the egg cell). She concludes that in the end, the two gametes(the egg and sperm cells) are similar to each other in that they both contain the same amount of chromosomes, and they both contribute equally to the process of reproduction. She studies many parts of human biology, analyzing the differences between men and women at every step. However, when looking at each aspect of the human body, there is still hardly anything to be found that could make a woman intrinsically Other.

All that is to say that biology is not sufficient to explain why the woman is seen as the Other. In the context of this thesis, the gametes are indeed not what makes a woman a woman and a man a man. In the context of robotics, these sexual characteristics are even more so irrelevant to gender, as the gender of a robot is purely based on what can be perceived and not what parts it has on the inside.

After dismissing biology as an appropriate reason for the Otherization of women, she looks to history for an explanation, and this is where she finds it. She states that if men and women have always lived among each other, it is not strange that there has been some sort of tension as to which gender is dominant and which is submissive. The only reason she sees for this desire for a power dynamic to come to life is if one of the groups has some sort of privilege that the other does not. She says that, while it is unclear whether women had an inferior muscle structure in primitive times, pregnancy and childbirth are what made the women submissive, as these were functions that were inevitably part of her fate. This means that men had the time for other things; inventing tools and weapons and using them to fish and hunt. Socially, this means that from the start men were more celebrated than women since he was inventing and putting himself in danger. This is what de Beauvoir sees as the source of the Otherization of women; because they have had no opportunity to create their own history and celebrate themselves, but rather have always participated in the celebration of men and their inventions, women don't perceive themselves as the Self, but rather participate in their own Otherization. After describing the origins of this Otherization, she describes how it has been perpetuated through time; women leaving their clans to move in with their husbands after marriage, women not being able to have jobs or vote until much much later on, and so on and so forth.

Of course, it has been a long time since Simone de Beauvoir wrote these texts and even longer since some of the examples she named were a reality. One might argue that as a society we have moved past this type of sex-based discrimination, and women and men are now seen as equals or are at least given equal opportunity. However, sexism is still very prominent in modern-day times. After all, the gender pay gap is still an issue we deal with to this day, and it is still more difficult for women to promote to leadership positions in their jobs than it is for men.

It could even be argued that the idea of the woman as the Other has its roots in the very language we speak, as one can't say "woman" or "female" without including "man" or "male", but the inverse is very much possible. The bathroom sign for the men's toilet is marked with the shape of a human, while that of the women's toilet is marked with the shape of a human *with a dress on*. While some overt aspects of sexism are discussed and dealt with,

it is something that is nestled into many tenets of our existence that are not brought up in mainstream conversation as of yet. This of course does not mean that the more deep-seated and covert aspects are not important to consider now and in the future. De Beauvoir does a good job at addressing the root of the issue as well as its repercussions in the society that she lived in at the time, which makes her observations very much relevant to current-day affairs.

Since robots are treated so similar to humans, it may be very worthwhile to look into whether a similar Otherization occurs when looking at female robots. Of course, female robots don't have the same history as human women, but since human femininity is projected onto them this might not matter. After all, the gender of a robot is a human property that we have given to it, and a robot does not inherently have a gender of its own.

3.2 Effects of a robot's gender on HRI

This topic has been researched numerous times, but in many of these research papers the interaction between human and robot gender is observed; it is researched how male and female robots affect male and female humans. However, by using the more general conclusions of these research papers we can still deduce certain patterns that have emerged about the effect of robot gender on humans in general. In broad lines, it seems that robots that are perceived as male and female are treated and perceived differently from each other, and this can take many forms. For instance, it seems that female service robots got more favorable responses than male service robots when the robots were highly humanized; the more human a robot seemed, the more important the gender of the robot became[15]. It was also observed that a female robot tour guide would receive more donations than her male counterparts, especially from male visitors[16] [17].

