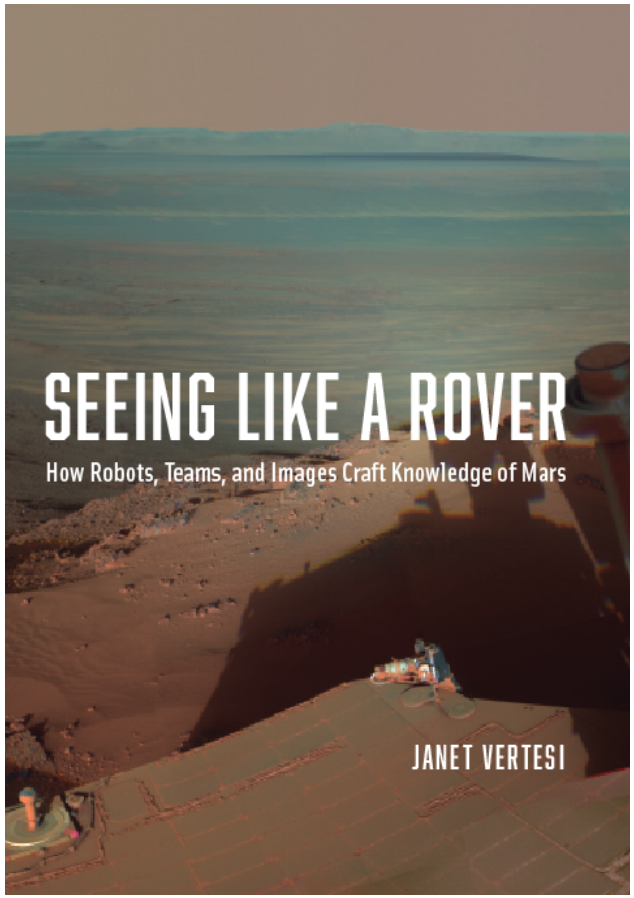
The “d” word

Solving for “diversity” on planetary science teams

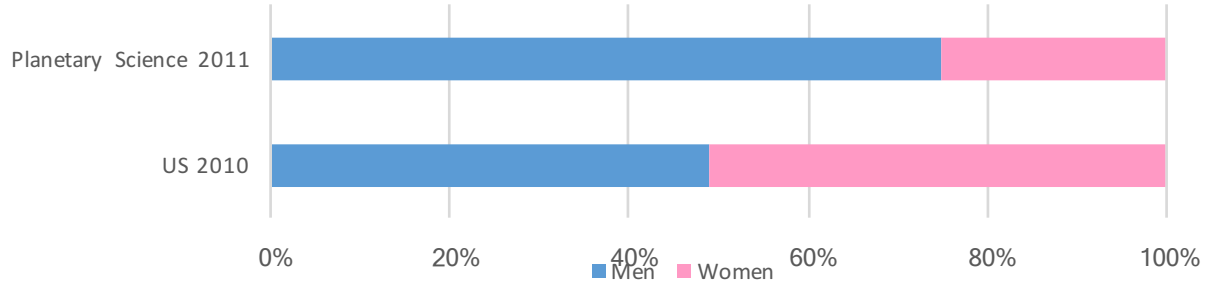
Janet Vertesi, Sociology Department, Princeton University

Introduction: your sociologist

- Studying planetary science teams since 2006
  - MER, Cassini, and Europa;
  - 250 interviews across planetary science teams and institutions;
- MPhil and PhD in the history and sociology of science and technology
- Sociology faculty at Princeton University
- Opportunity for cross-talk between sociology and planetary science



