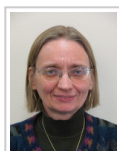# Engineering Newsletter

One-Hundred-and-Fortieth Edition: December 1, 2015 _Eng News Blog (Archives)_
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NOOGLER ADVICE   GAGGLE   THE DATA ON DIVERSITY   LEISURE

THE DATA ON DIVERSITY: IT'S NOT JUST ABOUT BEING FAIR

By Beryl Nelson

Beryl Nelson was an engineering manager at Google from 2009 until her untimely passing last month. She was a passionate advocate for diversity in the tech industry, and her efforts led directly to various diversity initiatives at Google, such as the unconscious bias training.

The following is an abridged version of her September, 2012 internal article. The complete external version that was published in November 2014's Communications of the ACM is available here.

It's not just about being fair

We're technical people, and we like data. And now, imaginative researchers have developed ways to gather quantitative data about the benefits of, as well as the challenges to, having a diverse workforce.

Data shows that diverse teams are more effective: better financial results, better results in innovation. It's not just a matter of fairness any more, or a numbers game (i.e., there is some portion of the population that we can't reach if we are not diverse). Rather, having a diverse organization becomes a business imperative!

Moreover, it turns out that there is quantitative data even on effects as difficult to evaluate as unconscious bias, and the effects of stereotype threat. And the results are very surprising.

This is a very brief survey of the literature. In this article, I thread together some of the interesting work so that it can be seen as a coherent whole.

Benefits of diversity: Financial results and innovation

Financial results

A number of studies have shown that financial results are better for organizations with a higher percentage of women in senior positions. For example, McKinsey and Catalyst have both published such results.

- McKinsey documented that companies with a higher proportion of women in top management roles have 10% greater return on equity (ROE), and 48% greater earnings before interest and taxes (EBIT).
- Catalyst measured financial results for companies with at least 3 women serving on the board of directors: Return on equity was 16.7%, as opposed to an average 11.5%; Return on sales (ROS) was 16.8%, as opposed to an average 11.5%; return on invested capital (ROIC) was 10%, as opposed to an average 6.2%.

Companies with a higher proportion of women in their top management ha performance

Economic performance of the companies with most gender-diverse management teams compared with their industry average

* 89 companies, identified with the scoring system developed by Amazone Euro Fund
** 87 companies, data not available for two companies
*** 73 companies, financial sector not included
**** Of the 89 most gender-diverse companies, 44 have a market capitalization greater than 2 billion euros
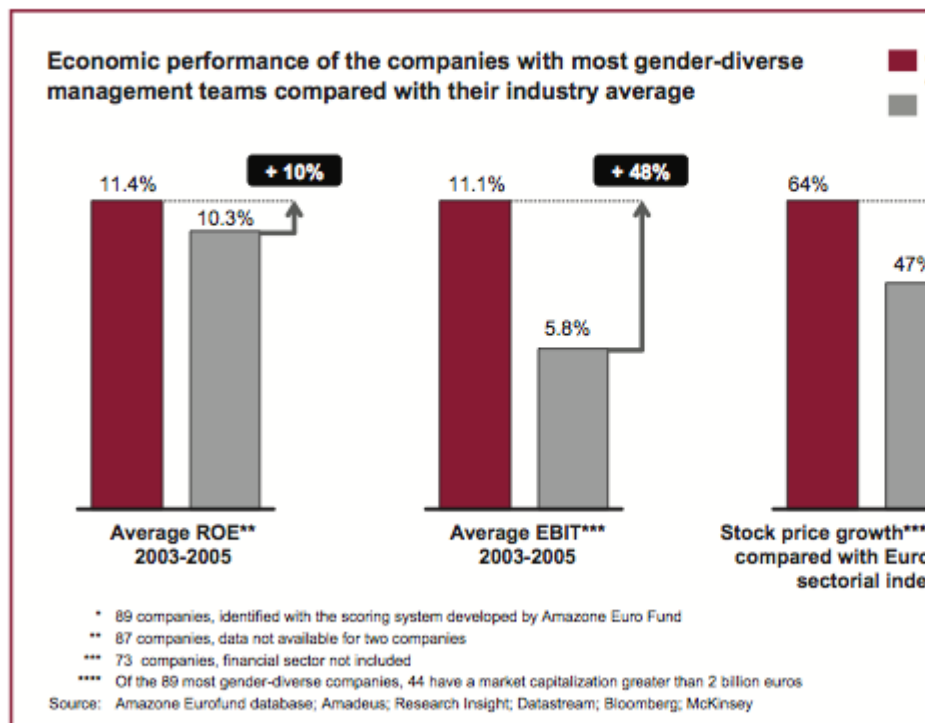Source: Amazone Eurofund database; Amadeus; Research Insight; Datastream; Bloomberg; McKinsey

