Minorities in Tech:
Disparities and Explanations

Xian Zhi Liu

xl2399

Economics of Race

Columbia University

Table of Contents

Introduction

The internship interview was wrapping up. Della, an African American student majoring in Computer Science, had finished answering the interviewer's questions and it was now her turn to ask questions. She asked her interviewer about his own experience as an African American software engineer. The interviewer traced the creases of his left palm. He admitted that it was "hard at times," noting that he himself was the only African American software engineer at his company. But he quickly pointed out that this was the norm, mentioning that high growth tech companies such as Dropbox and Airbnb (valued at a combined $35.5 billion) each only had one African American software engineer.[1] Della sat back in momentary shock. She just so happened to know one African American engineer at Dropbox and one at Airbnb. Turns out, they were all there were.[2]

The world of African Americans and Hispanics in tech is small. This paper attempts to gauge exactly how small and offer reasons for any potential disparities as well as potential solutions. Since "tech" is a nearly all-encompassing and extremely vague word, this paper has limited the scope of its analysis to data on the software sector. The term "minority" in this paper primarily refers to Hispanics and African-Americans. There is very little data on Native Americans in tech and Asians represent a disproportionate share of software engineering employees, a trend which suggests significantly different dynamics are at play for them compared to those for African Americans and Hispanics.

---

[1] Canipe, Chris, "The Billion Dollar Startup Club," *The Wall Street Journal*, February 2015, graphics.wsj.com/billion-dollar-club/
[2] Della (computer science student) in discussion with the author, December 2015.

Sector Overview

To get a broad sense of the software sector on a national scale, this paper uses nationwide data from the Bureau of Labor Statistics. Before diving into the data, it's first crucial to get a quick understanding of the dynamics of the software sector and what exactly it encompasses as defined by the Bureau of Labor Statistics. The software sector is comprised of the computer systems design and related services industry (NAICS code 5415), the software publishing subindustry (NAICS code 5112), the data processing, hosting and related services subindustry (NAICS code 518) and the other information services subindustry (NAICS code 519).[3]

By far the largest component of the software sector is the the computer systems design and related services industry, which accounts for about 91% of the total employment in the software sector in 2015. This industry as a whole includes companies such as IBM, Oracle, and IT consulting companies such as Accenture.[4] The Bureau of Labor Statistics breaks the industry down into four different subindustries: custom computer programming services, computer systems design services, computer facilities management services, and other computer related services.[5]

The computer systems design services subindustry includes establishments that "plan and design computer systems that integrate hardware, software, and communication technology." This is the largest subindustry comprising computer systems design and related services industry (thus the name), accounting for 46% of the industry's employment. In close second is the custom

---

[3] Shapiro, Robert J., "The U.S. Software Industry As an Engine for Economic Growth and Employment," *Software and Information Industry Association*, (2014): 4

[4] Shapiro, Robert J., "The U.S. Software Industry As an Engine for Economic Growth and Employment," *Software and Information Industry Association*, (2014): 8

[5] Csorny, Lauren, "Careers in the growing field of information technology services," Bureau of Labor Statistics, April 2013, .bls.gov/opub/btn/volume-2/careers-in-growing-field-of-information-technology-services.htm#_edn5

computer programming services subindustry, which accounts for 43% of the industry's employment and includes companies that write, test, support, and modify software for their customers. [6]

The rest of the computer systems design and related services industry is comprised of the the computer facilities management subindustry, which accounts for 4% of the industry's employment, and miscellaneous computer related services that don't fit into the other three categories, which account for 7% of the industry's employment. The computer facilities management subindustry mainly describes companies that manage and operate computer systems and data processing facilities and the miscellaneous category includes such organizations as companies providing disaster recovery services or software installation services.

The software publishing subindustry accounted for about 3.5% of the total employment in the software sector in 2015 and includes companies that produce, distribute, and support computer software. This software can be either prepackaged (Apple and Microsoft), customized for a client's use (IBM and Hewlett Packard), or created for internal use. The data processing, hosting and related services subindustry accounted for about 3.9% of the total employment in the software sector in 2015 and covers companies such as Dropbox and Box that provide infrastructure and data storage. Finally, the other information services industry accounted for about 1.7% of the total employment in the software sector in 2015 and covers companies such as Facebook and Netflix.[7][8]

From a purely employment perspective, the software sector seems relatively insignificant. In 2014, the software sector in the United States employed 2,611,000 people, which was only 1.78% of

---

[6] Csorny, Lauren, "Careers in the growing field of information technology services," Bureau of Labor Statistics, April 2013, .bls.gov/opub/btn/volume-2/careers-in-growing-field-of-information-technology-services.htm#_edn5

[7]   Shapiro, Robert J., "The U.S. Software Industry As an Engine for Economic Growth and Employment," *Software and Information Industry Association*, (2014): 8

[8] "Employed and experienced unemployed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity, Quarter III 2015," *Bureau of Labor Statistics*, 2015.

all employment in the United States.[9] Even though this percentage is miniscule, the software sector has an outsized impact on virtually every component of our economy. Software accounted for 12.1 percent of all U.S. labor productivity gains from 1995 to 2004 and 15.4 percent of those gains from 2004 to 2012. All told, the software industry contributed to 3.2 percent of GDP in 2012. Moreover, from 1990 to 2012, business investments in software grew at more than twice the rate of all fixed business investments; and from 2010 to 2012, software accounted for 12.2 percent of all fixed investment, compared to 3.5 percent for computers and peripherals.[10] Software is ubiquitous in our everyday lives ; for further proof, just look at your apps and browsers on your laptop, phone, and tablett.