A part of Otherization that was mentioned in the previous section is that the otherized group is often seen as more passive, or less autonomous. This effect is also seen in research that compares trait attribution by humans of male and female robots, where the male robots were rated to have more agency and the female robots were rated to have more communion, meaning that they were seen as more warm or friendly[18]. Female robots being seen as more credible or trustworthy(especially by male participants) appears to be a pattern in much of the literature[17] [19]. This is a risky thing. When we see results like this, it becomes obvious why service robots are often designed to be female, which can be very worrisome. When we use gender stereotypes such as women being friendly or trustworthy as an excuse to design robots in a certain way, this might only contribute to perpetuating these gender stereotypes, thus operating on a kind of circular logic[20].

Sometimes it is also seen that male subjects are more comfortable with female robots and vice versa[17]. Confusingly, the inverse is also sometimes seen[21]. Especially when considering these results, it might come to mind that we might not want to use a robot that leaves such a different impression on men and women. Thus, it may be valuable to look into making a robot that does not conform to the gender binary, as some humans also do.

3.3 The gender binary

While it's certainly worthwhile to look at and absolutely historically significant, looking at people in terms of "men" and "women" exclusively is quite reductive. It completely overlooks the existence of those living outside of the gender binary; people who identify as non-binary or who are otherwise gender nonconforming. These identities have plenty of historical precedent in many cultures, such as two-spirit identities in early tribes in North America and Canada, as well as the *machi* in South America.[22]. While people with non-binary identities are not the norm nor the majority, it's important to raise awareness of these identities, both to make sure people are aware of their options and to reduce prejudice against those who don't conform to the gender binary.

3.3.1 Representation

In many ways, non-binary people are also heavily Otherized. While both women and non-binary people are treated as the Other by virtue of not being men, non-binary identities are also still largely unknown and misunderstood by many people, which only amplifies this effect further. For Otherized populations, positive representation in media can be immensely important[23]. Not only does it make their identity feel normalized and accepted by being shown along other, non-Otherized identities, but it also normalizes their identity to the rest of society, even if just by a little. I think that representation among robots might have a similar impact to representation in media, as they are both simulations of human behavior that are being displayed to the public. When someone encounters a non-binary robot, this might make them more accepting when they later meet a non-binary person.

3.4 Genderless robots

So let's think about making non-binary or genderless robots. When we consider what de Beauvoir has written on the way women are seen as the Other, our intuition might tell us that it would be very hard to make a robot that will be seen as ungendered, since it would have no indicators of

male-ness or female-ness. Therefore, if we assume what de Beauvoir has written, it would be labeled by most as male by default, by virtue of having no female indicators.

In practice, it's hard to tell whether this is always true; there is not a lot of research on the subject. Most research I did find on the topic, though, was on a robot named Pepper. Pepper is not designed with any specific gender in mind, and the consumer is at liberty to decide Pepper's gender for themselves. In the case of Pepper the robot, while this is not a robot that is designed to be any specific gender, it is still often gendered, whether implicitly or explicitly[24][25]. However, this gendering tends to go either way; in some cases, Pepper is considered male, and in others it is considered female, and in some cases it is successfully kept ungendered by using either object pronouns or neutral pronouns.

More potential possibilities for different types of genderless or non-binary robots will be discussed in the next chapter.

3.4.1 Cultural factors

Something else that I ran into when reading about Pepper is that there are cultural differences when it comes to gendering a robot. While the difference most often discussed is that between the West and Japan, I'm sure that more differences exist in other parts of the world as well. Many of these differences, I believe, come from language. In English, we are still getting used to using gender-neutral pronouns when referring to someone. There are even some languages in which all inanimate objects are assigned a gender, and in which each noun is inherently gendered. However, in other languages, such as Japanese, it might be much more normal to refer to someone by their name instead of their pronouns. When you use a language that doesn't enforce gender when talking about someone or something, it might be a lot easier to see something as though it doesn't have a gender, or as though its gender doesn't really matter. Conversely, when you use a language that genders nearly everything, it may be very difficult to conceptualize something as "not having a gender". When asked about Pepper's gender, a Japanese store clerk said "*Docchi demo ii*", or "*Both are good*".

