TEAMS AND PROCES

Rohan Padhye and **Michael Hilton**

RETROSPECTIVE RESULTS

HW3 TIMING

We are willing to extend the due date till Friday 10/29.

There will be overlap with HW4

We will try to release HW4 sooner (but there will be two HWs out at a time)

RETROSPECTIVE RESULTS

Keep candy

In-class activities on canvas

- We will try this out

More explicit HW writeups

- Interpreting requirements is a learning goal of the course

More office hours

- Current office hours are not well attended, more feedback needed…

Penalize slackers in group project

- We have already, please let us know if you have concerns

RETROSPECTIVE RESULTS

More guests, more a

We have plan

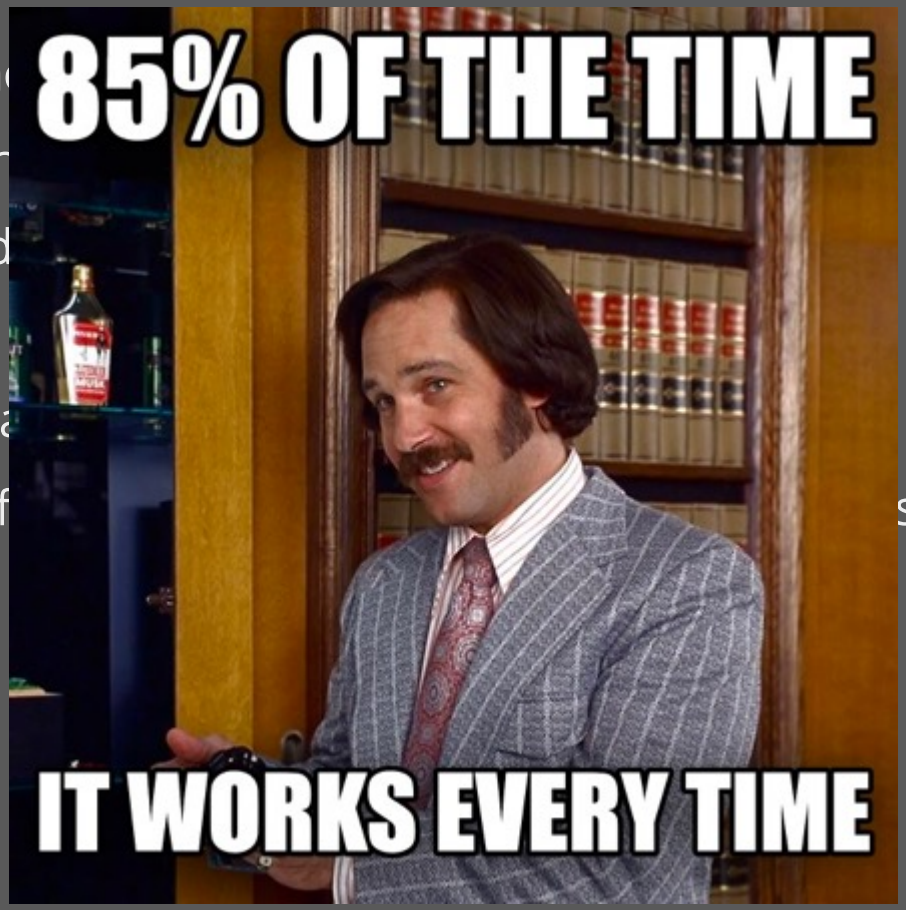
More chocolate cand

¯_(ツ)_/¯

Nice to have a bootca

I would love f sses

“humor hits like 85%



TEAMS

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.

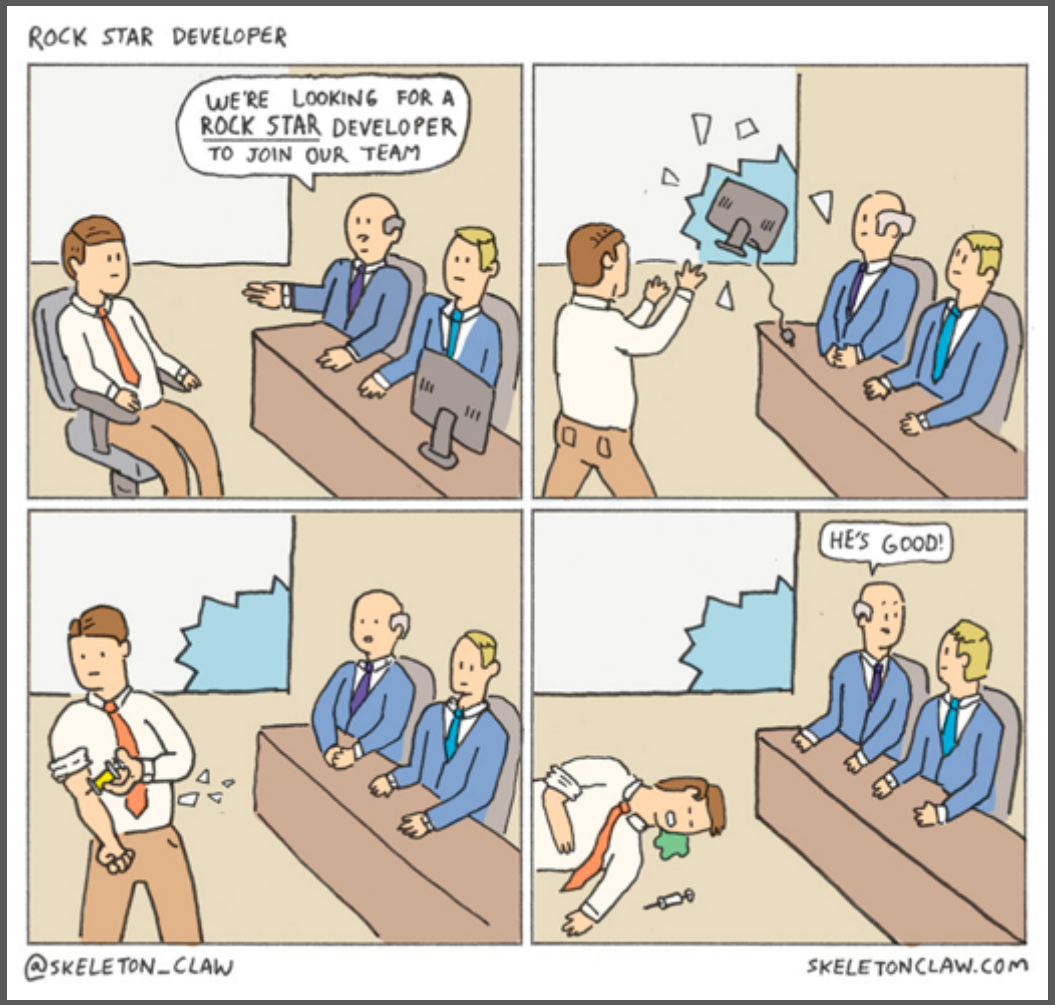
Design conditions that motivate developers.

Understand team development and progression.

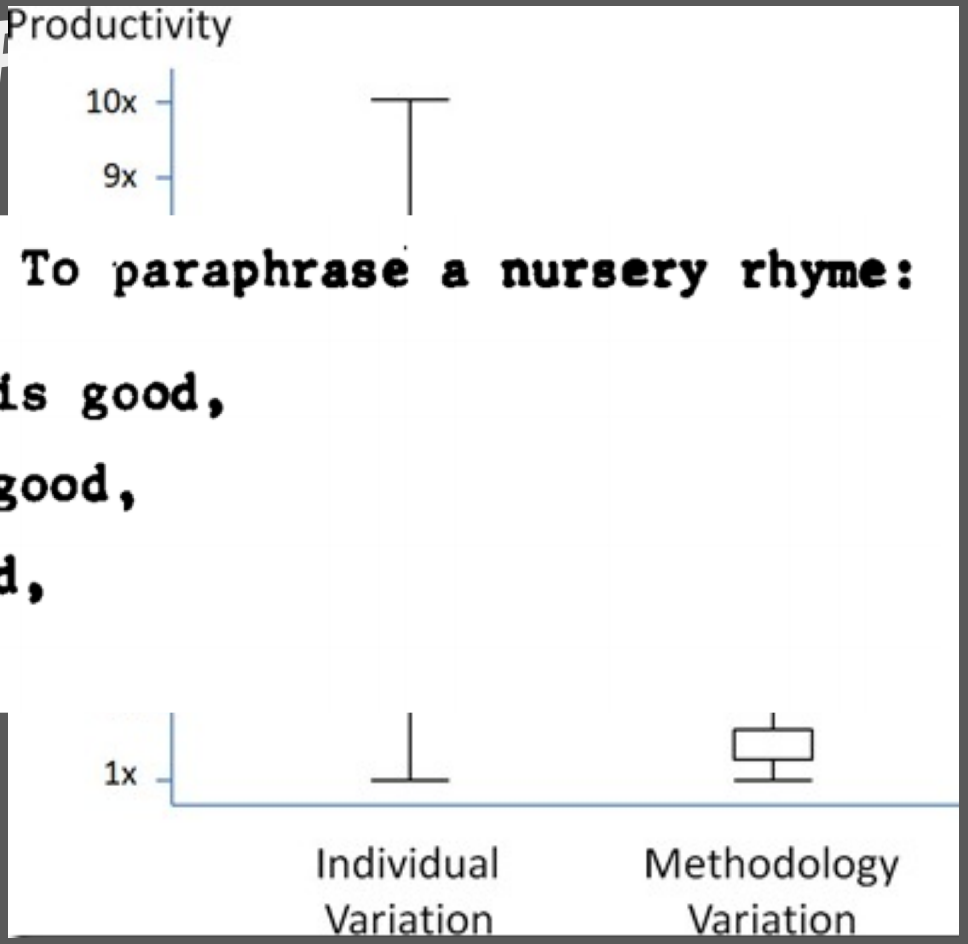
10X ENGINEERS

10X ENGINEERS

Aka “rock-star”, “ninja”