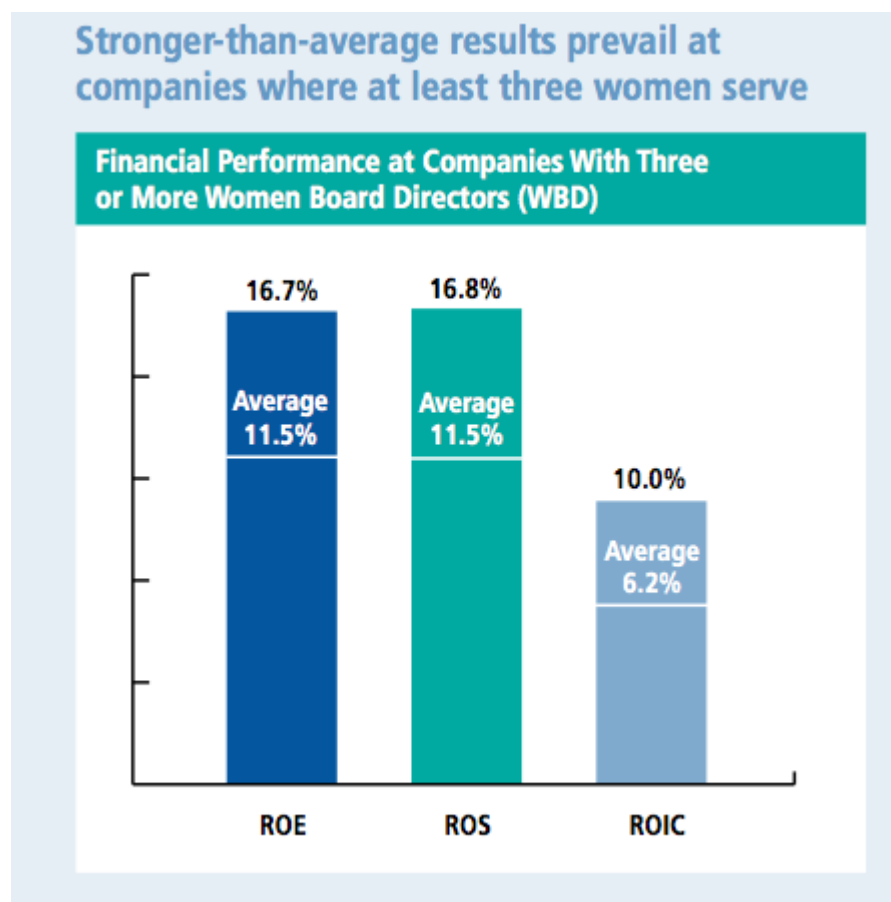Figure 1: from McKinsey, Women Matter: Gender diversity, a corporate performance driver.

Figure 2: From Catalyst, The Bottom Line: Corporate Performance and Women's Representation on Boards.

This is also true in other geographies. For example, profits of Indian companies headed by women grew 56% within five years, but grew even faster, at the rate of 64%, within three years, as reported in the Economic Times of India. The BSE-30 companies posted a growth rate of 27% and 23%, respectively, during the same period (NASSCOM-Mercer, 2009).

