Gender Gap in Tech Industry

Kerry Choy

Introduction:

Living in such a technologically advanced era surely is an amazing experience. Thanks to Steve Jobs, Mark Zuckerburg, and Bill Gates etc., technology has changed the way we lived, and experience life. I assume that most of us are very familiar with the names that were mentioned above since at some point in our lives, we have either used their products or heard about their success. I personally admire these incredible figures because it is my goal to become a great software engineer. However, making the decision to actually realizing my dream was not easy. As a matter of fact it took me years to finally find the courage to get on my computer, and wrote my first line of code. It wasn't because I didn't have the resources to learn, or the time to spend doing it. It was nothing else but an idea. It was this idea that was planted in my head so secretively that I myself did not understand or recognize it for a very long time. It is the idea that girls can't be programmers. It might sound odd to some people since this idea is definitely not true, or even close to the truth, but the strangest part is that no one ever told me this. Thus, as I eventually started my journey into the technology sector, I became more and more interested and curious as to why or how I got this idea. In this paper, I aim to develop a well structured discussion regarding what stops women or discourages women from getting into and even more importantly, succeeding in, the technology industry.

A typical day of a software engineer:

When people think of software engineers, many don't seem to really understand what they actually do for a living besides the fact that they are good with computers and writing complex looking codes. Thus to help my readers have a better understanding of my research topic, I will first attempt to describe the job of programmers by portraying my life on a typical workday as a developer.

8am: Before we start, I would like to point out one thing which is crucial about this job: software tools and languages are constantly evolving and changing, some tools that were extremely popular the previous year can be already abandoned by the majority this year. Thus it is important for engineers to keep learning the new materials and to stay on top with happenings and news in the tech industry on a daily basis. For that reason, the first task in the morning when I arrive at work and turning on the computer is usually dedicated to self-improvement on my programming skill: reading the news, and learning the new technics and languages whenever I find necessary. There are usually tutorials and other online resources that I can go on to acquire those new skills. However most of the time it still requires a lot of researching and testing on my own to fully comprehend the new materials.

10am: software development projects are usually done in groups. No matter how big a project is supposed to be, it would generally be split into smaller pieces

where each sub-project estimated to take about 2 to 3 weeks from start to completion. In those 3 weeks sprints, it normally takes 2 weeks to write all the codes needed to implement the feature, and the last week is used to do testing, bug-fixings, and last but not least, deployment, where the feature is released to the public.

If it is a start day of a new project, the engineering team would get together and begin the white boarding process. It is when we brainstorm and draw out precisely the steps and tools we are going to use to create the program and divide the tasks among the members. This is the most crucial part of the cycle. You can look at it as mapping out a blueprint for building a house: if one part goes wrong, the rest would collapse. Therefore, white boarding requires a lot of precision and critical thinking.

12pm: Lunch is usually the time for an engineer to get some vitamin D (sun), and exercise into their routine. I have colleagues who could squeeze in a spin class at the gym, and others who would do yoga but most commonly many would go for a long walk. It is especially important since exercising helps the brain to recharge and so to help refresh the developer's thought process. It also enables us to tackle problems from different perspectives instead of going down rabbit holes. You would be surprised to know how many breakthroughs were made during or after those lunch hours.

2pm to 6pm: The afternoon of a programmer is usually focused on writing codes to accomplish the task that is assigned. Coding is essentially a mix of logics and algorithms translated into readable lines using words and symbols. There is often very little interaction between coworkers during this course, since coding requires high concentration, and it is hard for one to pick up his or her thought process once it's been interrupted. Nevertheless, at the end of a workday, most teams would implement an end of day "check in" to examine where every team member stands and if changes have to be made. After the check in session, I usually go back to my desk and continue working on my own for another hour or two.

This is my typical workday of a software engineer. To be a great programmer, one must have great self-disciplinary skills, great concentration, and an extraordinary sense of logic. On the other side, as some might notice, it is also a job with certain level of social isolation and seclusion.

The non-existing gender in the upper tech sector:

While gender bias has been a longstanding issue in the corporate world, Silicon Valley is taking this problem to a whole other level. *The Huffington Post* had published an article regarding sexism in Technology firms. It showed a study done by the Fenwick and West law firm that, in 2014, forty percent of the top 150 Silicon Valley companies have no women on their boards of directors, and the other 40 percent had only one women. The issue was surely not that there are

not enough women in the work force. As Fenwick states, women makes up half of the US labor force, and more than half of professional jobs and management are women. Thus this signifies that the lack of female workers in Silicon Valley is most likely not a coincidence, but a blend of many different factors that are either stopping women from entering or failing to keep them in the technology industry.

Early Childhood development:

"A butterfly could flap its wings and set molecules of air in motion, which would move other molecules of air, in turn moving more molecules of air— eventually capable of starting a hurricane on the other side of the planet."
 Andy Andrews, The Butterfly Effect: How Your Life Matters

As I continuously to make discoveries during my research journey, the sources I discover often trace back to the beginning of time, childhood development. Therefore, this study will focus on the entire pipeline of engineering instead of the industry alone. It therefore includes the periods from early childhood development to college education environment. This approach would help the readers and I to observe all influences that would impact a person's life decision in joining the tech industry. It might also help me find a common denominator of why it 's hard for women to enter or stay in this field. First, let us eliminate some social stereotypes of capabilities between the two genders.

The research on math capabilities between the genders can be dated back a long time. In 1990, Janet Shibley Hyde, Ph.D., an analyst at the University of Wisconsin, and associates distributed a historical meta-examination that gathered information from 100 unique investigations of math performance. Orchestrating information gathered on more than 3 million members somewhere around 1967 and 1987; the analysts found no obvious contrasts between men and young women in math execution. Young women were marginally better at calculation in elementary and middle school. In secondary education, young men demonstrated a slight edge in critical thinking, potentially because they took more science classes that stressed those aptitudes. In any case, young men and young women comprehended math ideas similarly well, and any gender orientation contrasts contracted throughout the years, belying the thought of a settled or biological separating component.