1966 STUDY ON ONLINE/OFFLINE PROGRAMMING P



rmance variables. To paraphrase a nursery rhyme:

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

http://www.construx.com/10x_Software_Development/Origins_of_10X_%E2%80%93_How_Valid_is_the_Underlying_Research_/

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

TEAMS

NECESSITY OF GROUPS

Division of labor

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

TEAM ISSUES

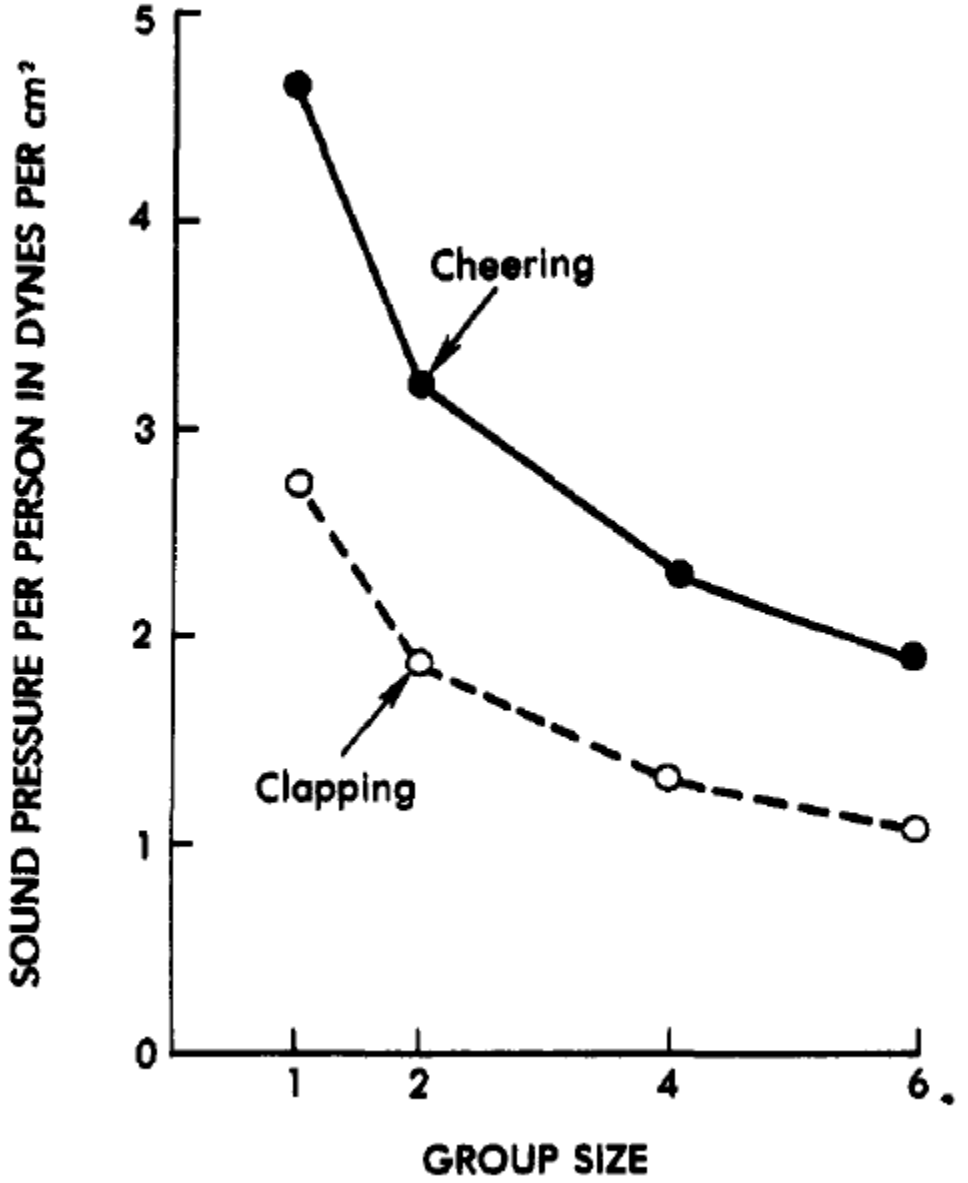
Social loafing

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

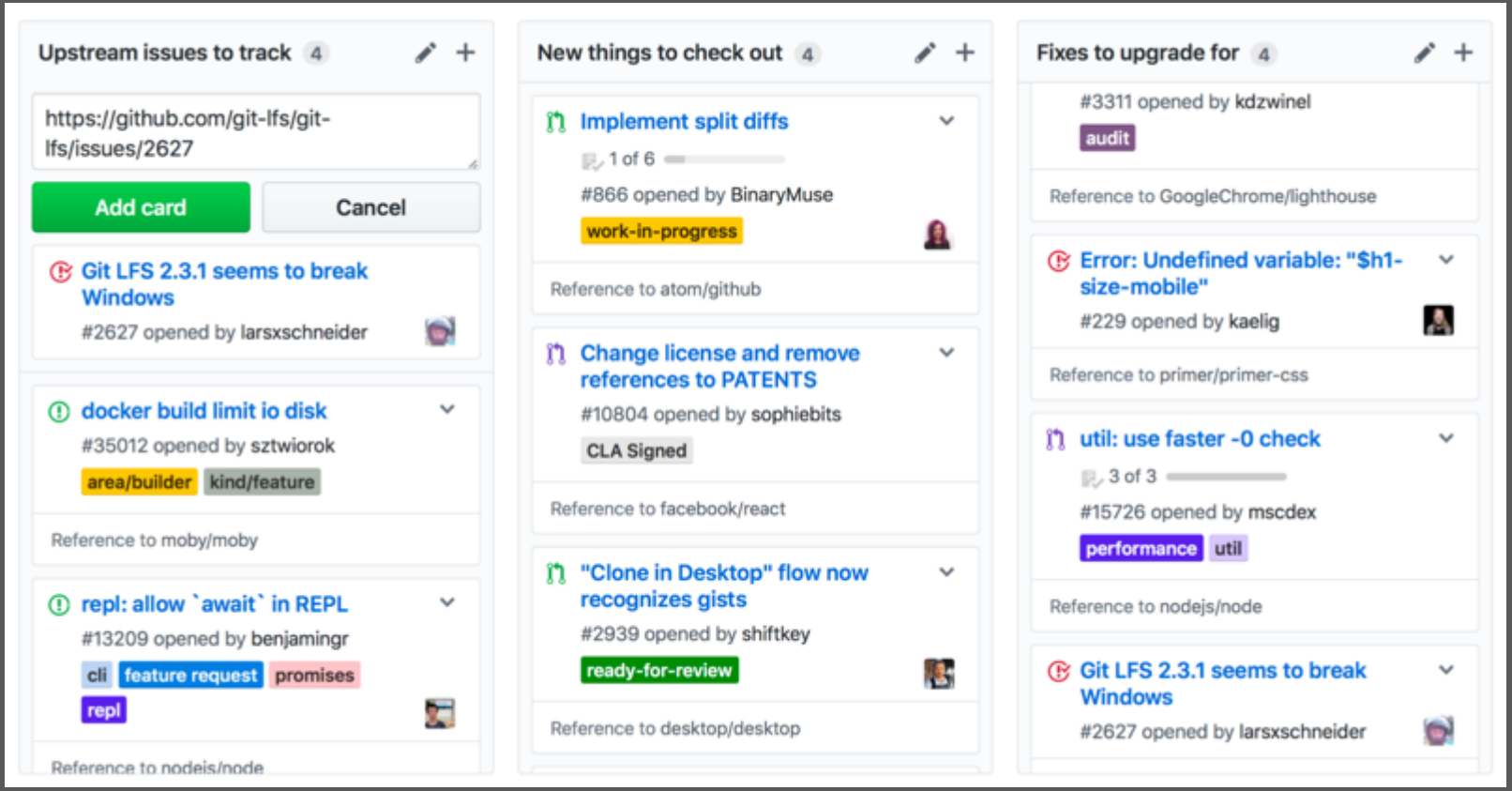
"Evaluation potential, expectations of co-worker performance, task meaningfulness, and culture had especially strong influence"

Karau, Steven J., 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

IN OUR CLASS:


Upstream issues to track 4
https://github.com/git-lfs/git-lfs/issues/2627
Add card
Cancel
Git LFS 2.3.1 seems to break Windows
#2627 opened by larsxschneider
docker build limit io disk
#35012 opened by sztwiorok
area/builder
kind/feature
Reference to moby/moby
repl: allow `await` in REPL
#13209 opened by benjamingr
cli
feature request
promises
repl
New things to check out 4
Implement split diffs
1 of 6
#866 opened by BinaryMuse
work-in-progress
Reference to atom/github
Change license and remove references to PATENTS
#10804 opened by sophiebits
CLA Signed
Reference to facebook/react
"Clone in Desktop" flow now recognizes gists
#2939 opened by shiftkey
ready-for-review
Reference to desktop/desktop
Fixes to upgrade for 4
#3311 opened by kdzwinel
audit
Reference to GoogleChrome/lighthouse
Error: Undefined variable: "$h1-size-mobile"
#229 opened by kaelig
Reference to primer/primer-css
util: use faster -0 check
3 of 3
#15726 opened by mscdex
performance
util
Reference to nodejs/node
Git LFS 2.3.1 seems to break Windows
#2627 opened by larsxschneider

IN OUR CLASS:

- First, open an issue...

