Motion Tracking Ring Light
(Technical Paper)

How Technology is Shaping Gender Bias

(STS Paper)

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Introduction

As development in computation currently stands, the algorithms that will soon guide our every decision could be designed with a strong bias against women and the end user will be none the wiser (Hamilton, 2019). If one were interested in maintaining a male dominated social order, technology would be a powerful tool to do so, even more so in the year 2020 when work, social gatherings, and politics have all largely shifted online. Since the dawn of modern computing, technologies have been wrought with the biases, be they explicit or not, of their creators. In the case of computing, men have been creating technologies that best suit their needs and beliefs for decades (Wachter-Boettcher, 2017).

Included in this prospectus are two projects aimed at investigating and alleviating the technological bias against women. One example of this unequal relationship with technology is found in the rise of video conferencing as a means of creating a virtual workplace. The video conference is an unflattering technology at best for many. Couple that fact with the well documented beauty bias that women face, where professional abilities are wrongly correlated with appearance, and the virtual workplace becomes a place that can halt women's professional advancement (Berry, 2007). How much one should care for their appearance is not the question addressed here. The fact of the matter is, a man will not regularly be judged professionally on the basis of his appearance, but women face this extra hurdle every day. The technical project aimed at addressing this is a motion tracking lighting system for the home office. The light will track the user's movements about their workstation and adjust itself to always provide optimal lighting during the video conference. The STS investigation into the problem seeks to answer the question of how technologies are perpetuating gender attitudes and what can be done to change that course. The work will draw on well-known writers in Feminist STS and consider cases of

technology-based gender discrimination. Ultimately, the project looks to guide future technologists in addressing their implicit biases and creating fairer solutions.

Technical Project

Due to COVID-19, there has been an unprecedented increase in those working from home. However, the current increase in remote work is not an isolated incident. Global Workplace Analytics (2020) found that between 2005 and 2018 there was an increase of 173% in regular remote working. The increase in remote work has outpaced the growth of the workforce by 11%, indicating that a growing portion of jobs are remote with an estimated 56% of employees whose work could be completed remotely (Global Workplace Analytics, 2020). Thus, remote work is expected to remain a not insignificant portion of the workforce.

However, even when working from home, appearance bias is still an issue in the virtual workplace. Thus, it is in an employee's best interest to take steps to protect themself from the effects of appearance bias when on camera in virtual meetings. According to Zoom Video Conferences (2020), the optimal lighting of one's face is with the primary light positioned "in such a way that it sits above you and points just above your head. You do not want the majority of the light to hit you, but you want just enough to make your face a bit more brilliant on screen." By utilizing good lighting, an employee can improve the perceived appearance, minimizing the negative effects of appearance bias caused by the Halo/Horns Effect (Mahajan, 2007).

The Automated Ring Light is a device for providing direct illumination to the user's face as they move about their workstation. Positioned behind the primary monitor, it will track the user's movements via a sensor on a headset and move left and right and rotate as needed to keep the ring light directly focused on the user from any angle they work at. In the age of video

conferencing and the prevalence of appearance-based judgements in the workplace, this device aims to present the user at their best to co-workers, clients, and managers. This issue does not affect men and women equally, however. “Where attractiveness is a highly desirable trait for women, attractiveness is thought to be less important for the traditional male role” (Wong & Penner, 2016). This leads to a disparity where, for women, “the perception of beauty seeps so deeply that external appearance simply equals aptitude and professionalism” and men seldom have their looks conflated with their professional abilities (Leibu, 2014). This device aims at allowing the user to tackle this unnecessary hurdle.

However, one projected issue with the Automated Ring Light is that it does not attempt to solve the issue of appearance bias. Instead it plays into appearance by instead aiming to improve the presentation of the user. By doing so, the Automated Ring Light perpetuates appearance bias. In a way rather than addressing the cultural problem of people being unfairly judged on presentation, we are creating a product that improves the user’s presentation due to the cultural issue they face. This leads to more people conforming to bias expectations, which further normalizes the bias (Mahajan, 2007).

Furthermore, another projected issue is the anticipated high cost of the device. This could potentially bring concerns about possible class discrimination. Considering the intersectionality of appearance bias and class bias, it is pertinent to also consider the relationship between those who are perceived as “more attractive” and higher average salaries (Bartlett, 1994). The combination of a high price along with the Automated Ring Light contributing to potential appearance bias, while helping minimize the effects of appearance bias for an individual, could result in further expanding and enforcing the effects of appearance bias in the workplace as a whole.

This project description is a collaboration of the group members: Sophia Fasano, Daniel Knorr, Ethan Staten, and Charles Ferraro. They will be working together on the development of this technical project.

