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Women in Industrial Design: A review | Mujeres en el Diseño Industrial. Una revisión

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Abstract:

In most countries, women are underrepresented in the industrial design industry. Some people argue that this is because women do not work hard enough to be good designers, so they do not get hired for jobs. Others argue that women are discriminated against in the industrial design industry, leading to their underrepresentation. In this paper, I review the research on women in industrial design to look for answers regarding the gender patterns seen in the industry. I employ theory from feminist Science and Technology Studies to explain how industrial design may be cast as a "masculine" field due to its association with technology, and areas of design where women have traditionally worked are considered "craft" rather than design. I describe how and why professional cultures and educational spaces in industrial design can be unwelcoming to women. I discuss how queer understandings can better inform our work in gender and design. I conclude with recommendations for future research and initiatives aimed at achieving better gender equality in the industrial design industry.

Keywords: Industrial Design; Female designers; Gender; Design Practise; Design Education

Introduction

Though the fact that women are underrepresented in the industrial design profession is not new, the issue has recently been gaining more attention. In 2020, a female industrial designer based in San Francisco, California, Ti Chang, published an Instagram post with some statistics from a UK report by the Design Council. The report stated that women make up 63% of students studying creative arts and design at university, yet design professions remain 78% male, and the specific field of product and industrial design is 95% male. Women working as product, clothing, and related designers earned 18.3% less than their male counterparts, and only 17% of design managers were female (Design Council, 2018). Chang wrote in her post that the statistics shared by The Design Council were "vindication of my suspicion that female industrial designers worldwide are simply not being hired. And when they are, they are earning less than men" (Ti Chang [@designerti], 2020). Chang's post is shown in Figure 1.

