MOVING BEYOND BIAS*

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Abstract

The benefits of diverse work groups have been well documented. Creativity, innovativeness and productivity are all improved by creating a team with a variety of backgrounds and perspectives. [1] While scientific laboratories strive for more diversity and inclusion, the field of accelerator controls remains strikingly homogeneous. This trend continues despite many long-standing programs to attract females and people of color to STEM (Science, Technology, Engineering and Math) careers and the explicit desire of leadership to create more inclusive organizations. Research consistently points to the strong role implicit bias plays in preventing organizations from truly providing equal opportunities. In reality, the desire of leadership to improve diversity must be coupled with a strong culture, cultivated to change deeply rooted practices which influence recruiting, hiring, development and promotion decisions based on stereotypes rather than accomplishments, skill and potential. Real change in this arena requires intentional action across the board, not just from human resources and less represented groups. This paper discusses practical approaches to changing organizational culture to enable diverse work groups to grow and thrive.

THE VALUE OF DIVERSITY

Numerous studies analyze ways diverse work groups produce better results in terms of productivity, creativity and innovation; all important qualities in a scientific enterprise. Bringing a wide range of perspectives to the table means a greater variety of ideas and methods are considered in getting to the best solution. We easily appreciate the variety of hardware and software and diverse set of skills needed to successfully build and operate control systems. If we did not have the option to use many types of commercial hardware and software, build custom cards, leverage open source software and write our customer software, it would be considerably more challenging if not impossible to meet the requirements of our customers. Similarly, having a variety to people from different backgrounds provides more perspective and enhances our ability to build the best solutions.

Taking a different point of view, it may be easier to appreciate the value of building a diverse and inclusive organization by considering the potential risk and consequences of failing to do so. There are abundant examples detailing how the shortage of diversity amongst working groups has led to notably bad results including products that are less than satisfactory to half the population and those that fail to perform their intended safety function for people who fall outside the standard model.

Rebuilding

In 2001, as the result of a powerful earthquake in Gujarat in western India, nearly 400,000 housing units were destroyed. [2] Thousands of people died, and an exclusively male team was formed to design and build replacement homes. Similarly, a devastating tsunami struck along the coast of the Indian Ocean in 2004, killing over 250,000 people across fourteen countries. In response, Sri Lanka formed an all-male rebuilding team. While both teams succeeded in building housing, neither included kitchens in the new homes. Surely a detail that would not have been missed if even a small number of women had been included in the planning or, conversely, if men were involved in the cooking.

Similar mishaps occurred even in the United States following hurricanes Andrew (1992) and Katrina (2005) when rebuilding efforts included few women and failed to account for the needs of low-income people, many people of color and single mothers, who were disproportionally impacted by these storms. In Miami, following Andrew, rebuilding focused on larger businesses and neglected childcare facilities, accessible health care and needs of small businesses. In post-Katrina New Orleans, repairable low-income housing was demolished and mostly replaced with more expensive units. Due to the costs of the new units, former residents were forced to relocate to less central locations that without important basics like public transportation and access to food markets and childcare. Without affordable, reliable transportation and childcare, people lost their jobs as well as their homes.

Such non-inclusive efforts to rebuild demonstrate the blinders in place when workgroups do not adequately represent the populations they serve. These examples show not only the need to include women, but also people of color, people of different income levels and those with various family situations when planning community resources. The design teams likely had no idea what was missing from their solutions until the inevitable backlash began as the omitted features were not central to their daily lives.

Safety

While the absence of an in-house kitchen is certainly an inconvenience that disproportionly impacts lower status women in developing countries, it is absolutely tragic when products and processes meant to address safety fail to protect the majority of the population due to testing on narrow, non-diverse models or groups.

Although it has been well known for decades that the vast majority of medical research has been conducted on Caucasian males, this practice has been slow to change and is true even for medical conditions that disproportionately affect women or people of color. [3] Doctors conducting medical research are likely influenced by the fact the medical textbooks and medical school courses most often rely on an average size white male default model and seldom address medical considerations unique to other groups. The failure of the medical profession to conduct research and devise treatments which consider gender and ethnic differences has led to less than optimal and sometimes dangerous treatment for people who differ from the normative type.