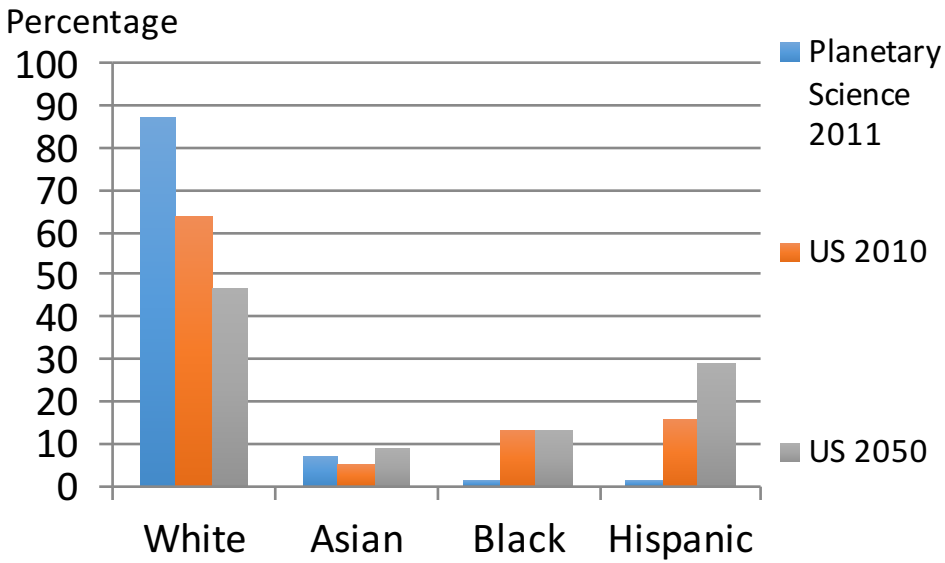
The problem



Source: Rathbun, 2017

- In planetary science, we continue to have limited numbers of women and minorities in important roles (see Rathbun et al, 2017)
- Reports of harassment and discrimination in the community; also cross the board in STEM and the tech industry;
- Concern about diversity as a problem and language in NF AO

What about merit?



Source: Rathbun, 2017

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

Team diversity is valuable

- Intellectual cross-fertilization is an important source of good ideas (Burt, 2004; Stark and Vedres 2011)
- And fosters better solutions to problems (Hoffman, 1958; Hoffman and Maier, 1961; Watson et al. 1993; MacLeod et al. 2013)
- Combats group-think (Vaughan, 1997)
- Ability to reach new groups for outreach and support, and not just for businesses (Wright et al. 1995)
- Reduces risk and adds robustness to a population (Neff 2012)

Sociological Perspectives

- A selective - and introductory - overview of a vast, vast literature

- Three frameworks for thinking about persistent problems
- A shared and neutral analytical vocabulary for describing them
- Examples from other fields (you are not alone!)

- **Solutions for addressing each issue**
- **Ways to meet the New Frontiers call**

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 planetary science. 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 and inform your conversations.

Three 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
Defined	We are enculturated into treating people differently	Proportions of minorities/majorities determine social experiences	Who you know and how well connected you are generates opportunities
Problems	Matthew/Matilda Effect Backlash against people who don't conform to frames Constraints become preferences	Low proportions = no advantages 15% groups experience tokenism Up to 30% experience backlash True advantages between 30-50%	Mens' networks tend to hold more advantages Women have less social capital Paradox of Meritocracy
Solutions	Calibrate using bias training Amplify minority voices Double blind review	Adopt and enforce the "thirty percent rule" … At each level of your organization	Tap into "weak ties" Bridge between networks Diverse/open networks better for minorities and innovation

Cognitive-cultural

- The idea that cultural frameworks & 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 every time.
  - **Reproduced** for gender, race, social class, other kinds of social stigmas
  - **Results are reproduced every time**, even in different cultural contexts
  - Demonstrates "implicit bias" in action

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"
- Effects also seen in science and tech industries (i.e. IT and biotech (Ridgway & Correll, 2004; Ridgeway, 2011; Smith-Doerr, 2004)
- In times of resource scarcity (e.g. after a recession) people double down on these biases in decision making (Thebaud and Sharkey, 2015)

Cognitive-cultural effects

- Results in 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 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)
- Result is a leaky pipeline where talented individuals drop out, do not apply, or resist self-nomination

Measurable effects: motherhood/fatherhood

Figure 2. Women's Median Weekly Earnings as a Percentage of Men's by Selected Characteristics, 2012[4]