The Data

An analysis of the Bureau of Labor Statistics' data shows stark disparities between the race/ethnicity composition for those employed in the software sector compared to those employed in general. This paper uses two main sources of data from the Bureau of Labor Statistics: the Annual Current Population Survey for 2014, the most recent year with annual averages, and the Current Population Survey for Q3 2015, which includes the most up-to-date data from the Bureau of Labor Statistics period (it's so recent it hasn't been released on the BLS website yet). Using both data sets allows us to compensate for gaps in each data set and rough comparisons can be made since fluctuations in the minority composition of new hires are not seasonal.

---

[9] "2014 Labor Force Statistics from the Current Population Survey," *Bureau of Labor Statistics*, Feb 2015, bls.gov/cps/cpsaat18.htm
[10] Shapiro, Robert J., "The U.S. Software Industry As an Engine for Economic Growth and Employment," *Software and Information Industry Association*, (2014): 3, 10, 18.

Industry	2014 (numbers are in thousands)				
	Total employed in industry	Whites	Black or African American	Asian	Hispanic or Latino
Computer systems design and related services	2,344	NA	183	499	124
			7.8%	21.3%	5.3%
Software publishers	136	NA	5	31	5
			3.7%	22.9%	3.5%
Data processing, hosting, and related services	92	NA	16	7	6
			17.8%	7.8%	6.3%
Other information services (OIS)	39	NA	-	-	-
			-	-	-
Number total (excluding OIS)	2572	NA	204	538	135
			7.9%	20.9%	5.2%

In 2014, the annual average total employment in the United States was 146,305,000 people (all employment statistics are for workers 16 years and older per Bureau of Labor Statistics classification). Out of this total workforce, 11.4% were African American, 5.7% are Asian, and 16.1% were Hispanic. In comparison, 7.9% of all software sector employees were African-American, 5.2% were Hispanic or Latino, and 20.9% were Asian (note: the 39,000 employed in the Other information services subindustry is excluded because the Bureau of Labor Statistics had no race/ethnicity breakdown for the category).[11]

Industry	2015 (numbers are in thousands)				
	Total employed in industry	Whites	Black or African American	Asian	Hispanic or Latino
Computer systems design and related services	2,514	1,663	170	590	165
		66.1%	6.8%	23.5%	6.6%
Software publishers	96	65	3.6	27	2
		67.7%	3.7%	28.1%	2.1%
Data processing, hosting, and related services	107	78	17	4	23
		72.9%	15.9%	3.7%	21.5%
Other information services	47	39	1	7	8
		83.0%	2.1%	14.9%	17.0%
Number total (including SP African American estimate)	2,764	1,845	191.6	628	198
Percentage breakdown		66.75%	6.93%	22.72%	7.16%
*Percentages add up to over 100% because Hispanic is an ethnicity while Whites, African Americans, and Asians are races					
Source: BLS Current Population Survey, 2015 Q3					

---

[11] "2014 Labor Force Statistics from the Current Population Survey," *Bureau of Labor Statistics,* Feb 2015, bls.gov/cps/cpsaat18.htm

From 2014 to 2015, the software sector increased in size from 2,611,000 employees in 2014 to 2,764,000 employees. Out of the entire software sector workforce, 7.2% were Hispanic, 22.7% were Asian, and approximately 6.9% were African American (there was no data on amount of African American employees in software publishing so I used the 2014 annual average as a rough proxy).[12] To put this into context, in the third quarter of 2015, there were 149,310,000 people employed in total and out of this workforce 11.8% were African American, 5.9% were Asian, and 16.4% were Latino.

The first thing that stands out from these statistics is that Asians make up a significantly disproportionate size of the overall employee pool in the software sector. Even though Asians account for less than 6% of the employees in the overall economy, they account for over 20% of employees in the software sector, a percentage that is currently on the rise.

On the other hand, African American representation in the software industry is much lower than in the overall economy. In 2014, African Americans accounted for only 7.9% of the employees in the software sector, a percentage that decreased to approximately 6.9% in the third quarter of 2015 despite the fact that African Americans' overall share of the labor market increased from 11.4% to 11.8%. A large part of this decrease can be attributed to the fact that there were only 170,000 African American employees in "Computer systems design and related services" in the third quarter of 2015, compared to an average of 183,000 in 2014.[13][14]

---

[12] "Employed and experienced unemployed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity, Quarter III 2015," *Bureau of Labor Statistics*, 2015.

