

# The Three Harms of Gendered Technology

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## Abstract

Marginalised groups experience both immediate and long-term detriment as a result of innovations in information systems. This paper explores three facets of technologically related gendered harm: physical, institutional, and psychological. These harms will be demonstrated by case studies. Firstly, technology can cause physical harm by denying women their bodily autonomy, demonstrated by the public availability of AI software that generates nude pictures of women, and smart home devices used in instances of domestic abuse. Secondly, technology can deny women institutional access, as increasingly widespread algorithms are shown to underperform on marginalised groups. Thirdly, anthropomorphised technology reflects and entrenches harmful stereotypes of women's submissiveness, causing psychological harm. Reducing harm must go beyond ensuring a diversity of representation in STEM fields. We conclude that effective regulation should focus on the design features in technological innovations.

**Keywords:** STEM; Diversity; Technology; Gender; Women; Sexism; Machine learning; AI; Bias

## 1 Introduction

The lack of diversity in STEM fields has been widely publicised (West, S. et al., 2019; Baranyai et al., 2016). It is uncontroversially recognised that technology is a male-dominated field. For example, in the burgeoning field of artificial intelligence (AI), only 10% of researchers at Google and 15% at Facebook are women (West, S. et al., 2019). The 2019 Australian federal budget allocates \$3.4 million in funding to support women in STEM, recognising that only 16% of the STEM qualified population are women (Baranyai et al., 2016).

The innovations that these fields produce are in response to the needs perceived by those that work in the field (Rakow, 1988; Rothschild, 1981). Therefore, the development of information systems is not neutral—it embodies the values that caused its production (Perry and Greber, 1990; Poulsen and Burmeister, 2019). As such, some take it that the values and corresponding identities of engineers behind the technology may influence the features of the technology created (Barratt, 2018; Williams, 2014). The Australian Government cites, as motivation to its women in STEM funding, that gender inequality is “bad for business” (“Advancing Women in STEM”, 2019), an oft-repeated adage grounded in the belief that greater female representation in the industry leads to products that are better tailored to women, widening the target market and increasing sales (Patterson, 2018; Barratt, 2018; Williams, 2014). The mainstream view, therefore, is that a lack of diversity creates biased, gendered technology, while a more representative industry will create unbiased and therefore better technology.

However, this view, in accordance with a historically liberal feminist perspective, “does not ask the broader questions of whether and in what way technoscience and its institutions [can] be reshaped to accommodate women” (Wajcman, 2007). It neglects to consider how gendered technology prevents women from entering STEM fields, and causes them harm in general. To

address this, we draw from socialist feminist frameworks that examine how gender relations are embedded in information systems, and therefore entrench gender hierarchies (Wajcman, 2007). The problem is cyclical: the fewer women there are in STEM, the more biased the technologies the field creates. The more biased technologies exist, the more severe the harm on women, and so prevent their representation in STEM. This paper uses case studies to focus on the latter, and examines how gendered technology causes further harm to women, framed by three facets of harm. We submit that ensuring the production of unprejudiced technology goes beyond ensuring mere representation—it requires regulation.

Our analysis will proceed in the following four steps. First, we will give an overview of the three harms of gendered technology: physical, institutional, and psychological. Next, we will provide cases of how technological development has exacerbated harms against women for each of the three facets. Third, we examine the flaws of focusing on diverse representation. Lastly, we argue that in light of gendered technology, regulatory and public attention ought not to only focus on who is making the technology, but what is being made.

Throughout this paper, we will take a consequentialist stance on ethics by considering the outcomes of technological design. We note that while there may be instances of biased, gendered technology that have beneficial consequences for vulnerable groups, we restrict our analysis to the gendered technology that has harmful consequences. Therefore, under this definition, gendered technology is unethical, as it causes or exacerbates harm against a particular group. The production of gendered technology is therefore unethical, whether it is done intentionally or unintentionally, and those managing production, including legislators with influence on technological development, have an ethical responsibility to prevent harms to anyone, but in particular, harms to groups that have increased vulnerability due to their existing social marginalisation.