Likewise in 2005, Elizabeth Spelke, Ph.D., an analyst in psychology at Harvard University, and associates reviewed 111 studies and reasoned that sexual orientation contrasts in math and science ability have a hereditary premise in intellectual frameworks that develop in early youth. All things considered, the studies proposed that men and women overall have an equivalent bent for math and science. Additionally, kid and young lady newborn children were found to perform similarly well as youthful as six months on errands that underlie arithmetic capacities. Regardless of such proof, inquiries of gender differences

have held on, to some degree since men still greatly dominate in science and math professions. In 2007, Diane Halpern, Ph.D., and partners including Hyde distributed an agreement explanation targeting this specific topic. Without a doubt, the result propose that women tend to score somewhat higher than men on verbal capacities while men have a tendency to have a slight edge with regards to visuospatial abilities, the analysts report. Be that as it may, science is just a little part of the clarification. The scientists infer that early experience, instructive approaches and culture likewise unequivocally influence achievement in math and science.

Different studies propose that with regards to math, young women, and young men are comparatively skilled. A 2008 investigation by Hyde and Associates reported that in youngsters from grade two to eleven, there were no gender disparities for math aptitudes. What's more, in 2009, Hyde and Janet Mertz, Ph.D., reported that while more young men than young women score high levels in math and science, that sex gap has been shutting after some time. Also, they reported that the gap is lesser in nations with more prominent gender balance, proposing that sex contrasts in math accomplishment are to a great extent because of social and ecological variables (Hyde & Mertz 2009).

The research proposes that apparent or real contrasts in psychological execution between guys and females are doubtlessly the aftereffect of cultural and social factors. For instance, where young women and young men have contrasted on

tests, specialists trust social connection assumes a critical part. Spelke trusts that distinctions in career choices are not due to varying capacities but rather to social components, for example, unobtrusive yet pervasive gender expectations that kick in amid secondary school and high school.

In a recent report, Steven Spencer and associates investigated sexual orientation contrasts among males and females who had a solid math foundation. They found that only telling women that a math test had beforehand indicated sex contrasts hurt their execution. The specialists gave a math test to men and women after telling a large portion of the women that the test had demonstrated sexual orientation contrasts, and telling the rest that it discovered none. Women who expected sex contrasts did fundamentally more awful than men. The individuals who were told there was no sexual orientation dissimilarity performed equivalently to men.

On the off chance that guys and females were comprehended to be scholarly equivalents, things may change in schools, colleges and universities, industry and the work environment by and large. As Hyde and her associates noted in 1990, "Where gender difference do exist, they are in basic regions. Critical thinking is fundamental for accomplishment in numerous arithmetic related fields, for example, designing and material science." They trust that long before secondary school, kids ought to be taught fundamental critical thinking abilities in conjunction with calculation. The scientists additionally indicate the quantitative

bit of the Scholastic Aptitude Test, which may tap critical thinking skills that support young men. The subsequent scores are utilized as a part of school affirmations and grant choices. Experimentally faulty gender stereotyping costs people, as well as society in general. (American Psychological Association, 2014)

Since we have found out that women and men are both gifted and have broken even with capacity in science and arithmetic, let us now concentrate on the real issue, the seemingly insignificant social and cultural environmental factors. Like the famous quote by Andy Andrews, a butterfly could flap its wings and cause a hurricane; a few gender bias comments through out a child's development can lead to girls dream shattered and result in them turning away from joining one of the most powerful sectors in the world.

"All children are born pure egoists. They perceive their needs to the exclusion of all others. Only through socialization do they learn that some forms of gratification must be deferred and others denied."
 Andrew Vachss

Sexual orientation compensation gap in engineering throughout history:

In order to comprehend the study more thoroughly, let us look at in some past statistics and studies done in this field. In 1995, women held 10 percent of the

employments in engineering occupations. Utilizing various relapse analyses, the researchers investigated different potential clarifications for the compensation hole in this occupation. The study demonstrated that the pay gap is fundamentally clarified by the way that female specialists, by and large, have fewer years of experience after their first baccalaureate degree than guys; pay rates of female and male engineers with comparable years of experience are the same.
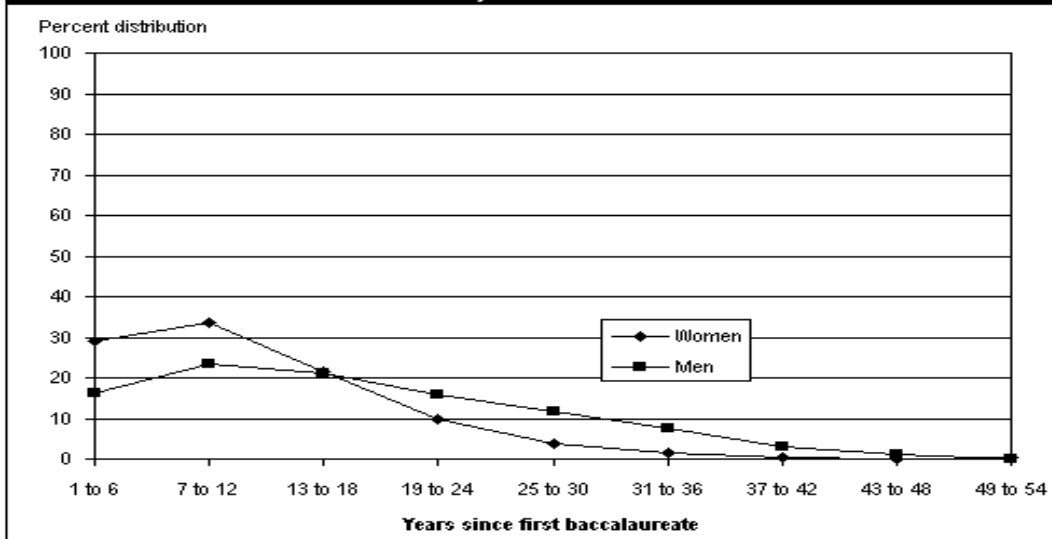
Utilizing 1995 review information from the National Science Foundation, included around 1.5 million school alumni of all ages in 16 engineering occupations. Median compensation for men; i.e., women in engineering earned 87 pennies for each dollar earned by men. This is reliable with different results that demonstrate that the profit hole diminishes fundamentally when women are contrasted with men with comparable instructive foundations and occupations.

