

Peopleware

Claire Le Goues

Michael Hilton

Learning goals

- Understand the differences among developers and implications for hiring and teamwork.
- Describe various models of motivation and their relationship to productive work environments.
- Design conditions that motivate developers.
- Understand team development and progression.

Administrivia

- Reflections.
- Final presentation protocol, video.



ML for Admissions

GRADE: Machine-Learning Support for Graduate Admissions

"GRADE makes the review process more efficient by enabling reviewers to spend most of their time on applicants near the decision boundary and by focusing their attention on parts of each applicant's file that matter the most. An evaluation over two seasons of Ph.D. admissions indicates that the system leads to dramatic time savings, reducing the total time spent on reviews by at least 74 percent."

Articles

GRADE: Machine-Learning Support for Graduate Admissions

Austin Waters and Risto Miikkulainen

■ This article describes GRADE, a statistical machine-learning system developed to support the work of the graduate admissions committee at the University of Texas at Austin Department of Computer Science (UTCS). In recent years, the number of applications to the UTCS Ph.D. program has become too large to manage with a traditional review process. GRADE uses historical admissions data to predict how likely the committee is to admit each new applicant. It reports each prediction as a score sim-

Graduate programs in fields such as computer science have received increasing interest in recent years. While the number of applicants to such programs has grown two- to threefold (figure 1), the number of faculty available to review applications has remained constant or grown very slowly over time. The result is that admissions committees face a prohibitively large workload, making it difficult to review applications thoroughly.

This article describes a system developed to support the work of the graduate admissions committees in the Department of Computer Science at the University of Texas at Austin (UTCS). The system, named GRADE (graduate admis-

[PHYS-ALL] Graduate admissions ▷ Inbox ×



Steven Rolston <rolston@umd.edu>
to PHYS-ALL ▾

9:52 PM (28 minutes ago) ☆ ↶ ⋮

Dear UMD Physics Community:

Today we had a Physics Colloquium describing an AI algorithm used by UT Austin's computer science department to aid in their graduate admissions since 2013. The algorithm was trained on previous admissions decisions and was intended to expedite the decision making process, for which it succeeded with a substantial reduction in the time spent by the committee. This approach has a obvious flaw - any biases existing in the decision making 8 years ago gets mapped onto the current decisions. There is a lot of concern in the AI community about making important decisions with black-box tools for which one cannot determine bias - and this tool in my opinion was even worse - explicitly leaving in place biases that certainly existed in the CS decision-making process. I was very heartened to see a great set of thoughtful questions challenging the speakers assumptions, many from our graduate students. Notably a grad student from UC Irvine was live tweeting the talk, and during the talk the UT CS department tweeted that they are concerned about fairness and diversity and are no longer using the algorithm!

There are many decisions that we make about people with incomplete information, especially when we are trying to evaluate human potential - everything from hiring employees to determining prison sentences to undergraduate and graduate admissions. Algorithms are deceptively enticing, eliminating a lot of effort for something that seems "objective" when in reality it is hiding the subjective (and potentially biased) nature with a patina of mathematics and coding. UMD Physics will never go down this road - we believe in the importance of a diverse and inclusive community of physicists and the value it brings to the department and the profession as a whole. Graduate admissions is a major task, with over PhD 800 applications to our department, but each one of those applicants is an individual, who cannot be reduced to a probability score by some code.

-Steve

Steven L. Rolston
Chair, Dept. of Physics

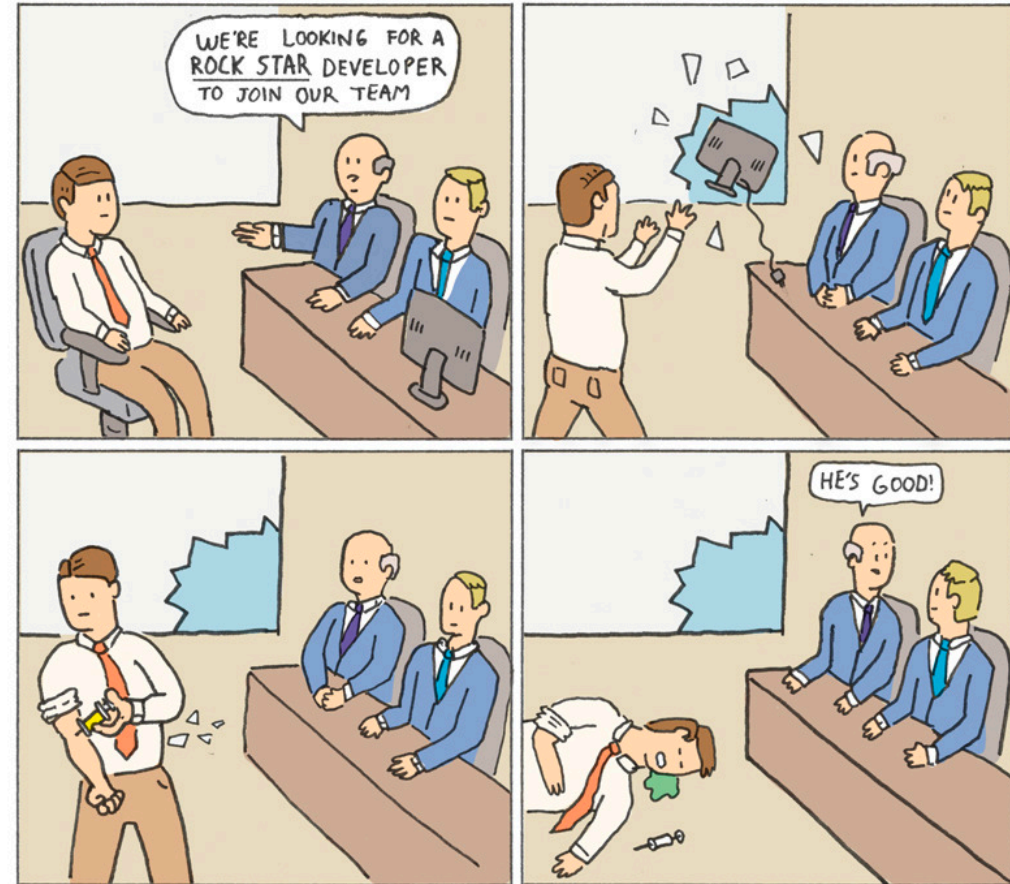
University of Maryland
College Park, MD 20742
(301) 405-5946
fax (301) 314- 9525
rolston@umd.edu

10X ENGINEERS

10X Engineers

- Aka “rock-star”, “ninja”

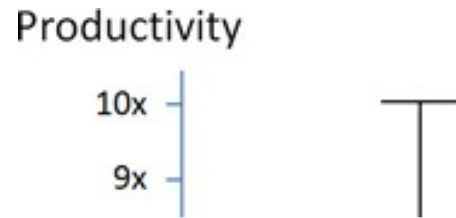
ROCK STAR DEVELOPER



@SKELETON_CLAW

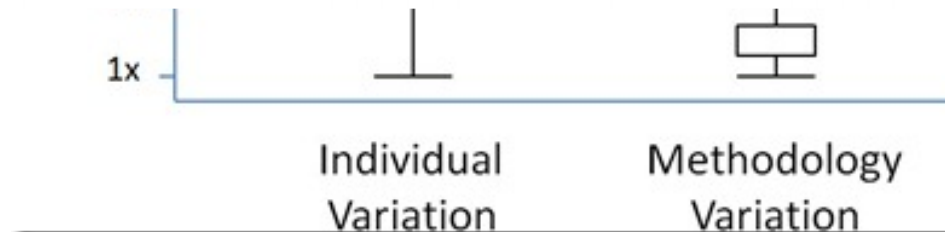
SKELETONCLAW.COM

1966 study on online/offline programming performance



performance variables. To paraphrase a nursery rhyme:

When a programmer is good,
He is very, very good,
But when he is bad,
He is horrid.

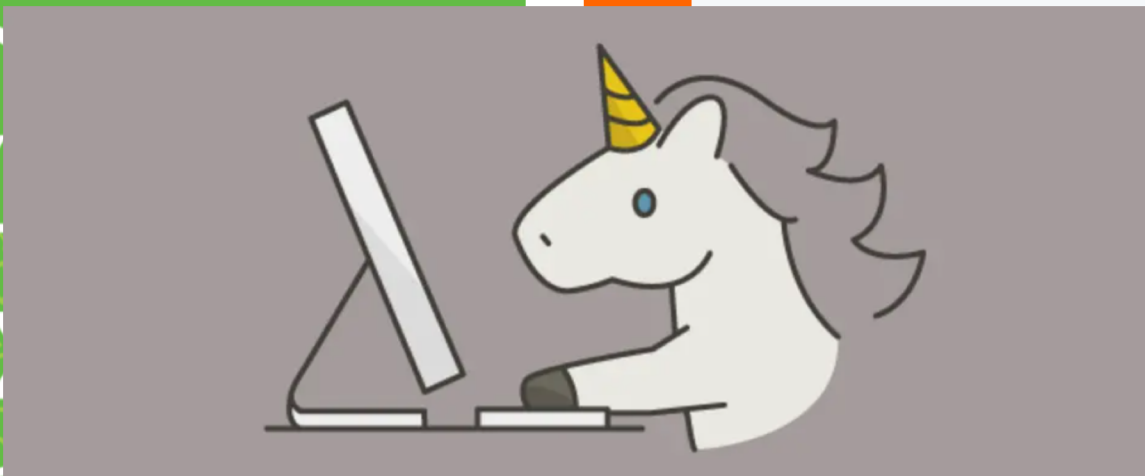


“Myth of the Myth of the 10x Programmer”



10x Developers are Good at T Can Be Too

MATT WATSON | SEPTEMBER 21, 2017 |
DEVELOPER CAREER DEVELOPMENT, DEVELOPER TI



What makes a 10x Developer?