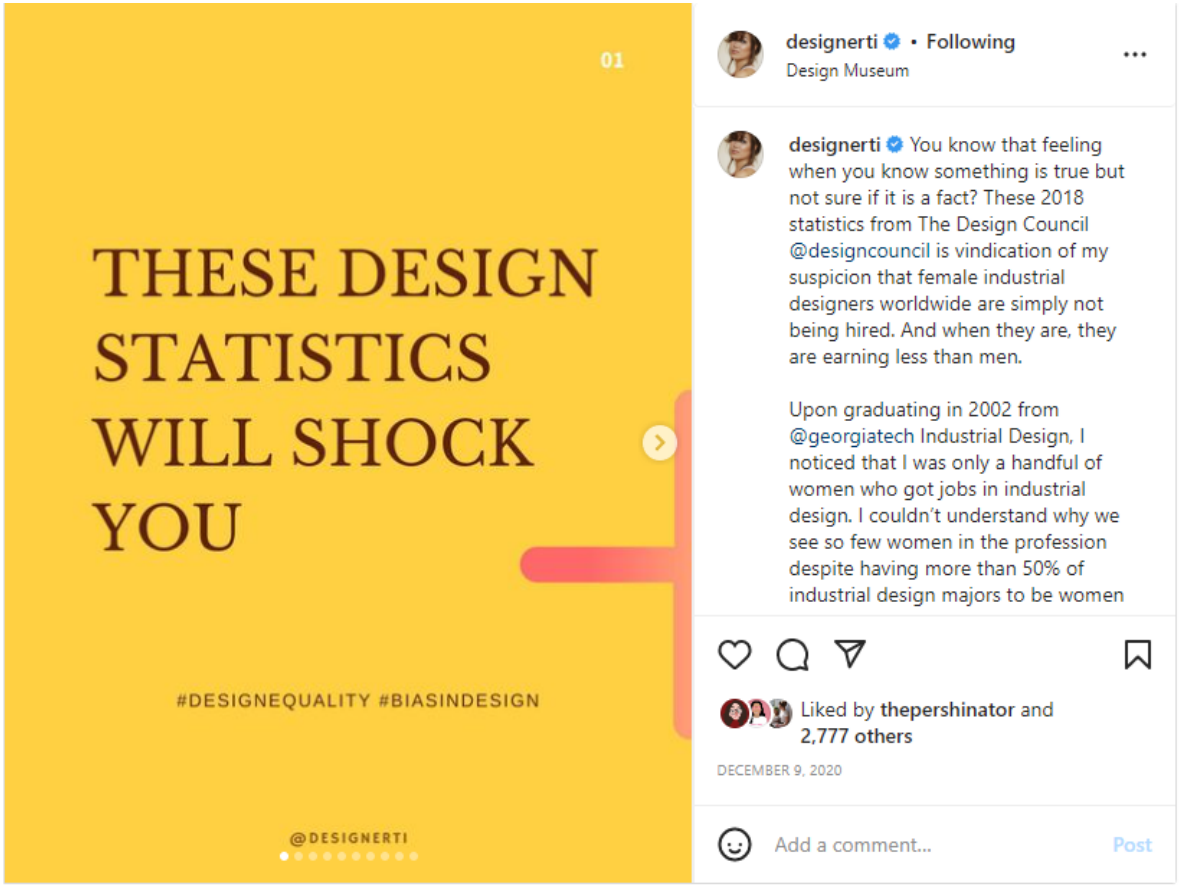

Figure 1. Instagram post by @designerti sharing statistics about women in design from the Design Council's 2018 report. The image reads "These design statistics will shock you #DesignEquality #BiasInDesign." The accompanying comment by the author reads "You know that feeling when you know something is true but not sure if it is a fact? These 2018 statistics from The Design Council @designcouncil is vindication of my suspicion that female industrial designers worldwide are simply not being hired. And when they are, they are earning less than men. Upon graduating in 2002 from @georgiatech Industrial Design, I noticed that I was [among] only a handful of women who got jobs in industrial design. I couldn't understand why we see so few women in the profession despite having more than 50% of industrial design majors to be women."

Chang's post was soon re-posted by Yanko Design, a design site with an international following (Yanko Design [@yankodesign], 2020). What drew even more attention to Yanko Design's sharing of the post were the comments that their post received. Many members of the design community left comments arguing that the field of design is purely meritocratic, and if women were getting disproportionately fewer design jobs, then it was due to female designers' lack of talent or effort. Some examples of the comments follow:

@jackdean6: "Yeah, when you go into a field where getting hired is based off of skill and what you can produce not what gender you are, it is possible to see stuff like this."

@daniel_pgtr: "I studied architecture. There were like 10 women in my year at the beginning and only like 4 at the end of the career. They just couldn't take the pressure, it was very common to see a girl cry."

@nxsaif: "Best people get hired regardless of what sex they belong to." "How many of the 63% [of female design students] even have their portfolios on Behance?"

@deependuajish: "It doesn't account for the extra hours males put in, likelihood of moving location, having a disagreeable temperament; all of which gets clouded by a disingenuous and ignorant statistic."

@troofbetold_: "Design is purely skill/talent based. So as a recruiter, you don't look at the gender of the applicant, you just look at how good their portfolio is...being promoted in the design industry is all about experience and skill."

@carla_trdz: "I'm not outraged, perhaps the reason more males are in the workplace is because they're capable at what they do. Simple."

@stevo.mansell: "Just get good."

@danielgalanofficial: "I could take care of 10 children and it would barely start to resemble the effort I put into having a successful design career. Instead of reading too much into these stats, women should go out there show us with facts that they are as competent."

While Chang's original post argued that discrimination against women designers was to blame for the lower representation and lower pay of women in the design industry, the above comments point to a different narrative. The commenters argued that women were less "good," less "competent," less "capable," have less "skill," "couldn't take the pressure," didn't put in as many hours, were unwilling to relocate for a job, and have a "disagreeable temperament." In other words, they argued that most women, even if they are interested in design and enroll in design school, are simply not cut out to be designers.

The online comments shared above do not represent the findings of an objective scientific investigation but are included here to provide background context of a debate that is going on among designers. People know that there are fewer women in the industrial design profession, but there is not a consensus as to why. If anything, the comments demonstrate that there are designers out in the world who hold very strong opinions about the explanation. In this paper, I will review the literature on women in industrial design in order to bring insights from research into the discussion. Women indeed face many barriers to advancement and acceptance in design, but our reality is much more complicated than what the Instagram discussion let on. I will conclude with recommendations for ongoing research and initiatives addressing gender and industrial design.

I am white American and an English speaker, and my review of the literature for this paper was limited to English-language articles appearing in English-language databases. Thus, this paper does not comprehensively represent world perspectives, and has a Eurocentric and Anglocentric bias in terms of which literature is represented and in terms of my own cultural background and perspective as an author.