The examination initially investigated whether men and women varied on various measures, for example, instructive field (engineering versus non-engineering), livelihood segment, geographic district, most astounding degree achieved, and years of experience. These datas were then used to figure out if these components, alone or together, could clarify the sex pay hole among engineers.

Men and women contrasted on these qualities:

•   Employment part. There was a slight distinction in the median of men and women as for the divisions in which they worked. Women were better spoken to in neighborhood, state and Federal Government (17 percent of women versus 13 percent of men) and less all around spoke to in the private industry (77 percent of women versus 81 percent of men).

•   Region. Men and women were appropriated distinctively as far as living arrangement, e.g., a higher division of female specialists lived in the Pacific Coast region (24 percent of women versus 20 percent of men).

•   Highest degree accomplished. The main striking contrast was at the doctoral level with a higher rate of men (5 percent) having doctorates than women (3 percent).

•   Years of experience. Utilizing the time slipped by from the year of an individual's first four-year certification grant as an intermediary for quite a long time of experience, figure 1 portrays the diverse distributions of years of experience of men and women engineers. Higher rates of women specialists were found among those with 12 or fewer years of experience. Figure 2 demonstrates the relationship between this measure of experience and middle pay. Of course, compensation levels increment with years of experience. Further, the rate at which compensation increments with experience is the same for men and women (La, 1999).
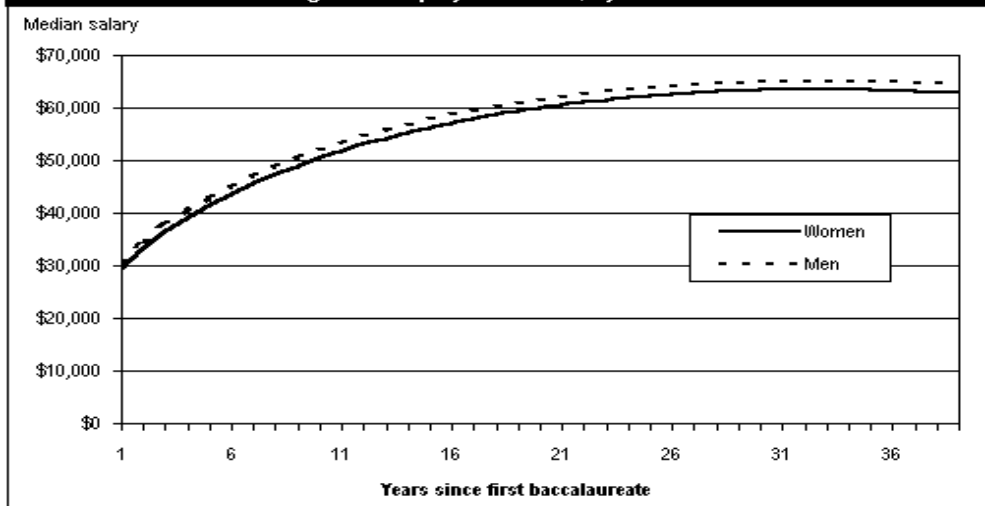
Figure 1. Percent distribution of years since first baccalaureate degree of U.S. engineers, by sex: 1995

Figure 2. Relationship between years since first baccalaureate and median salary of U.S. engineers employed full-time, by sex: 1995

Following the research was done and the data collected above, one can easily insinuate that women were disadvantaged previously in the history of the Engineering career. Initially, women were perceived to be of lesser skill than the men. This led to their denial of a fair chance of getting to train as engineers. The historical career prejudice towards women is dying, but its dying embers are still at large. The shadows of the injustices still affect women. For instance, many women do not earn the same salary and allowances as their counterparts basically due to lack of experience which they had previously been denied. Also, the societal expectations are the real cause as to why we have few women in the engineering sector. If all of us were to change our prejudice, then all women would have an equal ground to men. Women are usually weighed down by the mental situation in which the society predominantly puts them in.

Social predominant mental perception towards engineers:
People spend too much time finding other people to blame, too much energy finding excuses for not being what they are capable of being, and not enough energy putting themselves on the line, growing out of the past, and getting on with their lives.
J. Michael Straczynski

Whenever I tell someone that I am a programmer, I usually receive responses such as: "Oh I would've never guessed!" "Really? But you don't look like one!"

Before we go further, let me first clarify what I look like: tall, lean, Asian and South American female in my mid-20s, who enjoys fashion, travelling, and socializing with all types of people. So here is the question, what are programmers suppose to look and act like? I talked to a group of diverse people (all of them are well educated in non-tech fields) and they were all in agreement that computer programmers were generally looked down as the anti-social nerds, the arrogant jerks, the autistics, the "weirdos", etc. I understand that each field has its' own negative stereotypical associations, but the tech field seems to have a lot more when compared to other conventionally successful careers. The doctors for example, are seem as smart, workaholic gods; lawyers are known as being arrogant, slick, well-dressed, great negotiators; bankers are looked upon as ruthless, high-end party going, charming but sneaky wolfs; engineers, well… engineers are seen as either obese or underweight, mountain dew drinking dudes, who sit alone at their computer desks and are too scared to talk to women. These traits are even being validated in the media. TV shows such as the Big Bang Theory and Silicon Valley fully indulge themselves with all the negative characteristics mentioned about engineers.

Where did those negative connotations come from and is there any truth to them? There are several ways to analyze how those associations were created, and here I will determine a few. First, as I mentioned previously, software engineering is a job that doesn't require much social skill or interaction, and is comparably isolated and secluded. For some people who have trouble with inter-personal skills and discover their interest in programing at an early age,

it is a natural fit. Thus, there are some truths about this field attracting socially incompetent individuals. The working environment creates a comfort zone for them and thus they were able to develop and grow in these "bubbles". But also because of that, their incapability in inter-personal skills was never resolved or outgrown with age, and eventually, this group becomes the face of socially awkward loner engineers.