[13] "2014 Labor Force Statistics from the Current Population Survey," *Bureau of Labor Statistics*, Feb 2015, bls.gov/cps/cpsaat18.htm

[14] "Employed and experienced unemployed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity, Quarter III 2015," *Bureau of Labor Statistics*, 2015.

The numbers are also bad for Hispanics. 5.2% of the software sector was Hispanic in 2014, a percentage which jumped to 7.2% in the third quarter of 2015. A large part of this jump was due to the significant increase in the number of Hispanic employees in "Data processing, hosting, and related services," which jumped from an average of 6,000 employees in 2014 to 23,000 employees in the third quarter of 2015. Despite this encouraging increase, the percentage breakdown of Hispanics in the software sector is still lower than the 16.1% of total employment Hispanics account for.[15][16]

What's also interesting is the percentage of employees in the software sector that are white. In the third quarter of 2015, whites comprised 79.2% of the overall workforce but only accounted for 66.75% of jobs in the software sector. Although 66.75% is still the vast majority of the jobs in the software sector, it's also disproportionately small. Preliminary analysis of this data suggests that the crowding out of Hispanics and African Americans are in large part due to the disproportionate share of Asian American employees in the software sector rather than whites.[17][18]

The Two Explanations

Why is there such a disparity between outcomes? Multiple factors have been offered ranging from cultural factors to subtle bias in recruiting emails, but they all largely fit into two groups: issues with the pipeline and issues with the workplace.

[15] "2014 Labor Force Statistics from the Current Population Survey," *Bureau of Labor Statistics*, Feb 2015, bls.gov/cps/cpsaat18.htm

[16] "Employed and experienced unemployed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity, Quarter III 2015," *Bureau of Labor Statistics*, 2015.

[17] "2014 Labor Force Statistics from the Current Population Survey," *Bureau of Labor Statistics*, Feb 2015, bls.gov/cps/cpsaat18.htm

[18] "Employed and experienced unemployed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity, Quarter III 2015," *Bureau of Labor Statistics*, 2015.

Pipeline issues center around the journey from schools to careers. These issues focus on the low numbers of minorities who go through software-related educations, which in turn leads to a small pool of minorities who are suitable candidates for jobs in the software sector in the first place. People focused on addressing pipeline issues emphasize that the input of minorities at each stage of the process that eventually leads to a career in the software sector is extremely small and that even slight roadblocks at each stage have a big effect due to their cumulative effects on later stages. As a result, the people who focus on addressing pipeline issues emphasize the importance of tackling disparities in all levels of education and addressing academic environments not conducive to minorities pursuing STEM educations.

Workplace issues center around the bottom of the funnel and focus on what happens after potential hires graduate from the education pipeline with a computer science education. People who focus on workplace issues often point out that the predominant problems lie within recruiting and the workplace environment, both of which often have factors that, while not often outwardly racist, do unintentionally harm minorities and contribute to the disparity.

These two types of issues both play roles in explaining the employment disparity. However, there is debate about the magnitude of the problems posed by these two theories. Disillusioned minority software industry workers and job applicants often emphasize the unfairness of the workplace environment while large tech companies often complain that the pipeline is the main problem. As emphasized by Maxine Williams, the Director of Diversity for Facebook, "we are going against hundreds of years of historical inequity; all of our investments will take years to pay off."[19]

---

[19] Isaac, Mike, "Behind Silicon Valley's Self-Critical Tone on Diversity, a Lack of Progress," *The New York Times,* June 2015, bits.blogs.nytimes.com/2015/06/28/new-diversity-reports-show-the-same-old-results

The Pipeline Problem

Peter was the product of one such investment. Born and raised in Kenya, he had been interested in STEM fields (science, technology, engineering, and math) ever since childhood and moved to the United States for college. He attended various community colleges before transferring to the University of California Berkeley and graduating with a major in computer science. After he graduated, Peter immersed himself in the world of software engineering, taking on roles at companies such as Intel and Facebook. Support programs at these companies, such as mentor pairing programs, networking opportunities, and grants to subsidize the cost of graduate programs were critical in helping him obtain a Master's Degree, Computer Engineering from Columbia University this year.[20]

Peter is a clear success story but emphasizes that his case is far from the norm, specifically pointing out that although the engineering pipeline is filled with opportunities, more investment is needed in getting minorities through the pipeline in the first place.[21] The numbers back him up. The number of minorities pursuing a STEM education is small relative to their overall share of the higher education system. The Computing Research Association, which obtains its data directly from computer science departments, pegged the percentage of 2013 college graduates majoring in computer science, computer engineering, or information technology at 6.5% for Hispanics and 4.5% for African Americans.[22] A similar study by the American Society for Engineering Education shows

---

[20] Peter Njenga in discussion with the author, December 2015.
[21] Peter Njenga in discussion with the author, December 2015.
[22] Zweben, Stewart, "Computing Degree and Enrollment Trends," *Computing Research Association*, 2014, archive2.cra.org/uploads/documents/resources/taulbee/CRA_Taulbee_CS_Degrees_and_Enrollment_2012-13.pdf

that, in 2010, Hispanics accounted for 7% of all engineering-related Bachelor's degrees and that