Patterns of women's representation in the industrial design profession

While Design Council's (2018) statistics revealed a wide gap between the percentage of female design students and professionals, patterns of representation change over time and differ by country. In 1990, authors Bruce & Lewis noted that less than 1% of industrial designers in the UK were women, which is lower than the 5% shared in the Design Council's report, though not by much (Bruce & Lewis, 1990). Bruce said women were "invisible" in the industrial design profession. The profession was seen as masculine, and women's underrepresentation was justified by sentiments like the fact that industrial designers must work alongside male engineers "who would not take orders from or listen to a woman" (Bruce, 1985, p. 151). Bruce proposed thatan industry-wide strategy would be needed in order to challenge the ideology of the sexual division of labor in industrial design (Bruce, 1985).

In 1974, the industrial design profession in the United States was only 13% female, while the proportion of female students studying industrial design at a University was only 19% (Jenkins, 1982). The proportion of women in industrial design lagged behind other design professions such as fashion design, graphic design, and interior design, but exceeded the representation of women in architecture, which was only 5% female (Jenkins, 1982). More recently, the Industrial Design Society of America (IDSA) reported that now 50% of student members are female, 42% are male, and 8% are

nonbinary. Among professional members, only 27% are women, 69% are men, and 0.5% are nonbinary (3.5% unreported) (IDSA HQ, 2021). Thus, over time, there has been an increase of women in pursuing industrial design in university and industry in the United States, even though the industry remains gender imbalanced.

Representation of women in industrial design is not the same in all countries. Turkey has historically and presently seen a much more equal gender representation in industrial design. In Turkey, 47% of ID graduates are women, and 47% of members of the ETMK (Industrial Designers Society of Turkey) are also women (Kaygan, 2014). While Turkish female industrial designers do face various challenges, Turkey appears to lead other countries in terms of proportional representation in both university and industry, though not necessarily by rank, as women are still underrepresented in design leadership.

Ultimately, we need more data on women in industrial design. 2021 appears to be the first time that the IDSA reported statistics on gender and race, and the statistics were limited and did not discuss rank or pay. Furthermore, women may be overrepresented in professional organizations, which only represent a small slice of the wider design industry. More rigorous data collection and analysis is needed to understand the true picture of how women are faring the industrial design profession. However, statistics cannot tell the whole story. Many researchers have used qualitative methods to study the experience of women in industrial design, which I will now discuss.

A view from Feminist Technology Studies

As I begin my discussion of qualitative research on women in design, I want to introduce a helpful interpretative lens provided by the field of Science and Technology Studies (STS). Feminist scholarship in STS views the concept of "technology" as co-constructed or co-created with gender. Rather than an expression of biological sex, gender is a pattern of social relations in which differences between bodies are brought into social processes (Connell, 2021). Boundaries around professional domains are not accidental or arbitrary but are often drawn alongside gender patterns. The lack of women in "technical" professions such as industrial design is no accident – this dynamic has been historically and intentionally constructed. Domains of skill generally pursued by men are labelled "technical" while those mastered by women are considered "craft" (Johnson, 2010). "Technical skill" and "technology" are concepts that are considered to be masculine, and on the flip side, women are portrayed as unskilled with technology or less interested in it (Johnson, 2010). Technology has often functioned to further the oppression of women, guided by the hands of male decision-makers who hold the power over technological systems (Trescott, 1979). Gender divisions of labor around technology persist in part because people tend to equate masculinity and technical skill (Faulkner, 2001). As industrial designers are in the business of creating new technology, the concept of the co-construction of gender and technology can help explain the masculinization and male dominance in the industrial design profession.