#10xdeveloper #productivity #beginners #career

 Davide de Paolis Mar 11, 2019 · 6 min read

10x developers are the mythical creatures of our times.

Developer is NOT a

ering 40 Comments 7 min read

[slation of this blog post here.](#)

g:



t "10x" or "rockstar developers"
artists, writers, and, uh, rock



ng about this

10x

- Reported as early as 1968 (Sackman, Erickson, and Grant)
 - Coding time 20:1
 - Debugging time 25:1
 - Program size 5:1
 - Execution speed 10:1
 - No correlation to amount of experience
- "order-of-magnitude differences among programmers" repeatedly reported
- Differences not explained by
 - programming language
 - years of experience



"During the time I was at Boeing in the mid 1980s, there was a project that had about 80 programmers working on it that was at risk of missing a critical deadline. The project was critical to Boeing, and so they moved most of the 80 people off that project and brought in one guy who finished all the coding and delivered the software on time."

– Steve McConnell

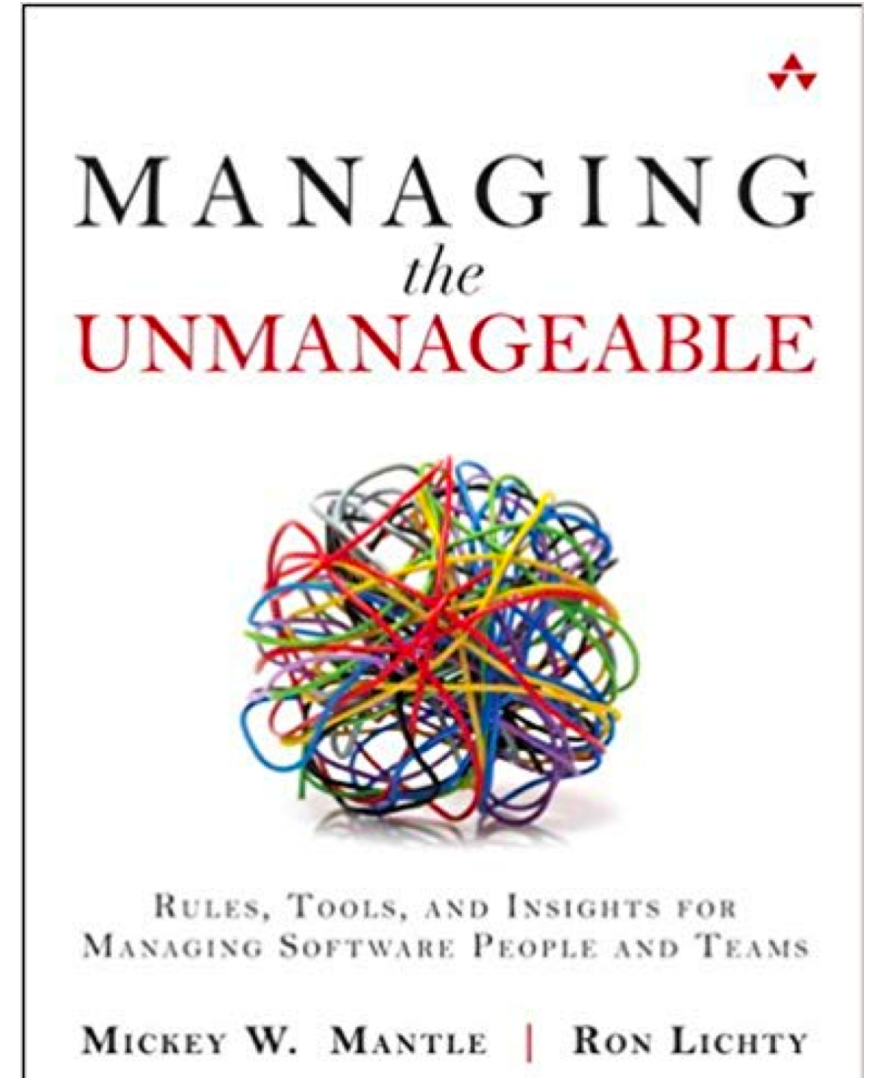
10x of Teams

- Lotus 123 version 3
- 260 staff years
- 400,000 lines of code.
- Microsoft Excel 3.0
- 50 staff years
- 649,000 lines of code

Great programmers according to Mantle and Lichty

- Intuitive sense for structure
- Discipline to design before code
- Write concise, clear, functional, high-quality code
- Produce the desired result

- Software as a craft



Challenge

- Find and hire great developers (Does balancing a red black tree on a white board correlate with being a better developers?)
- Mentor developers into becoming great developers
- Put processes in place to support developers

Interview Advice

Look for people who are:

1. Smart, and
2. Get things done.

<https://www.joelonsoftware.com/2006/10/25/the-guerrilla-guide-to-interviewing-version-30/>



DEVELOPER TURNOVER

Rank	Employer Name	Median Age of Employees	Median Employee Tenure	Median Pay
1	Massachusetts Mutual Life Insurance Company	38	0.8	\$60,000
2 - tie	Amazon.com Inc	32	1.0	\$93,200
2 - tie	American Family Life Assurance Company of Columbus (AFLAC)	38	1.0	\$38,000
4 - tie	Google, Inc.	29	1.1	\$107,000
4 - tie	Mosaic	37	1.1	\$69,900
6 - tie	Chesapeake Energy Corporation	31	1.2	\$60,500
6 - tie	Group 1 Automotive, Inc.	32	1.2	\$33,200
6 - tie	Ross Stores, Inc	29	1.2	\$23,800
6 - tie	Wellcare Health Plans, Inc.	38	1.2	\$49,900
*				
11 - tie	Amerigroup Corporation	39	1.3	\$54,800
11 - tie	Brightpoint North America, Inc.	45	1.3	\$42,100
11 - tie	Devon Energy Corporation	31	1.3	\$63,200
11 - tie	Family Dollar Stores Inc	38	1.3	\$23,400
11 - tie	Freeport-McMoRan Copper & Gold Inc	36	1.3	\$62,900
11 - tie	Paccar Corporation	33	1.3	\$62,200

Source: <http://www.techrepublic.com/blog/career-management/tech-companies-have-highest-turnover-rate/>; payscale.com data

18 - tie	Sandisk Corp	34	1.5	\$110,000
18 - tie	Tenneco Inc	40	1.5	\$69,900

Turnover

- > 20% turnover per year typical
 - average employment 15-36 month
- Costs?
- Reasons?
- Mitigations?

Unfolding Model of Employee Turnover

Organizational Science has studied employee turnover for over 100 years!

One Hundred Years of Employee Turnover Theory and Research

Peter W. Hom
Arizona State University

Thomas W. Lee
University of Washington

Jason D. Shaw
Hong Kong Polytechnic University

John P. Hausknecht
Cornell University

We review seminal publications on employee turnover during the 100-year existence of the *Journal of Applied Psychology*. Along with classic articles from this journal, we expand our review to include other publications that yielded key theoretical and methodological contributions to the turnover literature. We first describe how the earliest papers examined practical methods for turnover reduction or control and then explain how theory development and testing began in the mid-20th century and dominated the academic literature until the turn of the century. We then track 21st century interest in the psychology of staying (rather than leaving) and attitudinal trajectories in predicting turnover. Finally, we discuss the rising scholarship on collective turnover given the centrality of human capital flight to practitioners and to the field of human resource management strategy.