- Tag the issue with one or more of the existing labels as appropriate, add it to milestone “HW1”, and assign yourself.

- Once you are satisfied, open a pull request in the parent repository. The PR should link the issue that you previously opened (e.g. using the “resolve(s)” keyword), summarize the changes, and describe how much the Lighthouse score improved by due to your change.

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


WE NEED MORE DISSENTING OPINIONS.
ABSOLUTELY, SIR
WE AGREE 100%
Carol Simpson ©2004

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

TIME AND COST ESTIMATION

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)

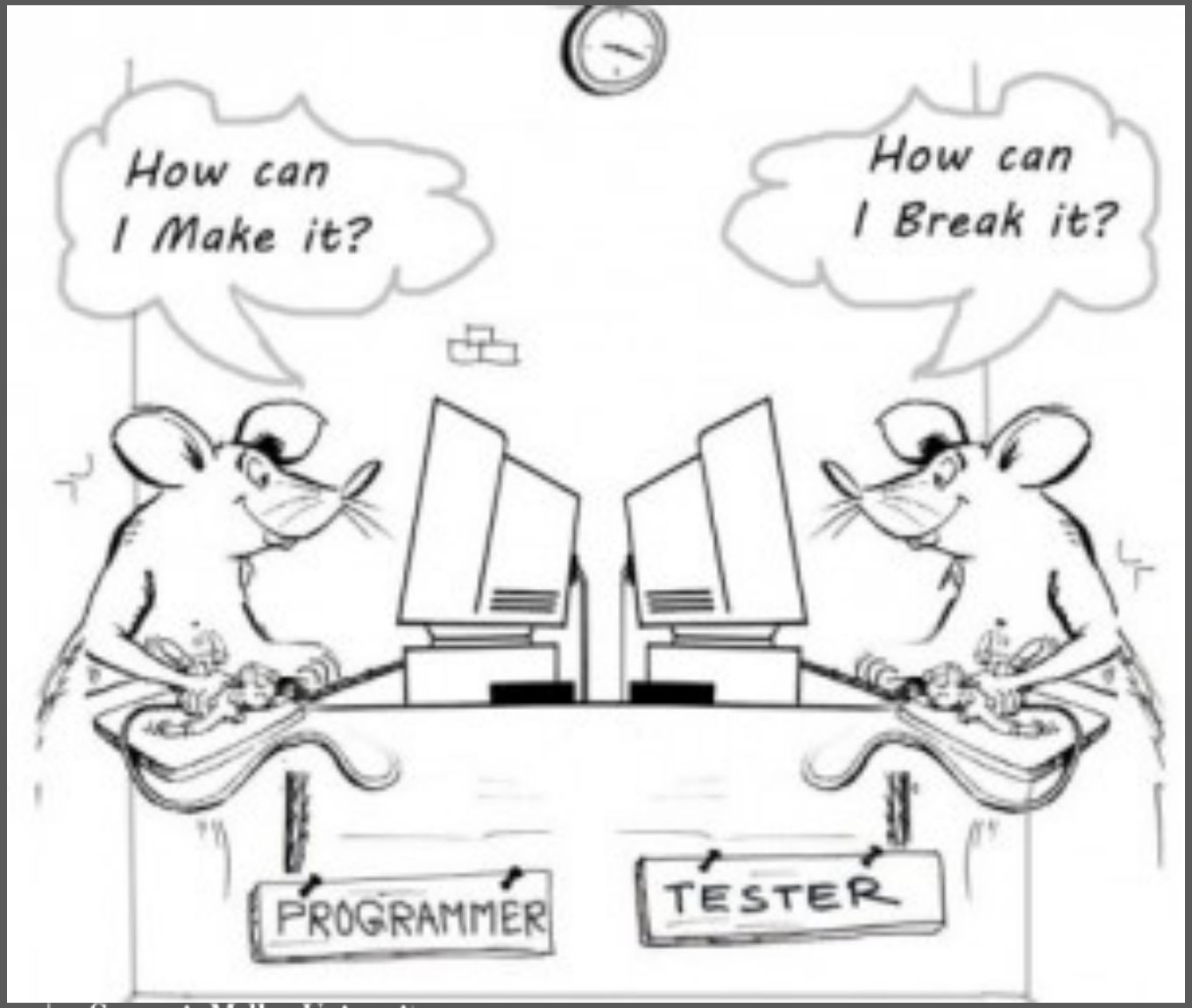
Gender diversity on technical work teams was associated with superior adherence to project schedules, lower project costs, higher employee performance ratings, and higher employee pay bonuses. -Turner, L. (2009)

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

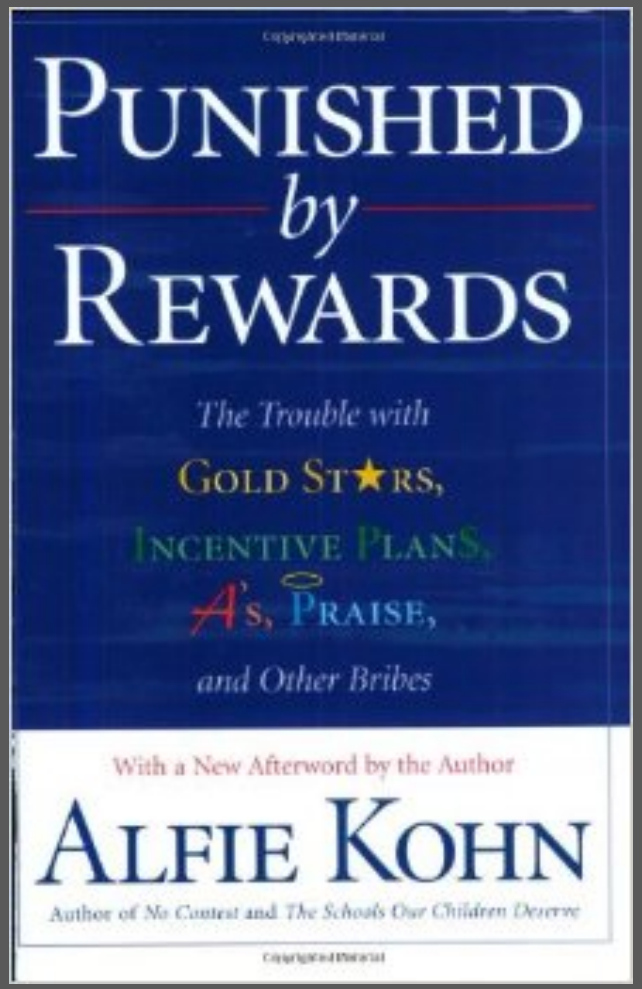
TEAM ISSUES: MULTIPLE/CONFLICTING GOALS


How can
I Make it?
How can
I Break it?
PROGRAMMER
TESTER

INCENTIVES?