Industrial designers work closely with engineers, and engineering is another discipline cast as "technical" and "masculine." Kaygan (2014) argued that relations between engineers and industrial designers are constructed around symbolic dualisms, including 'real'/'arty', objective/subjective, technological/aesthetics-based, and masculine/feminine. When placed next to industrial design, engineering is seen as 'real,' objective, technological, and masculine. Next to engineering, industrial design is seen as 'arty,' subjective, aesthetics-based, and feminine. When working in organizations that valued the technical sides of these dualisms, industrial designers found themselves in a position of disadvantage next to engineers. For women

in industrial design, the disadvantaged status of being a designer rather than an engineer intertwined with being a woman and deepened their "gender inauthenticity" for technological work (Kaygan, 2014, p. 85). Industrial design's proximity to technology and engineering is likely something that masculinizes the discipline, meaning industrial design is seen as more suitable for men, industrial designers are normalized as male, and female designers are seen as less talented simply because of their gender. In studying the industrial design field, Reimer (2016) found that understandings of creativity, craft, knowledge, and innovation may be presented as gender-neutral but often describe a subject who is presumed to be male. Design discourse normalizes designers as male. For example, a design team may be referred to as "the guys" (Reimer, 2016, p. 1036). Male stereotyped perceptions of the "creative genius" also persist (McMahon & Kiernan, 2017, p. 5). Our ideas about professional suitability and skill are shaped by our ideas about gender, and our ideas about gender also shape our images of professional ideals. This is something we cannot ignore.

Gender and design areas and skills

One way gender functions as a pattern of social relations is that depending on a person's perceived gender, they are viewed as more suitable to work in certain areas of design. Women who enter the industrial profession are seen as more "naturally" talented in styling, color, appreciation of the end user, jewelry, textiles, graphic illustration, and pottery (Bruce, 1985; Bruce & Lewis, 1990; Buckley, 1986). Design historians have also placed the highest value on mass-produced objects and left many women out of design history by ignoring the areas that have been more accessible to women, including craft modes of production and fashion design (Buckley, 1986). Thus, women are not always given a real opportunity to enter all parts of the design profession as they are often pigeonholed into certain areas (Bruce & Lewis, 1990). Furthermore, these areas that are seen as more suitable for women are not the "technical" skills which are highly valued in industrial design and are instead seen as "craft" or "soft skills," which are categories that are both associated with women and less valued. Traditionally the favored "technical" skills in industrial design included hand sketching and physical model-making in a machine shop. More recently, skills in computer-aided design (CAD) software and computer rendering software are also important to the profession, and one third of design roles are digital (Design Council, 2018). These new "technical" skills are likely being seen as something less suitable for women or something that women have less talent in, regardless of whether or not that is the reality.

Women with degrees in industrial design appear to be presently more highly concentrated in roles like design research, UX research, toy design, baby product design, soft goods, textiles and fashion, or color/material/finish (CMF) design. However, hard data on this is difficult to find, and more research is needed. We can explain this phenomenon through a "push-pull" model. Women may be pulled to the "softer" fields if they find the subject matter appealing. However, women also may find themselves pushed into the "softer" fields because teachers, co-workers, or bosses encourage them in that direction based on gender stereotypes. Women also may be pushed out of "harder" sub-fields due to negative experiences that made them want to leave. In contrast, male designers may avoid "softer" fields because they associate them with femininity, and they don't want to be seen as feminine, particularly when they are trying to assert their position and expertise next to engineers, who already view design as a "softer" field to begin with. For example, a male designer who was working in the more female-associated area of design research reported choosing the job title "design strategist" instead of "design researcher" because he felt the title "design researcher" didn't sound as masculine (Ronen, 2018, p. 525).

Gendered patterns of unpaid labor after work hours may also influence gender patterns in design subfields. A 2019 Australian study found that technology-related skills, which are highly valued in the architectural profession, were mostly gained in a self-directed manner outside of work hours. Invisible labor practices that disadvantage women were thought to be the reason that more men than women were engaging with computationally intensive design software, as they had more spare time to do so (Gardner, 2019). It is likely that female industrial designers are not spending as much time outside of work hours attempting to build their computer-related design skills, at least in part because women have to take on more unpaid labor in the home, such as cooking, cleaning, and childcare. Another factor may be that women are more frequently taking a more balanced approach to using their time and not spending all their free time on the computer, such as has been observed with male and female computing students. However, a critical lens would question why "technical" skills are seen as bringing more added value to a firm than other "non-technical" or "soft" skills that are also honed outside of work hours, such as management and communication skills.