High turnover is expensive

- Hiring overhead
 - Costs (1.5 month salary to agency)
 - Lost productivity (interviews)
- Getting new developers up to speed
 - Unproductive time (~6 month ramp up; 2 years in some estimates)
 - Training overhead
- Overhead for maintaining abandoned code
- Tendency to short-term viewpoints
- Premature promotions
- Young inexperienced staff

Causes of, mitigations for turnover

- Causes (from literature, caveats for tech companies):
 - Just-passing-through mentality
 - Feeling of disposability
 - “Loyalty would be ludicrous”
 - High turnover encourages turnover
- Mitigations:
 - Environment and culture
 - striving to be "the best"
 - teams
 - Investment in personal growth, via retraining, no dead-end jobs
- *Advice: enable appropriate processes to maintain productivity despite turnover.*

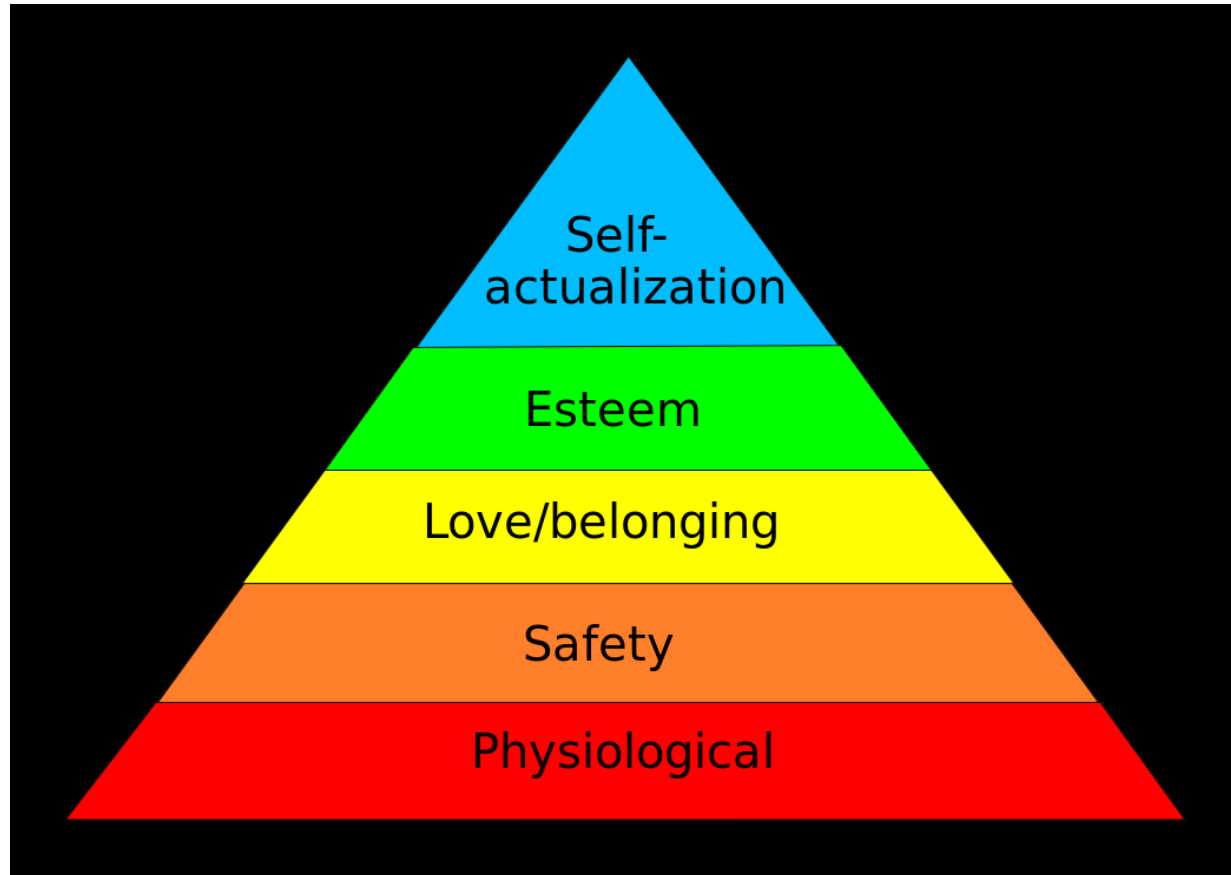
MOTIVATING PROGRAMMERS

Growth and Challenge

Theories

- Maslow's Hierarchy of Needs
- Herzberg's Motivation and Hygiene Factors
- Daniel Pink, Drive: The Surprising Truth About What Motivates Us.

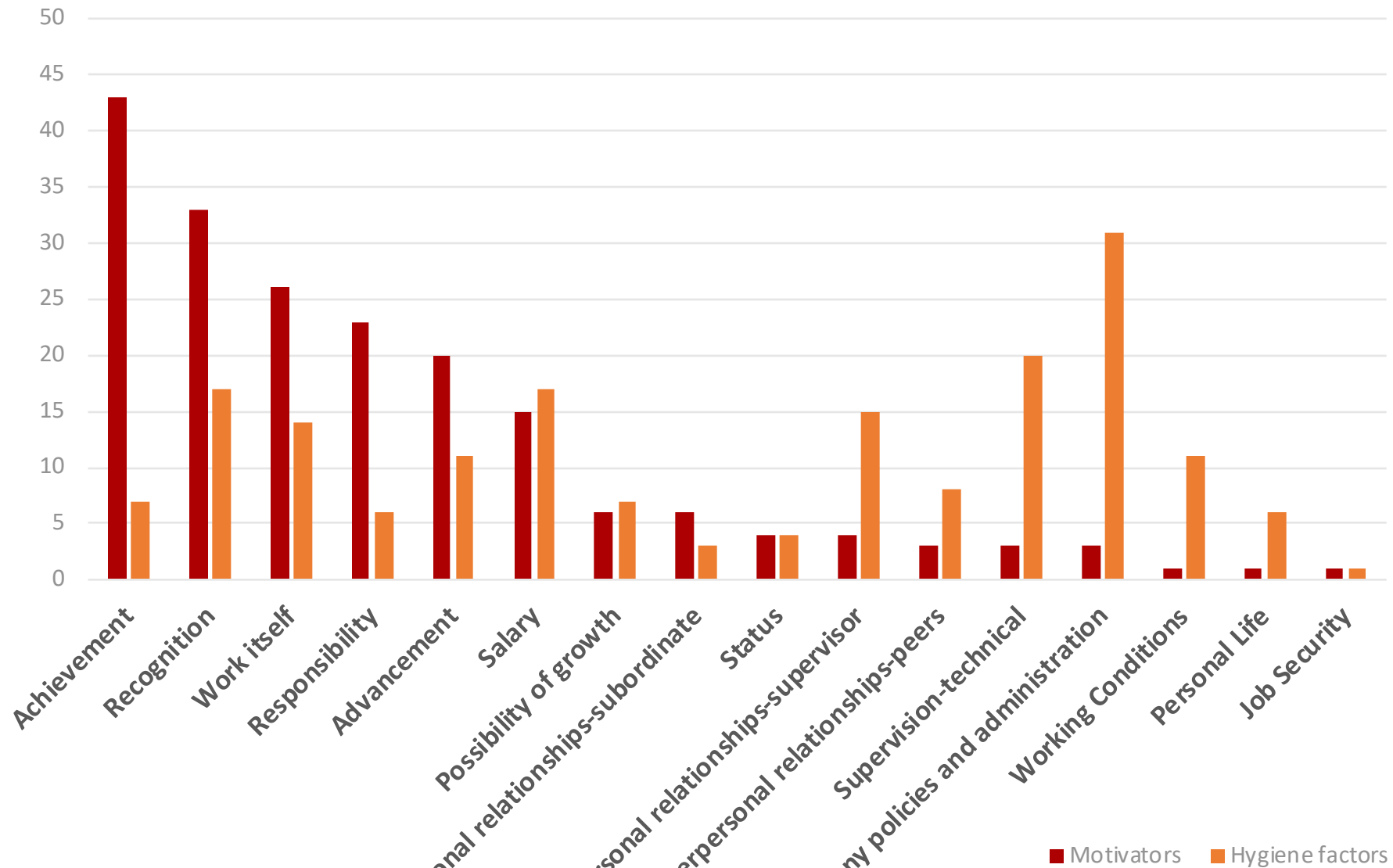
Maslow's hierarchy of needs (1943)



Herzberg's Motivation and Hygiene Factors (1960s)

- (aka two-factor theory)
- Different factors for satisfaction and dissatisfaction
 - Addressing dissatisfaction does not lead to satisfaction
- Step 1: Eliminate dissatisfaction
- Step 2: Create condition for satisfaction