African Americans accounted for 4.5%.[23] In comparison, Hispanics accounted for 8.8% of all

bachelor's degrees in the U.S. in 2010 and African Americans accounted for 10.3%.[24]

Interestingly, this disparity doesn't reflect initial aspirations. According to the National

Science Foundation, in 2012 36.4% of African American college freshmen and 41.6% of Hispanic

college freshmen intended to major in a science/engineering field, numbers which are comparable

to the 37% of whites that intended to major in a science/engineering field. In fact, data going back

to 1998 from the National Science Foundation show that African American and Hispanic college

freshmen regularly specify interest in science/engineering majors at a higher rate than their white

counterparts.[25]

So what happened during college? For one, the attrition rate for minorities in science and

engineering majors is particularly high. A 2012 study at Duke University tracked incoming students

throughout their college years and found out that 68% of African Americans that came in focused

on a science/engineering major instead ended up choosing humanities and social science majors, a

figure that was less than 55% for whites.[26] Catherine Riegle-Crumb, a sociologist at the Population

Research Center at the University of Texas, Austin, believes that the main reason behind this is lack

of previous educational preparation, emphasizing that the problem is "not a lack of interest in

science but rather the fact that educational disadvantages are cumulative in nature, so that failures

---

[23] Yoder, Brian L., "Engineering by the Numbers," *American Society for Engineering Education*, 2011, asee.org/papers-and-publications/publications/college-profiles/2011-profile-engineering-statistics.pdf

[24] "Degrees conferred by sex and race," *National Center for Education Statistics*, 2011, nces.ed.gov/fastfacts/display.asp?id=72

[25] "Freshmen intending S&E major, by field, sex, and race or ethnicity: 1998–2012," *National Science Foundation*, 2015, nsf.gov/statistics/seind14/content/chapter-2/at02-16.pdf

[26] Arcidiacono, Peter, Aucejo, Esteban, and Spenner, Ken, "What Happens After Enrollment? An Analysis of the Time Path of Racial Differences in GPA and Major Choice," *Duke University*, August 2012, public.econ.duke.edu/~psarcidi/grades_4.0.pdf

or low performance early on in school make it difficult for them to attain the prerequisites they need to continue."[27]

These disadvantages can be easily traced back to K-12 education. In 2012, African Americans made up about 15 percent of public elementary and secondary schools enrollment and Hispanics made up about 29 percent.[28] However, in 2013 only 3.7 percent of the nation's Advanced Placement Computer Science test takers were African American and 8.1 percent were Hispanic, with no Hispanic student participation in 8 states and no African American student participation in 11 states.[29] AP Computer Science courses, which offer a college-level education in computer science, contribute to a gap in knowledge between the students that take it and the students that don't. As Stanford University professor Londa Schiebinger notes, pre-college preparation methods such as Advanced Placement Computer Science classes, "reward students with early exposure to computers and fail to nurture those who are new to them and apprehensive."[30]

This disparity can also be traced to an environment of low expectations for minorities. Mohamed, a Sudanese-American student at Columbia University currently majoring in Computer Engineering, remembers the transition to one of Indianapolis' top boarding schools for 11th and 12th grade from an inner-city high school. There were approximately 300 students in his grade at the boarding school and he was one of the five African Americans in his grade. Even though the boarding school based its admissions on test scores, Mohamed was still initially treated with doubts

---

[27] Sasso, Anne, "African Americans Studying STEM: Parsing the Numbers," *American Association for the Advancement of Science*, May 2008, sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2008_05_16/caredit.a0800070

[28] "Racial/Ethnic Enrollment in Public Schools," *National Center for Education Statistics,* May 2015, nces.ed.gov/programs/coe/indicator_cge.asp

[29] Mason, Kyla, "Computer science's diversity gap starts early," *PBS Newshour,* May 2014, pbs.org/newshour/updates/teaching-coding-kids-key-closing-fields-diversity-gap/

[30] Weise, Elizabeth, "Tech: Where the women and minorities aren't," USA Today, August 2014, usatoday.com/story/tech/2014/05/29/silicon-valley-tech-diversity-hiring-women-minorities/9735713/

about his intelligence by other students simply because he was African American. Throughout his time at the boarding school, study groups would exclude him and people always reacted with surprise whenever they found out he scored well on tests.[31] Mohamed often joked that even if he was a troublemaker or failed his classes, he would never get expelled because that would have resulted in a double-digit decrease in the school's diversity numbers. Peter shared a similar sentiment about his experiences in college, noting that he often had trouble finding team members for group projects. Other teams often expected him to be the laggard and naturally formed around social groups of the same race, which handicapped Peter since there were very few other African Americans in his classes.[32]