Chapter 4

Consciously designing robot gender

So far, this thesis has mostly discussed how humans interact with gender, and how this affects how robots are seen when they are given certain characteristics. It seems that female robots are often attributed the same characteristics that human women are and that unfortunately some of these characteristics are based on Otherization, such as a lack of autonomy.

Of course, the way the robot is designed will make humans respond to it accordingly. This also means that we may be able to use this to our advantage to lessen gendered expectations and make representation for those who are either non-binary or gender non-conforming. Of course, this would require research to achieve the desired effect, but this may be worthwhile. In this chapter, I will propose several ways of designing robot gender that do not reinforce harmful gender stereotypes and that could potentially even change people's conceptions of gender for the better.

4.1 Reversing gender roles and expectations

As I've touched upon briefly before, the reasoning for most virtual assistants having female voices is largely circular; female voices are seen as friendly, and therefore they are used in virtual assistants, thus reinforcing the idea that female voices are good to use in this kind of context. While perhaps not commercially desirable, it would be a good idea to break this cycle by introducing more male-presenting AI and robots in subservient roles, as well as more female-presenting AI and robots in roles of power. While there is presently no evidence to suggest that this will change the way people see gender in humans (there is no research into this subject as of yet), at the very least this approach to robot gender would not reinforce the harmful stereotype of women not being good leaders.

However, seeing as the current research all points to male voices being perceived as less friendly than female voices, I don't see this being implemented in mainstream commercial robotics any day soon. Therefore, I will discuss some ways of approaching robot gender in a way that doesn't include "male" or "female" at all next.

4.2 Somewhere in between(or nothing at all)

Something that one might come up with when making a robot that doesn't fall into either gender is a non-binary or gender-less robot. While this is straightforward to conceptualize, it may be very hard to realize. This type of ungendered robot is already being made frequently in the current day, but as mentioned in section 3.4 and subsection 3.4.1, it may be very difficult to make a robot that evades gender assignment by humans, and it also may not be as effective in every culture. Another issue that I think will be run into a lot is that when a robot is complex and has many features, if one of the features is slightly gendered in some way or another, this could change how someone sees the gender of the entire robot. This brings a lot of variables into the mix, and even these different variables could have different degrees of importance in different cultures, making the creation of a gender-less robot even more complex. However, since this is the type of ungendered robot that is being pursued the most, it is still worthwhile to discuss and speculate about what properties could be used to advance this type of robot as our tools develop over time.

An example of recent research in this direction is the creation of a gender-less voice for a robot by using Principal Component Analysis to create a Text To Speech(TTS) voice that sits right between male and female[26]. While this is already a very interesting way to construct gender, I think it will be even more interesting to see this voice tested with human participants who try to attribute a gender to the voice, thus researching how effective this technique is at making a gender-less voice.

I do not think this is the most promising solution to the problem and this may be extremely hard to design in reality. Especially when considering cultural differences, there is a wide range of what is considered feminine and masculine by different people, and thus it will be extremely challenging to design a robot that will universally be seen as somewhere between male and female.

4.3 Mix-match gender

What I want to propose is a new type of robot gender: a mix-match gender. These robots would have a blend of characteristics that are seen as masculine and feminine. For instance, they will have a feminine voice while having a

face and waist-to-hip ratio that would typically be classified as male. There are many aspects of gender that could be thrown into the mix, including things that are usually interpreted as gendered in a subconscious manner, such as behavior or style of speech.

Of course, it's almost impossible to speculate on what kinds of reactions these robots would summon from people. However, I think it would be worthwhile to look into this approach for several reasons.

The first is that I think this will be an easier way to make a robot that people won't gender as male or female because both indicators will be present. When there are barely any gendered features present in a robot's design it may be more likely that someone will gender the robot according to these few gendered features than when there are many confounding gendered features present.

Another reason that I think this could be a desirable way to design robot gender is that it might diminish gender expectations and enhance the acceptance of people who express their gender in an unconventional way. As mentioned in subsection 3.3.1, representation can be a very important factor in making people feel seen and accepted, and robots could surely be a great source of representation.