Team incentives

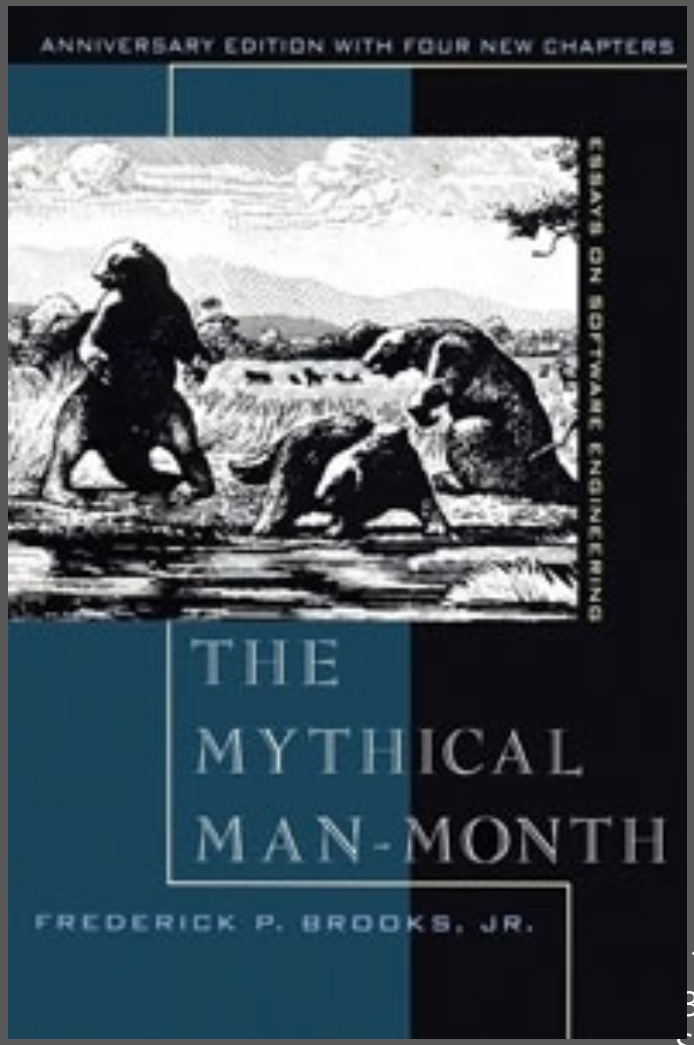
vs individual incentives?



TEAM ISSUES: PROCESS COSTS

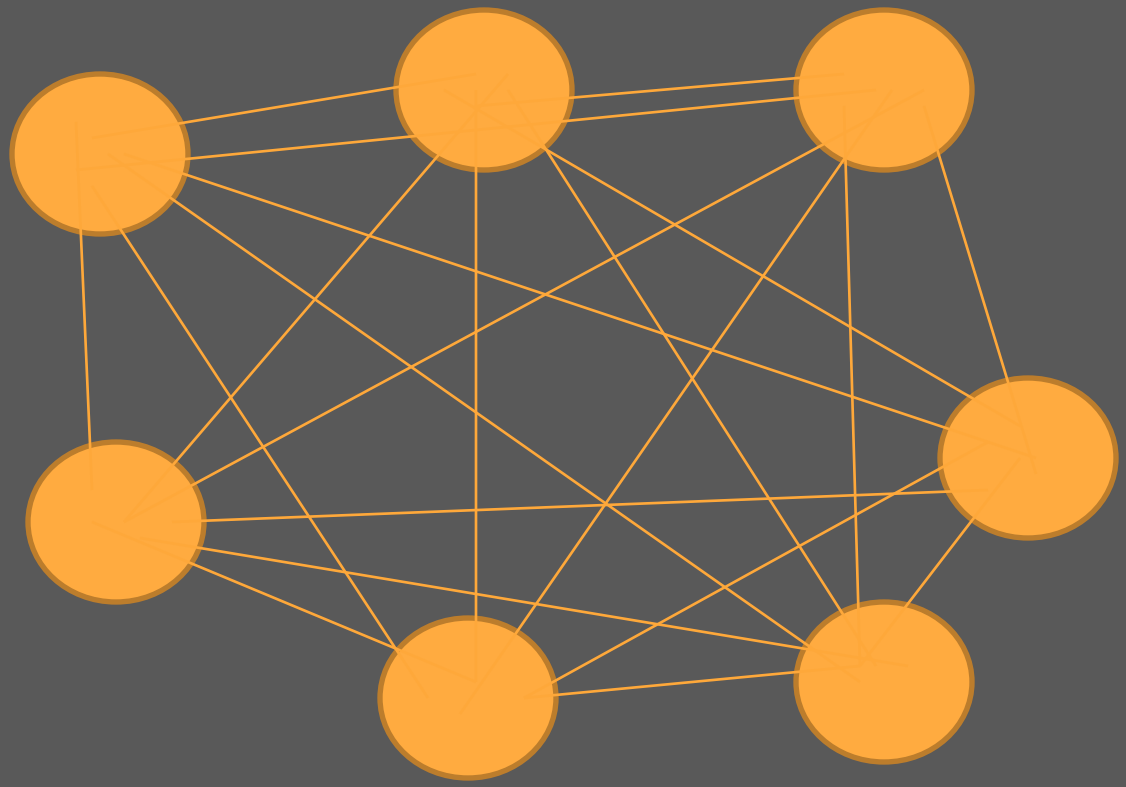
MYTHICAL MAN MONTH

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



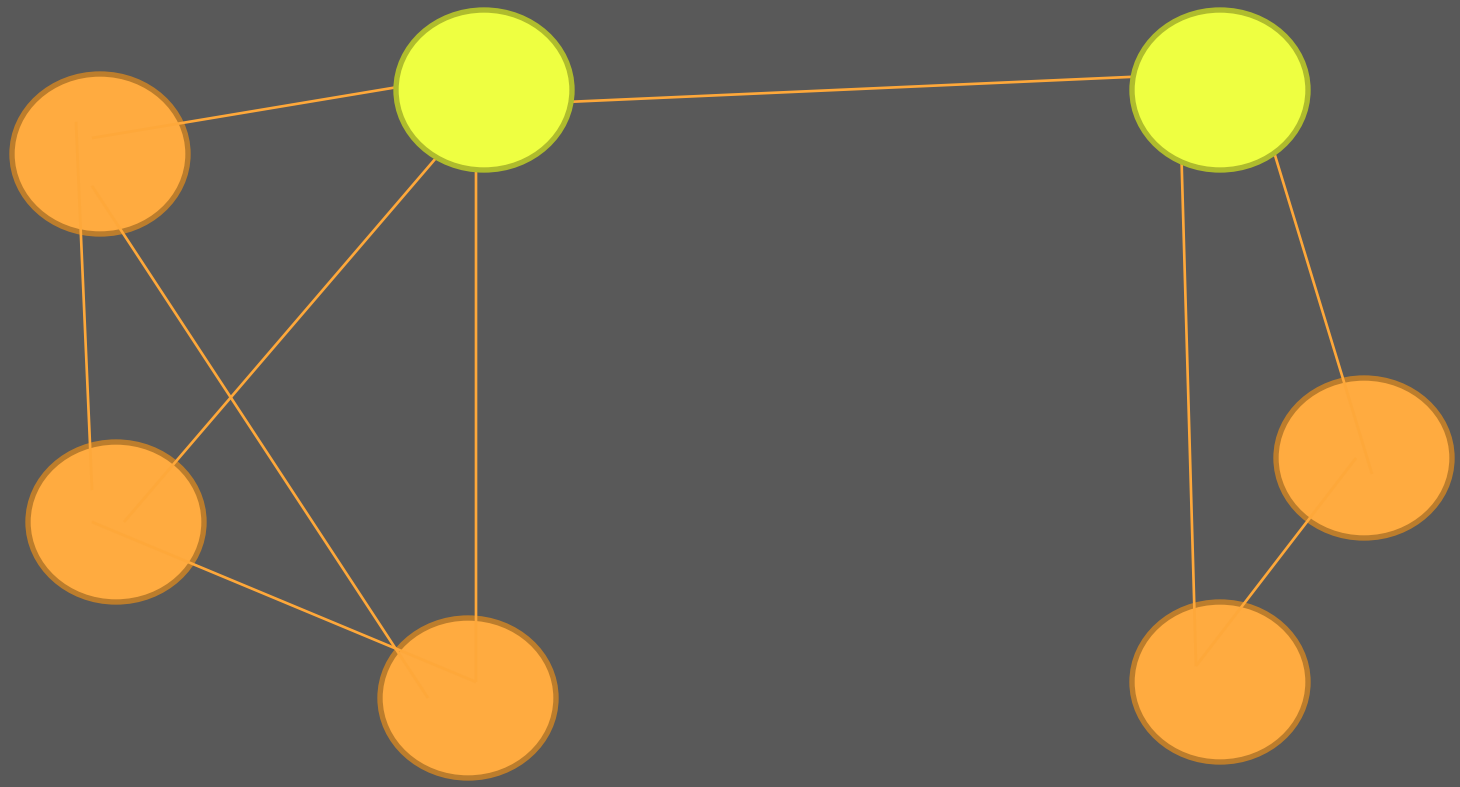
1975, describing experience at IBM developing OS/360

PROCESS COSTS



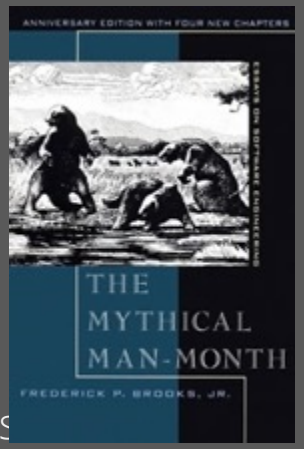
$n(n-1)/2$
communication links

PROCESS COSTS



IBM 1971

BROOK'S SURGICAL TEAMS



Chief programmer – most programming and initial documentation

Support staff

- Copilot: supports chief programmer in development tasks, represents meetings
- Administrator: manages people, hardware and other resources
- Editor: editing documentation
- Two secretaries: one each for the administrator and editor
- Program clerk: keeps records of source code and documentation
- Toolsmith: builds specialized programming tools
- Tester: develops and runs tests
- Language lawyer: expert in programming languages, provides advice on producing optimal code.