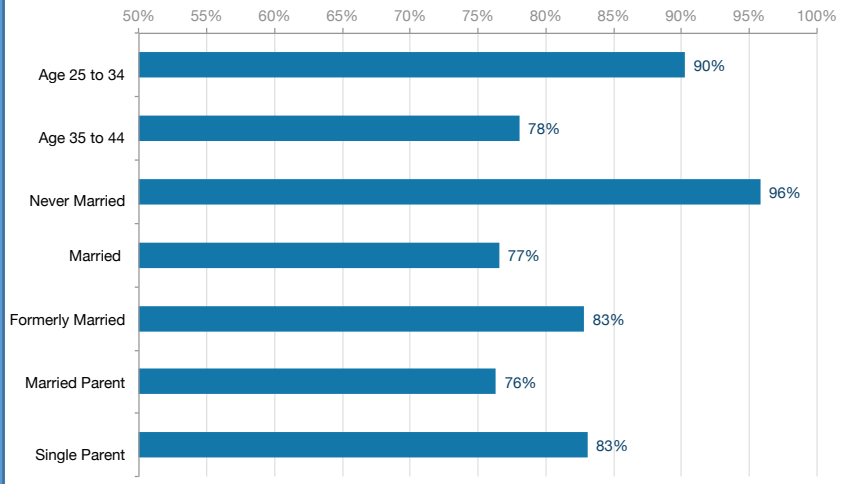
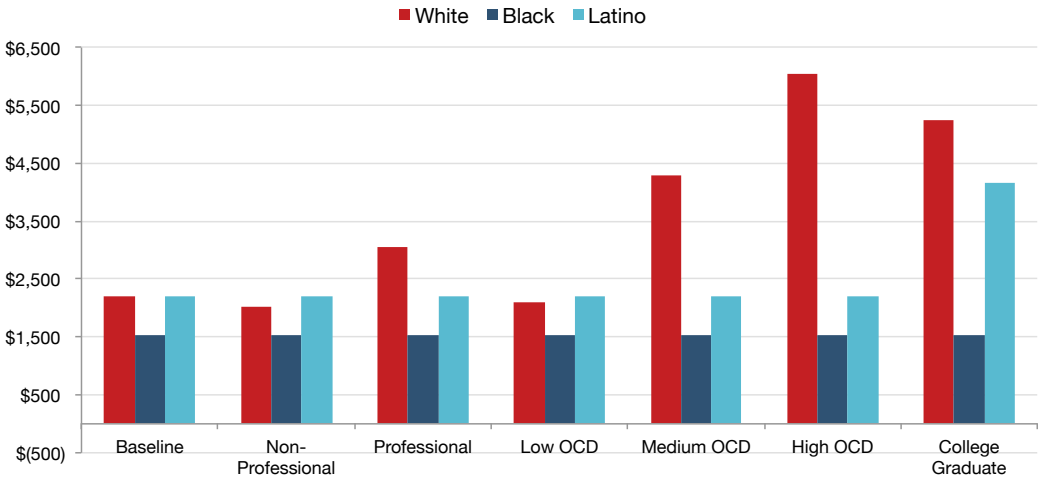


Figure 4. Fatherhood Bonus in Dollars, by Professional Status, Occupational Cognitive Demands Education (OCD), and Race/Ethnicity, Adjusted for Human Capital[15]



Sources: National Bureau of Labor Statistics
Graphs in Budig report

The Matthew Effect – and the Matilda Effect

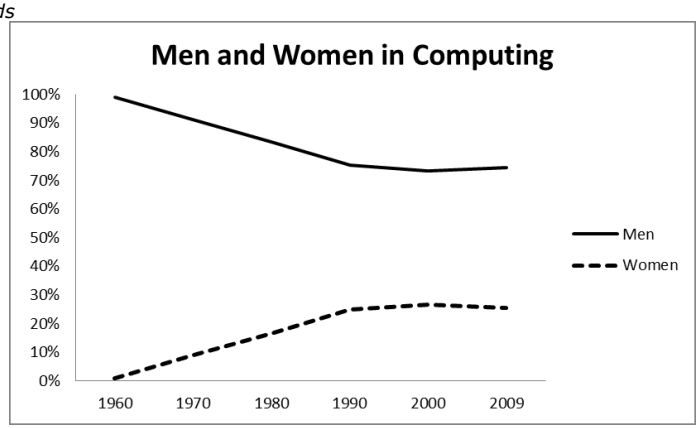
For whomsoever hath, to him shall be given, and he shall have more abundance; but whomsoever hath not, from him shall be taken away even that he hath. *(Matthew 13:12)*

