

The “d” word

Solving for “diversity” on high-tech teams

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An activity ...

Your friend wants to write a NSF grant together to start up a research program on a topic you know a lot about. On the phone, you're asked for ideas as to who to invite as a collaborator. You want to write a competitive proposal. Write down the first five names that occur to you ...

Who am I?

- Sociology faculty at Princeton University
- PhD in the sociology of science and technology, work in Human-Computer Interaction
- Working with NASA's robotic spacecraft teams since 2006
- The material I'll present today is "Sociology 101": well-accepted, peer-reviewed, widely read and cited, replicated (note: US focus)



FIELDS ARRANGED BY PURITY

→
MORE PURE

SOCIOLOGY IS
JUST APPLIED
PSYCHOLOGY

PSYCHOLOGY IS
JUST APPLIED
BIOLOGY.

BIOLOGY IS
JUST APPLIED
CHEMISTRY

WHICH IS JUST
APPLIED PHYSICS.
IT'S NICE TO
BE ON TOP.

OH, HEY, I DIDN'T
SEE YOU GUYS ALL
THE WAY OVER THERE.



SOCIOLOGISTS

PSYCHOLOGISTS

BIOLOGISTS

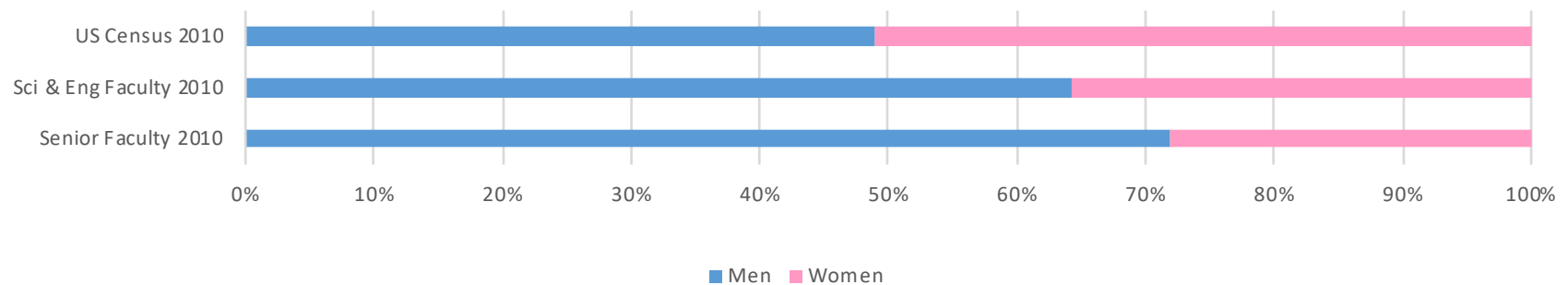
CHEMISTS

PHYSICISTS

MATHEMATICIANS

The problem

Gender breakdown, Science and Engineering Fields overall

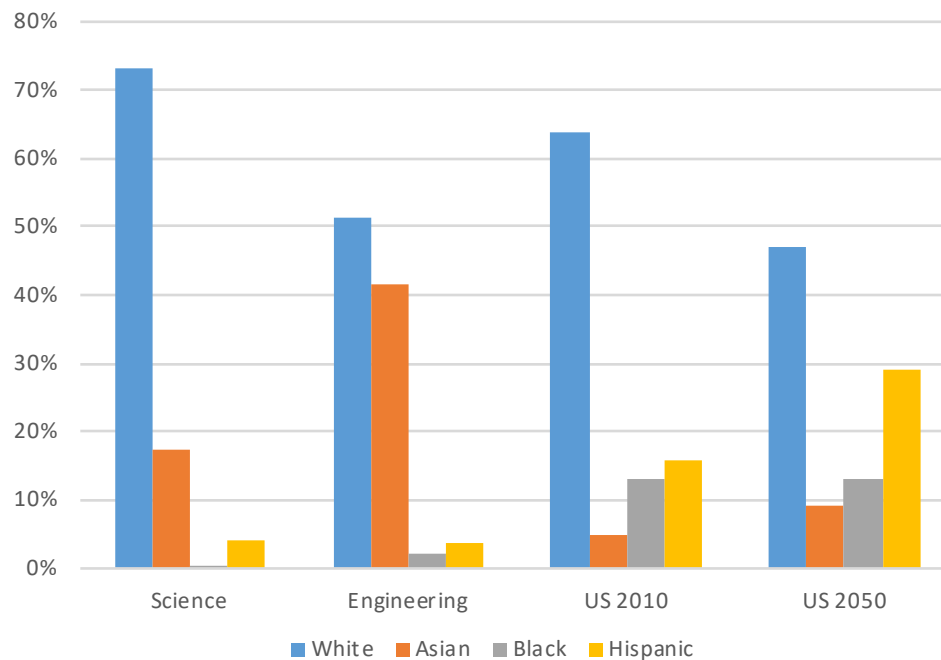


Source: National Science Foundation

- STEM continues to witness limited numbers of women and minorities in important roles ...
- Widespread reports of harassment and discrimination
- Also across the board in STEM and the tech industry in Silicon Valley

What about merit?

Full time employed scientists and engineers with doctorates in the US (NSF data), vs. 2010 and 2050 US population



- Even if intelligence and hard work were **randomly distributed** in a population (not equally), you would still end up with representation roughly proportional to the overall population
- The fact that STEM has these figures is a sign that **there are additional obstacles in the way**
- To encourage an **actual meritocracy**, we need to change some of these persistent barriers.



Team diversity improves performance & innovation

- Group cross-fertilization is an important source of new ideas (Burt, 2004; de Vaan, Vedres and Stark 2015)
- It fosters better solutions to problems (Hoffman, 1958; Hoffman and Maier, 1961; Watson et al. 1993; MacLeod et al. 2013)
- Diverse groups consistently outperform groups of like-minded individuals across fields and tasks (Phillips et al, 2008; Levine et al. 2014)
- It combats group-think that leads to catastrophe (Vaughan, 1997)
- Reduces risk and adds robustness to a population (Neff 2012)
- Also produces the ability to reach new groups for outreach and support – for business and for public engagement (Wright et al. 1995)

Also, better products...