This mismatch also continues into masters and Ph.D programs for the relative few that consider pursuing such programs. A survey by the Institute on Teaching and Mentoring showed that only 31 percent of African American and Latino graduate students felt that faculty members understood issues that affect underrepresented minority students. Another major theme in the survey was that many African American and Latino students feel that they are constantly being evaluated and that they feel extra pressure to perform well because of their minority status. In part due to these factors most black and Latino doctoral students in STEM fields are not earning their degrees within 7 years and the percentages of ones that end up earning their degrees is much lower than those of white doctoral students at every year of completion from the 5th year to the tenth year.[33]

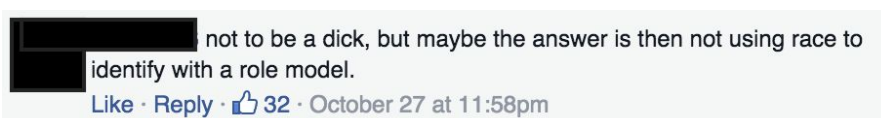[31] Mohamed Abedelmalik (computer engineering student) in discussion with author, December 2015
[32] Peter Njenga in discussion with the author, December 2015.
[33] Jaschik, Scott, "Missing Minority Ph.Ds," *Inside Higher Ed*, November 2014, insidehighered.com/news/2014/11/03/study-finds-serious-attrition-issues-black-and-latino-doctoral-students

Minorities also endure hardships in various online communities dedicated to connecting software engineering students across the nation. To get an unfiltered sense of one of these communities, I joined a 20,000 member Facebook group called Hackathon Hackers that bills itself as an "all-inclusive" group of computer science students (mostly undergraduate) passionate about hackathons. Sporadic posts about race and ethnicity pop up here and there and the responses are rarely positive, even though the group itself is extremely supportive when it comes to tech-related questions. Take this post for example, which asks a legitimate question about the lack of Native Americans in tech.[34]

> While we are talking about diversity in tech, I know a lot of minorities are under represented, but I can't think of a single Native American in the tech industry, not one. To my knowledge Native American's aren't underrepresented in the tech industry, they aren't represented at all. My grandmother is Native American (Naskapi, a subgroup of the Cree) a lot of my cousins are too, but it is difficult for my cousins to wrap their head around being in the tech field because there isn't anyone who they can look at in the tech industry that is native american.
>
> 44 Likes 34 Comments   Give feedback

Now take a look at some of the comments to this single post:

> not to be a dick, but maybe the answer is then not using race to identify with a role model.
> Like · Reply · 👍 32 · October 27 at 11:58pm

---

[34] Hackathon Hacker's Facebook page, accessed December 2015, facebook.com/groups/hackathonhackers/

I don't quite understand why it's necessary for someone to be your race and/or your gender for you to look up to them or treat them as a role model.

And I'm not white, btw, before you go and accuse me of that heinous crime.

EDIT: might just be an error on my end, but there was an above comment that talked about race/gender in a role model that seems to have disappeared. Might just be a glitch so keeping this comment up.

Like · Reply · 👍 10 · October 28 at 12:11am · Edited

You want to see a native American in tech? Look in the mirror

Like · Reply · 👍 20 · October 27 at 11:58pm · Edited

I personally have never seen a one-armed, eyepatch wearing, one-quarter black, one-quarter Hispanic, one-quarter Asian, one-quarter white woman with blonde hair and red eyes in tech. What can we do to increase the number of one-armed, eyepatch wearing, one-quarter black, one-quarter Hispanic, one-quarter Asian, one-quarter white women with blonde hair and red eyes in tech?

Like · Reply · 👍 22 · October 28 at 12:01am

I'm so tired of all this "race" identification. Can we just be "people" and not hide behind our physical makeup. I've never picked my role models based on their race.

If you want to be GREAT and change the world, you don't have to wait for a famous cultural representative to inspire you.

Like · Reply · 👍 17 · October 28 at 12:42am

ITT People trying to be politically correct in order to not offend anyone. 4real, i never understood why people bring up the issues of race in the "x" field (x=tech in this case). Yes, perhaps native indians are almost nowhere to be found in the tech field. So? Perhaps there haven't been any native indians that were passionate enough about it to make such an impact on the tech field. Why tf does it matter what race you are? Steve jobs was good because of what he did, being white had nothing to do with it. Similarly how the ceo of google now is Indian (correct me if im wrong). I really dont think he was picked because google thinks there needs to be mor "equality". He was picked because he was the best person for that role. This isn't elementary school; not everyone gets equal shares. If you want to succeed, you have to be good. Stop playing the race, or gender or sexuality card when you realize you're not as good as you'd like to be.