Innovation

The research also shows that diversity on all axes of life experience -- age, gender, race, national and cultural origin, sexual orientation, educational background, for example -- creates a cognitive and social environment which is a positive indicator for innovation and a negative indicator for routine tasks. If you have a factory, you want quick and clear communication, and culturally similar people make an ideal group. If you want to innovate, you want to have a variety of ideas, skills, and ways of thinking about problems within your group.

A few example studies:

More than 90% of all computer tech patents issued in the US since 1980 are male only. Yet mixed-gender patents are cited 26% to 42% more than any single gender patent (Ashcraft and Breitzman, 2006). An update to this report in 2012 showed that mixed-gender patents typically have a large number of authors. The higher citation rate (30 to 40%

more in the 2012 update) is associated with higher numbers of authors.
The reasons for this are not well known.

In another study, researchers gave subjects aged 18 to 60 standard
intelligence tests and assigned them randomly to teams. Each team was
asked to complete several tasks, including brainstorming, decision
making, and visual puzzles, and to solve one complex problem that was
too hard for one brilliant individual to solve: i.e. a team was required.
Teams were given intelligence scores based on their performance. The
only predictor of team collective intelligence was whether there were
women on the team. This was a surprise result to the researchers. With
more investigation, it was found that the difference was having the
social skills that made it possible to use the contributions of all the team
members, and these correlate more with women than with men. See the
discussion here. The following table shows the relationship of team
composition to success. Malone has some measures of social
intelligence that he would like to apply to real world project success
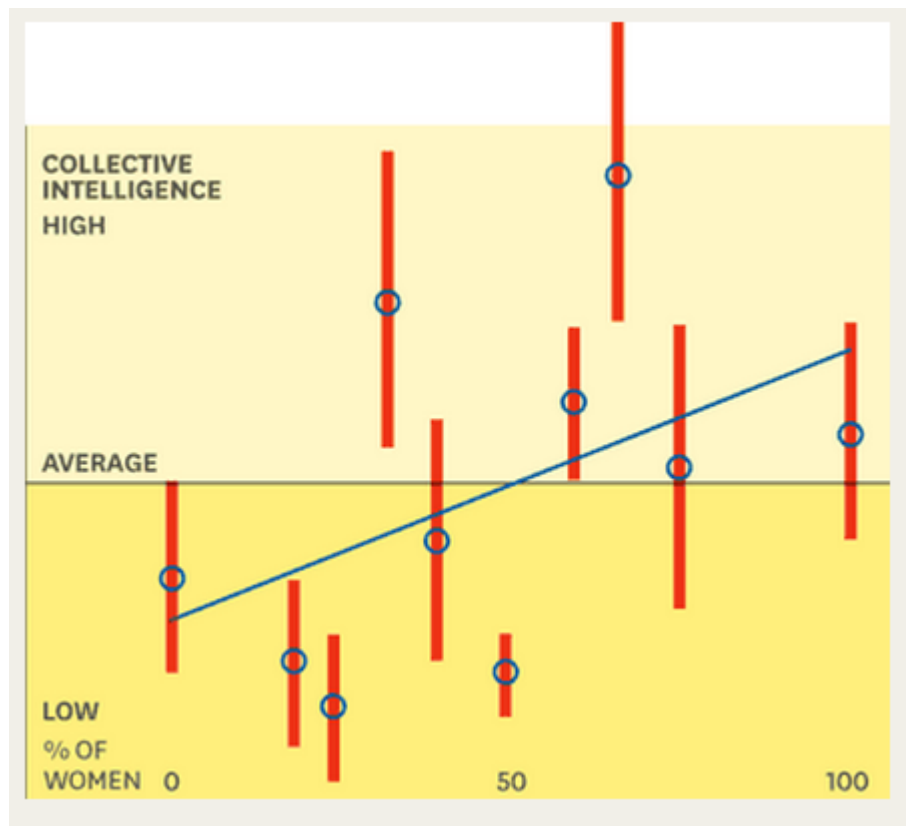studies; it would be interesting to try this out at Google.

Figure 3: from Woolley and Malone, Defend your Research:
What Makes a Team Smarter? More Women. The horizontal
axis indicates team composition. The red bars indicate
ranges of values for each level; the blue circles represent
averages.