R. Kanter,
Harvard Business School
Corporations



L. Smith-Doerr
U.Mass Amherst
Biotechnologists



S. Correll
Stanford
Gender inequalities



E. Branch
U.Mass Amherst
IT workers & race



N. Ensmenger
Indiana University
History of computing



S. Thebaud
UCSB
Entrepreneurs



R. Burt
U. Chicago
Networks



S. Traweek
UCLA
Physicists
& astronomers



J. Schug
William & Mary
Psychology of gender



D. Pedulla
Stanford
Gender/ Race



C. Ridgeway
Stanford
Gender in tech



Before we begin

- **You all have gender.** You also all have race. The patterns I will describe affect everyone in this room, even if you don't feel personally impacted.
- **This is not finger-pointing:** it's examining broad cultural & social trends that impact the social world of the sciences and engineering. Yet there are solutions you, as individuals and groups, can implement, with the right tools.
- **This is a sensitive topic.** Many of you have experiences with this, or opinions about this. My aim is to give a neutral vocabulary and examples to help you make decisions, navigate your careers, & inform your conversations.

Three sociological frameworks

1. **Cognitive-cultural:** *Culture impacts how we think*

2. **Demographic:** *Proportionality matters*

3. **Networks:** *Who you know matters*

- These are *sociological* approaches; social psychology, neuro-psychology, anthropology, history have different vocabularies
- There are more frameworks: *identity* (e.g. who looks like a scientist), *structural* problems (e.g. availability of parental leave), the “*leaky pipeline*” (e.g. who stays in and who leaves) ... But let's start here.

Type	Cognitive-Cultural	Demographics	Networks
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Cognitive-cultural (i.e. “stereotyping”)

- Cultural frameworks and socialization affect how we think
 - Cognition is culturally tinged and conditioned; culture biases cognition
 - This is at first an evolutionary advantage! But has drawbacks for diversity.
- Classic example: resume studies
 - Given **the exact same resume** with a different name at the top – varied for male and female, or traditionally Asian or African-American names – classic white male names are advantaged.
 - **Reproduced** for gender, race, social class, other kinds of social stigmas
 - **Results are reproduced every time**
 - Example: the “orchestra study” (Golden & Rouse, 2000)



How does implicit bias work?

- Through applying “gender frames”: an assortment of (dominant) stereotypes about how men and women are supposed to behave
 - *“... because we think “most people” hold these [gender stereotypes], we expect others to judge us according to them. As a result, we must take these beliefs into account in our own behavior even if we do not endorse them.”* (Ridgeway, 2009)
- Affects how we positively or negatively evaluate individuals by how well they fit the requisite “gender frame”
- In times of resource scarcity (e.g. after a recession) people double down on these biases in decision making (Thebaud and Sharkey, 2015)
- Result is a leaky pipeline where talented individuals drop out, do not apply, or resist self-nomination

Cognitive-cultural effects

- Significant and crippling double standards:
 - Backlash against “agentic women” who act domineering (Rudman and Glick, 2001): role incongruity with leadership qualities (Eagly and Karau 2002)
 - Sensitive men are considered weak leaders (Rudman and Fairchild 2004).
 - Ideal types – “the computer bum” or “the physics career” – discourage those who don’t fit (Traweek, 1985; Ensmenger, 2015)
 - The “motherhood penalty” and the “fatherhood bonus”: Men with children paid more; mothers’ salaries are penalized (Correll et al. 2011)
- Minorities incorporate these stereotypes or learn from others’ behavior and hold themselves back (i.e. *imposter syndrome*)
 - “*Constraints become preferences*” (Correll, 2004; or de-specialize: see Pager and Pedulla, 2015)

Measurable effects: motherhood/fatherhood

Figure 2. Women's Median Weekly Earnings as a Percentage of Men's by Selected Characteristics, 2012⁴

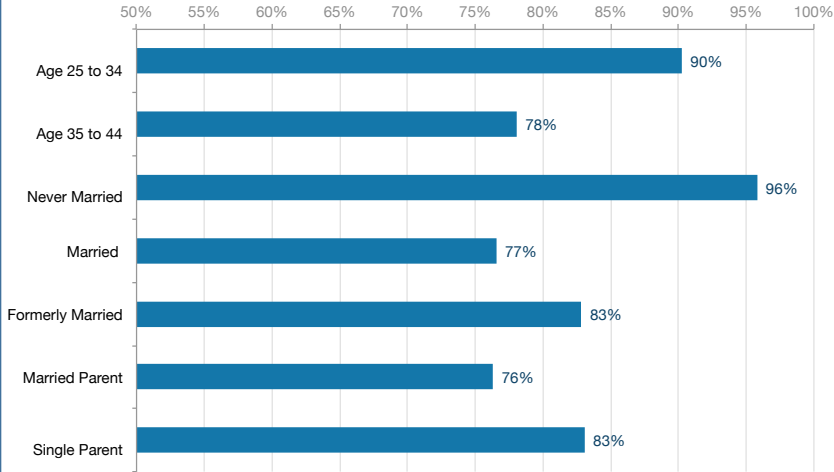
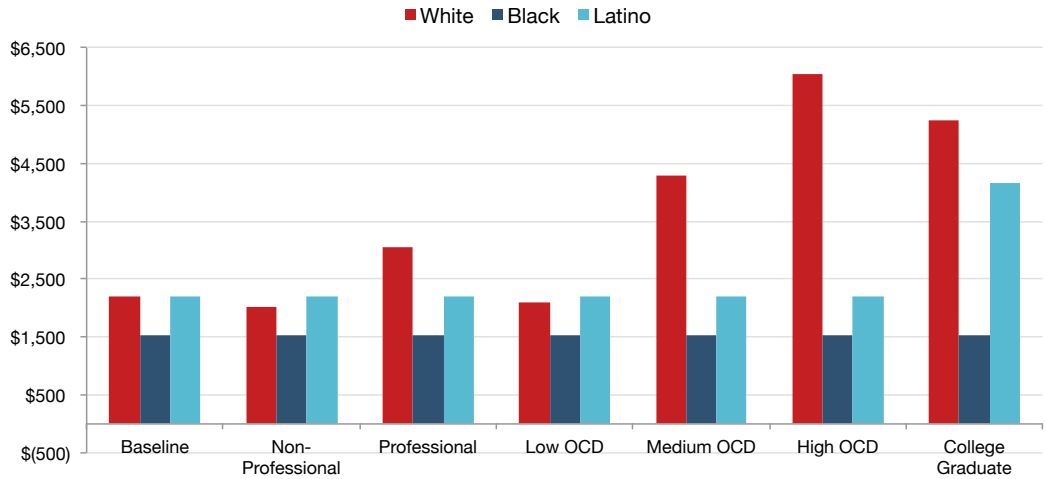