MICROSOFT'S SMALL TEAM PRACTICES

- Vision statement and milestones (2-4 month), no formal spec
- Feature selection, prioritized by market, assigned to milestones
- Modular architecture
  - Allows small federated teams (Conway's law)
- Small teams of overlapping functional specialists

Windows 95: 200 developers and testers, one of 250 products

MICROSOFT'S SMALL TEAM PRACTICES

Feature Team

- 3-8 developers (design, develop)
- 3-8 testers (validation, verification, usability, market analysis)
- 1 program manager (vision, schedule communication; leader, facilitator) – working on several features
- 1 product manager (marketing research, plan, betas)

MICROSOFT'S SMALL TEAM PRACTICES

"Synchronize and stabilize"

For each milestone

- 6-10 weeks feature development and continuous testing
  - frequent merges, daily builds
- 2-5 weeks integration and testing (“zero-bug release”, external betas)
- 2-5 weeks buffer

AMAZON TEAMS

AGILE PRACTICES E.G., SCRUM

7+/-2 team members, collocated

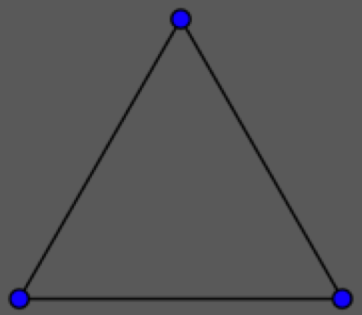
Self managing

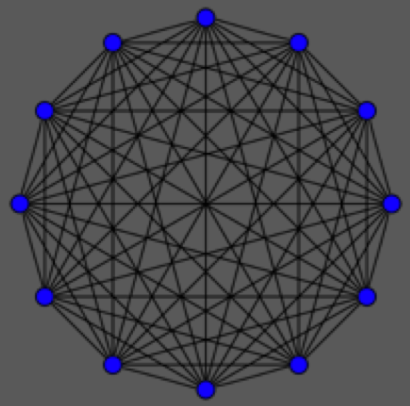
Scrum master (rotating role)

Product owner / customer representative

Large teams (29 people) create around six times as many defects as small teams (3 people) and obviously burn through a lot more money. Yet, the large team appears to produce about the same mount of output in only an average of 12 days' less time. This is a truly astonishing finding, through it fits with my personal experience on projects over 35 years.

- Phillip Amour, 2006, CACM 49:9





ESTABLISH COMMUNICATION PATTERNS

Avoid overhead

Ensure reliability

Constraint latency

e.g. Issue tracker vs email; online vs face to face

Design opportunity

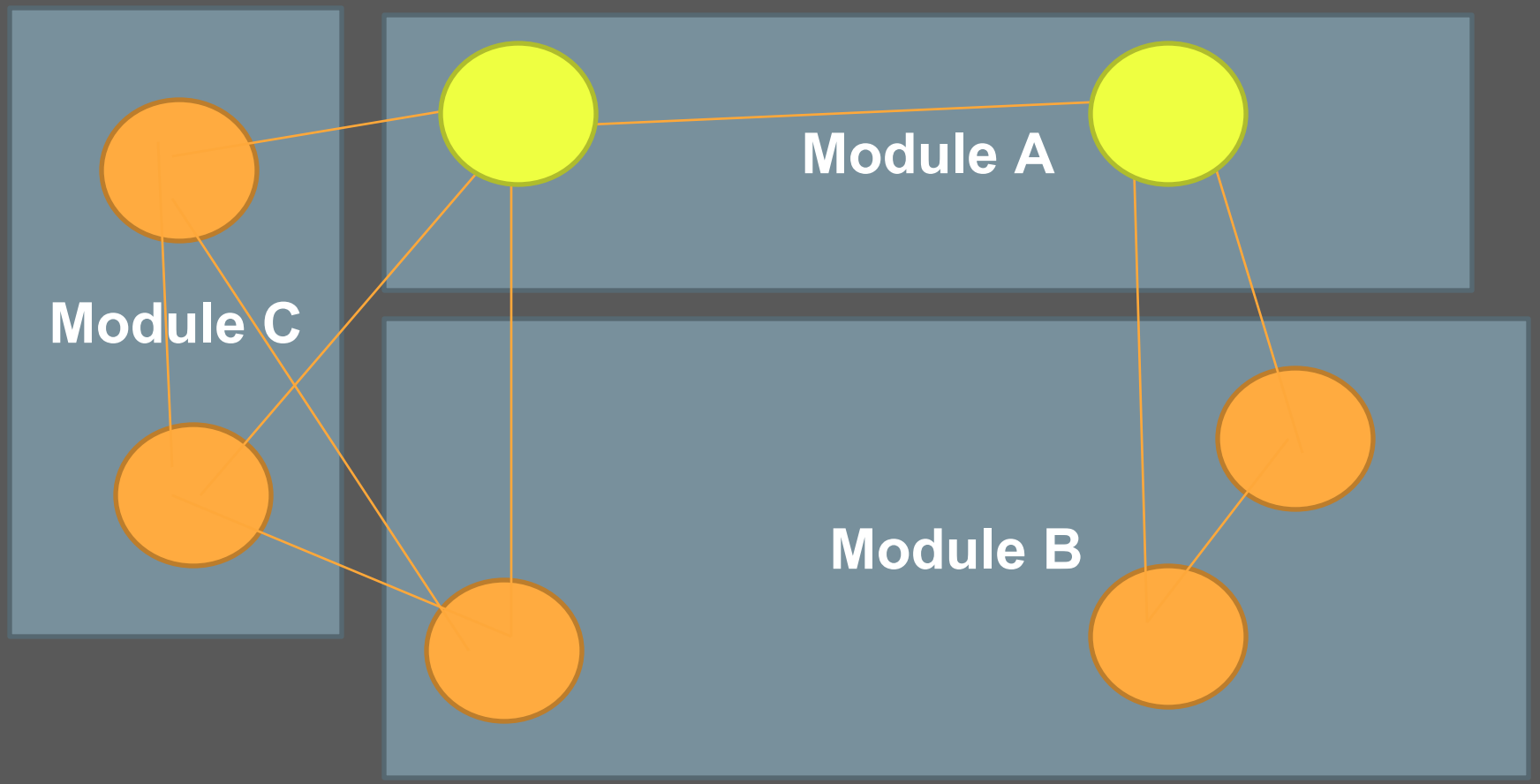
CONWAY'S LAW

"Any organization that designs a system (defined broadly) will produce a design whose structure is a copy of the organization's communication structure."

— *Mel Conway, 1967*

"If you have four groups working on a compiler, you'll get a 4-pass compiler."

