Proceedings of the 56th Hawaii International Conference on System Sciences | 2023

"I Felt Like I Wasn't Really Meant to be There": Understanding Women's Perceptions of Gender in Approaching AI Design & Development

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Abstract

Women continue to enter and remain in AI development at a rate far lower than men, and this glaring gender gap has caused AI technologies to contain inherent bias in their design. While studies have explored the challenges women face in the field, little has been done to explore the influences of women's gender identities on how women approach gender in AI design. In this study, we conducted semi-structured interviews with eight women with diverse experiences in various areas of AI design in order to understand how women perceive the role of their gender identity within the AI design community and how those perceptions have influenced their design approach for AI systems. Our research provides first-hand empirical evidence from women's own perspectives on how the enduring gender gap in the AI field is reinforcing harmful bias in designing and developing AI systems. We also propose initial design implications and highlight urgently needed future research for designing more inclusive AI technologies with diverse gender perspectives in mind.

Keywords: Women, Gender Roles, Gender Gap, Gender Bias, AI Design

1. Introduction

The enduring under representation of women in the area of Artificial Intelligence (AI) design and development is increasingly noticeable in recent years. Studies show that women compose less than 12 percent of contributors to AI research conferences and only 10-15 percent of AI designers and developers at major technology firms (Whittaker et al., 2018). Even the most generous estimates put women at 26 percent of the data and AI positions in the workforce (Forum, n.d.), and only 16 percent of tenure-track faculty globally are focusing on AI research (University, 2021). The gap widens even more substantially as women move up the corporate ladder (Thomas, 2005).

We understand this large gender gap and the lack of gendered perceptions as a major concern for developing the next generation of AI agents, which are increasingly embedded in every aspect of people's daily lives and seamlessly interact with human beings. Indeed, technologies inherently reflect the bias of those who design them, such that a lack of diversity in AI development necessarily means a lack of diverse perspectives (Piorkowski et al., 2021). Therefore, the large gender gap and the lack of gendered perspectives in AI development may unwittingly be reinforcing harmful gender stereotypes, and enhancing the gender narrative that boxes women out of the tech community and/or frightens women away from using AI technologies (He & Freeman, 2010). Despite this expressed concern, still little is known regarding how exactly the role of one's gender identity as a woman may affect the ways in which one approaches the design, development, and perception of AI agents, particularly when considering the future of AI work. Previous research studies on women in AI have focused on how the skewed gender ratio affects women's emotions and desire to remain within the field (Roopaei et al., 2021). While these studies provide invaluable insight into the challenges faced by women in the field of AI, they fall short of asking how those conditions affect women's viewpoints on the role their gender identity plays in how they view and approach AI design and development, and how those viewpoints and approaches manifest into design practices. These concerns motivate our study substantially, as addressing such issues will reveal the current state of the voice of women within the AI industry and further inform more inclusive AI design recommendations looking into the future from those best positioned to do so - the women working in the field themselves.

Therefore, this work explores the following two research questions about women, gender roles, and AI

URI: https://hdl.handle.net/10125/102650
978-0-9981331-6-4

design and development:

RQ1: How do women in AI design and development perceive the current role their gender identity plays in their experiences within the field?

RQ2: How do these gender identity specific perceptions influence women's approaches to designing and developing AI?

To answer these questions, we conducted eight in-depth semi-structured interviews with individuals who identify as women and have engaged in AI design and development in a variety of capacities. The richness of our findings contributes to HCI and the future of work in AI in two specific ways. First, we provide first-hand empirical evidence from women's own perspectives on how the enduring gender gap in AI development is reinforcing harmful bias and inaccurate assumptions about how to design AI from and for the perspective of a woman. Second, we propose initial design implications for AI agent systems based on the design practices of our specific women participants, who repeatedly call for practices toward intersectionality and/or gender neutrality. Thus, we lay the groundwork for urgently needed future research to work to ensure that the long-standing gender disparities that have negatively impacted women in STEM do not continue to influence the design and development of AI agents.

2. Related Work

Our focus in this paper is grounded in two bodies of interlinked literature: how the long-standing gender gap in STEM is also significantly affecting the workforce of the emerging AI industry; and gender bias in AI design and development.