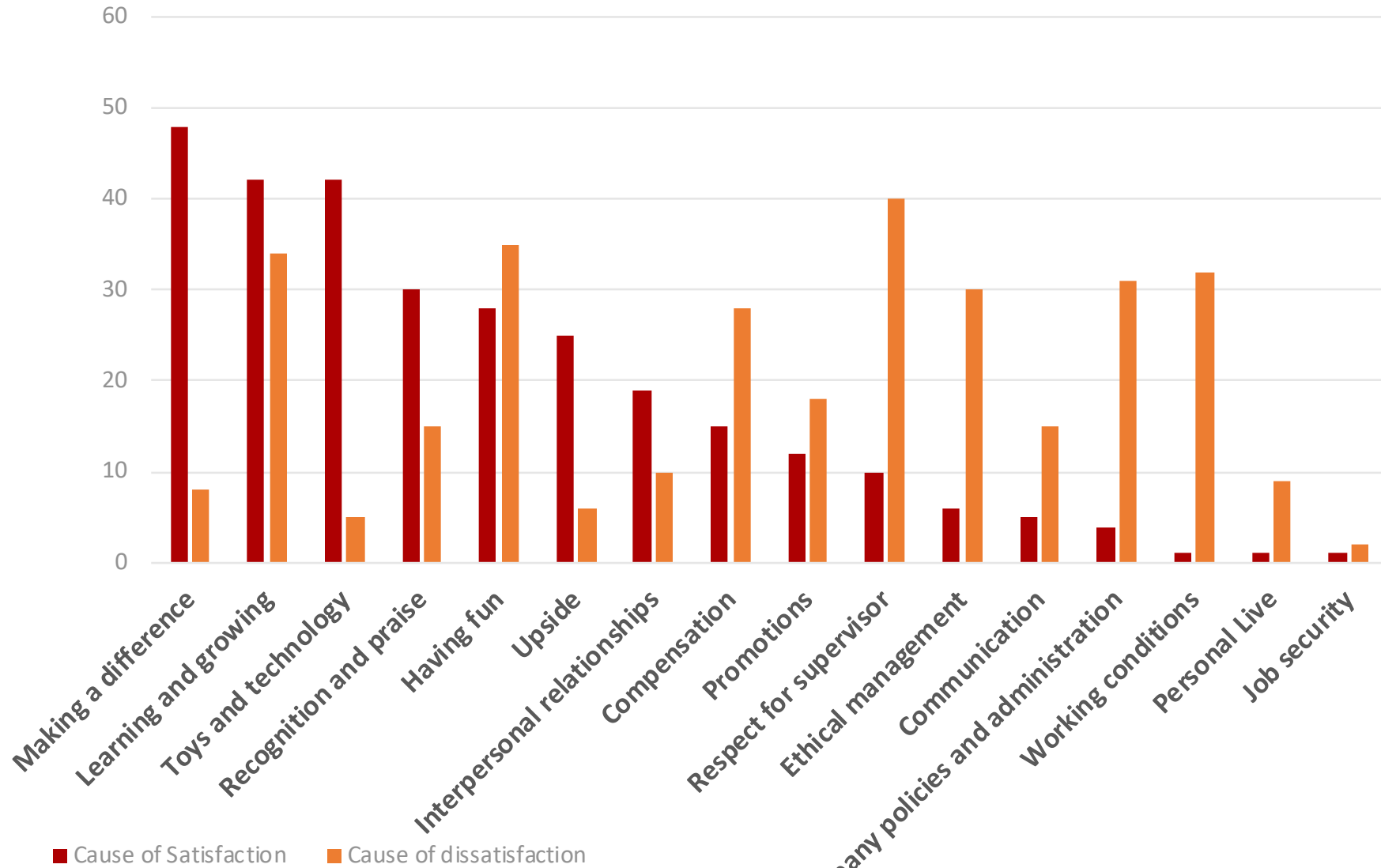
(Observation by Mantle and Lichty, not empirical data)



Identify Motivation and Hygiene Factors for Programmers

- Communication
- Company policies and administration
- Compensation
- Ethical management
- Having fun
- Interpersonal relationships
- Job security
- Learning and growing
- Making a difference
- Promotions
- Recognition and praise
- Respect for supervisor
- Toys and technology
- Upside

(Observation by Mantle and Lichty, not empirical data)



Addressing Causes of Dissatisfaction

- Respect for supervisor
- Having fun
- Learning and growing
- Good working conditions
- Sane company policies and administration
- Ethical management
- Fair compensation

- (often within control)

Addressing Causes of Dissatisfaction (selective)

- Respect as supervisor
 - gain technical credit
 - respect others
 - lead by example
 - help solve technical problems
 - manage and coach
- Having fun
 - out of office play
 - celebrations of accomplishments and occasions

Addressing Causes of Dissatisfaction (selective)

- Learning and growing
 - protect time for learning
 - explore new technologies; prototype
 - budget for attending conferences, seminars, inhouse training
 - invite guest speakers
- Good working conditions
 - plenty of whiteboards
 - room for discussions
 - Quiet space, Limit interruptions, avoid meeting culture
 - cubicles vs separate offices
 - fire “jerks”
 - free food
 - flexible hours, flexible dress, flexible space

Addressing Causes of Dissatisfaction (selective)

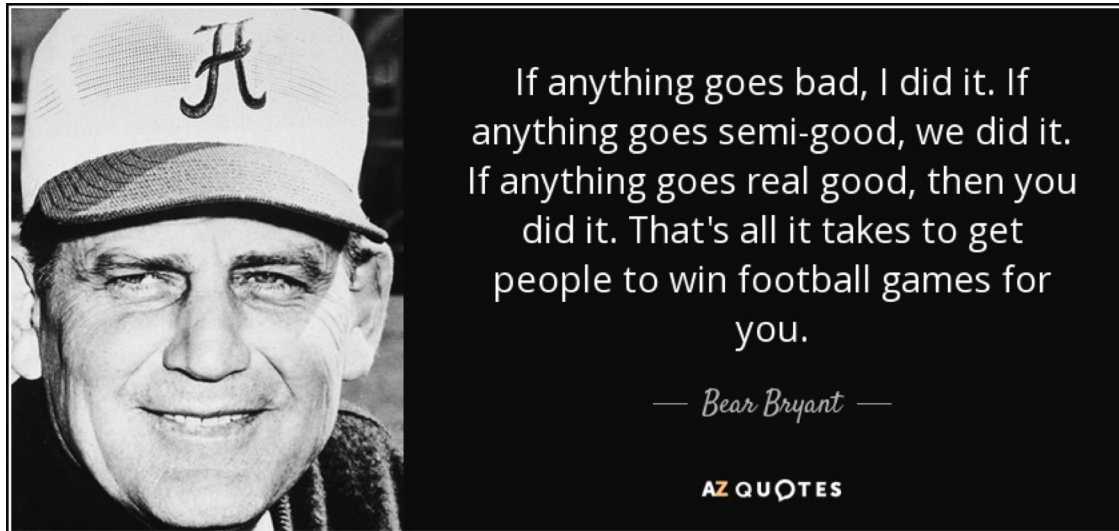
- Sane company policies and administration
 - communicate frequently (vision, intentions, requirements, schedules, ...)
 - protect staff from organizational distractions
 - protect staff from bad communication practices (establish culture)

Addressing Motivating Factors (selective)

- Making a difference
 - worthy goals, longterm vision
 - Steve Jobs when recruiting John Scully from Pepsi: “Do you want to sell sugar water or change to world”
- Toys and technology
 - modern hardware, large screens, phones, ...

Addressing Motivating Factors (selective)

- Recognition and praise
 - praise loudly and specifically, blame softly/privately
 - celebrate success

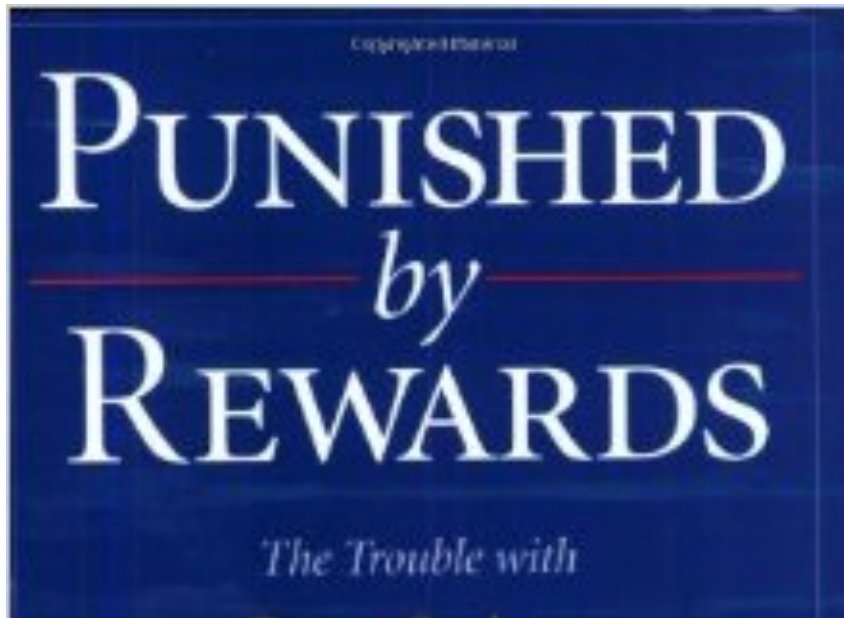


Why do engineers choose TO JOIN particular teams?