CONGRUENCE



SOCIO-TECHNICAL CONGRUENCE

Structural congruence

Geographical congruence

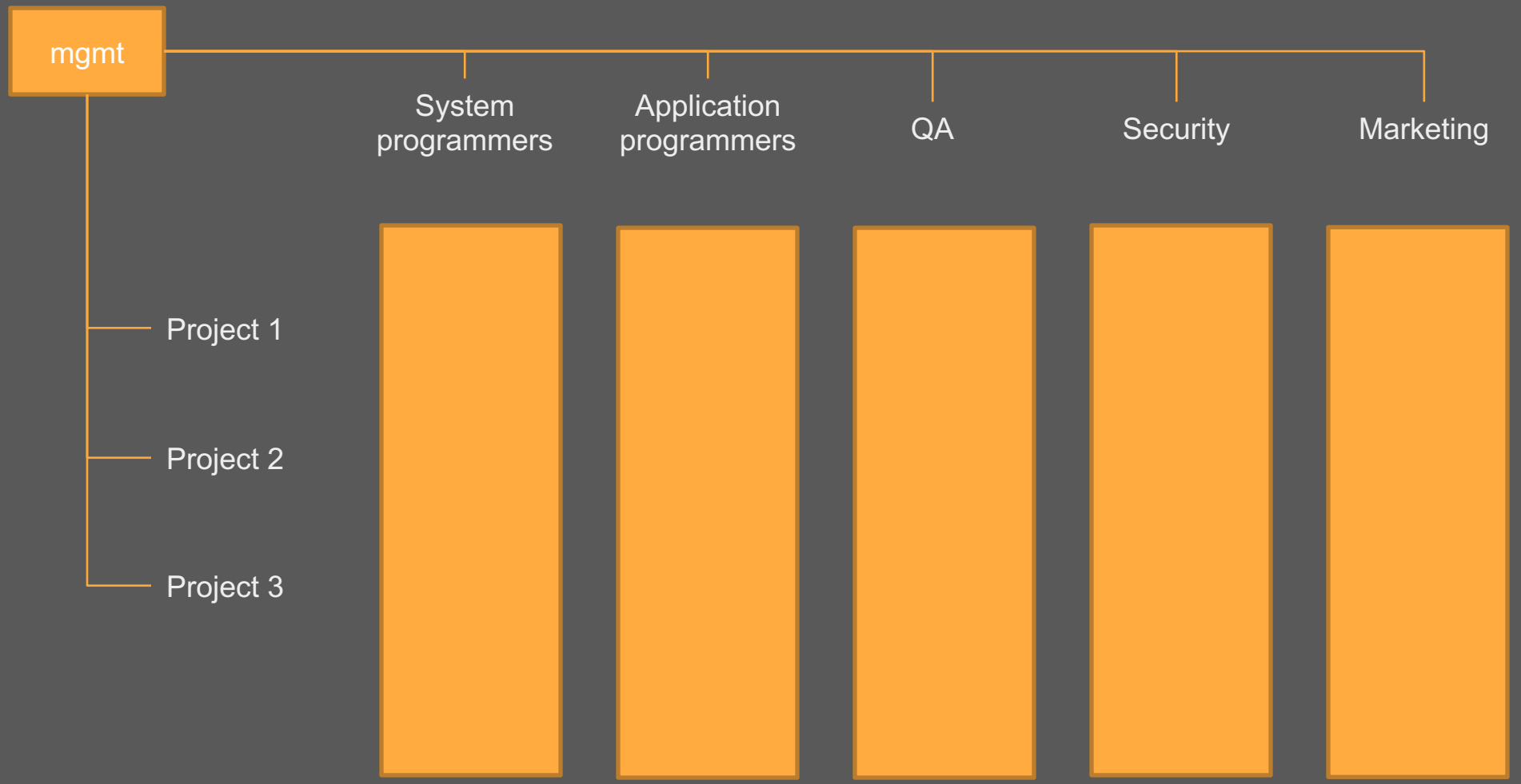
Task congruence

IRC communication congruence

TEAMWORK GUIDELINES

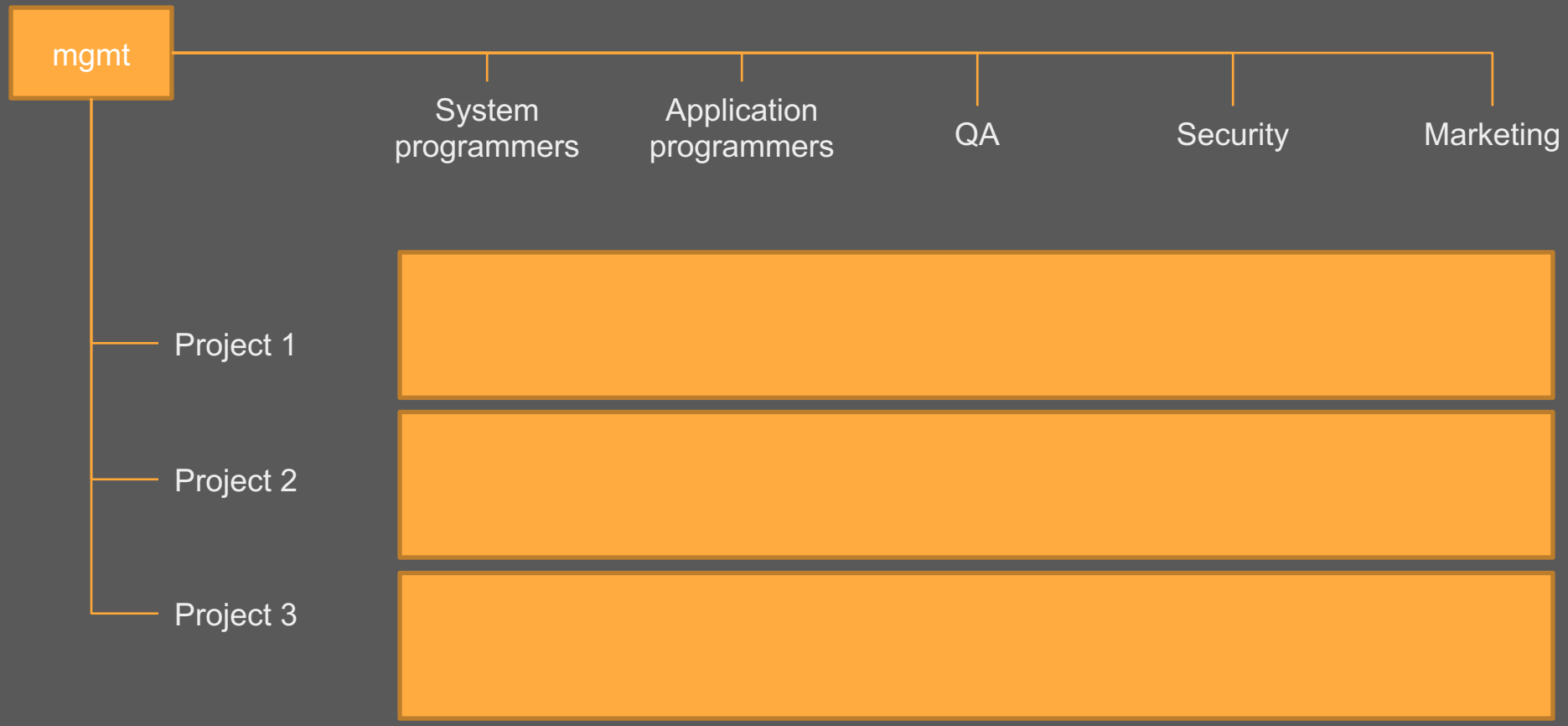
- Respect Conway's Law
  - Code structure and team structure should align
- Seek well-defined, stable interfaces

MATRIX ORGANIZATION



Temporary assignment to projects; flexible staffing

PROJECT ORGANIZATION



CASE STUDY: BRØDERBUND

As the functional departments grew, staffing the heavily matrixed projects became more and more of a nightmare. To address this, the company reorganized itself into “Studios”, each with dedicated resources for each of the major functional areas reporting up to a Studio manager. Given direct responsibility for performance and compensation, Studio managers could allocate resources freely.

The Studios were able to exert more direct control on the projects and team members, but not without a cost. The major problem that emerged from Brøderbund’s Studio reorganization was that members of the various functional disciplines began to lose touch with their functional counterparts. Experience wasn’t shared as easily. Over time, duplicate effort began to appear.

CASE STUDY


Brøderbund
SOFTWARE


Broderbund Software PRESENTS...
THE PRINT SHOP™
BY DAVID BALSAM & MARTIN KAHN
COPYRIGHT 1984 PIXELLITE SOFTWARE
ALL RIGHTS RESERVED


MYST


WHERE IN THE WORLD IS
CARMEN SANDIEGO?
DELUXE EDITION


PRINCE of PERSIA
©Copyright 1990 Jordan Mechner

COMMITMENT & ACCOUNTABILITY

Conflict is useful, expose all views

Come to decision, commit to it

Assign responsibilities

Record decisions and commitments; make record available

VIRTUAL TEAMS

SPOTIFY SQUADS

PRINCIPLES

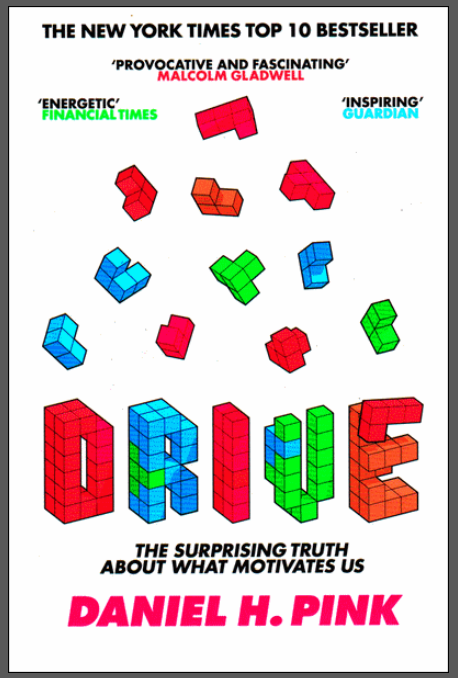
Rules are a good start, then break them when needed