Cultures of overwork, competition, masculinity, and assimilation

Creative design fields foster cultures of overwork, competition, and masculinity (Reimer, 2016), which may contribute to women feeling less welcome in industrial design jobs. In a study involving UK designers, working at a consultancy in London was valorized, while working outside London or for an in-house team (a design team within a larger corporation) was disparaged (Reimer, 2016). A branding agency director suggested that employees who were not "good enough" for his firm would go to work as in-house corporate designers to seek an easier lifestyle, and he later suggested that women with children would be especially likely to go this route (Reimer, 2016, p. 1041). A male design director reported that smaller firms "find it difficult to take on the liability of someone who may go off and have a baby" (Reimer, 2016, p. 1038). In spite of the fact that this kind of discrimination is illegal in the United States, a young American female designer reported being asked during her interview if she planned to get pregnant (Advanced Design, 2021). Another young designer reported having to turn down an industrial design internship offer because all interns were required to live in the company-provided apartment, which could not accommodate her newborn child (Advanced Design, 2021). Thus, women who have children or are perceived as potentially having children in the future are facing more difficulty getting hired at some design corporations. More research is needed to understand how widespread this phenomenon is and how much of an impact it is having.

Design firms reproduce a homogeneous male culture because hiring is often based on personality and "fit" (Reimer, 2016, p. 1037). Female designers in Ireland reported issues with workplace culture including inappropriate behavior directed toward them, having to work harder to be taken seriously on projects (especially "technical" projects), and being discouraged about their own prospects of advancement if they did not see women in leadership (McMahon & Kiernan, 2017). A comprehensive study of gender and racial issues in architecture revealed that both gender and racial discrimination were rampant problems in the profession. Underrepresented architects were often pigeon-holed into certain areas of work. Significant pay gaps existed between men and women architects and widened in higher ranks of the profession. A leap-frogging phenomena was present, where men with less experience were able to climb the corporate ladder more quickly than women with more experience. Women of color reported the lowest levels of satisfaction with their future career prospects. Many female architects reported having traded a family life for a career, while male architects did not experience this tradeoff (Anthony, 2001). Though less

research has been done on workplace discrimination, pay discrimination, and jury bias in industrial design, it is likely that the similar patterns to those in architecture would be found.

A behaviour of avoiding discussing gender or gender differences has been observed among industrial design professionals (Ronen, 2018). However, these discussions are increasingly being had in academic and professional settings. In a presentation titled "How to Lose a Female Designer in 10 Days," female industrial designers Mallory Evans and McKayla Barber illustrated a story in which a female designer joins a design studio and shows up on the first day wearing a patterned skirt (Figure 2). By the end of the story, the designer has experienced lots of disparaging comments in the workplace, and has also assimilated her clothing in order to blend in. In the end, she is wearing the typical architect/designer uniform of a plain black T-shirt and pants in an effort to assimilate with her male colleagues (Evans & Barber, 2019). Through this storytelling, the two young female designers expressed a reality about design culture, that female designers face pressure to change the way they present themselves in order to fit into male-dominated design workplaces.

Gender and design education

Women were historically not welcomed into industrial design education programs. Originally, the industrial education movement, involving courses like wood and metal work and mechanical drawing, was designed to prepare men for careers in paid employment, and the equivalent offering for women was home economics courses (Rury, 1984). Early arguments for the inclusion of women in industrial education courses like shop classes were rooted in the fact that housewives needed to know how to repair and maintain mechanical and electrical devices in order to perform housework, because, in the United States at the time, it was assumed that most women would eventually become housewives (Wells, 1946). While it is easy to believe that women are no longer steered away from certain professions because of their gender, recent research shows this is not the case. Female industrial design students in Ireland reported being encouraged to pursue more "academic" subjects or traditionally feminized disciplines (McMahon & Kiernan, 2017, p. 3), suggesting that the gendered nature of the industrial design discipline may be preventing women from being supported in their pursuit of it.