## **2 Identifying the three harms**

Generally, gendered oppression manifests not only in terms of lack of institutional representation, but also the pay gap, the increased burden of domestic and reproductive labour, gendered violence and assault, epistemic doubt and stereotype normalisation, and a lack of mobility and autonomy. This paper identifies three interconnected facets of this oppression, that we will call the three harms of gendered technology:

1. Physical harm: the denial of bodily autonomy including lack of prevention and exacerbation of domestic violence and sexual assault (AIHW, 2019), and restrictions to abortion,
2. Institutional harm: the restriction on the mobility and freedoms of women due to lack of access to institutional benefits, resulting in poorer education, the pay gap, and domestic and reproductive burdens,
3. Psychological harm: the perpetuation and internalisation of gender stereotypes that cause epistemic doubt and further entrench gendered oppression.

These issues are interconnected, for example reducing stereotypes could consequently mean greater access to institutions and monetary compensation that could reduce women's reliance on potentially abusive partners. Simultaneously, safer women are more mobile and therefore able to study productively, changing stereotypes of their social roles. Harms can also be

perpetuated concurrently—domestic violence does not merely affect women physically, but psychologically.

It is also relevant to note that while women are the direct targets of these harms, harm also occurs to people close to them, and also the perpetrators themselves. Ethical considerations surrounding domestic violence need to account for not only women, but consequently, children. Similarly, restricting abortion results in some children living in untenable situations. The perpetuation of stereotypes not only affects women, who come to view themselves through a distorted social lens, but in general, anyone participating in that stereotype internalisation, as their perception of the world becomes limited and, in some instances, unfairly prejudicial. Medina (2013) describes this epistemic oppression as deficits that affect perpetrators' ability to learn and contribute to the world. Indeed, this is how prejudiced technology arises from prejudiced production.

We also note that while this paper focuses on gendered harm to women in general, it is significant that this harm will not be felt equally by all women. An intersectional response, as detailed by Black feminists like Crenshaw (1989) will be necessary, as women with fewer socio-economic resources, or who occupy another identity, such as a marginalised racial or sexuality group, can potentially suffer greater consequences from the same harms. Stereotypes of race, for example, will affect how women are treated when they require health care as a result of domestic violence (Rodriguez et al., 2009).

Technological harms are also not merely gendered, but can also affect people of different sexualities, gender expressions, race, class, and physical and mental abilities. For example, an AI algorithm has been developed to detect a person's sexual orientation (Wang and Kosinski, 2017) which has privacy implications. Though these cases will remain outside the scope of this paper, we note that gendered harm is only one aspect of many potential harms of unethical, irresponsible technological development.

The three harms we have identified are general; they arise from complex, structural social issues. For the purposes of this paper, however, we will focus on technological cases that cause and perpetuate these harms. We will show that the lack of regulation in technological development, combined with the increasing pace and use of technology, means that women are vulnerable to these three facets of harm.

### **3 Cases of gendered technology**

#### **3.1 Physical harm: denial of bodily autonomy**

In December 2018, the Australian federal government passed encryption laws that allow police and security agencies access to encrypted messages without user consent (BBC News, 2018). However, the mainstream focus on how technological tools can infringe on general public privacy fails to consider gendered power disparity, and how these tools are especially harmful towards women's privacy and bodily autonomy.

The first case focuses on an application called DeepNude, made available online in June 2019. Given clothed pictures of women, it used neural networks to generate realistic images of said women naked (Cole et al., 2019). The problems with this application go beyond its assumptions of gender essentialism. The fact that these images are computer-generated does not detract from the effects of their publication. Firstly, it humiliates and objectifies the depicted women without their consent. Secondly, it supplements the phenomenon of revenge

porn, in which women find themselves subject to loss of relationships and careers as a result of photos and videos released online. Third, it increases the potential of targeted abuse towards the subject, both online and physically. The consequences of DeepNude render it a deeply unethical product. Further, DeepNude did not generate male nudes, as its requirement of a large training dataset meant, given the much higher proportion of female nudes online, it could only be trained on pictures of women. This is not to say that if it did generate male nudes, it would be ethical. Rather, it demonstrates that unethical technology like DeepNude, while problematic regardless of which genders it works on, is especially a concern for women as it intersects with and exacerbates the existing objectification of women. It underscores the cyclical nature of oppression: objectification of women means more nude pictures of women online, allowing for the construction of technology that creates more nude pictures that entrench this objectification.