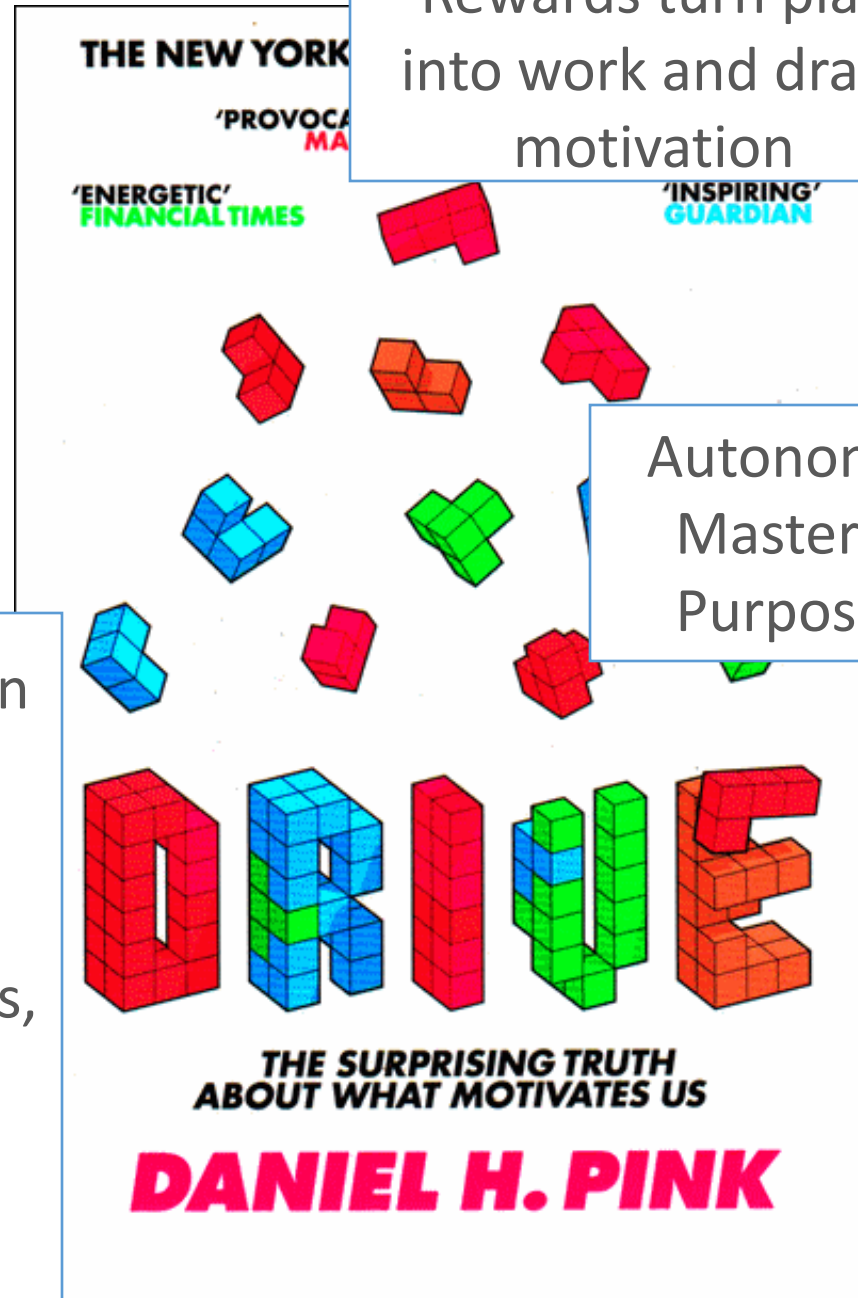
Reasons grouped by clustering analysis	Percent
Liked new team and/or technology (exciting, manager)	85.8%
Coworker asked me to join (new team, old team)	37.8%
Joined for better opportunities (location, domain, lack of other options)	24.5%
Followed my manager (former or current)	14.6%

Why do engineers want to leave their teams?

Reasons grouped by clustering analysis	Percent
Change is coming (technology, charter, re-org, turnover)	52.6%
Seeking new challenges or location (role, location, challenges)	39.0%
Dissatisfaction with manager (priorities, goals, person, actions)	31.6%
The grass is always greener on the other side (novelty, escape)	12.3%
Not a good fit (bored, no need for my skills)	5.3%
Poor team dynamics (dysfunctional, no career growth)	4.4%



- Can extinguish intrinsic motivation
- Can diminish performance
- Can crush creativity
- Can crowd out good behavior
- Can encourage cheating, shortcuts, and unethical behavior
- Can become addictive
- Can foster short-term thinking



Rewards turn play into work and drain motivation

Autonomy
Mastery
Purpose

Avoid “Gotcha Benefits”

- Fully paid vacations every, including airfare
- Three-day weekends all summer.
- 30-day-paid sabbaticals every three years.
- \$1,000 per year continuing-education stipend. (learn anything)
- \$2,000 per year charity match.
- A local monthly CSA (community-supported agriculture) share
- One monthly massage at an actual spa, not the office.
- \$100 monthly fitness allowance

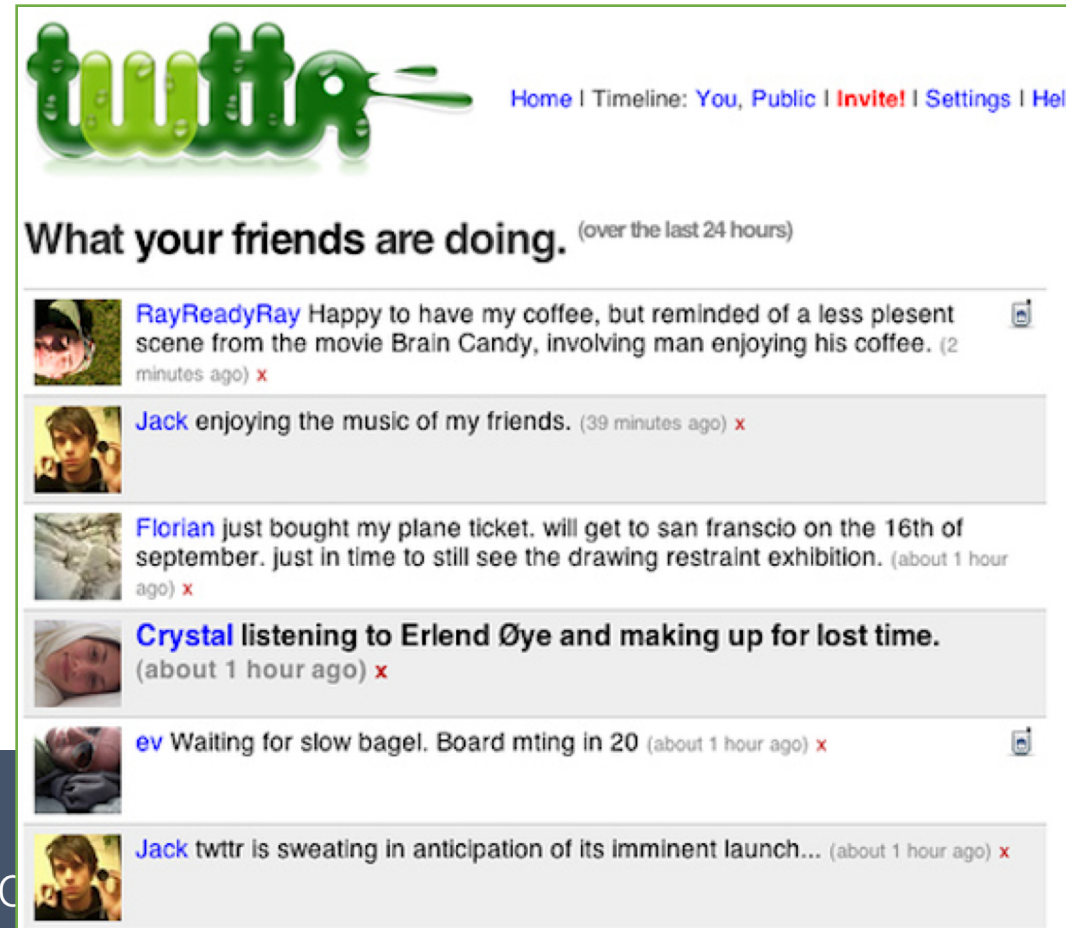


CASE STUDIES

Disclaimer: All pictures represent abstract developer groups or products to give a sense of scale; they are not necessarily the developers of those products or developers at all.