The gendered nature of the skills taught, masculine-oriented project topics, and masculine-oriented artistic styles are all factors that female students have reported to be discouraging during their studies industrial design. A Norwegian university had an imbalance where nearly all the students choosing service design were women, and nearly all the students choosing industrial/product design were men. A female graduate explained why she chose service design as her concentration, and why she believed more women were choosing service design and more men

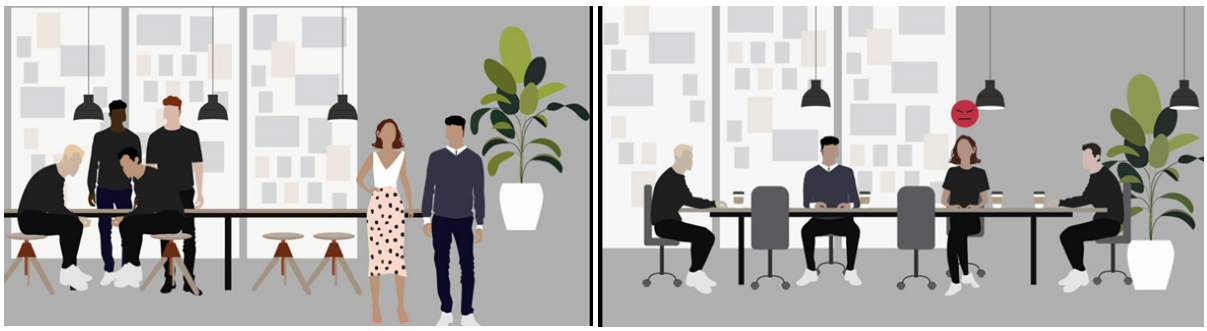

Figure 2. Left image is a drawing of a professional industrial design studio. Five male employees are dressed in all black clothing, and a female employee is dressed in a white tank top and a pink polka-dotted skirt. The rigth image shows the same design studio, and the male employees are still dressed in all black clothing, but now the female employee is also dressed in all black. A red angry face emoji is above her head. From Evans & Barber (2019).

choosing product. She said, "when I think of product design, the first I think of is very masculine drawings which are not relatable to me." She cited drawings of cars and drawings in the style of Koos Eissen as examples of "typical" industrial design drawings which she felt distanced from, because of their "un-personal, masculine style" (Bjørnstad, 2018, p. 5). She thought a greater variety of expression would encourage more girls to become industrial designers. Similarly, a United States-based study of industrial design sketching abilities found that while five out of six male students had prior experience with the common industrial design sketching style, none of the female students had prior experience in this style and only reported experience with a more "fine art" sketching style. The female students also preferred the "fine art" sketching style (Barnhart & Walters, 2018, p. 3). A female designer reported being told that she sketched "like a girl," as an implication that her sketches were done poorly or weakly, similar to being told "you throw like a girl" (Ronen, 2018, p. 524). Barnhart & Walters hypothesized that the industrial design style of sketching and idolization of the "hot sketch" was a contributor to gender disparity in the industry (Barnhart & Walters, 2018, p. 1).
Besides sketching, a female design student reported that CAD programs like Solidworks and Catia felt "very technical and not relatable" (Bjørnstad, 2018, p. 5). Female students in Australia also perceived themselves as not starting off at the same level as male students at the beginning of the CAD software courses due to having had fewer life experiences with those skills (Lockhart & Miller, 2016). The study also found that female industrial design students initially perceived the machine shop to be a daunting, "gendered" environment. Female students also felt that they started off behind due to having less prior experience in this area than the male students (Lockhart & Miller, 2016). Another study of university students in product and industrial design in the UK found design to be a "gendered discourse," where technical competency was seen as gendered, and tools like hammers, locations like the workshop, and computing skills were experienced by women as gendered (Clegg et al., 1999, p. 44).

The socially constructed connection between shop tools, computing tools, technology, and masculinity is clear. Although there are many female students who enter university with expertise in CAD and workshop, and there are plenty of female students who excel with and embrace the typical industrial design sketching style, we should be mindful of the fact that for many women, throwing themselves into these domains may feel like a violation of gender norms. Furthermore, industrial design instructors should be mindful of the fact that their students are raised in a society in which people are socialized very differently based on their gender, and that this affects the types of skills that people are encouraged to obtain prior to entering university. It is clear that CAD skills are currently essential for most industrial design roles. However, I question whether high-fidelity sketch rendering continues to be of wide importance in the industry now that computer-aided rendering with software such as Keyshot is so popular. The emphasis placed on a particular sketching style may now be an irrelevant and unnecessary gatekeeping tool. Similarly, machine shop skills may not be as important as they once were now that 3D printing is so widely used in the prototyping process. Future research should seek to understand what skills are most used in the design industry day-to-day to better align education with industry and ensure that gendered domains aren't serving an unnecessary gatekeeping purpose.