The second case focuses on the popularisation of the Internet of Things, which have led to the proliferation of smart home devices. Significantly, women and girls are 25% less likely than men to know how to leverage digital technologies and four times less likely to know how to program computers (West, S. et al., 2019). This technological education gap intersects with domestic violence such that, as a consequence, abusers are using smart home devices to surveil and psychologically harass women. A New York Times investigation in 2018 found an increasing number of domestic abuse cases incorporating technology (Bowles, 2018)—devices like Wi-Fi enabled doors, smart thermostats, and digital doorbells. Though these devices are pitched as helpful tools to optimise domestic life, the consequences of its misuse have not been adequately addressed. Abusers would remotely control and change the temperature, the music playing on the speakers, or the locks on the door, so that women at home “felt as if they were going crazy” (Bowles, 2018). Similarly, surveillance footage from indoor cameras was circulated as revenge porn. The investigation found that many victims of this type of abuse were women—in this case, the gendered nature of domestic violence is exacerbated by the gendered understanding of technology to exacerbate harm against women.

The investigation also highlighted an insidious aspect of gendered technological harm—unlike other types of harm, technology is developed at such a fast pace that legal regulation often falls behind. Restraining orders, for example, can neglect to include smart home devices. This underscores the importance of developing both forward-thinking technology and regulation.

### **3.2 Institutional harm: restricted access**

An issue more widely talked about is women’s institutional access to education, jobs, and how workplaces support domestic and reproductive equality. Technology will inevitably affect how women access these institutions: as workplaces become more digitalised, technological literacy becomes more important.

From the data cited in the introduction, women and girls tend to be less digitally literate (West, S. et al., 2019). Education therefore becomes vital in ensuring women can develop the necessary skills to achieve employment, and therefore financial independence.

Further, studies have shown some AI algorithms to be less effective for more vulnerable populations when their training sets neglect marginalised groups. Buolamwini et al. (2018) demonstrated how some facial analysis algorithms have 99% accuracy when identifying white men, and only 65% accuracy when identifying darker-skinned women. Google’s search

algorithm has misidentified darker-skinned women as gorillas (Simonite, 2018). These algorithms are increasingly embedded into institutions such that should they ever be used to screen for institutional access, such as screening job candidates, they will perpetuate and potentially worsen existing social hierarchies.

### **3.3 Psychological harm: stereotype normalisation**

The intrinsic purpose of technology is to aid and serve. And historically, women have done the same as child bearers, objects of sexual gratification, and homemakers. These gender roles have been entrenched in a self-perpetuating loop, as media and products both reflect social trends and display such roles, further entrenching them as the norm. This shared social conception causes psychological harm for women, as they internalise their positions and worth in society. As an example, women have constantly reported feeling the imposter syndrome (Clance and Imes, 1978). As those in positions of power also internalise such perceptions, they create direct, long-term harms, giving rise to physical and institutional harms. Technological progress plays a role in the normalisation of gender roles—to demonstrate this harm, we will use examples of anthropomorphised technology.

A majority of popular voice assistants: Apple's Siri, Amazon's Alexa, Microsoft's Cortana, the Google Assistant, etc. all have female sounding voices, while simultaneously serving as unquestioning helpers. Feminine anthropomorphisation was a deliberate choice—Amazon's market research indicated it would be perceived as more "sympathetic" and helpful (Schwar and Moynihan, 2020). A 2019 study on this topic is titled "I'd blush if I could", a response given by Siri when a user uses gendered slurs such as "you're a bitch" or "you're a slut" (West, M. et al., 2019). This normalises women's submission to gendered abuse—helpful voice assistants are not programmed to retort. The study found Alexa would even thank the user for gendered abuse. Siri would only tell the user to stop after the user uses gendered slurs eight times in a row—demonstrating that while the developers knew verbal harassment was harmful, once was not enough to warrant a response.