2.1. The STEM & AI Workforce Gender Gap

The gender gap in Science, Technology, Engineering and Mathematics (STEM) disciplines is a well known and well documented phenomenon (Beede et al., 2011), particularly in computing domains, where women comprise only 25 percent of the computing workforce in the U.S. (Fry et al., 2021). Extensive prior research has focused on investigating various factors that lead to the notable lack of women in computing and STEM-related professions, including gender-role associations from an early age discouraging young girls from associating STEM professions with women (Kanny et al., 2014), thereby lowering feelings of computer self-efficacy in the long term(He & Freeman, 2010). In fact, societal gender norms have been directly linked as a driving factor for why women are, numbers-wise, less technologically oriented and less likely to pursue a STEM discipline (Rodriguez & Lehman, 2017). Additional factors such as a disproportionate lack of STEM-readiness in high school (Card & Payne, 2021), insufficient friend influence and peer exposure to STEM prior to secondary education (Raabe et al., 2019), a lack of female role models (Beede et al., 2011), and gender-related stereotypes and biases (Wang & Degol, 2017) have been explicated in previous work to explain the STEM gender gap. Even when women are able to overcome these barriers to entry during their primary and secondary years of education, women are more likely to leave the STEM profession because of a lack of advancement opportunities (Thomas, 2005) and less family-friendly working hours and conditions (Beede et al., 2011). How these issues of gender disparity in STEM affect AI participation, though, remains a question which motivates our investigation.

Unfortunately, the huge disparity between men and women in general STEM education is also significantly affecting the workforce of the emerging AI industry. Generous estimates state that women only hold 26 percent of the data and AI positions in the workforce (Forum, n.d.), and comprise a concerning 16 percent of tenure-track faculty globally whose focus centers on AI (University, 2021). Additionally, only 22 percent of individuals pursuing AI and computer science PhD degrees in North America were women as of 2019 (Deloitte, n.d.). Even more studies show that women compose less than 12 percent of contributors to AI research conferences and only 10-15 percent of AI designers and developers at major technology firms (Whittaker et al., 2018). Various reports diving into the reasons for said gaps cite similar findings to previous research, such as lack of role models and mentorship opportunities (Deloitte, n.d.). A small body of work also explored how women in AI development experience their marginalization. For instance, Strok uncovered a variety of issues with how women feel they are treated within the AI community: they perceive the AI community to possess a "boys club" atmosphere that isolates women and minimizes their opinions; they also consider this community more intolerant to women designers' failures whereas men are given more leeway to try new things and innovate (Strok, 1992). What is not known, however, is how said gender gap and women developers' and workers' perceptions of their marginalization affect their perceptions of gender bias and mitigation in AI design, which becomes a critically important research gap to fill when considering how the design of technology can become biased towards the perspectives of developers, and therefor often biased against women.

2.2. Gender Bias and AI Design & Development

As the design and development of artificial intelligence increases in importance as the core driver of innovation in emerging technologies (Lu, 2019), so too have efforts within and outside of AI research communities to understand how gender biases are perpetuated by and integrated into AI in a way that creates large-scale social impacts. For example, Prates et al. (Prates et al., 2020) found that Google Translate will more often than not default to using male pronouns when translating phrases such as "He/She is an engineer," from English to a gender-neutral language, especially for fields traditionally associated with unbalanced gender distributions or stereotypes such as STEM. Such instances of clear and systemic gender bias arguably obscures the professional accomplishments of women in STEM fields such as AI development, which may in turn hurt women's self-development and self-worth (Waelen & Wieczorek, 2022). Additionally, gender bias presents itself heavily in AI chatbot design (e.g., Siri, Alexa, and Cortana), such that the vast majority of chatbots are designed to speak, look, and act like women (Feine et al., 2019; West et al., 2019). This in turn may lead to gender stereotyping women as subservient due to the "commanding" ways in which we interact with these technologies (Feine et al., 2019; Rosenwald, 2017). Facial recognition AI is yet another technological area that is often rife with gender bias (Domnich & Anbarjafari, 2021), with many facial recognition AI being 99 percent accurate when assessing white, Western males while that percentage drops dramatically for women who are ethnic minorities (Lohr, 2018).