Like · Reply · 👍 3 · October 28 at 1:50am

Most of the responses on the post were negative and the most "liked" comments were also the most

hostile and least empathetic. A dive into other posts related to diversity in tech brings up the same

results; this is the culture that minorities in tech often face themselves surrounded by.[35]

The Workplace Problem

"It is not a pipeline issue whatsoever," says Laura Gomez, the founder of Atypica, an

organization whose sole mission is to fix the diversity problem in Silicon Valley.Instead, Laura

believes that the lack of minorities at technology companies is due in large part to recruiting efforts

that disadvantage minorities and workplace environments that are uncomfortable for the few that

get in.[36]

People like Laura who focus on the workplace problem believe that one of the major

recruiting efforts that biases minorities is the referral system. A large part of the labor market is

now based on referrals, with referrals accounting for between 30% to 50% of new hires in the

United States.[37] Tech companies have taken this system to an extreme, frequently offering more

than $10,000 in referral bonuses to employees that refer a software engineer that gets hired.[38]

However, employees are extremely likely to first refer people from their social networks and these

social networks are hardly heterogenous. According to the Public Religion Research Institute,

---

[35] Hackathon Hacker's Facebook page, accessed December 2015, facebook.com/groups/hackathonhackers/

[36] Martin, Rachel, "More Than A Pipeline Problem: In Search Of Diversity In Silicon Valley," *NPR All Tech Considered*, July 2015, npr.org/sections/alltechconsidered/2015/07/26/426364306/more-than-a-pipeline-problem-in-search-of-diversity-in-silicon-valley

[37] Nisen, Max, "Employers ignore almost everything on your application–except this," *Quartz*, December 2014, qz.com/299923/why-job-referrals-matter/

[38] Nisen, Max, "Employers ignore almost everything on your application–except this," *Quartz*, December 2014, qz.com/299923/why-job-referrals-matter/

whites have 91 times as many white friends as African American friends, with three-quarters of them having social networks without any minority presence.[39] Combine this with a workforce that's already significantly white and this clearly exacerbates the diversity problem.

Another recruiting practice in the software sector that naturally limits diversity is a heavy emphasis on recruiting at top colleges such as Columbia, Stanford, Harvard, and MIT and relative neglect of other colleges, particularly state and historically black colleges and universities. This in turn leads recruiters to complain about lack of candidates in this select pool of students while not realizing the possibilities of obtaining solid candidates from other schools such as historically black colleges and universities. Most of these prestigious universities have disproportionately small populations of minorities. According to a study by the Georgetown University Center on Education and the Workforce, Hispanics make up only 7 percent of the student population of the 193 most selective colleges,, while African Americans make up just 2 percent (compare this to 29 and 15 percent respectively for public K-12 institutions).[40] This effect is compounded by the referral effect once students are hired; as Laura points out, "one person will refer the person that they went to school with, and that school happens to be Stanford. And then that person happens to refer another person that happens to go to the same school."[41]

The problems aren't over once minorities are able to get past recruiting and into software engineering roles. Once in the workplace, minorities continue to face unique challenges, a major

---

[39] "Race and Americans' Social Networks," *Public Religion Research Institute*, August 2014, publicreligion.org/research/2014/08/analysis-social-network/#.VnRoOpMrKRt

[40] Isaac, Mike, "Behind Silicon Valley's Self-Critical Tone on Diversity, a Lack of Progress," *The New York Times*, June 2015, bits.blogs.nytimes.com/2015/06/28/new-diversity-reports-show-the-same-old-results

[41] Martin, Rachel, "More Than A Pipeline Problem: In Search Of Diversity In Silicon Valley," *NPR All Tech Considered*, July 2015, npr.org/sections/alltechconsidered/2015/07/26/426364306/more-than-a-pipeline-problem-in-search-of-diversity-in-silicon-valley

one of which is wage disparity. According to the American Institute for Economic Research, a

Hispanic worker in the computer technology industry has an annual salary that is $16,353 less than

a that of a non-Hispanic worker with a comparable job. African American fare significantly better

but still make $3,656 less than white workers with comparable jobs on an annual basis.[42]

Moreover, an environment where nearly all of one's fellow colleagues are different

ethnicities/races can gradually deteriorate into a toxic environment due to misunderstandings,

insensitive jokes, and misplaced expectations. Erica, an African American working in a tech role at

Google, notes that during her time there, people had assumed she was a single mother, joked about

her having abusive husbands and parents, and mistaken her for a security guard.[43] In my interview

with Peter, he pointed out that he often felt that even though he quantifiably did the same amount

of work as his colleagues (measured by the amount of code submitted and approved), his

contributions were not regarded as having the same amount of impact and he wasn't considered as

having put in the same amount of effort.[44] When I asked Mike Vallejos, the founder of New York

Latino Tech Meetup if these workplace experiences were unusual, Mike sighed and said these

experiences were the norm.[45]

To combat this, minorities often reach out to each other in the workplace to connect. Mark,

an African American employee at Twitter, mentioned that whenever he sees an unfamiliar African

American face at the company, he excitedly messages his colleagues "I just saw a new Black person!

---

[42] Kreisberg, Nicole, "H-1B Visas: No Impact on Wages," *American Institute for Economic Research*, October 2014, aier.org/research/h-1b-visas-no-impact-wages

[43] Erica Joy, "The Other Side of Diversity, Medium, November 2014, medium.com/this-is-hard/the-other-side-of-diversity-1bb3de2f053e#.2mv52rcy9

[44] Peter Njenga in discussion with the author, December 2015.