Another way to look at this would be that computer is one of the most complicated machines that we humans to invent. In that sense, it takes a lot for one to truly understand it and use it well. To be a great engineer means you think like the machine, you speak its languages (a decent programmer knows more computer languages than human ones), you spend most of your time understanding its behavior, and communicating with it. Thus, one's energy and time that would otherwise be used towards development of social skills, and more importantly, empathy with other humans, is spent with a machine. Consequently when you finally come out of work and try to interact with a "normal", probably non-tech person, his or her behavior becomes foreign, and incomprehensible to you. Eventually, you retreat back in to your machine world, and only connect with people who are just like you, who speak the same language (computer languages), have the same humor (code jokes), and share the same insecurities. This situation surely doesn't apply to all programmers, but I have surely seen it first hand.

With the social perception explained, let us take a look at just how difficult it is for women to break the gender barrier to enter the tech work force in real life.

Gender bias in tech hiring process

"It seems to be a law of nature, inflexible and inexorable, that those who will not risk cannot win. "
John Paul Jones

During my research, I was able to carry out several interviews with my research subjects; two of them being a recently graduated programming alumnus Carolina, and the school's career coach Serena. Carolina is a twenty-seven years old woman from Mexico City. She has graduated from an immersive programming course three months ago. She was one of my classmates at the programming school. Serena is the Career coach in the same school. She helps graduates job search process. We got together after the school's monthly hiring mixer event and I had the chance to do a casual post graduation follow up with both of them. There were a few interesting happenings they updated me on. Carolina after a month of job searching in New York and had no luck, was planning to go back to Mexico and continue her job search there because the cost of living is just too high in the city. She was a bit devastated since many of the classmates from her cohort have already gotten multiple offers, and they

were in the stage of salary negotiation. (She graduated from a cohort that consists of 80% male students.) This mixer was therefore very important to her.

One of the topics in our discussion was about the hiring mixer that we just attended. For those who are not familiar with the event, let me first provide a description. Every month, the career coach Serena, would invite potential employers from about 10 to 15 companies who are looking for software developers to join their teams. All alumni are invited and eligible to attend this event so to help them land new jobs and expand their career network. Unlike a job fair, the set up is the opposite. The alumni who are also the jobseekers would be provided a table each as booths to demonstrate the apps and projects that they created. Most of these projects were created by groups of 2 to 3 people, thus the ones from the same project would be presenting at the same table. The companies' representatives would then go around the room and talk to the alumnus at booths that they found interesting.

One thing we realized was that during the event, there was a particular kind of employers that would skip booths, and only talk to the alumnus with certain physical appearances. At first, we all thought it was our own subjective thinking that was causing us to feel that way, but since all of us arrived at this conclusion individually, it was hardly a coincidence. The type of employers we were talking about were the male employers who are in their early 30s or older. They were one of the very few who came in actual formal attires, gray or black suit jacket

and pants with expensive looking ties. They would skip around the booths, which were occupied with female engineers and go straight for the ones who looked like younger version of themselves. Carolina created her project with one of the male engineers in her cohort and thus had a chance to interact with those suit guys. She was angry and bitter when mentioning her brief encounter with them, as she complains "They had no interest in talking to me, they only directed questions at Chris (her male teammate), like I wasn't even there! What they don't know is that I am the one who wrote (code) most of the project!" As fellow female members, we felt her pain and annoyance.

Since Serena was the organizer, she tries very hard to include all potential employers to maximize the possibility and benefit for these monthly hiring mixers. She expressed that this kind of issues happens almost every other time since she started two years ago. As a female career coach, she was well aware of all types of gender bias taking place in the tech industry, and she was indeed trying hard to improve the situation for female job seekers. Apparently, judging by the severity, some companies would never be invited back to any future mixers if their action were obviously prejudiced or unfair against any type of students. For example, as she mentions, there were once a tech company who admitted to only be interested in hiring young male engineers, as they felt that the presence of female coworkers would be a distraction to the team, making other members feel uneasy and uncomfortable. She had to politely inform them that they were no longer invited to the mixer. The issue here seemed to be that when companies

who have long been used to a working environment where there is a low female worker percentage, it is even harder for them to adjust to a healthier gender balance at their company. It is the fear of not knowing how the change in work place dynamic would affect employee performance that is most likely stopping them from hiring more female engineers in this case.

So what if these types of company decision makers get the chance to know the female engineers a bit better? Would they change their mind and give those candidates a try? When I was at the hiring mixer, I was standing at a booth with my other female teammate Jenna who created an app with me. We both noticed very quickly of the same suit men who were skipping booths including ours. Thus they were the first one to finish touring the room and were by the snack and drinks table half way through the mixer. Out of curiosity and for the sake of my research, I decided to go up and introduce myself to these men, hoping to get a better insight of how they are like. I started the conversation as followed: "Hi, I am Kerry one of the alumni here at the mixer. I noticed that you didn't have the chance to come by our booth, would you be interested in taking a look?" They were initially surprised but were friendly enough to follow me to my table. As I was demonstrating them my project, I realized some similar characteristic as Carolina experienced. I was the one mostly asking questions about their company and not so much in return. They were not interested in getting to know my teammate or me. Thus after a few minutes of meaningless and bland conversation, I decided not to waste more time and politely thanked them. I felt

like there was a solid wall between them and the female engineers who they were not going to hire. It appears to me that some type of employers just simply won't give up on their ideology of what software developers are suppose to look like, and they would not take the risk of exploring the new possibilities. This incident reaffirms the historical study discussed previously where female engineers were denied the chance to gain the necessary experience they need in order to advance in their professional career.

Unfamiliarity is certainly a risky territory when it comes to hiring employees, however by not taking that risk, companies would never get to gain the experience of how to manage a diverse team. Therefore, it is important to bridge the gap of the unknown, between the employers and the female engineers. There are many communication or educational tools can be used to support them to achieve so. Seminars can be held so employers can ask question they would normally too embarrassed to ask about such as: how to manage female employers and to deal with their particular needs.
Now, what happens when the already few women engineers are actually accepted and get hired into the tech firms? Can they now finally thrive and excel in their career?