Agile > Scrum

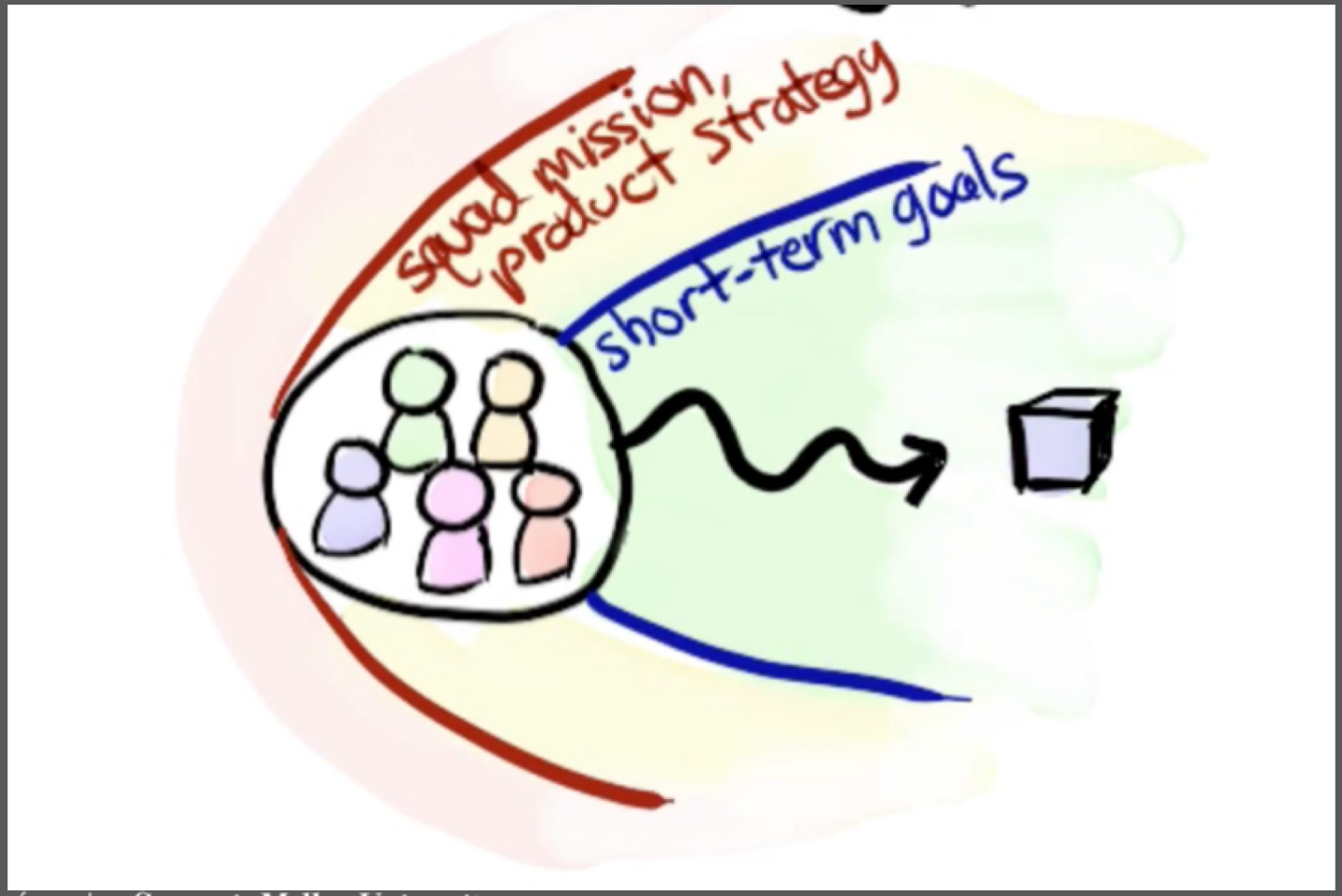
Principles > Practices

Autonomy, Mastery, Purpose

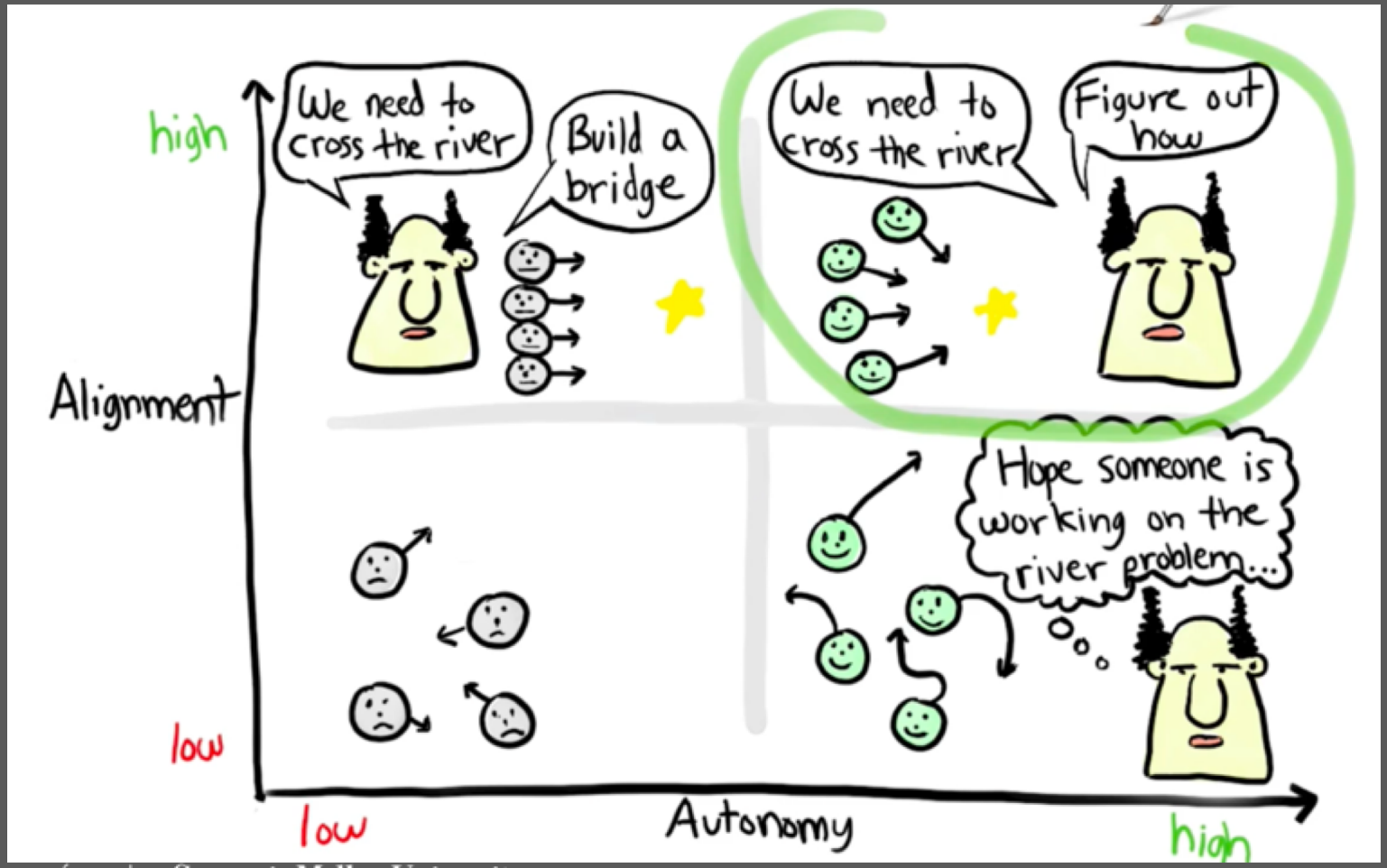
Be autonomous, but don't sub-optimize!