The increased awareness and recognition of the existence of gender bias in AI in various versions of the technology has thus prompted further investigation into the contributing factors leading to this bias and how to mitigate said bias. Much of this research has focused on the importance of diverse training datasets to avoid gender bias (Manresa-Yee & Ramis, 2021), as datasets can inherit the biases and prejudices of the humans who compile and use them (Buolamwini & Gebru, 2018). Nadeem et al. (Nadeem et al., 2020) go further and classify several additional sources of gender bias in AI, including lack of diversity in data, developers, and programmers, and existing gender bias in society being amplified by AI's computational power. This can be especially concerning in terms of AI tech that rely to some degree on gendered anthropomorphism for interaction (e.g., chatbots (Feine et al., 2019; West et al., 2019)), as it means designers and developers are unconsciously building in their biases of what it means to exhibit and replicate human-like qualities (Salles et al., 2020). Therefore, many researchers and practitioners alike argue that it is crucial for AI design and development teams to be diverse and possess a wide variety of backgrounds and capabilities (Piorkowski et al., 2021).

Indeed, the lack of gender diversity in both AI workforces and AI design and development may even lead to poor AI products that do not cater to their users and instead exhibit harmful gender stereotypes (Roopaei et al., 2021). This is because, generally speaking, gender is one of the most common ways to define user groups in the development of new technologies (Vorvoreanu et al., 2019), and designers often have to guess who their users are and how they should design for them in order to save time during development (Oudshoorn et al., 2004), thus designers are inherently limited by their own experiences (i.e., with their gender identity) to inform their choices on how to design for and from the perspectives of women. As previously detailed in 2.1, AI development as an industry is overwhelmingly male-dominated. Therefore, even AI technologies that are assumed to be gender neutral in fact generally favor the thought processes of the men who designed them (Burnett et al., 2011), and are therefor often based on stereotypes and beliefs that men have about gender and women.

In this sense, it is crucial for AI design and development teams to be diverse to pull from perspectives that are intimately tied to identity components such as gender. Yet, women are underrepresented in AI design and development in general, which means there is a lack of input from women regarding how AI technologies should be perceived, executed, and approached. Consequently, there is also an inherent lack of understanding of how women AI developers themselves consider the role their gender identity plays in their position within the AI industry and development process, and how such perceptions may affect their approaches for designing future AI technologiessince most of said tech does not reflect women's perspectives and can therefor not be analyzed to make this connection. Answering these questions would be a vital step to understand the role that gender identity plays - or, more crucially, should play - in AI design and development, which is important to addressing the harmful effects of gender bias and assumptions in this fast-growing technology area.

Participant ID	Age	Ethnicity	Occupation	Years of Experience
1	42	White	Data Scientist	6 Years
2	37	White	Business Owner	1 Year
3	33	White	University Professor (Military)	5 Years
4	27	Asian	Software Developer	2 Years
5	24	Latina	Analytic Support Officer (Military)	3 Years
6	67	White	Project Manager (Retired)	20 Years
7	24	Latina	Capability Developer (Military)	3 Years
8	28	Asian	Graduate Student	4 Years

Table 1. Participant Demographics

3. Methods

Recruitment and Participants. To recruit participants, we posted recruitment messages to specific forums for AI professionals on various social media platforms (e.g., Reddit, on Facebook, and Twitter) to recruit potential interviewees who are over the age of eighteen, identify as a women, and have professional work experience in AI design and development. We also sent recruitment flyers to several email listservs for AI professionals. While the utilization of social media as a recruitment tool can bias a sample as suggesting algorithms include bias (e.g., users' preferences for what is displayed in their feed), the highly specific population targeted (women in AI development) required a means of recruitment that was less randomized and more verifiable. It is interesting to note that our recruitment criteria received some push-back within co-ed social media forums. For example, in the subreddit "r/artificial", a male-identifying user commented *"Not to be that guy but isn't this just sexism. If someone made a men only AI event it probably would get ridiculed."*. Such comments were dealt with appropriately, and underscore the importance of the need to prioritize women's voices in the face of opposition. We then interviewed all participants who responded to our recruitment messages and agreed to be interviewed as voluntary participants from September to November 2021. In total, we interviewed eight professional women with current or previous positions in the field of AI design and development. Participants range in age from 24 to 67 (M=35.25, SD=14.32) and originate from three different countries: China (1), England (1), and the United States (6). It is important to acknowledge that half of our participants are younger (¡ 30 years old) professionals with 1-5 years of professional experience living in the U.S. Table 1 shows the demographic information of our participants.