Gender bias in critical reviews:

"Choosing with integrity means finding ways to speak up that honor your reality, the reality of others, and your willingness to meet in the center of that large field. It's hard sometimes."

— Terry Tempest Williams

To answer those questions, let me first tell you about a seemingly uneventful evening of my walk from school to home. I was cold and tired. All I wanted is to get home and out of the cold. Then a stranger came up to me and said "Hi precious, put on a smile! " From his tone of voice, I knew that he was just being friendly and most likely bored out of his mind. However, it really got me thinking, how many times in my life that I have been told by others to: smile more, act like a lady, you are too skinny, you should eat more, stop eating so much, speak softer, don't wear that etc. The answer is too many times. Throughout history, there have been many rules and demands women are expected to meet and follow. Personal attacks and shaming are often inflicted on the ones that fall out of line. This not only affects the small areas in a woman's daily life, but it is also a big issue for women in their professional careers, especially in male dominated industries such as the booming tech sector.

Kieran Snyder is the CEO of a popular start up, Textio. She is also the author of several well-published studies on languages, technology, and document bias. She has a PhD in linguistics and had worked numerous projects for giant tech companies such as Amazon and Microsoft. In one of the articles she published in Fortune in recent years, she did a study of work place

performance bias in 24 tech companies. She collected 248 reviews from 180 people who work in all type of sectors in the tech industry. In these reviews, 105 are from male workers and 75 from the female workers. The result of her research was very interesting. When the reviews are being separated by gender, nearly 90 percent of female employees received critical feedback while only about 60 percent of their counter partner did. This alone of course is not enough to prove the existence of gender bias at the work place. Thus, let us take a look into the type of criticism and words that are used in those feedbacks.

Out of the 248 reviews, both genders received constructive advices such as possible skills to be improved and habits that should be changed by that individual. However, there are certainly a few more elements in the women's feedback that is not being seen in the men's. Regardless of male or female managers who conducted the reviews, sharp and negative personality disapprovals are constantly mentioned throughout the women's reviews. Criticisms such as: "watch your tone! step back! stop being so judgmental!" appeared twice in the 83 reviews of the male employees while it showed up 71 times out of the 94 reviews for women. Just to take an even closer look, only in women's critical feedback where words like: bossy, abrasive, strident, emotional, and irrational were used to describe their personalities, and only "aggressive" has appeared in the male workers' feedback. According to Snyder, the word "abrasive" alone showed up 17 times on the women's reviews, while "aggressive" was used 3 times in the males.

Connecting it back to the issue with the modern world not having female CEOs and higher-level executives in the tech industry, it appears that there is a potential connection with how women are perceived differently than men at the work place. The existence of the discussed gender bias in the eyes of managers and others might be one of the main reasons why women are not being promoted or advanced as smoothly in their careers in tech as their counterparts.

Out of curiosity, I asked Erin, a senior software developer who is also the manager of the software engineering school, which I attended. I asked her what kind of feedback has her received throughout the years working in the tech industry. She told me that she had indeed gotten called all kinds of bad names: "Bossy", "Arrogant", "Loud", "Aggressive", "Easily offended" etc. From what I have seen of the way Erin is at work, I would have never associated her with any of these words mentioned above. I see her as a strong leader who is excellent at making decisions, has great management skill, and most importantly, is empathetic. She has given the female students in school so much encouragement and support. And she has been many of our mentor during our learning journey to become programmers.

As I tried to grasp the reason why would a woman like Erin being evaluated with such negative associations, I realized that the good qualities I see in her as mentioned above are more stereotypically related to men. Just to prove my point, as I am writing my paper, I casually asked 3 of my colleagues on the

same table the following: "The director in my school is a strong leader, who is excellent at making decision calls, and possess superb management skill, are you thinking of a man or woman?" As expected, they all thought of a man and are now looking very embarrassed. Indeed, whether subconsciously or not, people are not used to it when a woman holds the characteristics that are typically related to men. Therefore what was supposed to be a positive effort from that woman becomes filtered and perceived as those negative associations that those female employees received from their managers.

Despite the society being as technologically advanced as it is, it still has a difficult time of accepting women as an equal partner in the ever male dominating technology segment. Just like the quote states, it is hard to find the middle ground where one can keep a hundred percent of his or her integrity and purpose while not offending everyone else's, and sadly for women, the society is not as tolerating for this kind of progressive attitude.

Are women just not interested in STEM fields?

The stubborn gender gap in the tech industry or even any industry is contributed by various factors. Some might argue that to blame most causes on gender prejudice is an exaggeration to the issue. Some scholars such as Ceci, Williams, and Bennet claim that these biases are no longer prevalent in STEM fields. In the work they published (Ceci, Williams, & Barnett, 2009), they strongly suggest that women continually choose other fields over STEM fields due to their

own free will and preferences. As states in their research "Factors unique to underrepresentation in math-intensive fields include the following: (a) Math-proficient women disproportionately prefer careers in non–math-intensive fields and are more likely to leave math-intensive careers as they advance; (b) more men than women score in the extreme math-proficient range on gatekeeper tests, such as the SAT Mathematics and the Graduate Record Examinations Quantitative Reasoning sections; (c) women with high math competence are disproportionately more likely to have high verbal competence, allowing greater choice of professions…"

These factors all suggest that women, sometimes because of their unique preferences or capabilities, other times due to their greater career option pools, they choose not to be in the STEM industry. One of the main supporting argument was that by comparing the sole function of math ability between male and female, it would be a ratio of 2:1 at the top 1% tile, which is 2 men to 1 woman, and thus theoretically women should consist about 33% of the STEM field. However in the actual STEM field, women comprises of far less than the suggested 33%, it is in reality only half of the estimated number. Thus, as the authors conclude, "Clearly, preferences must be a strongly causal factor in their opting to enter other careers… unequal representation in STEM careers is not uniquely impeded by inequality in childrearing responsibilities between the sexes because such inequality, although omnipresent, leads women with children to have less time for all careers, not just STEM ones."