Another potential problem area regarding the gendering of design education is project topics. Female industrial design students in Australia reported feeling that course projects were generally more in-line with "masculine interests" such as designing power tools and cars, and this limited their interest and engagement in the course (Lockhart, Cathy & Miller, Evonne, 2015, p. 4). A study in engineering design found a similar phenomenon, that the project domain of

group assignments could be viewed are more oriented to one gender than another, which may contribute to female students feeling undervalued by male peers and lower self-efficacy reported by females (Okudan & Mohammed, 2006). Design educators should be more careful to select project topics that the students agree are gender-neutral or that appeal equally to all students.

Finally, critiques and juries are long-standing pedagogical methods in industrial design, yet the possibility of gender or race-based discrimination during design juries and critiques is very under-studied. One study of design juries found patterns of prejudicial behavior among and between jurors and students of different genders and races, and suggested that this phenomenon likely discourages talented female and/or racially minoritized students from continuing in school or in the profession (Frederickson, 1993). To further study this phenomenon, it would also be useful to look at how jurors and reviewers react to the types of projects presented by students. Could it be that women are penalized for presenting a project from a female-associated domain, such as a baby product, since they are confirming gender stereotypes, while the same project might be praised if presented by a man? Future studies could investigate questions like this.

Gender essentialism and queer understandings

Thus far I have primarily focused on the experiences of women in industrial design, but gender is not a fixed binary. Although femininity and masculinity are helpful concepts in the sense that they can be used to explain socially constructed categorizations that impact gender distinctions, our reality is more complex. Masculine and feminine are not two ends of a spectrum, instead, there are multiple different masculinities and femininities (Connell, 2021). Furthermore, there are many people who identify as non-binary or do not identify with a gender at all. Some researchers have aimed to incorporate queer understandings of sex and gender into design research and practice (Denz & Eggink, 2019; Prochner, 2014). Prochner (2014) argued that while projects that critique typical binary gender encodings into products are useful, for example, designing a power tool with a more "feminine" look, these projects would be more valuable if they went on to represent gender as more of a broad spectrum instead of a binary (Prochner, 2014). Some projects that have sought to better represent women's voices in design have taken a position that essentialized gender or put women in a box (Prochner, 2014). For example, the woman-focused design initiative Femme Den believes female users can be categorized and that they required an emotional connection with products (Prochner, 2014). Their website states, "a woman's purchase decisions reflect her good judgement–and it's not easy to gain her trust because it's personal and emotional" (Femme Den, 2023). Ronen (2018) found that postfeminist ideology in the US industrial design industry was contributing to the celebration of essentialized or fixed gender differences while simultaneously overlooking women's devaluation (Ronen, 2018). Designers need to be careful that our arguments for including women in industrial design do not put women into a box, such as by saying things like "women are more emotional and better able to empathize with users." We also need to be careful that our arguments for including women do not overlook other groups like nonbinary and gender nonconforming people, and that we do not ignore the reality of intersectional identities. Women who do not belong to the majority race or who are not heterosexual may face additional barriers that compound with their gender identity and make being welcomed into the industrial design community even more difficult.

Research connecting gender and industrial design can also fall into the trap of essentializing gender. For example, a recent study attempted to use EEG to measure gender differences in design cognition (Vieira et al., 2021). As motivation for the

study, the researchers said they wanted to know whether the practice of design was influenced by gender, yet the authors did not provide a theoretical reasoning for why they though that gender was an appropriate variable to use in this way. The paper also stated that "women less often than men have outstanding creative achievements" (Vieira et al., 2021, p. 572). Instead of looking for "gender differences" in brain activation to explain observations like this, we should be seeking to understand why our society counts men's "creative achievements" as more "outstanding" than women's. Furthermore, a recent review on brain research suggests that rather than a male-female binary or even a male-female continuum, "non-binary" is a better way to understand the brain. Human brains are comprised of a "mosaic" of male and female characteristics, and sex category only explains a small part of variability in brain structure (Joel, 2021, p. 1).