[45] Mike Vallejos in discussion with the author, December 2015

Does anyone know who it is?"[46] At a company in which African Americans account for 2% of the total workforce and less than 1% of tech roles, any new African American face was appreciated.[47] Yet even when minorities created social circles for support, there could be judgment. Erica points out that when she was connecting with an African American male coworker, another coworker "not so subtly hinted" that the interactions "were anything other than professional."[48]

Solutions

The statistics clearly show a pipeline issue that constricts the available pool of minority talent that tech firms can recruit for software sector roles. However, they paint a mixed picture with regards to recruiting and workplace treatment for the software industry as a whole. Out of all the 2013 college graduates majoring in computer science, computer engineering, or information technology, 6.5% were Hispanics and 4.5% were African Americans.[49] There doesn't seem to be a significant dropoff from graduation to industry in the software sector as a whole for African Americans, since African Americans comprised 7.9% of the software sector in 2014.[50] There does seem to be a slight dropoff for Hispanics, who comprised only 5.2% of the software sector, but this

---

[46] Luckie, Mark, "What it's actually like to be a Black employee at a tech company," *Medium*, September 2015, medium.com/@marksluckie/what-it-s-actually-like-to-be-a-black-employee-at-a-tech-company-e32bb222818b#.staqqc6ha

[47] Huysse, Janet, "We're committing to a more diverse Twitter," *Twitter,* August 2015, blog.twitter.com/2015/we-re-committing-to-a-more-diverse-twitter

[48] Joy, Erica, "The Other Side of Diversity, *Medium*, November 2014, medium.com/this-is-hard/the-other-side-of-diversity-1bb3de2f053e#.2mv52rcy9

[49] Zweben, Stewart, "Computing Degree and Enrollment Trends," *Computing Research Association*, 2014, archive2.cra.org/uploads/documents/resources/taulbee/CRA_Taulbee_CS_Degrees_and_Enrollment_2012-13.pdf

[50] "2014 Labor Force Statistics from the Current Population Survey," *Bureau of Labor Statistics*, Feb 2015, bls.gov/cps/cpsaat18.htm

figure is from a different study so the comparison isn't perfect.[51] There's also not enough conclusive data on workplace quality for the overall software sector to make any conclusions. In particular, there seems to be no data on the attrition rate of minorities in the overall software industry, which isn't much of a surprise since attrition data is a closely guarded secret by tech companies.

There are various aspects of recruiting and the workplace that we don't have data for and some people undoubtedly face negative experiences due to their races/ethnicity at specific companies.   As a result, for the software industry as a whole, the statistics paint a much more comprehensive picture of the effects of the pipeline issues. At the same time, from a company perspective, attempting to expand even segments of the pipeline is a much more expensive, slow and daunting task than fixing its recruitment strategy. Moreover, any investment in the pipeline will take time to come to fruition and will be diluted in effectiveness because there will be people who drop out of the pipeline at all stages of education before actually graduating.

On the other hand, relatively easy to implement solutions, such as diversity training, can be ineffective and even detrimental to actual diversity. *A Journal of Personality and Social Psychology* study found out that the mere presence of diversity policies led employees to be less likely to believe racial discrimination existed in the workplace through creating an "illusion of fairness."[52] This illusion occurred even if the diversity policies were completely ineffective. A study in the *American Sociological Review* also showed that diversity programs that targeted stereotypes through education and feedback, such as diversity training, were the least effective types of diversity programs, and in some cases subsequently reduced diversity in areas such as minorities in management. On the other

---

[51] "2014 Labor Force Statistics from the Current Population Survey," *Bureau of Labor Statistics*, Feb 2015, bls.gov/cps/cpsaat18.htm

[52] Kaiser, C. R. et. al., "Presumed Fair: Ironic Effects of Organizational Diversity Structures," *Journal of Personality and Social Psychology*, November 2012, advance online publication, depts.washington.edu/silab/Documents/JPSP%20in%20press.pdf

hand, the most effective programs were "responsibility structures" such as diversity committees, diversity staff positions, and affirmative action plans, which are harder to implement than diversity training but are more successful because "if no one is specifically charged with the task of increasing diversity, then the buck inevitably gets passed ad infinitum. To increase diversity, executives must treat it like any other business goal." [53]

There is no easy solution. In the short term, companies should first start creating and gathering data on diversity programs, with an emphasis on treating diversity like a business goal. Companies should also look at their recruiting processes and modify them to put less of an emphasis on referrals and to conduct more outreach at diverse colleges and universities. However there also needs to be a serious, concerted effort by both companies, nonprofits, and the government to equip underprivileged minority students with the knowledge and resources to pursue engineering careers in the long term.

---

[53] Kalev, Alexandra et. al., "Best Practices or Best Guesses? Assessing the Efficacy of Corporate Affirmative Action and Diversity Policies," *American Sociological Review* 71, no. 4 (2006): 589-617.