However, this study failed to examine the revolving factors a step further, such as questions like: why do women prefer other industries over STEM ones? If a woman were highly skilled in math and science, why would she want to work else where instead? Are there any hidden factors that are pushing them to choose the exit door? And can those factors be so subtle and mild that women who left couldn't even bother to justify their real reasons? Indeed, I agree with the article that women are leaving the STEM field based on their own will, however I question the motive behind this action. If preference were the main reason, men would have the exact same reason not to work in the STEM field, but they do. Thus, a deeper examination is needed to understand the fact that women are the only sex who is not choosing this particular field.

Similar to the financial industry in the early 90s where it was a frat party with rich young white males that had power and control over the industry, they therefore acted foolishly and out of context. The engineering field shares some similar depictions with its own flavor of subtlety and passive aggressiveness. Indeed most of the people in this filed are successful, white, young men who possessed the skill of micro aggression. The real challenge for women in the tech industry is neither pregnancy nor the shortage of competencies in this field, but the lack of empathy and social awareness through out the engineering pipeline. With the absence of these two essential elements for human's social wellbeing, school and work places become the incubator for micro aggressions,

from unconscious biases to innocent ignorance, regardless the true intention, STEM women are being causally degraded on a regular basis.

In "Gender Bias in STEM Fields" published by Robnett, the study focused on girls and women, from their school years, to later on work lives in the STEM industry. The result concludes that 61% of the participants experienced gender bias in the past year. Math-intensive undergraduate majors were especially likely to encounter such experience, which pre-dominantly caused by the male counter parts. As a result, the author finds that "participants who encountered gender bias had lower STEM self-concept than participants who did not." But as Robnett describes, this negative impact was offset if the participant has a supportive network in her STEM circles, which suggest that the positive mental support and connection within the industry may be the key for girls and women to stay in the STEM pipeline. To achieve this, interventions and other forms of social interference is needed to create a more inclusive and supportive environment for all genders. It can take various forms and purposes, whether to reduce gender bias itself, or to eliminate its negative after affect on women. It is especially important to reach out to the male STEM fellows with messages about the value in gender equity, since they result to be the most common sources of gender bias. Moreover, it is vital to promote supportive network in order to help forging strong and positive social ties among the Stem students.

Why did they leave?

Indeed, a lot of statistics and data point out the extreme lack of women in the tech industry. One of the issues is that women don't stay in tech, so what caused those women tech workers to walk away from their chosen career? Let us look at a few stories of women software developers, during their time working in this industry.

In an article published by the *Fortune*, Kieran Snyder interviewed 716 women who left the tech industry. The title of this article states: "Why women leave tech: It's the culture, not because 'math is hard'." Snyder started with her story of a coworker who came back from maternity leave only to quit two weeks later. Sandhya, who was a talented and experienced project manager in a tech firm the author used to work at, was seeking support from another woman, and mother when she confided to Snyder that she was thinking to leave the firm. She found herself suffocating from trying to balance between work and home. The reasons were because her manager was forcefully asking her to return from her already short lived maternity leave early, and on top of that, he was pushing her again to go on a business trip while leaving her nursing infant at home. She could barely get any sleep. She felt that she was constantly disappointing her work and her family all at once. However her boss did not seem to understand her physical need of a mother who just gave birth to have time for herself, and her need to focus on her newborn child for that period of time. Despite Snyder's effort at trying to help Sandhya resolve the problem, she quit two weeks later.

Similar stories followed as Snyder points out, one of the main reasons for women leaving their long term tech careers behind was motherhood, not because they wanted to become stay at home mothers, but the lack of mental and physical support from their tech employers. It turns out 85 women she interviewed stated the absence of a maternity leave policy as their main reason of quitting their jobs. Some firms demanded that the moms who just gave birth to come back to work when their child was only 6 weeks old.

As some might argue, pregnancy and motherhood are very common reasons for women to quit their jobs across most fields, what makes the tech industry any different? The answer is that the working condition of the software engineering position can be potentially one of the most comfortable and safe physical environments. Most firms require no physical labor from their developers, and provide them with decent amount of workspace to eliminate distraction. Most firms also accept remote working requests for special situations. On top of that, software engineers are usually well paid across the country, which can be very vital for their children's future investments. So why are women quitting because of pregnancy or mother hood in the tech industry? The fact is that these young male dominated firms, despite their great abilities in many other areas such as creativity, logic, and business senses, are yet incompetent when it comes to empathy. Thus, they are not aware that their demands and requests are creating huge problems and conflicts for the expecting or new mothers. As I have mentioned previously, programmers can be socially unaware due to their isolated working conditions. Thus when the firms are not being empathetic, they

are not able to see a female employee's pregnancy or mother hood as the essential event that it is. They are not able to emotionally connect and acknowledge the needs of their employees and allow them the necessary time and working conditions to balance the new changes at home. Let's take Sandhya's boss for example. If he was empathetic and understood where she was coming from, he would not have made those unreasonable requests to her. But without feeling emotionally supported or understood by her firm and employer, Sandhya chose to leave.

   Let's look at one more example, this time with issues that aren't related to biological needs of a woman. Elissa Shevinsky, a co-founder of a start up company called Glimpse labs, is able to recall the exact moment when she felt like she had become an outsider of the industry she works in. It was during a TechCrunch hackathon in 2013, a massive event where top engineers get together and create new things in short periods of time. During the show, two young male Australian entrepreneurs got on stage and presented their project yelling "Titstare is an app where you take photos of yourself staring at tits," It was followed by pictures of women's chests on a cellphone appearing on the massive screen behind the two. The hoodie wearing, young white males, who make up 90 percent of the audience, burst into laughter and clapped for the "great" demonstration from the two entrepreneurs. This is when Ms. Shevinsky, 35, realized that if there is ever a need to prove that the tech industry needs more women, this has to be it.