Similar results have been found on other axes of diversity, such as race;
e.g. Does Diversity Pay?.

These results show a correlation between diverse organizational composition, financial success, and innovation. While there is [not a clear causal relationship](#) shown between diversity and success, the results have been shown with varying methodologies and in varying geographies, to a degree that demands attention.

Challenges

Unfortunately, it is not easy to make diverse teams effective. There are a number of forces that work against the desired effect: having the entire team be productive. For example, there can be potential negative effects of any of the following:

- Unconscious bias
- Stereotype threat
- Cognitive illusions
- Exclusion from critical social networks
- Lack of role models
- Unaware managers

Let's look at a few of these effects.

Implicit bias

A number of books have been written about the effect of unconscious decision making, like [Blink](#) by Malcolm Gladwell, a very popular author. A different point of view is presented by Shankar Vedantam in [The Hidden Brain](#): how is it that we make decisions which are at direct odds with our conscious goals?

Many people tend to believe that some decisions are biased, but in individual cases this can be very hard to verify. So let's first look at these numbers:

- About 58% of CEOs of Fortune 500 companies are taller than 6ft. (about 183 cm), and almost a third are taller than 6ft. 2in. (about 188 cm). In the population in general, about 14.5% are taller than 6 ft., and 3.9% taller than 6ft. 2in. Do we really think that people who are taller are more competent? (Reported in [Blink](#))
- In a laboratory situation, applicants were seen in the waiting room either alone, or sitting next to another applicant. Applicants who were seen sitting next to an overweight applicant were less likely to be hired than an applicant sitting alone or next to an average weight applicant, and regardless of their own weight. (Reported in [The Hidden Brain](#))

Clearly, there was unconscious decision making in each of these cases.

A very important result in the area of bias has been in the development of Implicit Attitude theory. A number of researchers have made progress in this area, but one very accessible study is the [Project Implicit](#) test: this measures bias via response time in an internet-based test. There are results for many axes of bias, and the results are stunning.

- Almost everyone has such biases (e.g. 70 to 80% have biases against women in tech, or preferring white to African American, or preferring young people, for example)
- Almost no one reports such biases (e.g. 15% report a preference for white people)
- Even the people who are the subject of a bias may have that bias. For example, I tested as moderately biased against women in science and technology, and this is totally against my self-interest.

This result is confirmed in other experiments; for example, there was a study of US Science Faculty in respected research institutions, which showed that science faculty had significant biases against women students: they were given applications for lab manager which varied only in the gender of the name. Male students were rated significantly more competent, and were given higher salaries and more mentoring opportunities. Importantly, even the female faculty showed this bias (PNAS, Discover).

We should have better knowledge of our own biases and unconscious decision making. Taking the Implicit Attitude test for a few kinds of attitude is highly recommended!

Stereotype threat

Claude Steele has published a history of the research by himself and others about stereotype effects and identity threat in a book called Whistling Vivaldi. The original problem he tried to solve was, why were college entrance scores not predictive of college success for Black Americans? Steele asserts that we each have multiple identities (such as I am a woman; I am an MIT alumna; I am American); that each of these identities can have what Steele calls *identity contingencies;* that each of these contingencies can be positive, neutral, or negative in a given social situation; and that we respond to the identity under threat.

Based on research into this and other areas, including the success of girls and women in science and math, it has been established that when someone is confronted with a situation that is consistent with a stereotype, and that stereotype places his or her identity with a negative contingency, and if the person cares about this, then performance suffers. For example:

- Girls perform as well as boys in math tests when there is no stereotype threat, but significantly worse when there is high stereotype threat.
- Girls aged 5 to 7 show worse performance on a math test if they color a picture of a girl holding a doll, compared to coloring a picture with an Asian child eating with chopsticks, or a landscape.
- White men perform worse in math when reminded of the Asian math stereotype.
- Black men perform better than white in athletics ability tests but worse if the problem is presented as a problem of "sports strategic intelligence".