Interviews. One-hour, one-on-one semi-structured interview sessions were held over the Zoom video conferencing platform in order to protect participants and researchers from the ongoing COVID-19 pandemic. Cameras and microphones were set to "on" for both the interviewer and the participant for the duration of the session. Participants first provided verbal informed consent and confirmed recording permissions.

The interview guide was constructed using a mixture of dialogic (Way et al., 2015) and phenomenological (Bevan, 2014) interviewing techniques, and included questions relating to participants' lived experiences as a woman in AI development and their perceptions of designing AI in general and in regards to women users. In each interview, a researcher presented questions to the participant, but allowed the participant to lead the conversation. The conversation was constructed to be open, but occasional directed follow-up questions were necessary to ensure questions were answered in full. Some demographic questions were asked initially. Further questions were designed to gain insights about environment, tasks, people, cultural influences, and systematic influences as they relate to women in AI. These consisted of a diverse set of open-ended questions related to thoughts and opinions about how women conceptualize their world and their role in designing human-like AI systems, what kinds of design decisions they make, and how they design for women users. The interview concluded with an opportunity for participant feedback and questions.

Data Analysis. Data analysis was conducted using a Grounded Theory approach (Charmaz, 2014) . This qualitative approach does not focus on inter-rater reliability but endeavors to yield recurring concepts and themes of interest, find relationships among them, and formulate them into more complex groups and broader themes (McDonald et al., 2019). First, four authors conducted the first four interviews. They then conducted an initial round of line-by-line coding of the transcripts for the interviews. Next, the four authors consolidated their own codes into several codes that encapsulated the key themes emerging from the data. Third, the four authors conducted group coding sessions to highlight the differences and similarities of their codes until the final categories were achieved through axial coding (Charmaz, 2014). Then, the research team revised the interview guide to address shortcomings of the current guide (e.g., focused too much on the experiences of women in AI and not enough on the influence their experiences have had on their AI design approach) and used theoretical sampling (Charmaz, 2014) to recruit and interview another four participants. Two more group analysis sessions were held to interactively and collaboratively code the data as a whole in order to comprehensively assess the relationship between each category to find a cohesive explanation of the data. Group analysis included converting transcript data into codes of interest on physical sticky notes, organizing sticky notes onto a whiteboard by card sorting, viewing emerging categories, assessing category relatedness, paring categories down, and combining categories for likeness.

4. Findings

In this section we utilize quotes from the participants' own accounts in order to present our findings in regards to RQ1 and RQ2. Each section is divided into three main themes that emerged from our data.

4.1. How Women Perceive the Role of their Gender Identity in the AI Industry

In analyzing the interview data, we uncovered three main themes that relate to how women perceive their gender identity within the AI industry: the influence of gender imbalance in the workplace, expectations to change behaviors to fit organizational culture, and the existence of the "Bro Code" in a male dominated AI industry.

4.1.1. The Influence of Gender Imbalance in the Workplace. We found a distinct division amongst our participant's perceptions of gender roles and their gender identity in their workplace. This division in perception is due, in part, to each participant's background.

Some of our participants are used to being the only woman in the room and, as a result, do not generally notice the gender imbalance in the workplace. For example, P3 (33, University Professor, White) had prior experience in a male-dominated field, the United States Army. When asked about her perception of gender imbalance in the workplace, she stated *"yes, [women are] definitely the minority, but not to the extent that we are in the army, right?...when I'm in environments with large percentages of females, I'm more surprised'.'* P8 (28, Graduate Student, Asian), also echoed this sentiment, *"because my previous background was also in engineering, there were only like four girls in my previous like, undergraduate class. So it's like, I'm not totally sure what it is like, although I know it will be different."* For both participants, they are well aware of the status quo gender imbalance in their workplace and seem to even consider it as a "natural" state – they will be "surprised" if more women are present.

On the other hand, many of our participants noticed less gender balance in the workplace and felt that they were treated as somewhat of a work "mom" because of their gender identity. P4 (27, Software Developer, Asian) described this phenomena in the following way, *"the thing is, you work with a ton of men. And you tend to have - they tend to look at you to be more nurturing, caring, maternal in the workplace. They want to come talk to you about their problems, they get confused if you are serious or maybe even stern."* For P4, the influence of gender imbalance in her workplace is not only shown as women being outnumbered by men but also demonstrated by men's expectations for traditional gender roles – such as women serving as *"more nurturing, caring, maternal."*

4.1.2. Expectations to Change Behaviors to Fit Organizational Culture. As a result of this significant gender divide in AI development, the majority of our participants noted the need to adjust their normal behavior at work.