STS Project

If the first computer scientist could see the state of the computing field in 2020, *she* would be very disappointed. While there is not yet consensus on who qualifies as the first computer scientist, Countess Ada Lovelace is certainly a top contender as her work in the field began over 200 years ago (Coe & Ferworn, 2016). Her disappointment would most likely be in regards to the fact that in 2020 only 26% of computing related jobs are held by women (Daley, 2020). While the lack of diversity in the technology industry is a problem in and of itself, the pernicious effects of this gender imbalance are felt by society as a whole. The products developed by male dominated firms are, intentionally or not, imbued with the biases of their creators and thus continue to discriminate against women and reinforce gender biases in the workplace and beyond.

There are a number of parties involved in addressing this problem. First and foremost, there are those in engineering roles at large technology firms. However, there are also a host of non-technical roles involved in the development of discriminatory technologies. These roles include designers, product managers, and human resources professionals. Upper-level management also has a stake in addressing the problem of gender discrimination. Should tackling the issue seem feasible while also delivering returns to shareholders or bolstering public opinion of the firm, one should expect swift action from technology leaders (Zheng, 2020). Finally, it is the consumers of technology products who have the most to gain from action on this issue. As technology becomes more abstracted from the user and human centered design pushes

the principles of "unobtrusive technology," end users have less and less awareness of the products acting on their behalf. It is this lack of awareness that is both beautiful and terrifying. Having technology that seamlessly anticipates the needs of the user and acts silently in the background is considered by some to be the height of user experience (Noessel, 2017). There is even a new word for such experiences, "automagical." However, technology that acts "automagically" also provides the perfect vehicle for enforcing the biases of the product's creators on the lives of others without their knowledge.

To explore this problem, this project will employ the STS framework of political technology developed by Langdon Winner and the lens of feminist theories of technology as expressed by Judy Wajcman. Winner proposed that technologies could be judged by "the ways in which they can embody specific forms of power and authority" (Winner, 1980). As this project seeks to understand how biased technology entrenches the powers of the creator, the political artifact framework seems well suited to the task. Winner did not propose this framework without some controversy. Amy Bruckman, professor of interactive computing at the Georgia Institute of Technology expressed in her blog her frustration with Winner's framework. "OK, artifacts have politics. What does this mean for us as designers and engineers? Beyond high-level platitudes like "be mindful," what should we do differently? I'm still wondering" (Bruckman, 2011). This is a major shortfall of Winner's framework. As the goal of this project is to suggest guidelines to newly minted engineers on how to separate their biases from their work, another framework is needed. In Wajcman's "Feminist theories of technology," she addresses the notion of technology as gendered. Like Wajcman's work, this project is intended to address the "proclivity of technological developments to entrench gender hierarchies" (2010). The benefit of investigating this problem within Wajcman's framework is that she developed it intentionally as

a response to previous work which did not emphasize the "prospects [technological developments] afford for change. In short, not enough attention was paid to women's agency" (2010). It is Wajcman's inclusion of women's agency and a goal of change that makes her framework helpful in addressing the shortcomings of Winner's work as a means for understanding the problem of gender bias in technology. Wajcman notes "that gender is connected to other axes of power such as race, colonialism, sexuality, disability, and class" (2010). Addressing the relationship of technology to all of these areas is far beyond the scope of this project, however it is the notion of intersectionality that makes this research important. Technology is not only being used to perpetuate gender biases against women, it is a tool for entrenching those in power. For engineers who truly want to use their skills to build a more just and equitable world, understanding the problem presented in this project is just the first step. As technology takes on a larger and more subtle role in our daily lives, it is important to act now in addressing old biases before they become permanently ingrained in emerging technologies.

Methodologies

This project will explore the question of how technology challenges or reinforces gender biases. To investigate this topic, the project will use documentary research methods. Case examples of discriminatory technology will illustrate the current state of the technology industry. A few examples of how technology was used to overcome bias will be explored as well in order to provide guidelines to recent graduates. These examples will include case studies, company publications, and accounts from industry professionals. The keywords for this investigation include "gender discrimination," "algorithmic bias," "design bias," and "sexist technology." These were selected because technology can be discriminatory on the 'backend' where the actual computation takes place but also in how it is presented and how accessible it is. "Design" and

"algorithmic" bias are terms which capture these two sources of discrimination. The other two terms were selected in an effort to surface examples of both implicit and explicit technological bias. Because the research question is trying to find 'how' biases are perpetuated, finding case examples and studying the underlying causes is the best method for supporting the answer to the question.

Conclusion

The technical project herein described will deliver a device for tracking the user's head as they move about their workstation and providing professional lighting from any angle for video conferencing. This device is aimed at alleviating the additional hurdle that women face in the workplace where professional abilities are wrongly conflated with appearance. Though this device does not address the underlying bias, it is nevertheless helpful for individuals who do not want to miss out on any career opportunities as a result of appearance-based judgements. The STS project will be an exploration on how technology reinforces gender biases and provide guidelines to recent engineering graduates on how to avoid integrating bias into their own practice.

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