- **Matthew Effect in science**: the most famous "name" gets all the work attributed to them. Lower status scientists 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

Factoring in race and other markers…

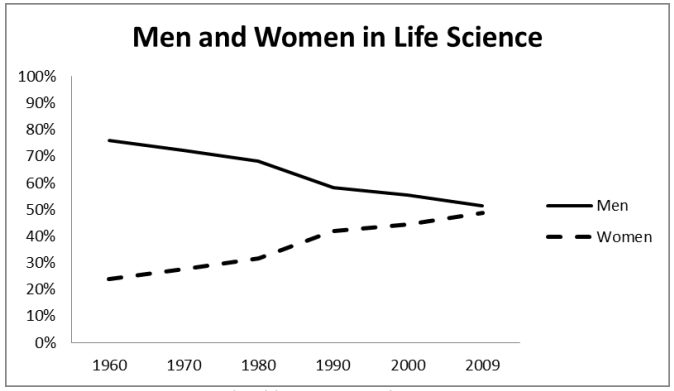
- Social psychology experiments show people do not recognize African American women's faces; and forget or mis-attribute the contributions of African American women and Asian men (Sesko & Biarnat, 2010; Schug et al, 2015)
- Resume studies that code for sexual orientation (member of LGBTQ clubs for instance) also produce negative effects for white men, positive for African American men (Pedulla, 2014)
- In STEM, disaggregating race, nationality, and gender show how these matter career advancement (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



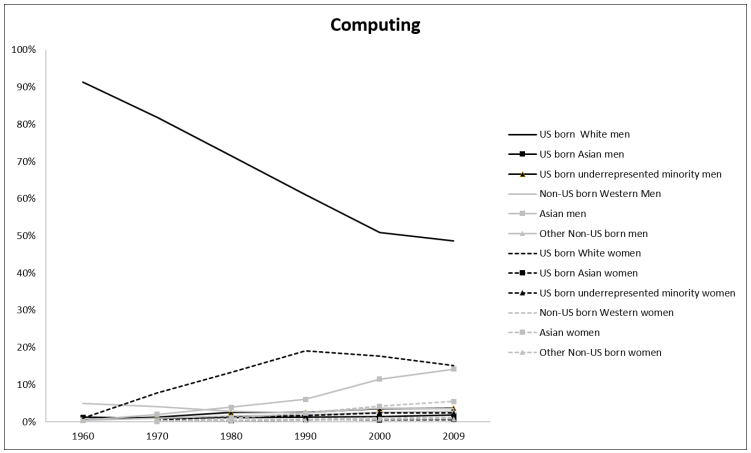
Source: Integrated Public Use Microdata Series, version 5

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



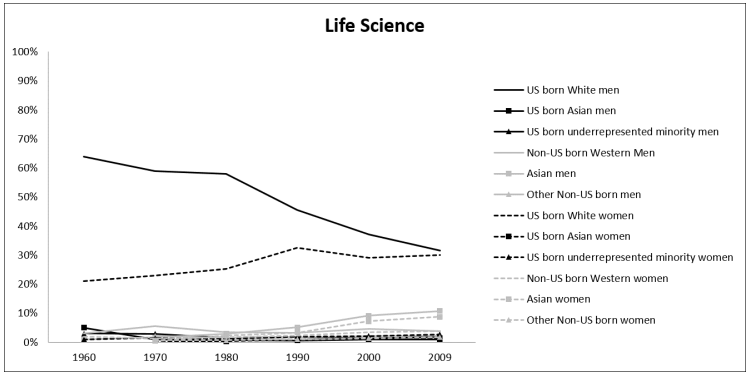
Source: Integrated Public Use Microdata Series, version 5

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



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

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



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

- (Branch et al, 2015)

How to counter Cognitive Cultural problems?