Figure 4. Fatherhood Bonus in Dollars, by Professional Status, Occupational Cognitive Demands Education (OCD), and Race/Ethnicity, Adjusted for Human Capital¹⁵



Sources: National Bureau of Labor Statistics
 Graphs in [Budig report](#)

The Matthew Effect – and the Matilda Effect

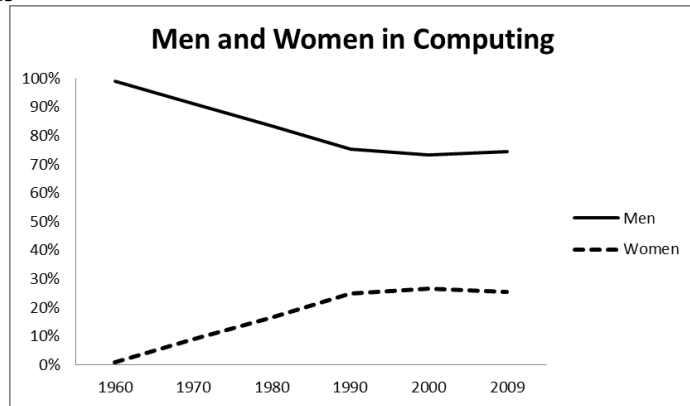
For whomsoever hath, to him shall be given, and he shall have more abundance; but whomsoever hath not, from him shall be taken away even that he hath. (Matthew 13:12)

- **Matthew Effect** : the most famous “name” gets all the work attributed to them. Lower status scientists and engineers are overlooked and their work is attributed to their high status collaborators (Merton, 1968 & Harriet Zuckermann)
- **Matilda Effect**: Women in collaborations with men – whether married or unmarried – typically receive less credit and men profit more from their discoveries. (Rossiter, 1993)
 - “Well maybe they just aren’t as good!” doesn’t hold up when their co-authors received Nobel prizes for the work

Race and other markers (“intersectionality”)

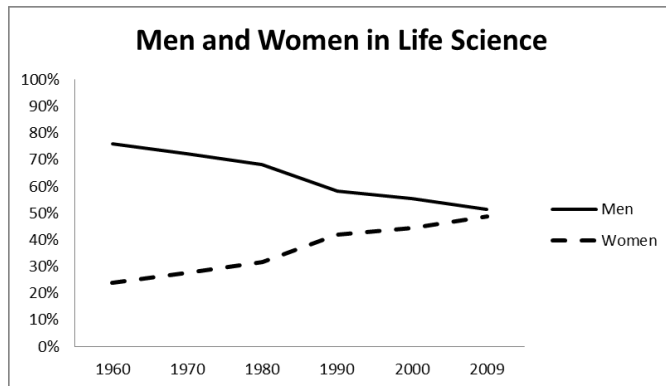
- **Implicit biases:** Social psychology experiments show many Americans do not recognize African American women’s faces; and forget or mis-attribute the contributions of African American women and Asian men (Sesko & Biarnat, 2010; Schug et al, 2015)
- **Status interactions (1):** Sexual orientation and race: negative effects of LGBTQ status for white men, positive for African American men (Pedulla, 2014);
- **Status interactions (2):** Social class markers: white upper class men and white lower class women do better in elite labor market (Rivera and Tilcsik, 2016)
- **Who counts?** Disaggregating race, nationality, and gender show how these matter career advancement in STEM (Branch 2015)
 - US-born white men have declined as overall percentage of the workforce from near 100% in 1960; but diversity in hiring is largely through foreign-born workers
 - E.g. In computing, Non-US born Asian men and women outnumber US-born Asian men and women (for men, by 14.4% to 1.82% of total workforce in 2009)

Figure 3: Percent of Men and Women with at Least a Bachelor's Degree Working in IT Fields



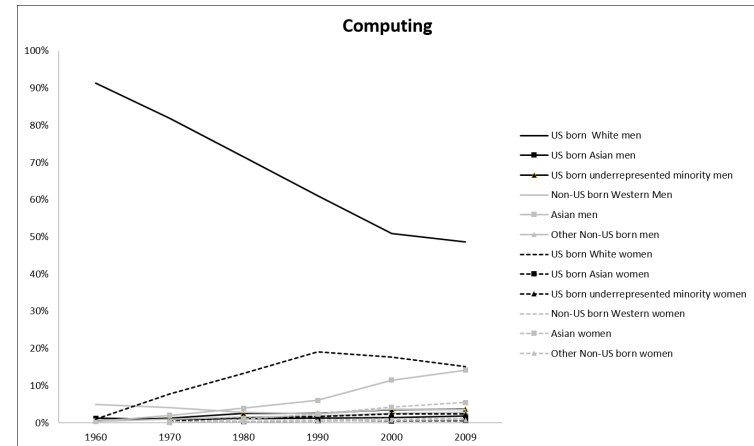
Source: Integrated Public Use Microdata Series, version 5

Figure 4: Percent of Men and Women with at Least a Bachelor's Degree in Life Science, 1960-2009



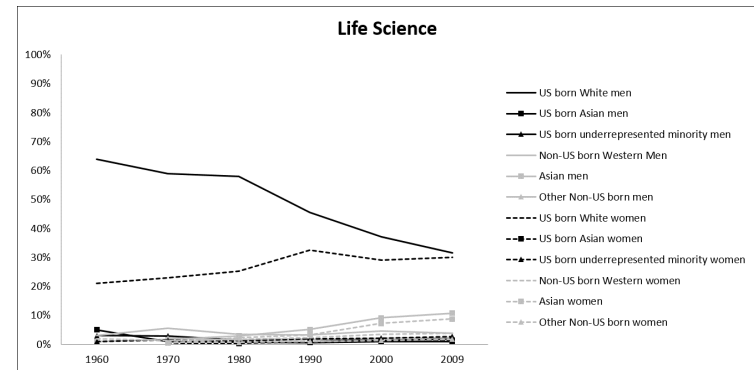
Source: Integrated Public Use Microdata Series, version 5

Figure 5. Full disaggregation of Computing occupations 1960-2009.