Multiple participants stated feelings of imposter syndrome in this male-dominated work environment. For example, when asked about her experience in the AI field, P2 (37, Business Owner, White) said: *"At first I felt like I wasn't really meant to be there. And I'm kind of ashamed to say that as a feminist, and why shouldn't I be? Why shouldn't I be in a space?"* For P2, it seems to be necessary for her to make additional effort to prove why she belongs to this field and why she deserves to be in this field.

Additionally, P6 (67, Retired Project Manager, White) described multiple accounts of male clients not listening to her ideas and, as a result, becoming more assertive in the workplace: *"I had a lot of instances where colleagues, all men, actually had a problem...[when they] get to the same level that you are."* P1 (42, Data Scientists, White) echoed this sentiment, saying *"I had to be more aggressive, be forward, be a loud voice...and I actually had to dial it down."* Both participants acknowledged that being assertive may not be their style in their personal lives. However, to make their voices heard and their opinions valued in their workplace, it seems necessary for them to adjust their behaviors *"to be more aggressive, be* *forward, be a loud voice."* – in a sense, to be more masculine.

4.1.3. The Existence of the 'Bro Code' in a Male-Dominant Industry Another interesting topic brought up within many of our interviews is this concept of the "bro code" within their workplace. Many participants mentioned their male colleagues backing each other up in group meetings, often at the expense of their female colleagues. This behavior evokes an unhealthy dynamic between employees, allowing for a *majority rules* mindset to dictate the workplace. For example, when recounting an incident where she came to the defense of another woman colleague's idea in a meeting, P6 (67, Retired Project Manager, White) described: *"I think if she didn't have me there, I really think the guys would have just continued to say majority rules."* P6's experience demonstrates how the uneven representation between men and women in AI workplaces inherently creates a dynamic in which men's voices are prioritized by other men, and how the burden of making their voices heard fall on all of the women in the room.

With respect to group work, our participants also noted distinct differences in the ways their male and female colleagues behave in collaborative meetings, and how those differences affect whose voices are prioritized. For instance, P1 (42, Data Scientist, White) stated that *"women are looking for a more collaborative approach; whereas, men are more inclined to steamroll the conversation. If women don't recognize that, their voice would often be dominated, because they didn't want to engage in confrontation."* For P1, such different working/collaborative styles unfortunately does not help women build a strong voice in the AI industry, as their working styles are not given the space they need in meetings to flourish. Indeed, even when women are able to have their voices heard, it is only in light of having a "back up option" to fall back on that makes the majority men feel comfortable, as P7 (24, Capability Developer, Latina) explains: *"If a female states an idea, they're like 'okay, we'll try it out but we'll have a Plan B."* Here it can be seen that, even if women are "allowed" by their male colleagues to have an idea, their contributions are undermined by their male colleagues' insular thinking of what is best.

Oftentimes, this *bro code* even exists outside of work hours, as many of our participants mentioned their male colleagues bonding in activities outside of work and refusing to invite their female counterparts. For instance, P2 (37, Business Owner, White) discussed not being invited out for social outings with her male colleagues: *"at least in the Silicon Roundabout area in London, it was very much like the beards and the ping pong, and the beer, the microbrewery bear and all this kind of stuff."* This additional bonding time further emphasizes the division between the majority and the minority members of the AI field, a stratification that is then re-codified in the meeting room.

4.2. Women's Approaches to Design and Develop AI

The above perceptions of the role their gender identity as women plays in the AI workplace influenced our participants' design approaches in a variety of ways. In particular, they discussed three approaches to AI design that are important for reducing gender bias in the AI industry and developing more inclusive AI technologies: Design with Gender Neutrality in Mind, Focus on Reducing Gender Stereotypes, Incorporate More Specific and Intersectional Use Cases.

4.2.1. Design with Gender Neutrality in Mind. The majority of our participants agreed that AI should have a gender neutral design. In fact, most already design as gender neutral as possible, seeing gender as a confounding variable. For instance, P3 (33, University Professor, White) somewhat took offence to the question when it was posed: *"more than gender...I'm not going to design it pink, if you will, because it's for females"*.