Further, the market for robotic companions is largely dominated by those anthropomorphised as women—these devices allow for sexual gratification and even violence without deviating from their programmed submissiveness and without requiring consent. Hence, they normalise and potentially promote the objectification of women (Richardson, 2016).

In Australia, one in six women have experienced physical or sexual violence from current or previous cohabiting partners, and one woman is killed every nine days by a partner (AIHW, 2019). These statistics do not arbitrarily arise; they are a result of ingrained attitudes towards women, attitudes that are reflected and perpetuated by the technologies identified above. In the long-term, entrenched gender roles in technology and the psychological harms they entail will normalise and hence potentially cause violence against women, intersecting with the physical and institutional harms we identified above. The ethical implications of technological development must therefore be considered with these consequences in mind.

## **4 The flaws of mere representation**

Characterising representation as the primary factor determining the kinds of technology that are made paints an incomplete and inaccurate picture of technological development. We will highlight two factors it neglects: internalised norms, in particular, internalised misogyny, and

external market forces. Hence there is a need for technological regulation, which better accounts for these neglected factors.

Internalised misogyny is a complex topic, one which we will only briefly outline. We take it to be a form of what Fricker (2007) describes as an epistemic injustice: a wrong perpetrated to someone in their capacity as “a knower”. That is, gender stereotypes are so ingrained in our shared collective understanding so that, even if someone identifies as a woman, and believes herself to be a feminist, she can unwittingly share prejudices against women. Internalised misogyny manifests in a number of ways, including self-objectification (McKinley and Hyde, 1996) and passive acceptance of stereotypes (Bargad and Hyde, 1991). The prevalence of internalised misogyny is such that it would be untenable to assert a causal link between diverse representation within the technology industry and the creation of unprejudiced technology.

Similarly, technology is not merely a product of its engineers; it arises out of the socio-political context and profit motivation that influence its design, development and deployment. As a brief demonstrative example, technology company Palantir continues to collaborate with United States Immigration and Customs Enforcement despite employee pushback (MacMillan and Dwoskin, 2019). As such, the identities of the engineers do not guarantee a product in line with their beliefs. Because of this, we must look beyond mere representation to examine how to rectify the problems caused by gendered information systems.

## 5 Regulation

The current focus of gender equity in technology is on increasing the participation of women in the field. The rationale for the focus is the hope that more diverse engineers will create more diverse datasets and use their lived experiences to create technologies that cater to their needs, not just the needs of the social default: white, heterosexual, male. But this is just a hope; as we described earlier, given how embedded gender roles are in society, women can just as easily suffer from internalised misogyny and therefore make products that harm women, just as men do.

Regulation, therefore, needs to take into account ethical consequences—not just who makes the technology, but what the technology will do. It is recognised that changing the former can change the latter, but there is not enough recognition that changing the latter—the effects of information systems—will also change the former. More socially responsible technology will avoid entrenching gendered stereotypes and prevent the harm to women that reduces their institutional access to STEM fields. We cannot expect STEM to diversify if we do not create the conditions for it, not just by increasing access to education, but also by ensuring women are safe from abusive partners and revenge porn. Regulation needs to occur throughout the technological production process, from its inception to regulating its effects.

We will make some positive assertions as to what this regulation would encompass, but acknowledge that the details of its implementations are outside the scope of this paper. This regulation ought to redefine abuse so as to include abuse perpetrated through digital mediums, such as through smart home devices. It ought to focus on improving digital literacy for girls, and other institutional mandates, such as anti-bias training. It ought to regulate when algorithms can be used to screen for institutional access. It should recognise the cultural role of anthropomorphised technology, and create guidelines for the appropriate responses to digital abuse—just as online forums are moderated for hate speech, voice assistants could

perhaps respond with statements or educational resources against abuse, rather than obsequiousness.

Technological design is an important site for socially motivated intervention (Layne et al., 2010). Indeed, if technology is normatively a tool that serves humans, that means it ought to serve its most marginalised groups—it should not exacerbate harms against them.

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