Source: Integrated Public Use Microdata Series, version 5. Originally published online in Alegria, 2014

Figure 6. Full disaggregation of Life Science occupations, 1960-2009.



Source: Integrated Public Use Microdata Series, version 5. Originally published online in Alegria, 2014

• (Branch et al, 2015)



How to counter Cognitive Cultural problems?

- Come up with clear criteria in advance for appointment or promotion – and stick to them
- Retrain your brain! Use implicit bias tests as a calibration tool
- Look at co-authors on key papers for ideas for collaborators
- Double blind reviewing: remove the names from the resume and many of the gendered and racialized effects disappear
- “Amplification” can counter the Matthew/Matilda effect and its cognates (strategy used by women in the Obama White House)
- To see how or if differential outcomes are being produced, track statistics for gender, race, sexual orientation for your department/lab

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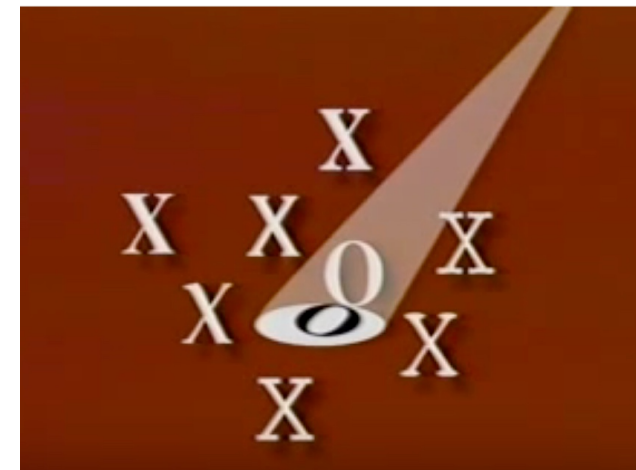


2. Demographics: Proportionality matters

- *“As proportions shift, so do social experiences.”* (Kanter, 1977)
- Studies of groups with minorities indicate certain patterns persist:
 - **Uniform groups:** No minorities; no effects of diversity on team
 - **Skewed groups:** Minorities less than 15%: tokenist dynamics
 - **Tilted groups:** Minorities up to 30%: group reaps some benefits of diversity; but there is backlash from majority
 - **Balanced groups:** 50-50: Traditional minorities contribute equally and at ease; no group minority or majority
- The THIRTY PERCENT RULE: aim to have minorities make up at least thirty percent at each rung of your organization

What happens in skewed groups?

- Not “she got this job because she’s a woman” or “he got the job because he’s African American” or “we need someone Hispanic in here” ...
- That’s the EFFECT, not the cause or definition, of tokenism.
- If you ever hear yourself or someone else saying this, it shows you have a skewed or tilted group
- Tokenism is a primary observed effect of skewed groups (under 15% representation)
- Backlash effects from majority groups up to 30%
- Devastating effects on individuals and groups include:



Kanter, [“A Tale of O”](#)



Tokenism

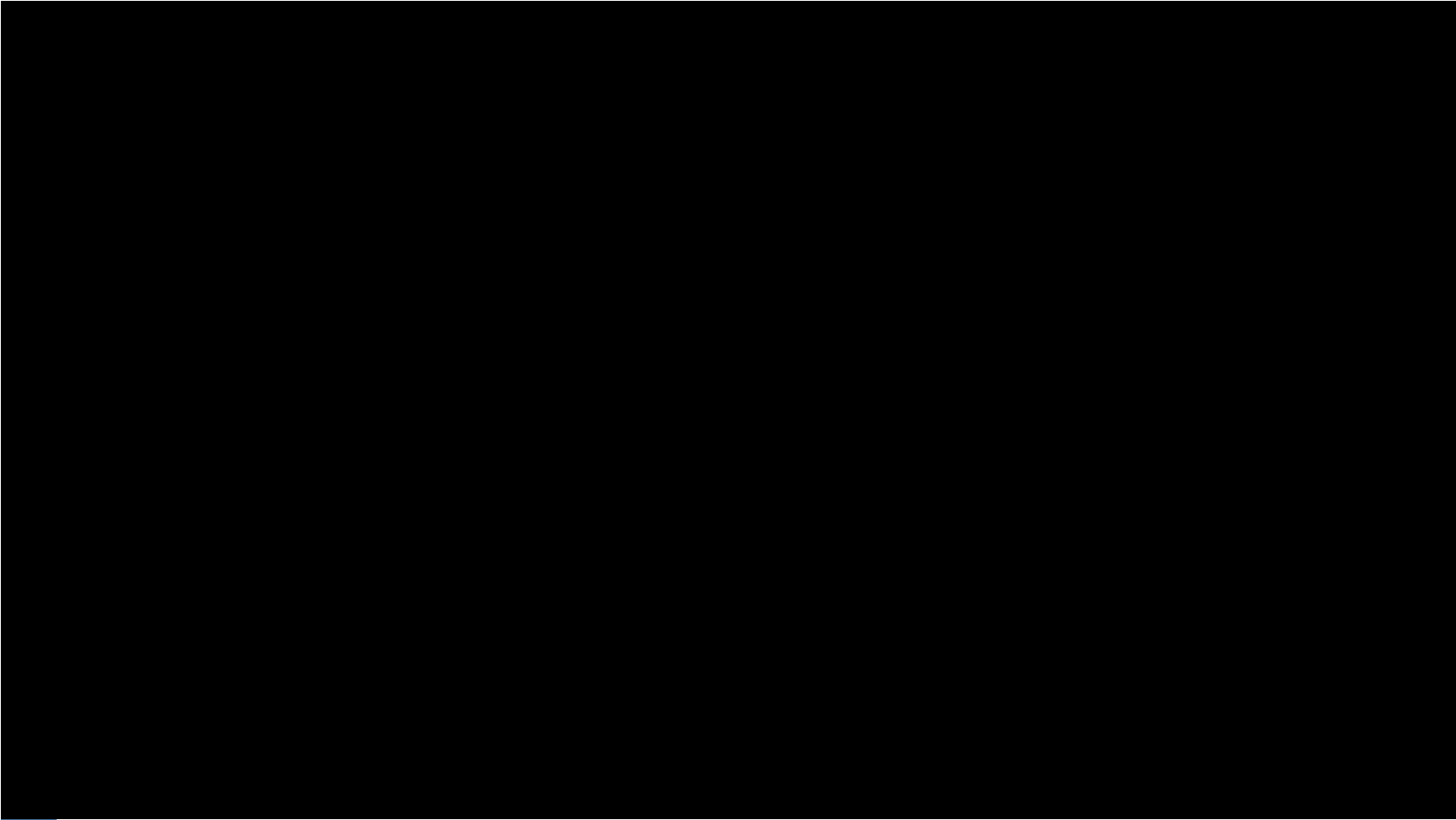
- Stereotyping
- **Standing in for a group**
- **Publicity as double-edged sword**
- **Fear of visibility and retaliation**
- Unique performance pressures
- Role encapsulation
- **Informally isolated**
- Uncertainty about control or response
- **Tested for loyalty: which group do you belong to?**
- Reminders of difference
- **Boundary and status management** by majority (Pierce 1995)