- Retrain your brain! Implicit bias tests are a good 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 in the Obama White House)
- To see how or if differential outcomes are being produced, track statistics for gender, race, sexual orientation, migration status

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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**: Minority makes up <15%; minorities behave like majority; no effects of diversity on team
  - **Skewed groups:** Minorities hover around 15%: tokenist dynamics
  - **Tilted groups:** Minorities at 30%: group reaps some benefits of diversity; but there can be 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?

- Tokenism is a primary observed effect
- Not “she got this job because she’s a woman” or “he got the job because he’s African American”
- 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
- Devastating effects on individuals and groups include:

Kanter, “A Tale of O”

Tokenism (2)

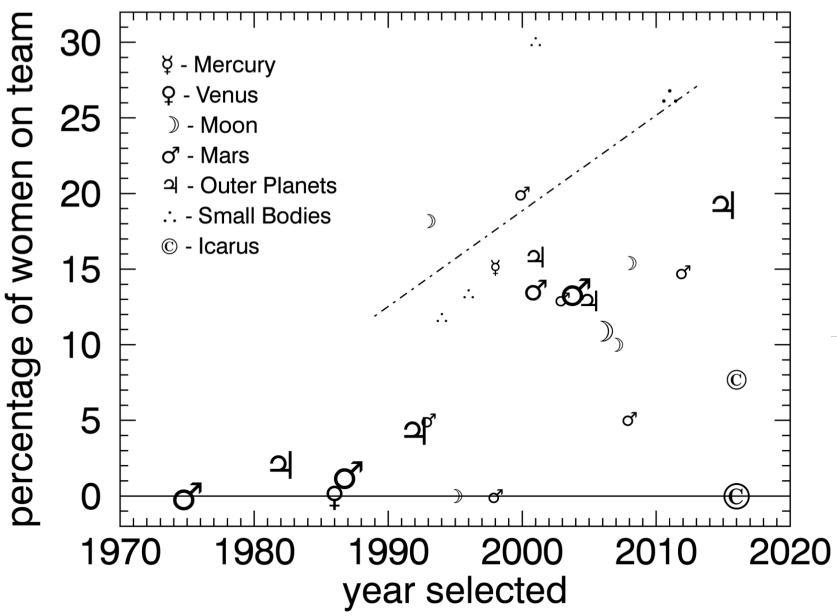
- Stereotyping
- **Publicity as double-edged sword**
- **Fear of visibility and retaliation**
- **Standing in for a group**
- Unique performance pressures
- Role encapsulation
- Uncertainty about control or response
- Reminders of difference
- **Informally isolated**
- **Tested for loyalty: which group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

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

Why enforce the 30% rule?

- Tokenism is a terrible position to put anyone in. It's ineffective for leadership and often 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)
- Effects hold for women in traditionally male occupations, men in traditionally female occupations (i.e. nursing), sexual and racial minorities (Vallas, 2003)

So what are your proportions?



Source: Rathbun et al., 2017

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

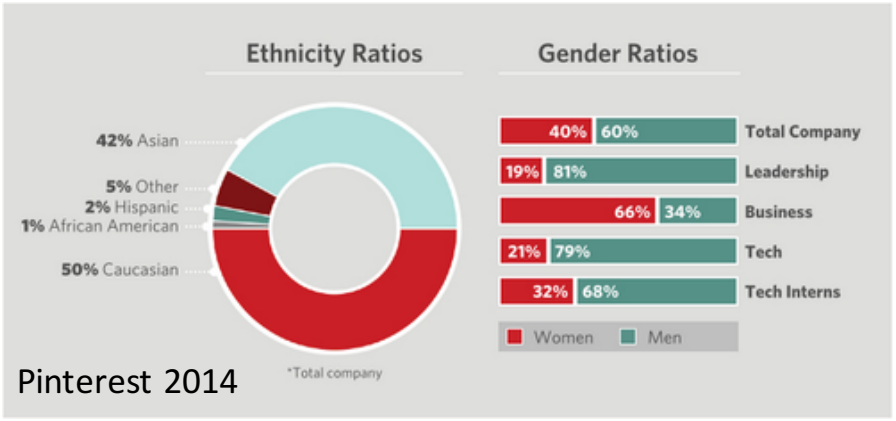
Discipline	FY2002*				FY2007			
	Assistant	Associate	Full	All Ranks	Assistant	Associate	Full	All Ranks
Chemistry	21.5%	20.5%	7.6%	12.1%	21.7%	21.3%	9.7%	13.7%
Math	19.6%	13.2%	4.6%	8.3%	28.0%	15.5%	7.2%	12.1%
Computer Sci	10.8%	14.4%	8.3%	10.6%	19.5%	11.3%	11.5%	13.5%
Electrical Engr	10.9%	9.8%	3.8%	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