Therefore, many of our participants choose not to develop with gender in mind. For example, when asked about specific examples of an AI tool for women, P7 (24, Capability Developer, Latina), refuted the idea that you could group women users into a single category: *"I would focus on the process of how women users would be using, you know, whatever product...Women kind of approach it more from a problem solving perspective, whereas the guys have, like, a gaming perspective."* P7 seems to think that looking at an AI agent as a component to solve a problem, rather than something a specific gendered user operates, is the right approach.

Interestingly, one of our participants, P8 (28, Graduate Student, Asian), does not acknowledge AI as gendered entities: *"I don't necessarily put a gender on [Alexa], because I don't know, it's just a machine that you can tell it what to do but it does not need to be a girl or a boy...I feel like it's more like a machine type of creature."* For P8, even if the AI agent is an avatar with a defined gender, she still does not perceive gender as a necessary factor in AI design. From her perspective, gender isn't something you can ascribe to a synthetic entity and is based in biology. P8's view points to the complicated and evolving nature of gender in modern society – while the contemporary understanding of gender has gone beyond a binary dichotomy regarding one's biological sex assigned at birth, the question becomes if the same understanding is or should be applied to AI.

4.2.2. Focus on Reducing Gender Stereotypes.

The vast majority of our participants believe that current AI design is far too gendered. For instance, when asked about the current state of AI design, P2 (37, Business Owner, White) discussed the gendered state of AI tools: *"I mean, I think people have been calling out for a little while, haven't they? The fact that these tools seem to be too gendered."* When asked the same question, P5 (24, Analytic Support Officer, Latina) stated *"I don't ascribe to the idea of gender essentialism, where women are always this way and men are always this way."* For both participants, how gender is approached in the current AI design and development process seems to simply reinforce traditional gender stereotypes, rather than incorporating the key values of inclusiveness and diversity embedded in a gendered perspective. Therefore, they consider such *"gender essentialism"* more harmful than beneficial to AI development.

When asked about what designs women would prefer, P8 (28, Graduate Student, Asian) points out exactly how gender essentialism can creep its way into the process of designing human-like AI systems: *"Males are different from us [women]. They probably would, you know, would like those [sexy female avatars]."* Here P8 speculates on the effects that having predominantly male developers can have on design (i.e. *"[sexy female avatars]"*), which might not appeal to non-male users and thus alienate women (i.e. *"males are different from us,"*). In essence, P8's statement acts as a commentary on how design is often too focused on gendered attributes like sex appeal, when in fact, as she goes on to mention, AI is *"just a machine that you can tell it what to do but it does not need to be a girl or a boy."*

In light of participants' adamant resistance to gender stereotypes and gender essentialism, P8 goes on to highlight how designers can reduce gender stereotypes in AI design: *"There are different types of gender, different types of AI like different characteristics, but gender is not elicit to me not one thing on it is more like different behaviors of it. Our different knowledge it has, or even different algorithm it uses, but not gender."* For her, it is important not to associate certain users' gender with their behavioral patterns. Rather, it may be promising to focus on characterizing behaviors and optimizing AI agents to accommodate different user behaviors rather than different user genders.

4.2.3. Incorporate Use-Case Specificity and Intersectional Practices.

Focusing on how to design AI for women users, our participants collectively highlighted use-case specific and intersectional AI design as promising approaches.

Many of our participants mentioned the need for a use-case specific approach to design AI for women. For example, P7 (24, Capability Developer, Latina) tried to reorient the conversation towards user-centric design when asked about designing a product for women users: *"I would focus on the process of how women users would be using, you know, whatever product."* Rather than focusing on the user population's gender identity as the primary design driver, P7's reorientation focuses on how the product would be used as the primary driver with the user population's gender identity as secondary. A few participants also believe that developers should utilize social listening practices when designing for a particular audience rather than making assumptions about the intended user population. Social listening as described by our participants refers to an investigatory process undertaken after securing a client with the purpose of establishing the problem and population area for a design project. For instance, P4 (27, Software Developer, Asian) described how she would handle a client asking her to design for women users by redirecting the client toward a social listening approach,

> *"You might actually have a really big hole in the LGBT community, and you have no idea....or it could be a totally different income level than you realize...I try to like bring that perspective that is like, we come into something with our own biases, whether we realize it or not. So why don't we take a step back and see what's actually out there before we react?"*