However this is just the start of Ms. Shevinsky's journey to her push back with the bro culture in the tech industry. The Titstare incident quickly became a heated debate on twitter and throughout many other online platforms. As expected, Ms. Shevinsky entered the debate with a blog-post manifesto she drafted up: "I thought that we didn't need more women in tech. I was wrong." However what she did not see coming was that Pax Dickinson, who was her business partner in the company, also the chief technology officer at the news site *Business Insider*, jumped in on twitter in defense of Titstare and posted "It is not misogyny to tell a sexist joke, or to fail to take a woman seriously, or to enjoy boobies," This was the last straw for Ms. Shevinsky, who, a few days later, resigned from her company. Apparently, there had been multiple incidents before the Titstare case where her ex-partner had joked about rape or the concept of feminism, such as stating: "Women's suffrage and individual freedom are incompatible. How's that for an unpopular truth?" She was able to overlook it because of her admiration towards Mr. Dickinson's technical talent and work ethic.

Some of you might wish to stop me here and ask: how are these incidents such as Titstare, or Dickinson's comments not becoming an issue in tech firms? Since many of those start up firms are relatively new and sometimes consist less than 10 employees, their regulation also tends to be looser than what cooperate companies would have. Most of the tech CEOs like to hire friends who they have worked with in the past thus it becomes a very casual working relationship.

As a whole, Ms. Shevinsky's epiphany was not just about her partner, but the computer engineering culture itself and how it made her feel. She emphasized that she loves coding and her career in tech. For years, she has had no issue with working with men, she sees herself as one of the bros, and was able to joke around with the guys at work. But Titstare showed her that this is no longer the reality, and it has crossed the line of her self-respect as a woman, and a colleague.

Ultimately Mr. Dickinson, the Australian entrepreneurs, and TechCrunch each publicly apologized. However these cases are not uncommon in the tech industry, and to some degree, is almost expected as a stereotype. Thus, let us go back and try to answer the question, "Why are there so few women in the tech industry?" Women don't want to work in a sexually hostile environment like that to begin with, and for those who entered, they eventually leave for the same exact reason.

It is fascinating to think about how much we have advanced culturally and socially. There are elite schools, which educate more women than men, and there are women presidents around the world. The Gender gap in general is closing up bit by bit. But still, when it comes to computer engineering, one of the most creative and innovative sectors of the world, it is still so far behind in this

essential area of humanity. Without improvement, women never will want to be a part of this great industry because they simply don't feel like they belong.

Importance of diversity in business:

We need to give each other the space to grow, to be ourselves, to exercise our diversity. We need to give each other space so that we may both give and receive such beautiful things as ideas, openness, dignity, joy, healing, and inclusion.

Max de Pree

As I spent more time processing through my research, I have come to a realization that the statement: "There are not enough women in tech", on its own does not prove a point of why it is a problem at all. Some can argue that just like construction work or nursing jobs, some work just suits one sex better than the other. Thus, if I don't prove the fact that not having enough women in the tech sector is an actual problem for society, my research can be easily dismissed and concluded as pointless. So this week, I would like to thoroughly discuss the importance of having a balanced and diverse work force in the technology industry.

Lets take the famous Apple stores' architectural design for example. As some of you might not be familiar, the signature style of Apple's staircases are made of mostly glass panels. Indeed it looks incredible, and innovative. However, to some

visitors, it is the ultimate nightmare. I find it hard to believe how this major design flaw was able to escape the eyes of all the decision makers and got approved. What can go wrong with glass panel staircases, you might ask? How about the millions of female visitors who are going to visit the stores wearing skirts and dresses? I often wonder why no one in the architectural team thought of this issue, and then I realized that it is a special kind of problem, which only a specific kind of people have to deal with or experience it, who would see the flaw. In this case, the specific kind of people would be women who wear skirts or dresses on a regular basis. But in a male dominated industry with little diversity, this seemingly obvious design flaw was overlooked and approved by on every level. As said by Scott E. Page, professor of complex systems, political science and economics at university of Michigan: "Diverse groups of people bring to organizations more and different ways of seeing a problem and, thus, faster/better ways of solving it." This is definitely one of those cases that, by having a diverse decision making group, a mistake like this could be easily avoided.

As stated in the opening quote, we need to exercise the diversity and give each other a chance, so to both give and receive beautiful things and ideas. When an employee represents a specific group of users that use the product, it is more efficient and easier for that employee to build a device that would provide high satisfaction to this group of costumers. Because this employee knows and understands the particular needs and desires that this group of customers is looking for in a product. Thus, when a firm lacks an employer who holds the

similar background from a particular group of users, failures that could have been simply recognized end up being carried into the final product. Another example would be YouTube's almost all right hand engineers who built the first iOS app for iPhones. As none of them thought about how would the left-handed users use their phone differently, 10% of the videos were uploaded upside down as a result. As one can imagine, if the difference in dominant hands can become such an issue, the differences between genders would lead to even bigger and unresolvable problems. A firm cannot build a project that is suitable for both genders with only one gender present in the team.

Another study from Paradigm shows that there is a strong correlation between diversity and positive financial outcomes in companies. In its 2011 study consists of 1500 firms in the pool of Standard & Poor's Composite, research showed that "female representation in top management leads to an increase of $42 million in firm value." The tech industry values innovation and creativity. Paradigm has gathered stacks of data to support the claim which biased hiring process significantly damages the chances for candidates from underrepresented backgrounds and genders. For an industry that prides itself as coming up with the "best ideas", this is self-destruction. As the popular app Slack's chief of staff Nolan Caudill states: "Like almost every tech company, our own upbringings, biases and life experiences result in referral networks that are very homogeneous, and we know we are missing out on great candidates based on these shortcomings." Indeed, by attracting a diverse pool of engineers, firms

would have a significant better chance at discovering best new ideas and concepts.

Interviewing research subjects for solution to the gender gap:

"The easy confidence with which I know another man's religion is folly teaches me to suspect that my own is also."

— **Mark Twain**

The lack of women in the technology sector has little to do with the assumption that women are not good at math or science. It is the lack of empathy and awareness of people in this industry that is forcing women out of the door. Companies might hire an even amount of men and women employees into a tech firm, but with this issue at stake, women would seldom stay long enough to progress to higher positions in the firm. Thus in order to close the gender gap, companies have to invest in developing empathy among their workers, focusing on the human side of software engineers.