Bibliography

Canipe, Chris. "The Billion Dollar Startup Club." *The Wall Street Journal.* February 2015.

graphics.wsj.com/billion-dollar-club/

Shapiro, Robert J. "The U.S. Software Industry As an Engine for Economic Growth and

Employment." *Software and Information Industry Association* (2014): 1-23.

Csorny, Lauren. "Careers in the growing field of information technology services." *Bureau of*

Labor Statistics. April 2013.

bls.gov/opub/btn/volume-2/careers-in-growing-field-of-information-technology-services.

htm#_edn5

"2014 Labor Force Statistics from the Current Population Survey." Bureau of Labor Statistics.

Feb 2015. bls.gov/cps/cpsaat18.htm

"Employed and experienced unemployed persons by detailed industry, sex, race, and Hispanic or

Latino ethnicity, Quarter III 2015," *Bureau of Labor Statistics*, 2015.

Zweben, Stewart. "Computing Degree and Enrollment Trends." *Computing Research*

Association. 2014.

archive2.cra.org/uploads/documents/resources/taulbee/CRA_Taulbee_CS_Degrees_and_

Enrollment_2012-13.pdf

Yoder, Brian L. "Engineering by the Numbers" *American Society for Engineering Education.*

2011.

asee.org/papers-and-publications/publications/college-profiles/2011-profile-enginee

ring-statistics.pdf

"Degrees confered by sex and race." *National Center for Education Statistics.* 2011.

nces.ed.gov/fastfacts/display.asp?id=72

"Freshmen intending S&E major, by field, sex, and race or ethnicity: 1998–2012." *National*

Science Foundation. 2015. nsf.gov/statistics/seind14/content/chapter-2/at02-16.pdf

Arcidiacono, Peter, Aucejo, Esteban, and Spenner, Ken. "What Happens After Enrollment? An

Analysis of the Time Path of Racial Differences in GPA and Major Choice." *Duke*

University. August 2012. public.econ.duke.edu/~psarcidi/grades_4.0.pdf

Sasso, Anne. "African Americans Studying STEM: Parsing the Numbers." *American*

Association for the Advancement of Science. May 2008.

sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2008_05_16/cared

it.a0800070

"Racial/Ethnic Enrollment in Public Schools." *National Center for Education Statistics.* May

2015. nces.ed.gov/programs/coe/indicator_cge.asp

Mason, Kyla. "Computer science's diversity gap starts early." *PBS Newshour.* May 2014.

pbs.org/newshour/updates/teaching-coding-kids-key-closing-fields-diversity-gap/

Weise, Elizabeth. "Tech: Where the women and minorities aren't." USA Today. August 2014.

usatoday.com/story/tech/2014/05/29/silicon-valley-tech-diversity-hiring-women-minoriti

es/9735713/

Facebook. "Hackathon Hacker's Facebook page." Accessed December 2015.

facebook.com/groups/hackathonhackers/

Jaschik, Scott. "Missing Minority Ph.Ds." *Inside Higher Ed.*November 2014.

insidehighered.com/news/2014/11/03/study-finds-serious-attrition-issues-black-and-latin

o-doctoral-students

Martin, Rachel, "More Than A Pipeline Problem: In Search Of Diversity In Silicon Valley,"

   NPR All Tech Considered, July 2015,

   npr.org/sections/alltechconsidered/2015/07/26/426364306/more-than-a-pipeline-problem

   -in-search-of-diversity-in-silicon-valley

Nisen, Max. "Employers ignore almost everything on your application–except this." *Quartz*.

   December 2014. qz.com/299923/why-job-referrals-matter/

"Race and Americans' Social Networks." *Public Religion Research Institute*. August 2014.

   publicreligion.org/research/2014/08/analysis-social-network/#.VnRoOpMrKRt

Kreisberg, Nicole. "H-1B Visas: No Impact on Wages." *American Institute for Economic*

   Research. October 2014. aier.org/research/h-1b-visas-no-impact-wages

Joy, Erica. "The Other Side of Diversity." Medium. November 2014.

   medium.com/this-is-hard/the-other-side-of-diversity-1bb3de2f053e#.2mv52rcy9

Luckie, Mark. "What it's actually like to be a Black employee at a tech company." *Medium*.

   September 2015.

   medium.com/@marksluckie/what-it-s-actually-like-to-be-a-black-employee-at-a-tech-com

   pany-e32bb222818b#.staqqc6ha

Huysse, Janet. "We're committing to a more diverse Twitter." *Twitter*. August 2015.

   blog.twitter.com/2015/we-re-committing-to-a-more-diverse-twitter

Kaiser, Cheryl et. al. "Presumed Fair: Ironic Effects of Organizational Diversity Structures."

   Journal of Personality and Social Psychology. November 2012. Advance online publication.

   depts.washington.edu/silab/Documents/JPSP%20in%20press.pdf

Kalev, Alexandra et. al. "Best Practices or Best Guesses? Assessing the Efficacy of Corporate

Affirmative Action and Diversity Policies." *American Sociological Review* 71, no. 4

(2006): 589-617