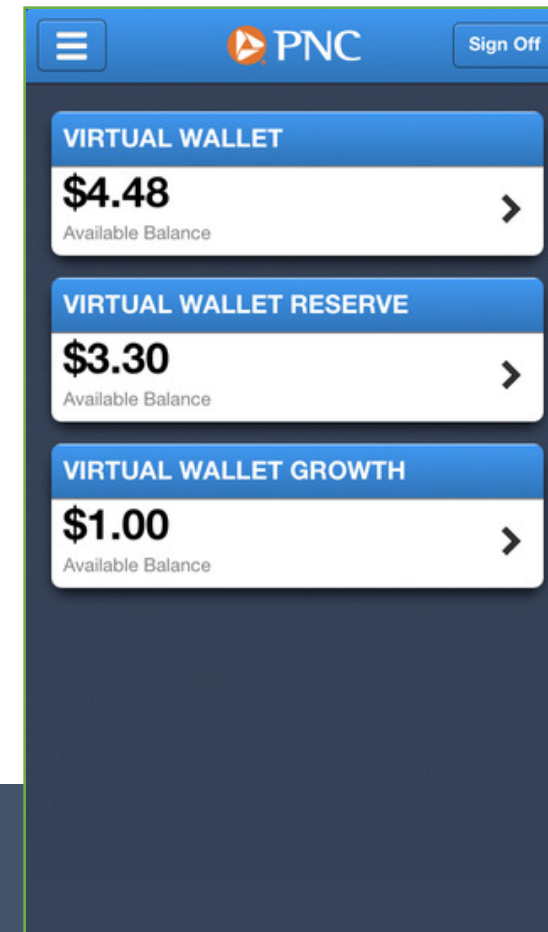
How to structure teams?

- Microblogging platform; 3 friends



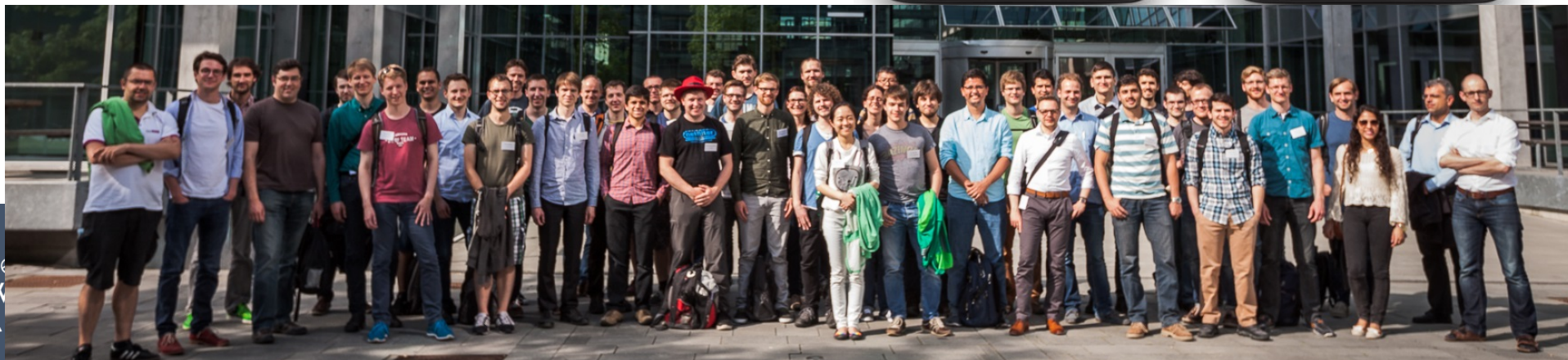
How to structure teams?

- Banking app; 15 developers



How to structure teams?

- Mobile game;
- 50ish developers;
- distributed teams?



How to structure teams?

- Mobile game;
200ish developers



How to structure teams?

- Ride sharing app and self-driving cars; 1200 developers; 4 sites



TEAMS

Necessity of Groups

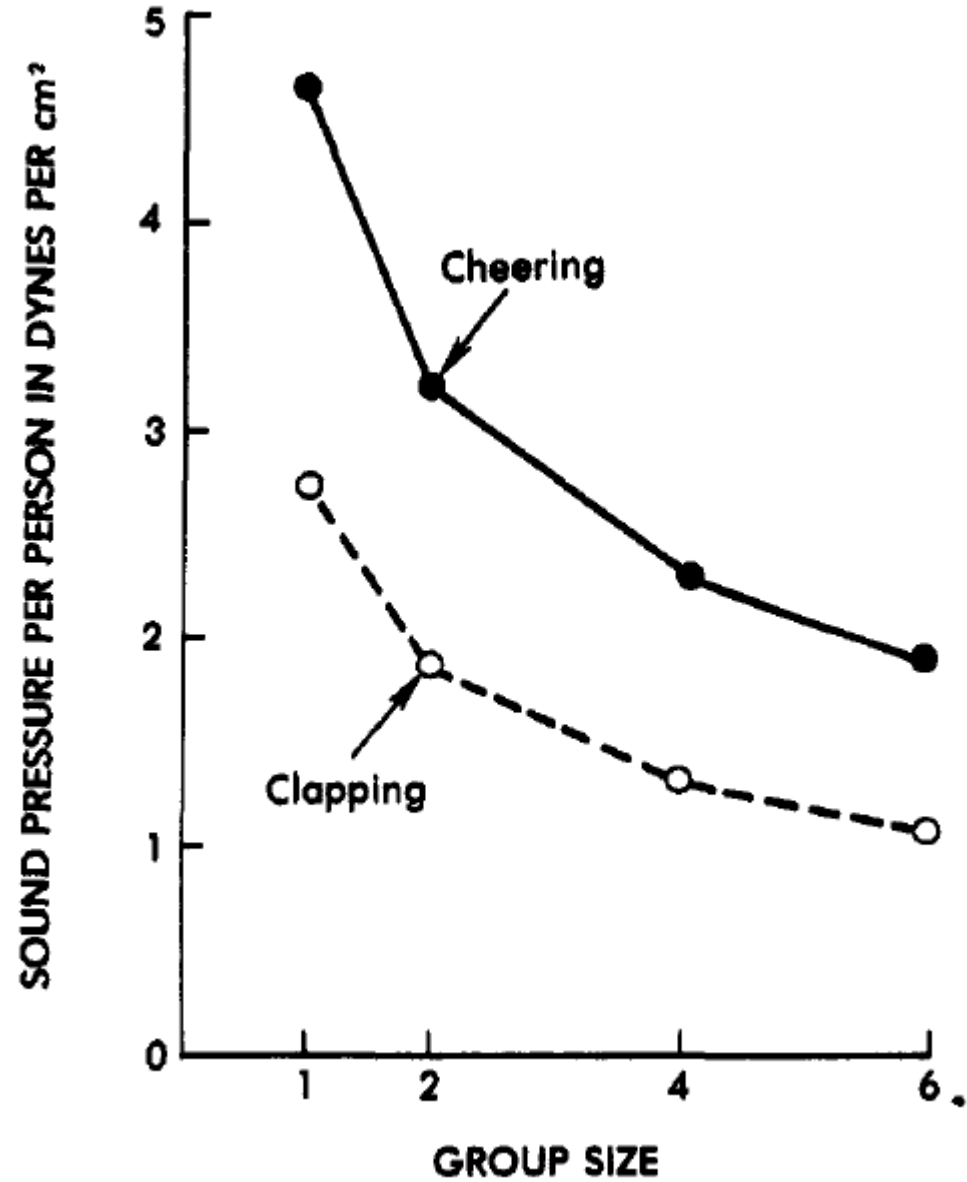
- Division of labor
- Division of expertise (e.g., security expert, database expert)

Team Issues

- Social loafing
- Groupthink
- Multiple/conflicting goals
- Process costs

TEAM ISSUES: SOCIAL LOAFING





Latane, Bibb, Kipling Williams, and Stephen Harkins. "Many hands make light the work: The causes and consequences of social loafing." *Journal of personality and social psychology* 37.6 (1979): 822.

Social loafing

- People exerting less effort within a group
- Reasons
 - Diffusion of responsibility
 - Motivation
 - Dispensability of effort / missing recognition
 - Avoid pulling everybody / "sucker effect"
 - Submaximal goal setting
- "Evaluation potential, expectations of co-worker performance, task meaningfulness, and culture had especially strong influence"

Karau, Steven L. and Kipling D. Williams. "Social loafing: A meta-analytic review and theoretical integration." *Journal of personality and social psychology* 65.4 (1993): 681.

Mitigation Strategies

- Involve all team members, co-location
- Assign specific tasks with individual responsibility
 - Increase identifiability
 - Team contracts, measurement
- Provide choices in selecting tasks
- Promote involvement, challenge developers
- Reviews and feedback
- Team cohesion, team forming exercises
- Small teams

Agile Practices as Mitigation?

Responsibilities & Buy-In

- Involve team members in decision making
- Assign responsibilities (ideally goals not tasks)
- Record decisions and commitments; make record available

TEAM ISSUES: GROUPTHINK



Groupthink

- Group minimizing conflict
- Avoid exploring alternatives
- Suppressing dissenting views
- Isolating from outside influences
- -> Irrational/dysfunctional decision making



Star Wars: Episode I - The Phantom Menace (1999)

🌟 55% 🍿 59%

Critics Consensus: Burdened by exposition and populated with stock characters, *The Phantom Menace* gets the *Star Wars* prequels off to a bumpy – albeit visually dazzling – start.

Starring: Liam Neeson, Ewan McGregor, Natalie Portman

Director: George Lucas



Star Wars: Episode VI - Return of the Jedi (1983)

🍿 80% 🍿 94%

Critics Consensus: Though failing to reach the cinematic heights of its predecessors, *Return of the Jedi* remains an entertaining sci-fi adventure and a fitting end to the classic trilogy.