With these workplace pressures, tokens frequently lash out, micromanage, become territorial, do not support subordinates – elements which are also counted against them

Tokenism (2)



Pixar's "Purl" -- <https://www.youtube.com/watch?v=B6uulHpFkuo>

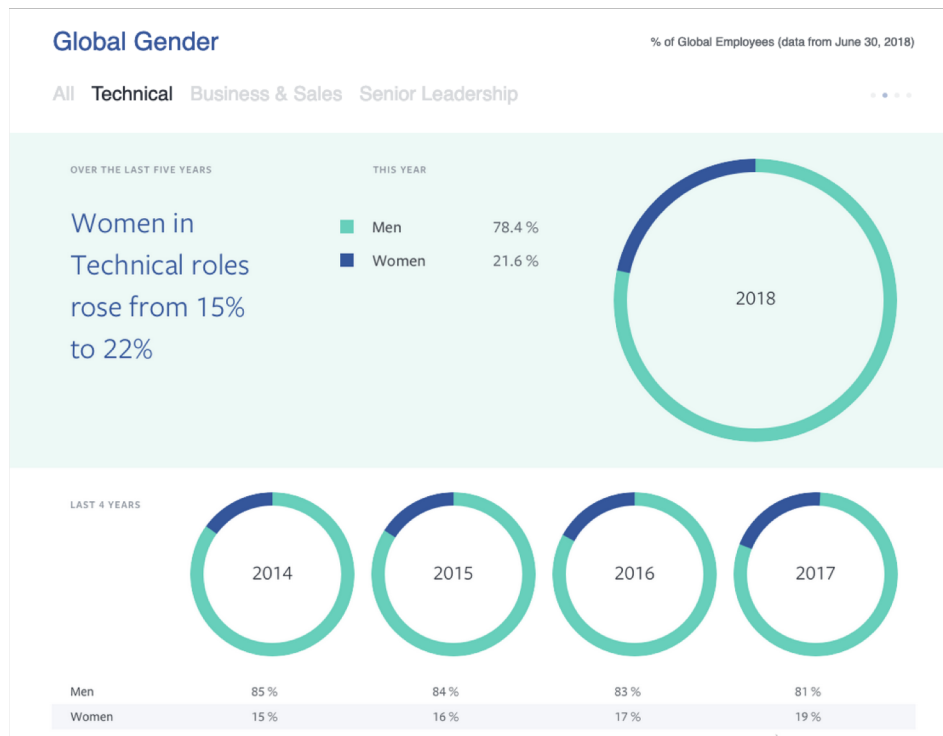




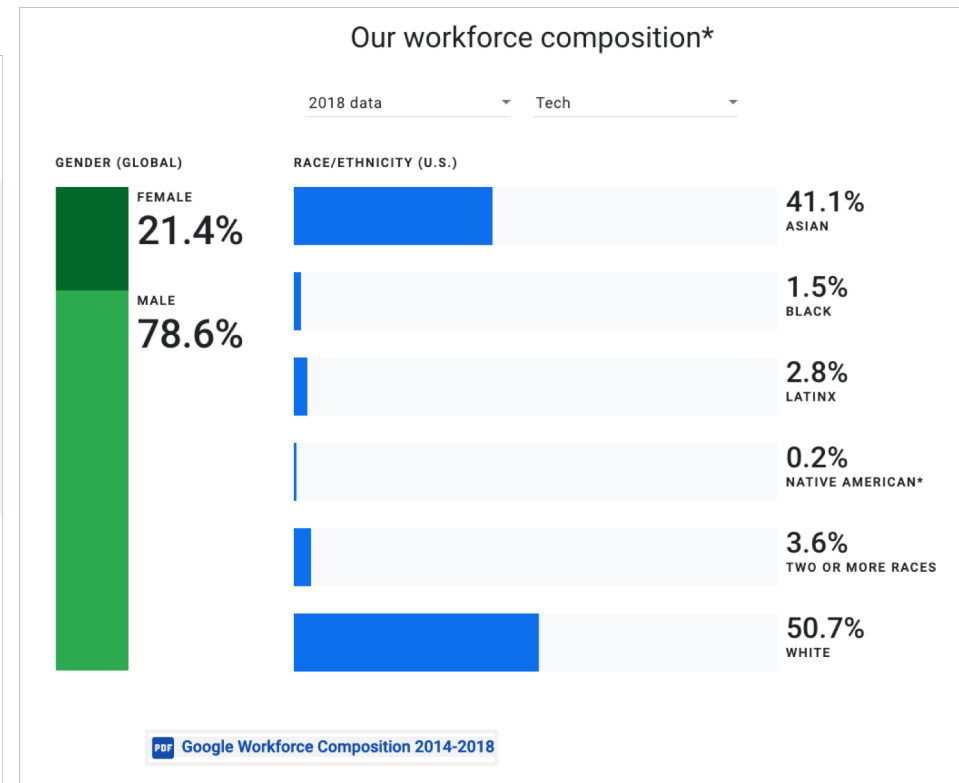
Why enforce the 30% rule?