Here P4 is pointing out that, while a client may believe that their intended user population is women, the reality of who the client should be targeting as their intended user *"could be a totally different"* population than the client realizes. Social listening, then, acts as a strategy for pushing back against the idea that AI designers can and should start from a single conception of a user (e.g., women). P4 additionally points out how making assumptions about a user and design based on the category of "women" can be problematic, *"Oftentimes, it's pretty, like straight white woman, middle class...your audience could actually be totally wider than that...women is super broad..."* Taken in combination with her previous quote, P4 emphasizes how social listening as a practice can provide a deeper understanding of factors like income and LGBT status that are crucial for designing at the intersection of multiple identity factors. That intersectionality is fundamentally lost when a user population is reduced down to a singular broad category (e.g., women) because hegemonic views on what that category represents (*"pretty, straight white woman, middle class*") excludes large swaths of potential users (e.g., women of color, women of different classes, LGBTQ+ individuals). This is not only problematic for the making of functional and effective AI designs that fulfills the needs of a client and their users, but is also socially problematic because it perpetuates social bias through the upholding of hegemonic social ideas of who is a "woman".

The majority of our participants echoed P4's emphasis on an intersectional approach to AI design. For example, when commenting on the importance of diverse data sets, P2 (37, Business Owner, White) mentioned *"...we're living in this exponential age and this [fast] pace that comes with that...I guess it would be to kind of slow down and to ensure that the data sets that you're using are ethical and have been considered from lots of different perspectives..."*. There is a recognition in P2's comment that the AI design industry is moving and evolving rapidly, and that such a rapid pace has the potential to lead to the reductive reasoning previously mentioned (e.g., P4's *"pretty, straight white..."*), which in turn can lead to ethical issues. Thus, the response to how to design AI for women needs to involve a consideration from *"lots of different perspectives"* in order to truly fulfill the practical and ethical obligations of AI designers.

5. Discussion

The gender gap in technology at large (Burke et al., 2007) and within the field of AI development (Whittaker et al., 2018) prompted some limited past research on the experiences of women AI developers (Strok, 1992). However, existing literature on HCI and AI is lacking in theoretical conceptions and explorations of how the experiences associated with being a woman in AI development specifically impact the ways in which these women approach designing various AI systems. In this section, we discuss how findings from interviews with eight women in AI fields address these above-mentioned issues. Overall, our findings show that the lack of representation of women in AI has led to a majority rules mentality and gendered approaches to AI development. In response, women in AI find themselves altering their behavior in various ways to survive in such a culture. Their subsequent views on design display a resistance, however, to the existing unnuanced and gendered approach of the man-dominated industry.

5.1. Women's Resistance to Unnuanced Gendered Ideas in AI design

Our findings paint a holistic picture of the perceptions of women's gender identities within the field and within the workplace affecting - implicitly and explicitly - the ways in which these women view AI design and development, particularly in terms of gender bias. First, despite the only other prominent study on the perspectives of women in the AI industry being conducted nearly 30 years ago when the AI industry was in its infancy (Strok, 1992), interestingly - and sadly - our findings show that there still exists a similar sense of unequal treatment and barriers to entering the boy's club of AI today. However, despite the existence of other more recent works on women's perspectives in AI (Roopaei et al., 2021), no other studies to our knowledge have sought to link how these perspectives and experiences could be playing a role in how these women view and approach AI design from the perspective of a woman.

This gap in understanding was particularly concerning as technologies inherently reflect the experiences and biases of the people that design them, and this is especially apparent in the case of AI technologies such as Google Translate (Prates et al., 2020) where gendered stereotypes of women not belonging in STEM jobs are on display. This issue poses problems in AI development partly because developers inevitably define through their biases what it means for an AI system to replicate and exhibit human-like qualities (Salles et al., 2020), in turn perpetuating gender stereotypes such as women being in subservient positions as is arguably the case with chatbots anthropomorphized as human women (e.g., Siri, Alexa, Cortana) (Feine et al., 2019; Rosenwald, 2017). Even more concerning is the fact that technologies act as key societal artifacts that can inadvertently reinforce and shape user identities, including within the realms of gender roles and stereotypes (Oudshoorn et al., 2004), further underscoring the danger inherent in excluding women's perspectives from the design process. Prior to this study, HCI and HCC research has been missing how women's perspectives could be manifesting themselves through the designs we see today, and how their viewpoints are shaping the future of design. Therefore, our findings fill this gap by going beyond simply describing women's experiences, and instead focusing on how their experiences shape their design choices and philosophies.