Starring: Mark Hamill, Carrie Fisher, Harrison Ford

Director: Richard Marquand



Star Wars: Episode V - The Empire Strikes Back (1980)

🍿 95% 🍿 97%

Critics Consensus: Dark, sinister, but ultimately even more involving than *A New Hope*, *The Empire Strikes Back* defies viewer expectations and takes the series to heightened emotional levels.

Starring: Mark Hamill, Harrison Ford, Carrie Fisher

Director: Irvin Kershner



Star Wars: Episode IV - A New Hope (1977)

🍿 93% 🍿 96%

Critics Consensus: A legendarily expansive and ambitious start to the sci-fi saga, George Lucas opened our eyes to the possibilities of blockbuster filmmaking and things have never been the same.

Starring: Mark Hamill, Harrison Ford, Carrie Fisher

Director: George Lucas

Causes of Groupthink

- High group cohesiveness, homogeneity
- Structural faults (insulation, biased leadership, lack of methodological exploration)
- Situational context (stressful external threats, recent failures, moral dilemmas)

Symptoms

- Overestimation of ability
 - invulnerability, unquestioned believe in morality
- Closed-mindedness
 - ignore warnings, stereotyping
 - innovation averse
- Pressure toward uniformity
 - self-censorship, illusion of unanimity, ...



Studies Show

- Gender-diverse management teams showed superior return on equity, debt/equity ratios, price/equity ratios, and average growth. -Rohner, U. and B. Dougan (2012)
- Gender-balanced teams were the most likely to experiment, be creative, share knowledge, and fulfill tasks. -Lehman Brothers Center for Women in Business. (2008)
- Gender diversity on technical work teams was associated with superior adherence to project schedules, lower project costs, higher employee performance ratings, and higher employee pay bonuses. -Turner, L. (2009)

Neurodiversity

Agile in the Wild

Why you want an Autist on your tech team.

salfreudenberg / May 19, 2016 / neurodiversity, psychology of programming, Uncategorized

“By autistic standards the neuro typical brain is easily distractable, obsessively social and suffers from a deficit of attention to detail” – Steve Silberman

Autism is said to effect 1 in 62 people. That’s around a million people in the U.K. alone. It appears there is a correlation between autism and the world of science and technology. There is a pretty compelling body of evidence showing this link (Baron-Cohen et al, 1998; Windam, 2009; Roelfsema et al, 2011; Wei, 2003). So why this tendency towards tech for autists? Well there are a number of traits of the autistic mind that lend themselves very well to working in the technology sector. Here are just three examples:

<https://salfreudenberg.wordpress.com/2016/05/19/why-you-want-an-autist-on-your-tech-team/>

<https://salfreudenberg.wordpress.com/2016/05/19/why-you-want-an-autist-on-your-tech-team/>

<https://www.microsoft.com/en-us/research/publication/understanding-the-challenges-faced-by-neurodiverse-software-engineering-employees-towards-a-more-inclusive-and-productive-technical-workforce/>

Implicit Bias



We all have shortcuts, or “schemas,” that help us make sense of the world. But our shortcuts sometimes make us misinterpret or miss things. That’s **implicit bias**.

Mitigation Strategies

- Several agile techniques
 - Planning poker
 - Tests, continuous integration
 - On-site customers
- Diverse teams
- Management style
- Avoid HR evaluation by metrics
- Separate QA from development
- Outside experts
- Process reflection
- ...

Practical Help

national center for

women

&

**INFORMATION
TECHNOLOGY**

Sidenote: Implicit Bias in Teaching Reviews

 Download PDF Export ▾


ELSEVIER

Journal of Public Economics
Volume 145, January 2017, Pages 27-41

Gender biases in student evaluations of teaching *

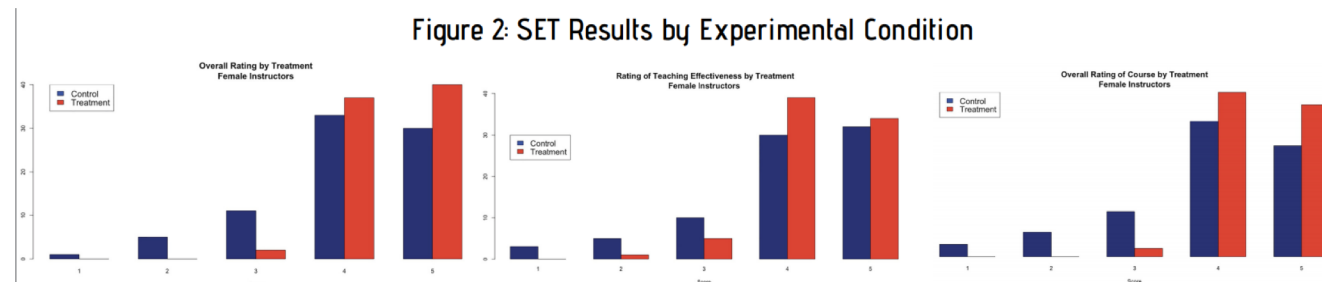
Anne Boring

 Show more

<https://doi.org/10.1016/j.jpubeco.2016.11.006> [Get rights at](#)

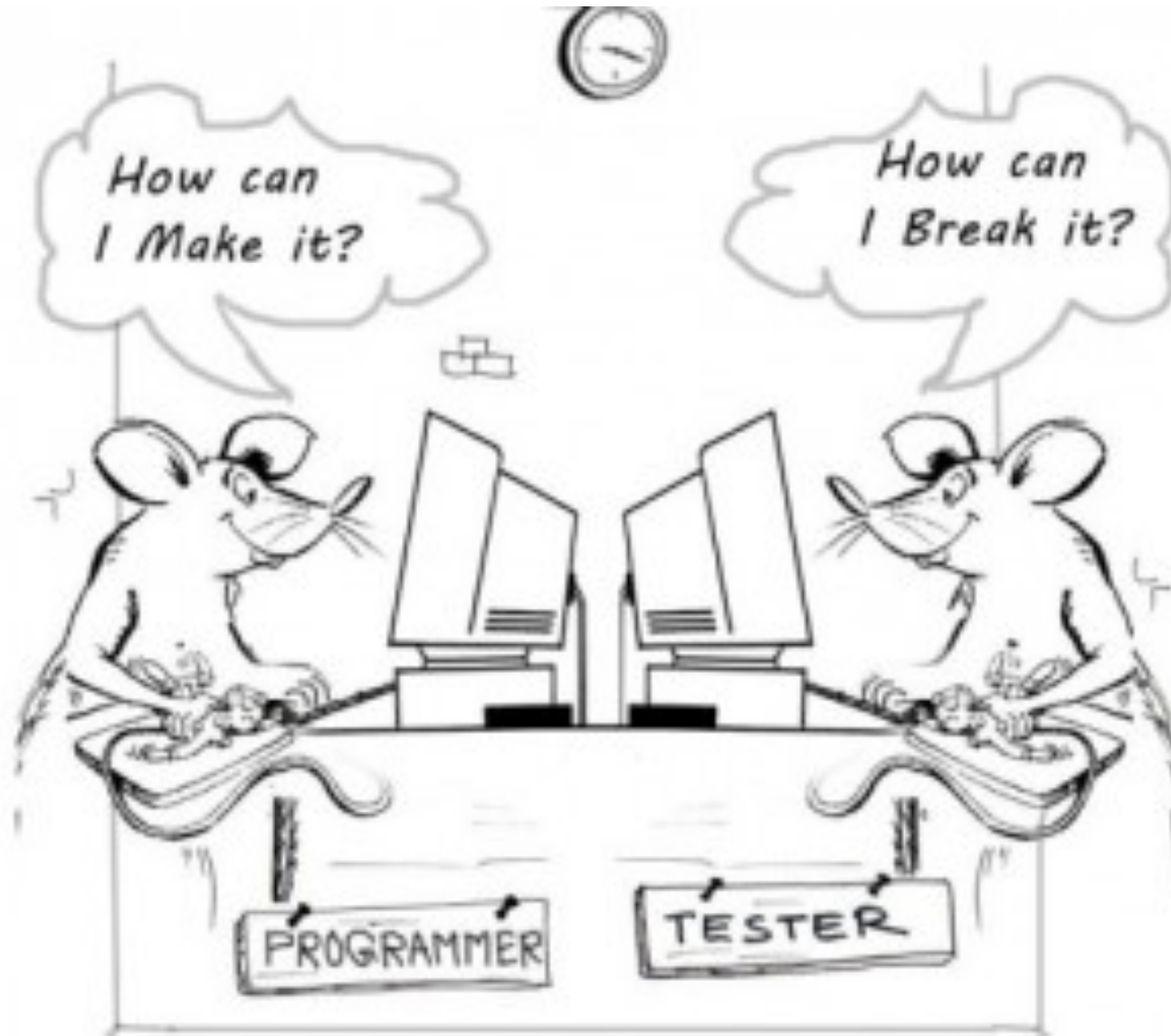
Implicit Bias in Teaching Reviews

- Men are more likely to be perceived as more accurate in their teaching, competent, organized and professional compared to their female counterparts [1, 4, 5, 6, 11, 18, 27, 28, 34, 36, 37, 40, 42].
- A study conducted at Iowa State University by Fan et al. found that students who were informed of potential bias rated their female instructors higher than those who did not receive such information [32].