Non-inclusive drug trails can lead to medication dosages for women, children and even for smaller men, which are too high, potentially causing more severe side effects than necessary. For decades, women were diagnosed with anemia due to low iron levels and prescribed iron supplements, along with the side effects and risks, to correct this deficiency. Eventually, research on women showed that most of these women had perfectly normal iron levels, for women, without supplements.

The lack of diverse subjects in medical studies has also negatively impacted women and people of color in getting the correct diagnosis for medical conditions. Medical research is used to define the industry "standard of care" which is in turn used extensively by doctors for diagnosis and treatment. However, women and men often develop different symptoms in response to the same condition. This has led to women needlessly dying after being sent home from the emergency department while having heart attacks because they experienced discomfort in their neck along with shortness of breath instead of searing chest pain. Conversely, men with panic disorder are assumed to be having a heart attack and quickly connected to an electrocardiogram machine. When the EKG shows they are not having a heart attack, they are sent home with no treatment only to return again the next time they experience a panic attack.

Since airbags, an important automobile safety advance, became available in the 1989, they have been credited with reducing injuries and preventing over 1000 deaths each year in the US. [4] Unfortunately, airbags were initially only tested on crash dummies the size of the average American male (5'8" tall and 165 pounds). This omission led to cases of severe injuries and even death for some shorter drivers, usually women under 5'4" tall or children who should ride in the back whenever possible. The industry maintained this was not a design flaw, but rather the fault of drivers positioning their seat too close to the steering wheel than recommended for safe airbag deployment. Of course, short drivers do this in order to actually reach the gas and brake pedals so they can operate the car. The auto industry knew this and despite the fact that half of all women in America are 5'4" or shorter, few cars are offered with adjustable foot pedals, which, for a modest cost, could largely solve this problem. More recent advances in airbag technology use sensors to determine the size and the posi-

tion of front seat occupants and can make some adjustments to the speed and pressure of the airbag deployment or turn the airbag off completely. [5]

Justifications for failing to include a representative sample of the population in medical and safety studies range from the desire to keep costs down, to concerns about increasing the complexity of the data and therefore the effort and time required for analysis. Government regulators often relent to industry lobbyists expressing concerns about higher costs when agreeing to non-inclusive study requirements. One cannot discount the fact that many studies are carried out by researchers who are themselves not a diverse group and their approach is limited by their life perspective. Unfortunately, the pervasive failure of safety and medical studies to include women and minorities has allowed manufacturers to deliver dangerous products without sufficient consideration of the risks to people outside the model group.

BARRIERS TO DIVERSITY

Sociocultural Factors

Centuries of strong socially, culturally and even legally defined gender and ethnic roles have led to strong stereotypes making it common for society to view women and people of color as less capable than white men when it comes to fields requiring strong mathematical skills. Studies show this is not a view that is supported by data when women and minorities get the education and support resources which are routinely afforded to white males. Various inequities, ranging from implicit bias to outright discrimination, undermine well-meaning efforts to develop, recruit and retain a diverse workforce. The existing system and power structure are well supported by persistent stereotypes and homogeneous leadership to filter out non-traditional candidates at each phase of career progression.

From birth, boys and girls are treated differently, receiving much different messages about their potential and worth. People are socialized to dress children in gender appropriate colors and styles and use gendered vocabulary when speaking to or about children. Toys are marketed by gender and children who want to play with the opposite toys are often ridiculed by adults. Boys are bombarded with expectations tied to strength and success while girls are socialized to value beauty over their intellect and are discouraged from pursuing male dominated careers.

In recognition of the need for greater diversity, the past two decades spawned innumerable programs aimed at increasing participation of female and minority students in STEM fields. Despite the fact that the majority of all degrees in the US are now earned by females, the percentage of degrees earned by women in physical sciences and engineering has remained stubbornly below 20%. While these programs are necessary to increase broader participation, they are not sufficient. Girls and children of color grow up absorbing a ubiquitous stream of images and social messages telling them they are not well suited for STEM careers. There is even evidence that children receive different college and career path advice from their parents,

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teachers and school guidance counselors depending on their gender and color rather than their academic performance, interests and test scores. It is then hardly surprising that occasional targeted STEM events aimed at girls and minorities are not enough to overcome a young lifetime of messages steering them to female dominated and lower paying careers over engineering and science, regardless of their potential.