5.2. The Importance of Gender Considerations to Future AI Design

Our findings also provide crucial insights as to why representation of women and diversity of viewpoints within the AI industry is important for design. Prior research has shown that gender is one of the most common groupings for possible users when developing technology (Vorvoreanu et al., 2019), leading to male AI developers making assumptions about women's perspectives that in turn may lead to AI products that do not cater to their users and instead exhibit harmful gender stereotypes (Roopaei et al., 2021). Our findings show that, despite this prevailing knowledge, women in the AI industry are fighting back against the very notion that using gender as a primary grouping for users is either appropriate, or accurate. Instead, our participants call for and enact various ways to resist this unnuanced approach to designby instead emphasizing the intersectional nature of women's identities, and how the needs of the intended users are more important to focus on than the gender of the users.

Finally, participants also revealed specific design implications for AI development that are important to note. First, developers should engage in social listening and extensive user research to identify a client's target users *regardless of the assumed characteristics (e.g., gender) of the users*. Second, if gender is still considered to be an important characteristic of the target users, it *still does not mean that the AI itself has to be designed in a gendered manner*. There are many circumstances in which an AI does not need to be explicitly gendered in appearance or voice in order to still provide use and value to the user regardless of the users' gender, and, according to our participants, gender neutrality should be the standard to start from so as to avoid perpetuating harmful stereotypes. Third, human-like AI should be, to the greatest extent technically possible, customizable to the individual users' wants and needs, because *women users are not a monolith*. The needs, desires, and backgrounds of individual women users, when applicable, can never fully be accounted for even with careful user research and an intersectional approach, thus necessitating customization to reach a more ideal state of design.

5.3. Limitations and Future Work

This study has several limitations. First, this is a qualitative study, and as such neither causal effects nor generalizability can be extrapolated from our findings. Second, our sample size of eight women is on the relatively smaller side for ideal Grounded Theory work (Charmaz, 2014). However, our sample is diverse in age (ages 24-67), occupation (e.g., Graduate Student, Business Owner, and Software Developer), years of experience in AI development (1-20 years), and is relatively diverse in race (4 White, 2 Latino, and 2 Asian). It is, however, still important to acknowledge that the majority of our participants are younger professionals with only 1-5 years of experience in AI development, and live in the U.S. Thus, the findings of our study are contextualized within this population and the U.S.. Future studies should specifically look into perceptions of gender bias in AI design in different cultural contexts, age groups, and work environments for more nuanced and diverse perspectives. Although future work should include a greater number of participants and more diverse perspectives (e.g., Indigenous women, Black women, LGBTQ+ women, etc.), our sample still provides a variety of perspectives that are worth highlighting as a preliminary investigation.

Future research should also look beyond gender and into how other minorities (e.g., BIPOC individuals) feel about the ways in which their minority status is currently and should in the future be operationalized and accounted for in design. Additionally, P8's (28, Graduate Student, Asian) interpretation of gender and sex highlighted for us the need for a study to focus specifically on how a person's definition of gender plays into their approach to AI design. While U.S. society has come to understand gender as separate from a person's biological sex, the degrees to which different cultures and age groups can separate the two likely affects the way in which they design human-like AI.

5.4. Conclusion

The ever-growing gender gap in fields dedicated to the development of Artificial Intelligence is a prevailing concern, considering AI's history as rife with gender bias and often perpetuates gendered harm in society (Domnich & Anbarjafari, 2021; Feine et al., 2019; Lohr, 2018; Rosenwald, 2017; Waelen & Wieczorek, 2022; West et al., 2019). Our findings highlight the ways in which women in AI are forced to modify their behaviors in order to fit the preconceptions of women that their organizations hold and the subsequent push-back against the role of gender as a design assumption (Vorvoreanu et al., 2019) in AI design that these preconceptions have often perpetrated. Ultimately, our findings have pointed to the urgent need for the field to reorient AI design away from gendered assumptions and biases, and towards an inter-sectional, user-specific design process to minimize gender bias and its harmful effects in the development of new AI technologies.

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