- Tokenism is a terrible position to put anyone in. It's ineffective for leadership and leads to self-sabotage.
- Tokenism *“sets in motion self-perpetuating cycles that served to reinforce the low numbers of [minorities] and ... to keep women in the position of token.”* (Kanter, 1977: 210)
- Ultimately tokens become *“... instruments for underlining rather than undermining majority culture.”* (Kanter, 1977: 223)
- “The glass escalator”: status effects still benefit men in traditionally female occupations (i.e. nursing, teaching) (Williams, 1992)

Tech industry numbers

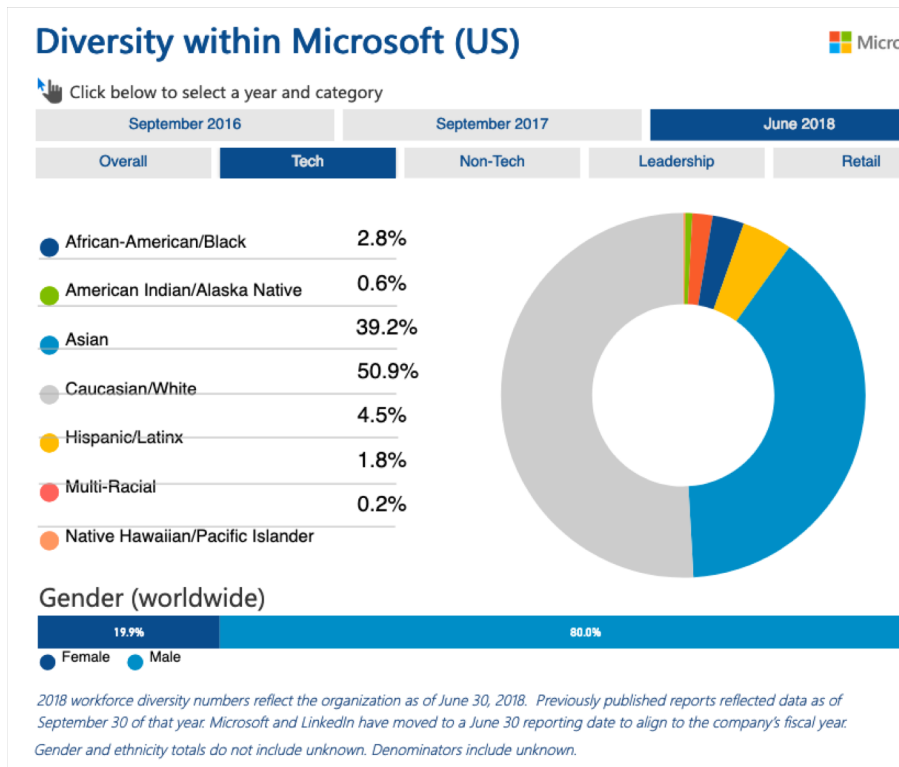


Facebook (<https://www.facebook.com/careers/diversity-report>)



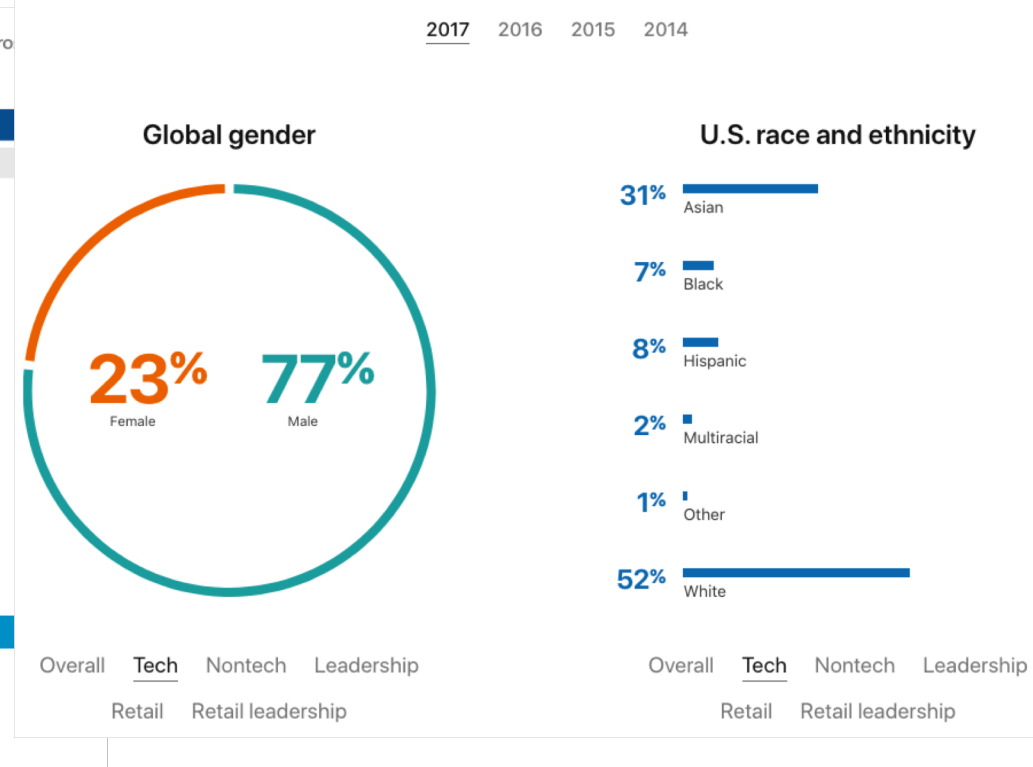
Google <https://diversity.google/annual-report/>

Tech industry numbers



Microsoft
<https://www.microsoft.com/en-us/diversity/inside-microsoft/default.aspx>

Here's data from the last four years.