This made me realize that in order to solidify my own knowledge and beliefs, and arrive at a sufficient policy, it is important to see things from different angles and perspectives. Thus, I asked a favor from the staff of my programming school and organized a women's lunch session on campus. The purpose of this meeting was to discuss what would each woman need in order to feel comfortable and motivated to stay in the tech industry. We were able to gather about 10 to 13

people, including staff members, which is actually 80 percent of the women on campus. Our programing school has about 80 people and only about a quarter of them are women.

The lunch meeting was held for about a little more than an hour and each of us took turns answering the topic question and gave our own opinions and perspectives about the subject. I pinpointed 3 of the most common themes that were brought up during our session. First, the group of female engineers emphasized that the company must have great coverage on pregnancy and maternity leave policy. Second, it is important for companies to have an efficient system for employees to file complaints and report internal incidents, and they must be well investigated and taken seriously. Last but most importantly, it is essential for women engineers to work in an environment where staff members are well informed and trained regarding gender bias and discrimination towards women in the tech field.

Half of the women who came to the meeting were in the age range between 25 and 30. Carolina, who was mentioned earlier about the hiring mixer, stated that she is starting to think about the idea of having kids but there are a lot of external factors that are stopping her and her husband from committing to this idea at the moment. She felt that it would deal a significant amount of damage to her chosen career path and right now, she is not quite ready to give up on her professional life, as she mentions that tech companies such as start-ups often have very

intense work schedule and little stability. It often consists of a high concentration of male engineers, so very rarely can one find a company that covers the maternity leave policies, or has a breast feeding area in place. Carolina, along with several other women who are on the same page with her when it comes to their private timeline, feel that it is almost impossible to achieve their career goals and personal wishes at the same time. It is a battle with time, and these women are trying to get ahead in their career, hoping eventually they will land a job in a company that allows for these personal needs in the tech industry before their biological clock starts the final count down. Most of the women at lunch came to the agreement that an ideal maternity policy for a firm would be to allow women at least 6 weeks of leave, with reduced work load or an option to work remotely for the next 3 to 6 months after labor. Also, some of them mentioned a desire for at least one breastfeeding area at their work place. None of them made any extreme demands such as wanting to take an annual leave of absence for pregnancy.

I believe that they simply wish to work for a company that has empathy, that can understand and hear out their needs. They want to work at a place where being pregnant won't be seen as a burden to the team, but a natural and normal course for women. They are looking for the most basic support for being the sex that has to go through child birth.

During our discussion, many women who have had previous work experience expressed the need for companies to take their policies seriously, especially

when it comes to work space relationship issues. They state that in order to feel supported and motivated to work in an environment that is overly male dominating, they need to feel mentally and physically supported by the firm that they are working for. They need to be reassured that if any problem or issue occurs at the work place, their voices are heard and appropriate actions are taken to solve them. Thus, even with the unbalanced number of male and female coworkers, the minorities of the group will still feel safe and respected by the firm. In other words, they want to work at a place where people come into work with integrity, kindness and whole self.

Throughout the engaging discussions we had over lunch, the word "Respect" seems to be the common theme women engineers hold onto when picking an ideal work place. Our school's chief of business strategy, Erin, told us an interesting story of her encounter with one of the big tech firms she visited. Erin is a well-established programmer and has a lot of experience and achievements in the tech industry. She is in her mid 30s, 5'10, blond, and lean, with short hair down to her neck. One time she went for a job interview in a big tech company, she was asked to wait in the lobby for about half an hour. She was wearing her usual semi formal clothing, a gray cashmere sweater with long white pants. Apparently because of her feminine look, the receptionist did not think that she was the "Erin" that was interviewing for the senior developer position. Despite having introduced herself several times to the receptionist, the person never connected the dots. After waited for half an hour and having had the manager

come out to check for the missing interviewee, she was finally escorted to the interview room. Erin told us that the first thing she said to the interviewer was that "There is no way I will take this job, but I am still here because you guys need to be educated!" In the follow up interview I did with her, I asked her what exactly did she have to say to the interviewers in that company. She replied, "I told them that it is companies like these that are creating the barrier for women to love tech, because they never believed in women programmers in the first place. How do you expect any woman to work there without feeling disrespected?" According to Erin, they did send a post interview email apologizing for the unfortunate misunderstanding.

 Almost all the female programmers who came to the meeting agreed that they could not and would not tolerate a work place that did not take the time and effort to inform and train their employees regarding gender biases and mutual respect at work. It is very important for women to receive the same amount of respect as their male counter parts at the company. Since in reality women programmers are just as capable as men, the concept that great engineers are young white men who work in their basement drinking Mountain Dew really has to go. Companies such as the one Erin mentioned could surely use more educational programs to help them and their employees get rid of the stereotypical ideas of what engineers are supposed to look like. Technology is evolving and changing the way we live in a rapid fashion, and it would only make sense for us to update

our old mindset and mentality about who are the real creators behind the curtains.

Studying and working in the tech field gave me the opportunity of witnessing and experiencing the gender bias in first hand. It can be extremely frustrating at times. However people cannot fix something that they don't know it's broken. In this case, it is the perception and attitude towards female members entering the field that is causing the leakage in the STEM pipeline. Girls and Women are the element that is drip out of the channel, and unfortunately, since the leak is small and subtle at every stage of the pipe that people tend to ignore or overlook the problem. Eventually, there are no women left at the end of the tube. Thus, in order to gather the manpower to fix the source of the leakage, people across both end of the pipeline need to be informed and educated to improve their segment of the pipe. Whether in the early on education system, hiring process, or work environment, seminars and interventions should be used accordingly in order to tighten the gender gab in the technology sector.

In fact, it is not enough to only give the chance and open the door to people who don't seem to fit in the norms. For example, they could hire plenty of female engineers but still not have one beyond the management level in the company. Because, as I mentioned in my previous discussion, when a woman tries to strive for more, she is perceived as being bossy, aggressive, or abrasive. Therefore, companies need to provide these new comers with the necessary space and

environment to grow and excel: the space to speak up instead of being silenced,

the space to experiment instead of being pushed aside, but most importantly, the

space to exercise their differences without being judged or looked down upon.

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