Industrial design has a history of designing around an "ideal" male user's body. Dreyfuss' (1966) anthropometric charts, representing the foundation of human factors for design, proposed designing for the average male body size, or for a range that would accommodate 95% of men (Dreyfuss, 1966). This phenomenon is manifested is with cars, for example, which have historically been designed to be safest for the average male body shape and size. Regulatory requirements in the United States didn't even require crash test dummies modeled after female bodies to be used at all until 2003 (Fu et al., 2021). While the push for inclusion of female bodies is valid, projects that focus on the way products ignore female bodies are often short-sighted in that they then go on to ignore a broader diversity of bodies by ignoring trans and intersex bodies (Prochner, 2014). Like gender, biological sex is also not a binary (Karkazis, 2019). While it is important to understand how social structures like gender shape the profession of industrial design, we should also be careful that we do not marginalize other groups in the process of attempting to improve equality.

Conclusions and recommendations for future research areas

I began this essay with a story of an Instagram post igniting a debate about whether women's lower representation in industrial design was due to a lack of talent or due to discrimination. I then provided a review of the literature about gender and industrial design to present what research can tell us about the issue. None of the literature indicated that female design students or professionals don't work hard enough or aren't as "talented" as male designers. The reality is much more complicated, as gender is a very powerful concept that shapes the organization of society. Gender, as a structure of social relations which brings differences between bodies into social process, influences ideas about design and technology versus craft. At the same time, associations of technical skill shape our ideas about gender. Thus, it doesn't make sense to discuss why there are fewer women in industrial design without interrogating bigger topics like the co-creation of gender and technology. Women have historically and presently been written-out of industrial design when the boundaries of the discipline are drawn to exclude areas where women have been more prominent, calling those areas "craft" instead of design.

What is considered "technical" is not an accident. Despite the clear ergonomic similarities between operating a sewing machine and operating a band saw or operating a drill and operating a hand-mixer, the skills of operating tools associated with men are considered technical, and the skills of operating tools associated with women are considered domestic, non-technical, or even "craft." Although industrial design involves many other skills besides CAD, sketching, and model-making, these skills are highly valued and often highly emphasized in design education programs. Since some female students have reported being discouraged by entering CAD or machine shop classes

with less prior experience than their male classmates, instructors should keep this in mind and make sure the classes are welcoming to students of all backgrounds and baseline skill levels. In my own time studying in a design program, I observed that my shorter and smaller classmates, who tended to be women, could not get leverage to use some tools in the shop because the worktables were too tall. Some of the tools were also too large for their smaller hands. It is somewhat ironic that education programs like industrial design, which often teach subjects like human-centered design and ergonomics, also house spaces where many of the students face poor ergonomic conditions that limit their ability to perform their assigned work. Furthermore, educators should take care to avoid exclusively promoting "masculine" sketching styles or assigning projects topics that are perceived as masculine. In reality, there are many styles of sketching that can communicate design concepts clearly, and industrial designers work on all kinds of projects in the real world, not just projects from domains associated with men.

Arguments for including women in the industrial design profession often bring up the fact that women are the primary decision makers in over 50% of the purchases of home furnishings, automobiles, and consumer electronics (Silverstein & Sayre, 2009). While design teams benefit from being more diverse, women have much more to offer design teams beyond being able to understand female consumers. We cannot essentialize gender in our arguments for the inclusion of women. This would mean saying things like "we need women on design teams because they are better at empathizing with the user." People are not defined by their gender, and though patterns of socialization often mean women are trained and rewarded for more social behaviors, truly anyone of any gender has the capability of gaining any skill.

Ultimately, creating diverse design teams is critical because a diversity of experience will bring about a better ability to make decisions which account for the diversity of users who the products will serve. We should ask questions like: how might our definition and standards of "good design" be gender and culturally biased? Or how might the focus on a "hot sketch" or "sexy render" be acting as a gatekeeper that values certain "technical" skills over the wide variety of other design skills which are critical to making a product successful? Future research in industrial design should focus on social factors that may be preventing historically excluded individuals, whether that be women, nonbinary people, minoritized racial groups, people with disabilities, or LGBTQIA+ individuals from thriving in industrial design education and professional sphere. Future research should also explore the issues of gender in design in other regions, such as Latin America and Africa, as cultural and regional differences likely impact the issue as well.

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