Apple <https://www.apple.com/diversity/>

Table 12. Female Professors by Rank and Year at Top 50 Departments

Discipline	FY2002*				FY2007			
	Assistant	Associate	Full	All Ranks	Assistant	Associate	Full	All Ranks
Chemistry	21.5%	20.5%	7.6%	12.1%	21.7%	21.3%	9.7%	13.7%
Math	19.6%	13.2%	4.6%	8.3%	28.0%	15.5%	7.2%	12.1%
Computer Sci	10.8%	14.4%	8.3%	10.6%	19.5%	11.3%	11.5%	13.5%
Electrical Engr	10.9%	9.8%	3.8%	6.5%	14.5%	14.1%	6.2%	9.7%
Mechanical Engr	15.7%	8.9%	3.2%	6.7%	18.2%	12.0%	4.9%	9.0%
Physics	11.2%	9.4%	5.2%	6.6%	17.5%	12.6%	6.8%	9.5%
Civil Engr	22.3%	11.5%	3.5%	9.8%	25.3%	14.3%	7.1%	12.7%
Chemical Engr	21.4%	19.2%	4.4%	10.5%	23.7%	17.8%	8.3%	12.9%
Astronomy**	20.2%	15.7%	9.8%	12.4%	25.3%	21.6%	12.3%	15.8%
Economics	19.0%	16.3%	7.2%	11.5%	30.7%	16.0%	8.5%	15.1%
Political Science	36.5%	28.6%	13.9%	23.5%	35.9%	30.1%	17.4%	25.6%
Sociology	52.3%	42.7%	24.3%	35.8%	57.9%	45.6%	28.0%	39.7%
Psychology	45.4%	40.1%	26.7%	33.5%	44.8%	41.9%	29.9%	36.0%
Biological Sci	30.4%	24.7%	14.7%	20.1%	36.0%	30.9%	17.7%	24.8%
Earth Sciences	not available				28.6%	21.7%	10.6%	16.1%

*Chemistry and astronomy data are for FY2003. **Top 40 departments

Source: Donna Nelson, 2007, http://cheminfo.chem.ou.edu/~djn/diversity/Faculty_Tables_FY07/07Report.pdf



Solutions: demographics

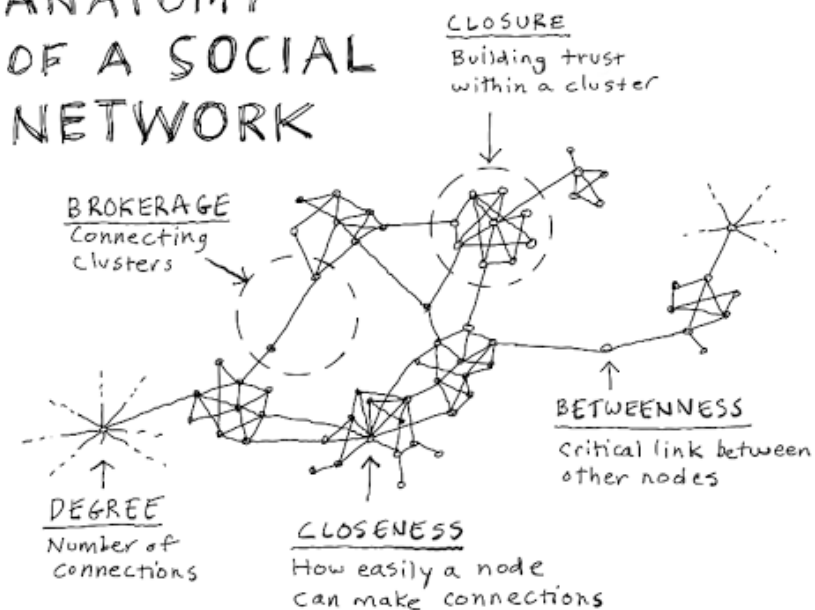
- To benefit from diversity, aim to have *at least 30%* of minorities represented **at each level of your organization**
 - Gender, race, sexual orientation, age, national identity, etc...
- If you are stuck between 15-30% you will get backlash dynamics
- If you hover around or below 15% you will get devastating dynamics that will affect your whole team
- If you add just 1 person to a team to “increase diversity,” you might as well not have anyone there at all.
- It’s not about absolute numbers, **it’s about proportions**. Make sure each part of the hierarchy – full prof, assoc. and asst. prof – hits this 30% mark if you can.
- When that is actually impossible, be empathetic and give URM’s extra support

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Networks: some ground rules

- **Homophily:** “birds of a feather flock together”
 - People forge network and social ties based on social similarities
 - Naturally occurring social networks display considerable homophily
- **Brokerage:** people who bridge networks
- **Intercohesion:** Overlapping networks that share membership
- **Strength of ties:** Strong ties (tightly connected) or weak ties (further removed) (Granovetter, 1973)
- **Social capital:** not human capital (e.g. how much skill you have) but how *socially connected* you are
 - Sociologists can measure networked relationships to see who is in (who has more social capital) and who is out (who has less social capital)

ANATOMY OF A SOCIAL NETWORK



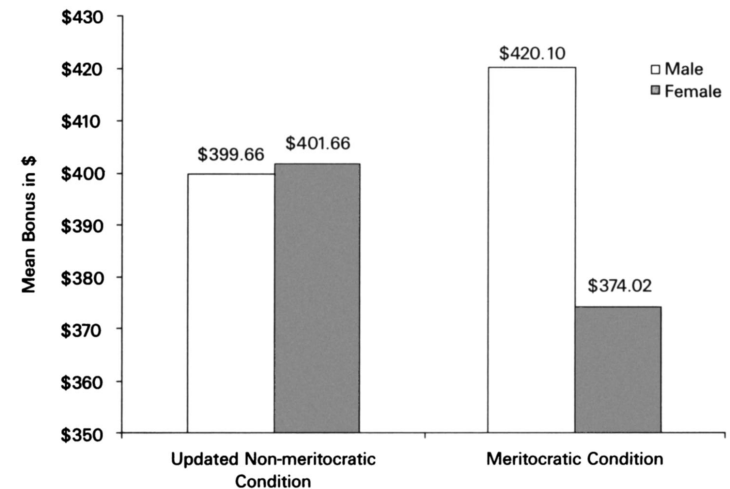


Gender and social networks

- *Gender matters for accrual of social capital in a network*
- Women's networks provide local advantages but does not translate to social capital more broadly, especially when their networks are closed (Lutter 2015; Burt 1998; Ibarra 1997; Brass 1985)
- The "boys' club" effect: "people in white male networks* receive twice as many job leads as people in female/minority networks." (MacDonald, 2011)
- Women do not benefit as much from positions of brokerage unless the network is already diversified (Burt 1998; Lutter 2015)
- Social capital can be "borrowed" if a woman is mentored by a man or in a subordinate hierarchical relation to a man (Burt, 1998) ("the work uncle")
- Young men are also disadvantaged in networks of primarily senior men but unlike women, they make up the disadvantage as they age.