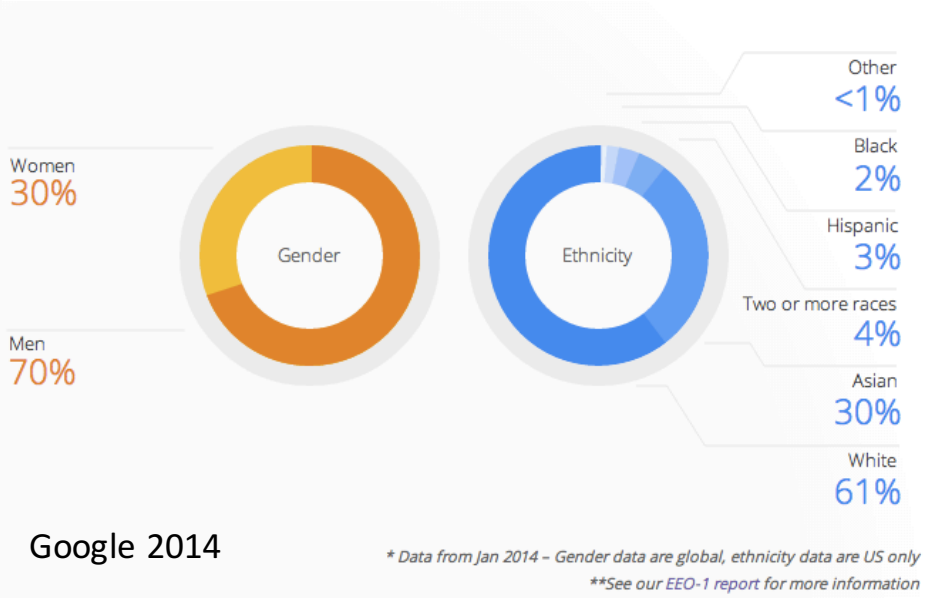
Source: Donna Nelson, 2007, http://cheminfo.chem.ou.edu/~djn/diversity/Faculty_Tables_FY07/07Report.pdf

(You are not alone)