Chapter 5

Discussion

To conclude, I will summarize my findings and then discuss some of the limitations of my research, as well as possible future research that would broaden the horizons of science in this field.

After a brief explanation about robotics, HRI and the way robots are usually gendered, I explained what issues exist in human gender, based on Simone de Beauvoir's *The Second Sex*. This book explores the role of the woman as the Other, always seen as secondary to men rather than something wholly independent. In her book, she explained that women's role in society does not necessarily come from their biology, but rather from the roles they have historically had compared to men. Since women were expected to perpetuate the human race, they could not participate in the process of invention, while men were at liberty to do this. Of course, this is not something that should still affect the present, but unfortunately, it still seems to have its roots in many of the systems that exist in the modern day.

These effects of Otherization are also seen when observing female robots. It appears that they are often interpreted to have more friendly personalities and less autonomy than their male counterparts. To counter this, one might attempt to make a robot without any gender at all, but this might be much more difficult than it initially seems.

Finally, I proposed and evaluated a few explanations for the issue of robot gender, including the countering of gender expectations using robots, using advanced techniques to try and make an ungendered robot, and making a robot with both male and female features. I hope that this thesis was able to offer some insight into the world of robot gender, and the issues it brings with it.

5.1 Limitations

It's very hard to write about a topic as deeply ingrained in society as gender and not resort to assumptions that logically unsound arguments, as topics

such as these often affect society while also being affected by society. Therefore, I often found it hard to find arguments that felt solid enough for myself to fully believe in them. I hope that I got around this well enough to make some arguments that are convincing and understandable to most.

Another one of the difficulties encountered when researching a topic like this one is that cultures all over the world are different from each other and thus it is quite hard to compare how people will view things relating to gender. At times, one might find research from one country and then find research from another country that contradicts the previous research in some kind of way. As was discussed in the sections on The Second Sex and the feasibility of making genderless robots, many things influence how gender is perceived in different countries, one of these things being language. For instance, many European languages are very gendered, whereas Japanese for example is not, making both gender norms and the perception of robots extremely different between these two places. This has led me to be rather selective in what information I used, and I fear that this may have made some parts of my research incomplete.

Another confounding factor was time, specifically in what years the different research papers I consulted were published. While gender has of course always been a very relevant topic, in recent years societal views and norms surrounding this topic have shifted drastically. Similarly to cultural differences across different research papers, the papers I consulted were also conducted in many different years, at times making it difficult to find a way to structure the information in a way that makes sense and isn't using outdated information. While it might be very easy to use research papers on sexism in the 90s to make my points, this might have been deceptive when discussing them in relation to modern-day robotics and what should be considered in their design process.

All in all, while I think that the conclusions and connections I have made in this thesis are still relevant, I wish I had more recent research to back them up and justify them.

5.2 Further research

5.2.1 A more curious approach to robot gender

Gender is an extremely complicated topic. But this is not something that should deter us from talking about it earnestly. I think that gender is an extremely important thing to consider when designing a robot. With how rich and often unbalanced the history of gender is, it's not something that should be decided without much thought, or purely based on what people instinctively like or want.

Therefore, I think it would be extremely valuable to see more research on

robot gender. While there is already a lot of research on the effects of a robot's gender, these papers rarely ever question *why* these effects exist, let alone ask their participants for the reasoning behind their judgments.

I believe that if we want to prevent the perpetuation of harmful gender stereotypes, one of the most important things is that we stay curious and critical about the choices we make and what effects they have. Ideally, every robot designer would conduct research of their own about what effects their design choices might have on their intended user base, and adjust the design accordingly, but understandably the costs of doing research on this scale would deter most people from conducting it.

5.2.2 Giving mix-match gender robots a try

Finally, and most obviously, I would love to see the mix-match gender approach being tried in the field of robotics to learn more about what effect this design choice could have on its users. This could initially be done by having participants react to a written hypothetical or even a chat bot that shows the user a picture that is gendered one way and a voice that is gendered in a way that contradicts the picture; it does not immediately need to be expensive research. But of course, eventually it would be very interesting to see a fully fledged humanoid robot with a mix-match gender.

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