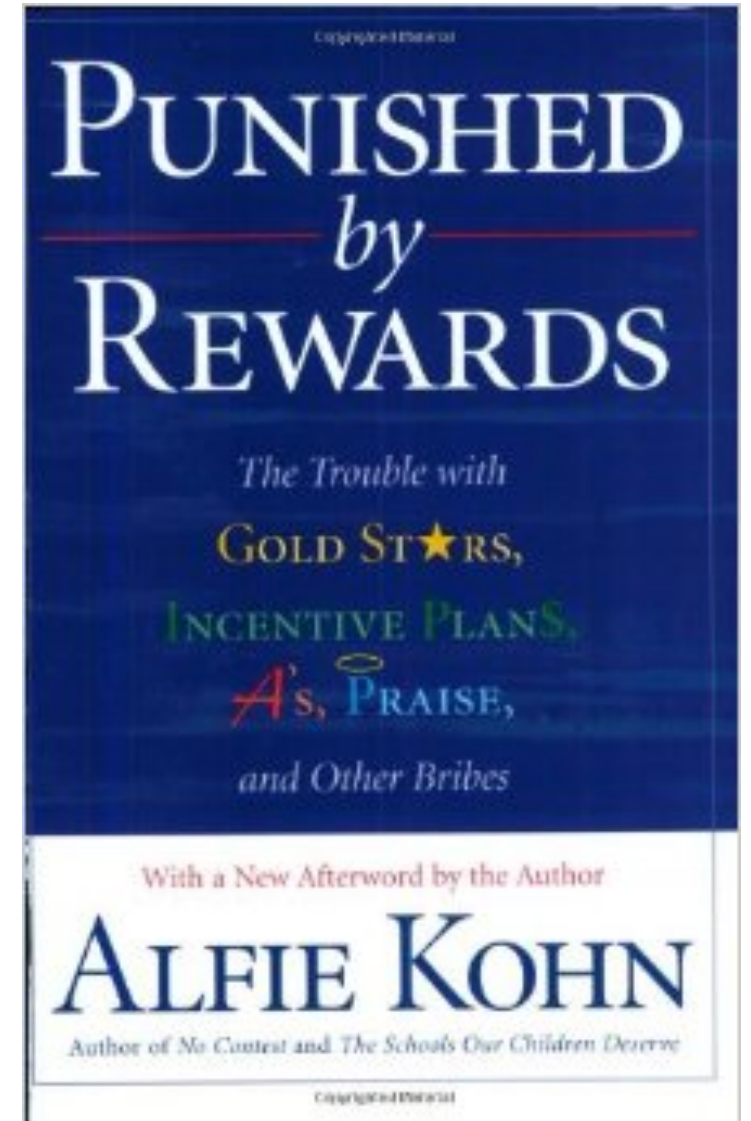
<http://www.rebeccakreitzer.com/wp-content/uploads/2019/10/Bias-in-Teaching-Evaluations-Policy-Brief.pdf>

TEAM ISSUES: MULTIPLE/CONFLICTING GOALS



Incentives?

- Team incentives
- vs individual incentives?

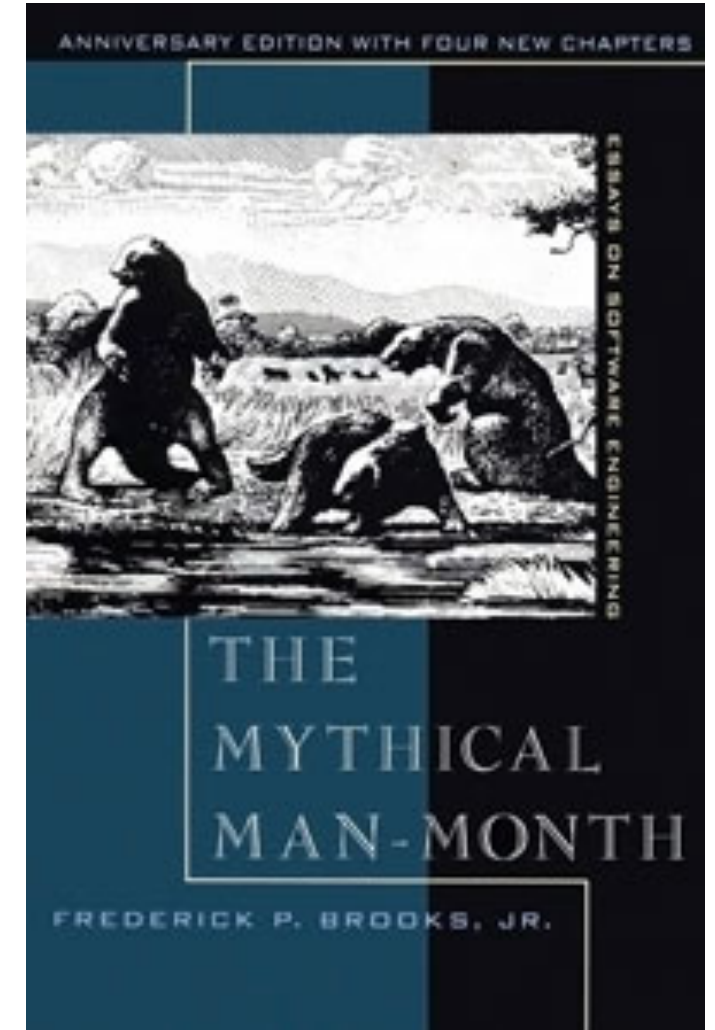


TEAM ISSUES: PROCESS COSTS

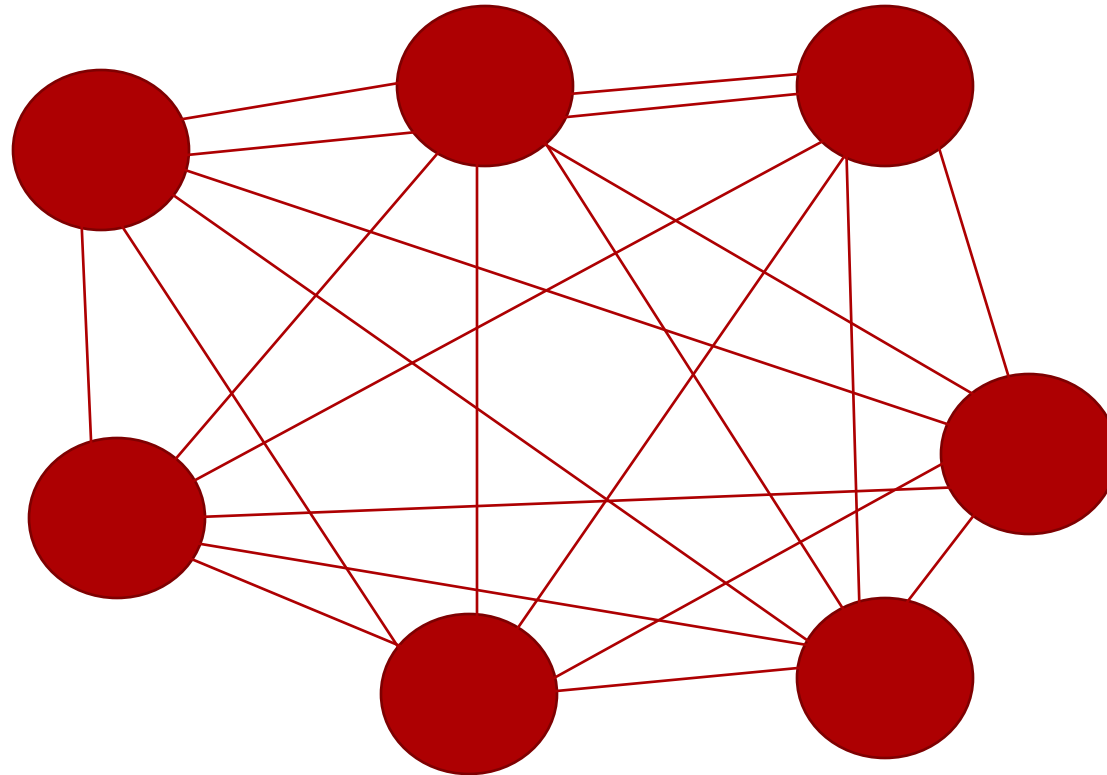
Mythical Man Month

- Brooks's law: *Adding manpower to a late software project makes it later*

1975, describing experience at IBM developing OS/360



Process Costs



$n(n - 1) / 2$
communication links

Process Costs