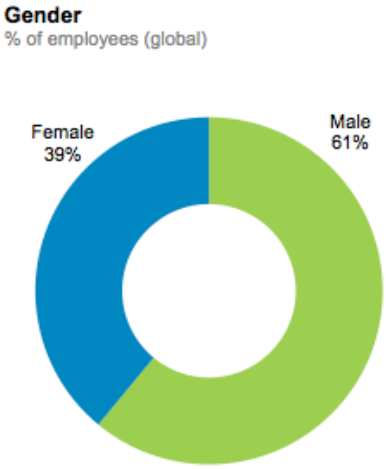
Facebook 2014

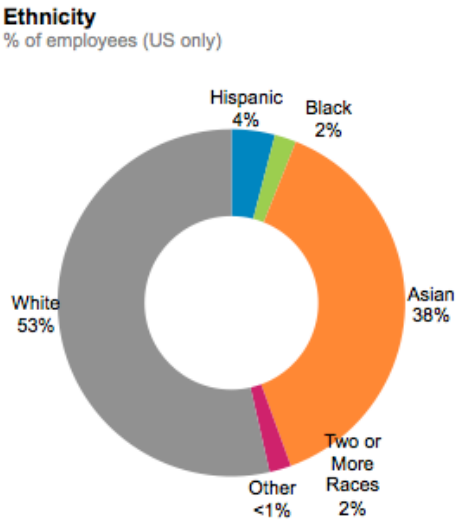


Pinterest 2014



Google 2014





LinkedIn 2014

Location matters too

- Proportionality must be maintained in each rank of the organization
  - Say you have 50% women on your mission but they are all deputies and postdocs
  - Or say you have 30% African Americans PS's but none elsewhere
  - …Then you'll still have a tokenism problem
- Each rank needs to have at least 30% or more: otherwise you'll still get tokenism

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 hover between 15-30% you will get devastating dynamics that can affect your whole team
- If you have fewer than 15% minorities you might as well have no one at all, you will not benefit from team diversity
- It's not about absolute numbers, it's about proportions. Make sure each part of the hierarchy – PI's, participating scientists, Co-I's, postdocs if you can – hits this 30% mark if you can.

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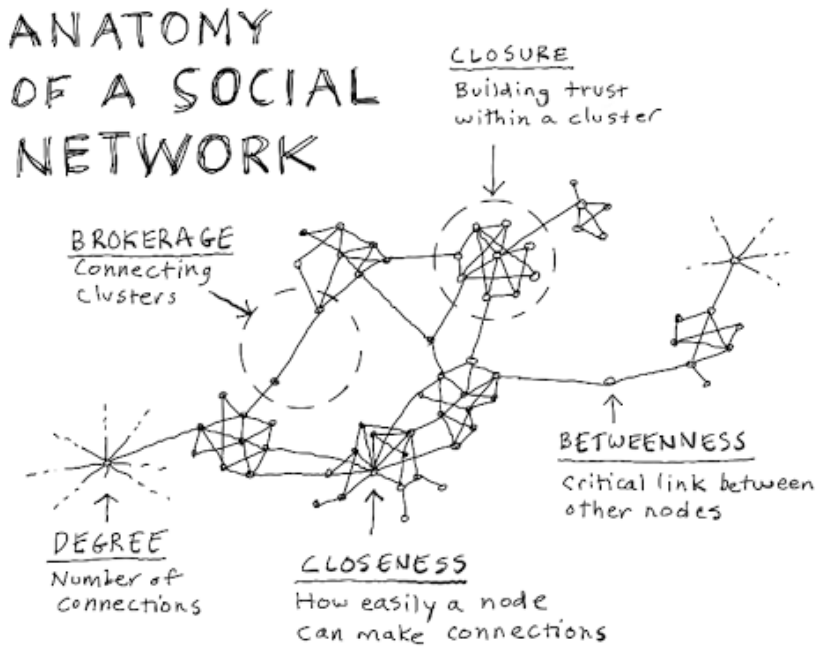
Networks: some ground rules

- **Homophily**: "birds of a feather flock together"
  - People forge network and social ties based on social similarities
  - Naturally occurring social networks display considerable homophily
- **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)

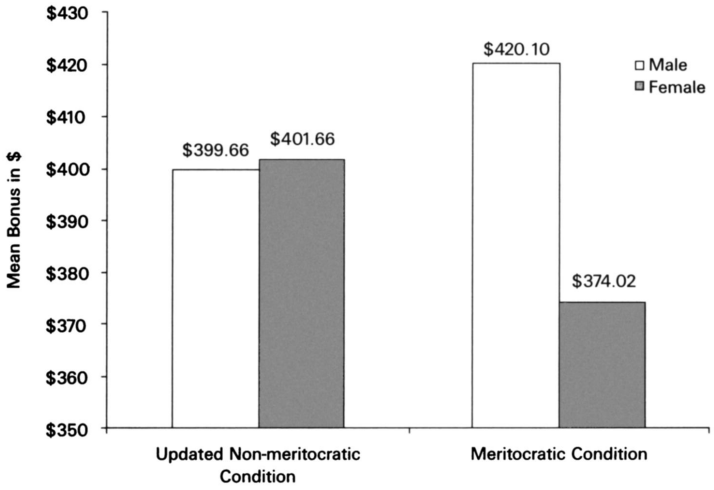


Gender and social networks

- *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"*
- Choosing a team for your PI-led mission is all informal social relations!