Career outcomes based on merit

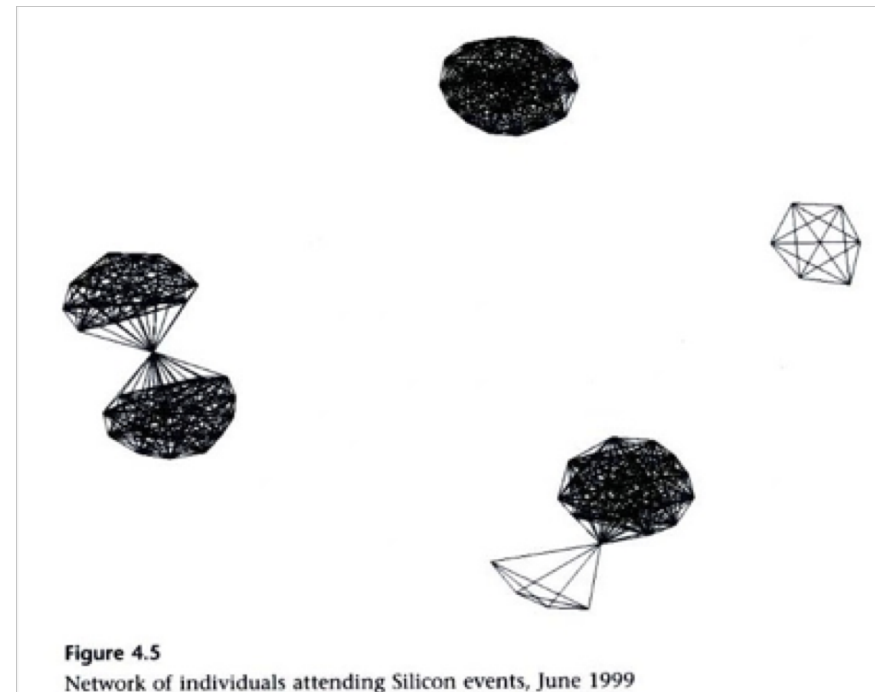
- “The Paradox of Meritocracy”: In organizations that determine advancement through criteria of “merit” alone, there is *increased* gender disparity between women and men in senior roles (Castilla and Bernard, 2010)
- Why? Because people use reputation and similarity to recruit and promote based on “fit”! (Rivera, 2015; Castilla 2008; Castilla et al 2013a & b)
- *The more informal the rules for advancement, the more people rely on **relationships, reputation, and social capital** to determine “merit”*
- Informal social relations dominate startup and VC culture and team assembly!



Castilla and Bernard, 2010

The dangers of closed networks

- Heightened exposure to risk!!
 - Silicon Alley startups shows increasingly tight network ties and an inability to buffer against the risks of the industry (Neff, 2012: right)
 - When the bubble burst, everyone was caught off-guard
- Heightened group-think and doubling down on existing resources
- Exposes another reason why diversity on teams is so valuable





Make networks work for you!

- The best opportunities can come from tapping “weak ties”: people on the periphery of your network (Granovetter, 1973)
 - So reach out! Tap a friend of a friend for a recommendation!
- Use bridging points or overlaps between distinct networks as sites of innovation or creativity (Burt, 2004; Stark and Vedres 2011)
 - Seek out people who are not like you and solicit their expertise!
- Diverse networks and loose connections arguably bolster minorities’ careers (Burt 1998; Lutter 2015)
 - Locate the women’s and minority networks and ask who they would recommend for a job! Or founda. Metwork yourself
- Reaching out through your networks and beyond, tapping other networks, and mixing networks together can actually get you diversity
- If you are senior and male, actively foster mentorship ties with minority candidates in your care, put them forward for positions, and stand up for them when tokenism strikes. *Be their work uncle!*

To sum up

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What to do: When putting together a team

- Retrain your brain! **Try implicit bias training as a calibration tool** to avoid cognitive cultural traps whenever evaluating candidates
- Recall the **Matthew/Matilda** effects when evaluating promotions
- **Aim for the 30% rule.** Even though it is hard: the payoff is significant.
- **“Amplify”** minority voices in the room in discussion
- To decrease risk by diversifying your network, draw on the strength of **weak ties** by reaching out to distinct or distant networks –at least two hops away
- Avoid the “paradox of meritocracy” by **setting (and sticking to!) clear criteria for inclusion and opportunity**



What to do: in your community

- **Stick to clear promotional criteria** (and require clear assignment criteria from projects), so that you do not resort to personal networks, a cultural sensibility toward “merit” or “fit”
- **Double blind** review or selection processes wherever possible
- **Don't require self-selection** or self-nomination for bonuses
- Foster and draw on **mentorship** roles and responsibilities
- **Foster minority networks** (i.e. Anita Borg Institute; National Society of Black Physicists) **developed around meaningful scientific and technical topics** -- and draw these individuals in to meaningful project roles and tasks
- **Collect and track demographic** information about your community so you can see which experiments work and which do not



What to do: as a junior career URM scientist

- **Get yourself a “work uncle”** (if you don’t already have one)
- **If you’re in a tokenist situation: be wary.** Seek extra support through more robust networks and a strong connection to your field’s central network. Use opportunities to bring others into the room.
- Recalling the **Matthew/Matilda** effect, cite and seek out others in a similar situation to foster next generation collaborations.
- Join in a minority network and recommend qualified candidates from that network for opportunities when possible
- When safe to do so, **“amplify”** other minorities’ voices in the room in discussion.
- If you are actively sexually harassed, seek Title IX protection at your University or seek out HR in your corporation



Finally: things to keep in mind

- **Diversity payoff is in the long run, not the short term.**
 - Immediately, you may not feel your team is “gelling.” And you may prefer working with your friends.
 - Recall that the payoff is longer-term. Your team will be more innovative and creative after that initial hump of learning to trust and communicate with each other.
- **Keep these issues in mind when relating to others.**
 - If you find yourself in a room where people are behaving strangely, tokenist or other bias issues may be at play.
 - If you’re unable to make change, act with empathy

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