Discrimination and Lack of Inclusion

Diversity is further eroded in educational institutions and workplaces when people who differ from the white male majority are not welcomed by an inclusive environment. Rather, they can face daily challenges ranging from being ignored, hostile comments and actions, efforts to undermine their work, not being given proper credit, casual dismissal of their ideas and being interrupted or talked over in meetings. In the worst cases, they are the targets of sexual harassment and even sexual assault. Such obstacles discourage some non-traditional candidates from completing their degrees or cause them to leave the STEM workforce prematurely.

If you doubt this reality, consider the experiences detailed by Dr. Ben Barres, a respected neurobiologist, in his autobiography. [6] Dr. Barres grew up and earned his MD and PhD as a female. While working as a professor at Stanford, he made the difficult decision to transition from female to male despite concerns that such a change could result in negative consequences for his career. This worry was unfounded as his colleagues readily accepted his transgender status. What Dr. Barres did not expect was how differently he would be treated as a man. Following his first seminar as Ben, a male colleague, commented on how much better Barres' work was than that of his sister, Barbara Barres. Of course, Barbara was not Barres' sister, but rather, was Barres' name before his transition. In his book, Dr. Barres recounts other examples of being treated with greater respect after his transition including that he was "finally allowed to finish his sentences without being interrupted". This experience gave him unique insights to the slights, oversites, harassment and discrimination heaped upon females who choose to pursue STEM career, and he became a strong advocate for equal treatment of women in science. Ironically, it was only after experiencing life as a male that Dr. Barres really understood how the discrimination he experienced as a woman.

Harassment

Academia holds the dubious distinction of being second to only the military with respect to the rate of harassment in the workplace. This coupled with stunningly inadequate response to reports of sexual harassment and even sexual assault in the scientific environment makes it more difficult for women to navigate STEM education and careers. [7] There are many documented cases where reporting sexual harassment negatively impacts the reporter rather than the harasser. With a strong culture of valuing science over all else, harassers who produce results, bring prestige to an institution and garner research funding are

protected while women's complaints are minimized or ignored. In extreme cases, where there are repeated credible reports against a single powerful scientist, universities may opt to quietly allow the perpetrator to take a position at another university, keeping the harassment quiet, and subjecting a new cadre of students to this abhorrent behavior. [8] It is unsurprising that women, who often fear retaliation, are reluctant to report in a system that is really designed to protect institutions and their reputations rather than victims.

How can we actually improve diversity?

You Can't Fix the Women

Early efforts to help women succeed in the workforce were largely aimed at somehow improving or training women and people of color to adapt to the white male dominated working world rather than appreciating the very value their differences bring. Fortunately, such efforts were not very successful. It is well past time to stop trying to "fix the women" and address systemic inequities that impede diversity and embrace the benefits we can gain from an inclusive workforce. Given centuries of tradition and culture supporting white males almost exclusively as the normative type in science and engineering, it is logical that culture change is the only avenue to making meaningful diversity improvement in the STEM workforce. What might be less obvious is the critical role the dominate group must play to make such change possible.

Keeping this in mind, it is first necessary to reject the notion that diversity is a "problem" to be fixed by human resources and the small number of women and minorities in the organization. These groups do not possess the power to address systemic organizational bias and change the processes that support such discrimination. We can start by considering that diversity is not a problem at all but rather an opportunity for organizations to excel. Culture change efforts, like those undertaken when institutes develop poor safety performance, must permeate all levels and aspects of an organization. Much like an error or oversight by any employee can contribute to an accident, diversity and inclusion efforts can be undermined by a few powerful individuals.

To illustrate this point, consider the case of Facebook, a high-tech company with a powerful female Chief Operating Officer who is a persistent advocate for diversity in the tech industry. [9] In 2015, as part of a well-intended effort to improve diversity amongst their engineering staff, Facebook offered an extra incentive to recruiters who identified diverse candidates who were eventually hired. The incentive worked and recruiters quickly increased the number of female and minority candidates who were recommended for hire following a multistage interview process. This effort backfired when a small, non-diverse, committee, at the highest level of the organization, frequently rejected the diverse candidates in the final approval stage of the hiring process. As this became a pattern, recruiters actually stopped trying to attract diverse candidates in order to improve their hiring rates and Facebook's representation

of women and underrepresented minorities in the engineering staff has not significantly improved. While the recruiters demonstrated they could bring qualified diverse candidates to the table, and balanced interview committees recommended hiring some of these candidates, this effort failed because the high level leadership remained uncomfortable with these candidates especially if they did not already know someone in the company who could recommend them.