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

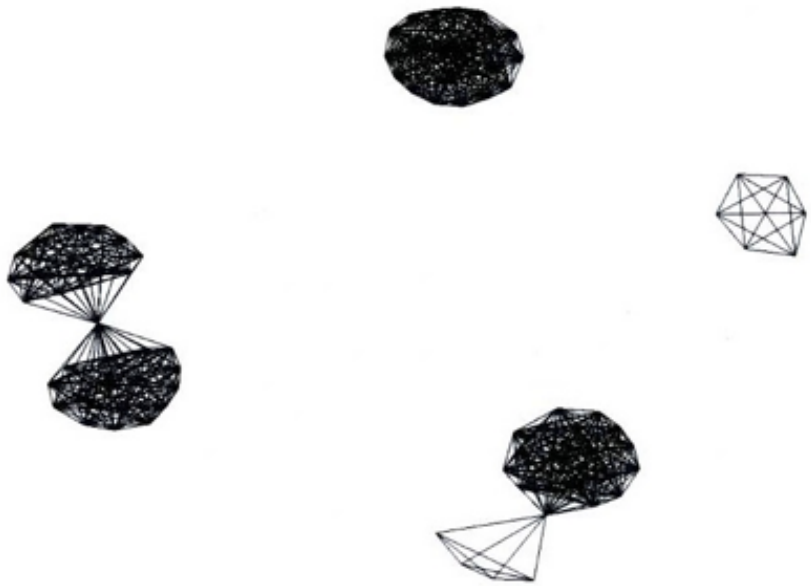


Figure 4.5
Network of individuals attending Silicon events, June 1999

But networks can also help!

- The best opportunities can come from tapping "weak ties": people on the periphery of your network (Granovetter, 1973)
- Bridging points between distinct networks are sites of innovation (Burt, 2004)
- Overlaps in networks with different expertise are sites of creativity (Stark and Vedres 2011)
- Diverse networks and loose connections arguably bolster minorities' careers (Burt 1998; Lutter 2015)
- Reaching out through your networks and beyond, tapping other networks, and mixing networks together can actually get you diversity
- Concordant with reasons why the the PS program is considered so valuable (Prockter et al 2017)

To counter closed network effects

- Reach out! Tap *a friend of a friend* for a recommendation
- Locate the women's and other minority networks and ask who they would recommend for the job
- Seek out people who are not like you and solicit their expertise
- If you are male and senior, foster mentorship ties with minority candidates in your care as much as young men, put them forward for positions, and stand up for them when tokenism or bias strikes (be "the work uncle")

To sum up

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What to do: Individuals meeting the NF call

- Retrain your brain! **Try implicit bias training as a calibration tool** to avoid cognitive cultural traps
- Recall the Matthew/Matilda effects when evaluating personnel options
- **Aim for the 30% rule**. Even though it is hard: the payoff is significant.
- 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 clear criteria for inclusion

As a community

- … to help surface deserving individuals for NF inclusion:
  - **Double blind your review processes wherever possible**
  - "Amplify" minority voices in the room in discussion
  - Don't require self-selection or self-nomination for bonuses
  - Adopt clear promotional guidelines so that you do not resort to personal networks, a cultural sensibility toward "merit" or "fit"
  - Foster and draw on mentorship roles and responsibilities
  - **Foster minority networks** (i.e. Anita Borg Institute) developed around meaningful scientific and technical topics -- and draw them in to primary roles and tasks
  - **Collect and track demographic** information about your community (i.e. NSPIRES)

In conclusion …

- There are things you can do to address "diversity" as a requirement
- Diversity is hard and challenging at first but the payoff is in the long term
- This is a huge field! So if there are specific topics you would like your sociologist to research and report back on, let me know: jvertesi@princeton.edu
- **Good luck!**

References (1)

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