Note that people in general do not report that they are under stereotype threat; they say that they don't feel any stress. But there are physiological effects that can be measured: blood pressure, sweat; and which correlate with performance.

Why is this important? We want to distinguish between people who can do work but are stressed, and people who cannot do the work. Moreover, these effects are continuous: it does not end at the job interview. We want to provide an environment in which everyone can perform at their maximal level, and stereotype threat interferes with this.

A web site with a good summary of recommendations on dealing with stereotype threat is http://www.reducingstereotypethreat.org/

Prospect Theory, and cognitive illusions

Daniel Kahneman, a psychologist, received the Nobel prize in Economics for the work that he and his colleague Amos Tversky did in the development of Prospect Theory, a study of risk-taking behaviours where the probabilities of outcome are known. He has recently published a book, Thinking, Fast and Slow, which includes a discussion of what he calls cognitive illusions. These are situations where the coherence of a story, rather than truth or data, leads to an illusion of confidence. A section from his book was reprinted in the NY Times magazine here, with reference to some interesting case studies.

In the first case, Kahneman himself was a psychologist in the Israeli army, assigned to assess enlisted soldiers during a training exercise for whether they were suited to be leaders. After a few months, results would come back from the commanding officers, and there was almost no correlation between his predictions and the assessment in the field. But it was the army, and he had to keep doing his job. What was remarkable to him was that he and his colleague would still make the same kind of assessments with the same level of confidence, even in the face of evidence to the contrary.

In a much later incident, he was asked to speak to a group of financial advisors to wealthy clients. He received 8 years of performance data. He reasoned that if a financial advisor's results were the result of skill, then there should be some consistency from year to year. So he computed the correlation coefficient between years 1 and 2, years 1 and 3, etc. He found that the average correlation coefficient was 0.01, meaning that the results were essentially random.

When he presented this embarrassing result to the investment firm, there was not that much surprise: they expected the results to be low, though they did not expect it to be quite that low. But when one of the executives drove him to the airport, he said, "I have done very well for the firm, and no one can take that away from me". Kahneman was thinking, "But I just did".

These are both situations in which very educated and qualified people, presented with strong data, still held their previous beliefs, contradicting the data. Instead, they find it easier to believe in a narrative that

supports their professional accomplishments. This is relevant to this conversation, as many people do not believe that there is a significant effect of bias in their work lives, as they don't see the connections. Kahneman calls this tendency to only believe the narrative we see WYSIATI: "What you see is all there is". This is also particularly interesting in the case of women, as they are frequently believed to lack in confidence, and so (it is believed) lack the qualities of a leader. See for example [The Power of Talk: Who Gets Heard and Why](#) by Deborah Tannen.

What works

In September of 2010, former Google SVP Alan Eustace sent an email to all Engineering, citing data on the rate of self-nomination and promotion. It showed that at lower levels, women self-nominate less, but once nominated, are promoted at the same rate as men. This email resulted in a higher nomination rate for women in following cycles, much closer to that of men.

At Harvey Mudd College, within 5 years the college went from the average 12% of women in CS to about 40% by taking these actions:

- They changed the introductory CS class to be more holistic, and not assume the students already know how to program.
- A large percentage of women students were taken to the Grace Hopper Celebration of Women in Computing, a large (about 2000 person) conference, regardless of major.
- After the first year, a research program is available.

None of these is a particularly new insight, but in combination they had a dramatic and lasting effect.

To summarize things that can be done by leaders to make diverse teams effective:

- Create an atmosphere of trust.
- Pay attention to critical mass.
- Provide a credible narrative. Provide opportunities for everyone to see themselves as successful: e.g. to meet more experienced, successful people, similar to themselves, and who have faced the same barriers. Adopt an expandable view of intelligence: show that you believe that skills can be learned.
- Know your own biases. Take the Implicit Attitude test.
- Embrace differences: as a manager, pay attention to differences in needs by individuals.
- Foster intergroup conversations as learning opportunities.
- Remember that the subject of a bias is not always aware of the effects on him or her.
- Actively pursuing diversity is more trusted than saying "we are color blind".
- Education: data works!