Changing the Culture

Culture change demands the commitment of decision makers at all levels along with policies and processes that are aligned with this commitment. It is not sufficient for the top leader to declare that the organization will practice fair and equitable hiring practices when a lower level manager can select all interview candidates, appoint the interview committee and approve their own hiring decisions without review. Even when not intended, leaders lead by example, so it is important that all leaders embrace and demonstrate their commitment to organizational values that support diversity and inclusion through their actions and their words. Conversely, it is not productive to establish quotas for diverse hiring. Organizations must hire the best candidates they can attract but should consider the attributes that really make someone the best candidate for the job rather than automatically seeking the closest match to existing staff.

These same principles apply to all organizational career building processes such as promotions, evaluations, project assignments, professional development and mentoring. It diminishes the value of diverse staff when they are not fully included and afforded the same opportunities for career advancement as their peers. Women even experience reduced opportunities due to well-meaning mangers who decide not to assign them to the most desirable projects (interesting, challenging, career building) once they start a family. The manager may intend to help the employee with work life balance, but such efforts should always be discussed with the employee who may need a simple schedule adjustment rather than career limiting job assignments. Options for better balance should also be extended to male employees with children who also need to manage their careers in balance with their family responsibilities.

Extending Privilege

Any meaningful effort to transform our workplaces into inclusive environments must fully engage the workforce, and especially the dominant group which in STEM fields is white males. This group, in any organization, holds the vast majority of the power, it follows that they are in the best position to compel the cultural and organizational changes needed to prevent business decisions based on implicit bias and comfort zones instead of equal opportunity. Career success is most often the product of hard work and opportunity, although men tend to emphasize how hard they worked for their success and women often attribute some of their success to their good fortune. The reality is that men also benefit from such opportunities and are most often the ones in the best position to extend their privilege to others as they advance to higher levels in their careers.

Privilege comes in many forms such as advantages gained by matching the dominate group in characteristics like gender, skin color, ethnicity, nationality, religion, size, socioeconomic status and sexual orientation. These attributes often come to us by virtue of our birth rather than through our own effort. Factors such as socioeconomic status, birth country, gender and skin color can significantly impact one's ability to get a good education. Recognizing privilege often requires some education and introspection. As we can clearly see from Dr. Barres story, the difficulty with understanding privilege is that people who experience such benefits usually had this advantage for their entire life and lack first-hand experience of the obstacles in place for others. This is an area where we can all likely contribute to advancing diversity and creating a more inclusive workplace regardless of level in our organizations.

An important characteristic of privilege is one's ability to offer it to others, however, most often, it is only offered to people who are most like ourselves. Even though it is not often acknowledged by people in the dominant group, they likely benefited from advantages due to privilege. Once we can fully understand our privileges and the barriers less privileged groups routinely face, it is important to extend our privilege in an equitable manner, taking care to include people who are not necessarily just like ourselves. Sharing advantage can be as simple as pointing out when a woman is being talked over in a meeting and giving her a change to speak without interruption. A message like this, in our existing culture, carries a lot more weight coming from someone in the dominant group than from the woman herself and contributes to equalizing the workplace. In this way, we help our organizations become more diverse and inclusive and gain the benefits of bringing a more complete perspective to our work. Accordingly, because white males form the majority of the people in the international accelerator controls community, they hold immense power to extend the benefits of their privilege outside their dominant group and really change our community for the better.

SUMMARY

Improving diversity in our organizations is key to gaining more complete perspectives of the systems we produce and how they can be better. We are regrettably locked in a holding pattern with respect to diversity supported by social factors, strong culture and our human tendencies to form homogenous groups and resist change. Becoming more diverse can surely be uncomfortable, but by not taking steps and becoming more inclusive we risk maintaining a narrow worldview and missing opportunities for consequential improvements in our field. Examples from other fields show us that non-diverse workgroups can produce inadequate and even disastrous solutions simply because they do not include a wide enough worldview. To paraphrase Jonathan Raymond, "We don't know what we don't know" and only by broadening our perspective can we

identify our blind spots and eliminate them. By implementing culture changes in our organizations and extending the benefits of our privilege to a wider group we can remove barriers and become a stronger community, better positioned to provide the advanced control systems that will be needed by future machines.

ACKNOWLEDGEMENTS

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