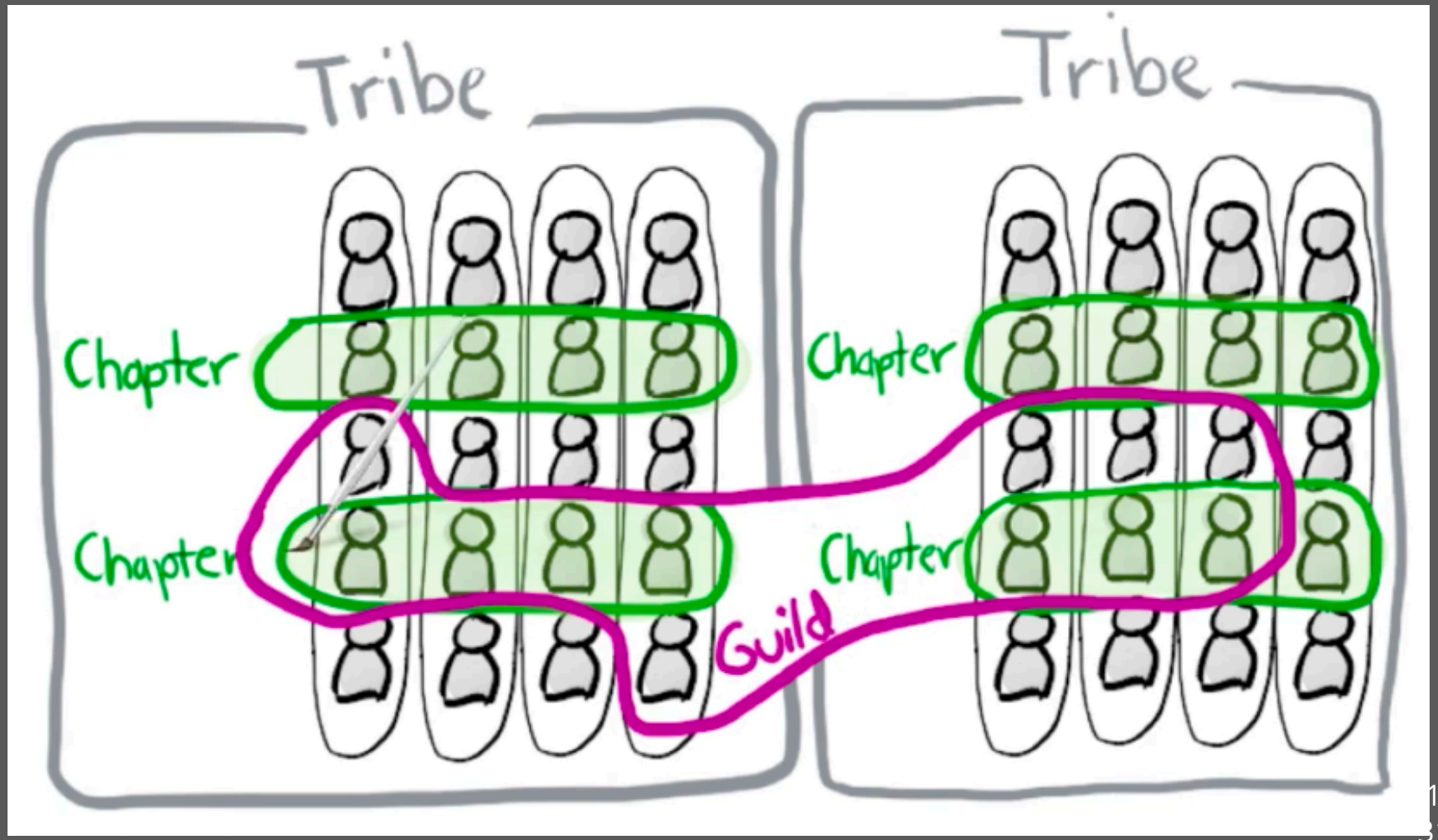
AUTONOMOUS SQUADS



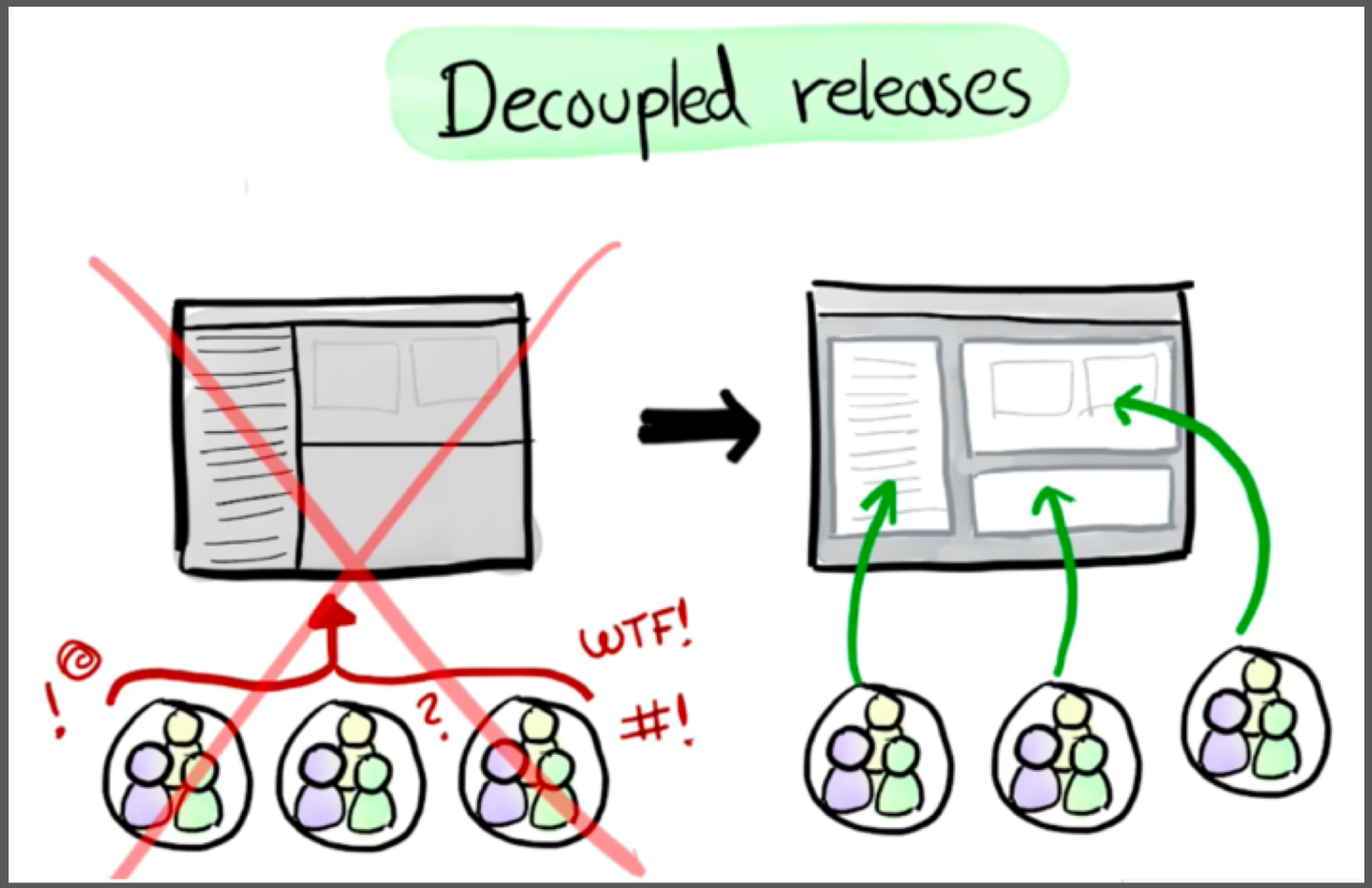
ALIGNED AUTONOMOUS SQUADS



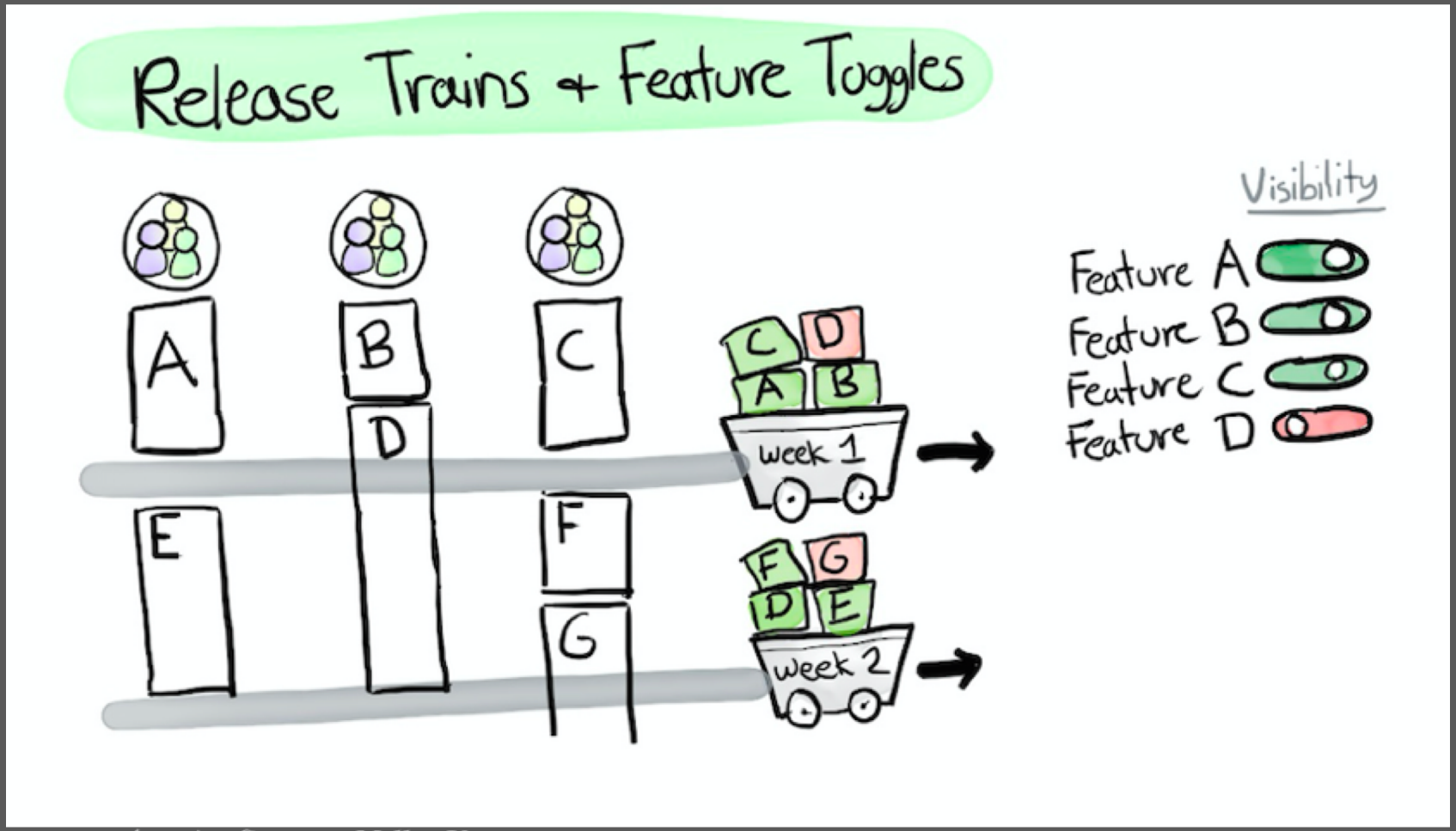
SQUADS, TRIBES, CHAPTERS, GUILDS



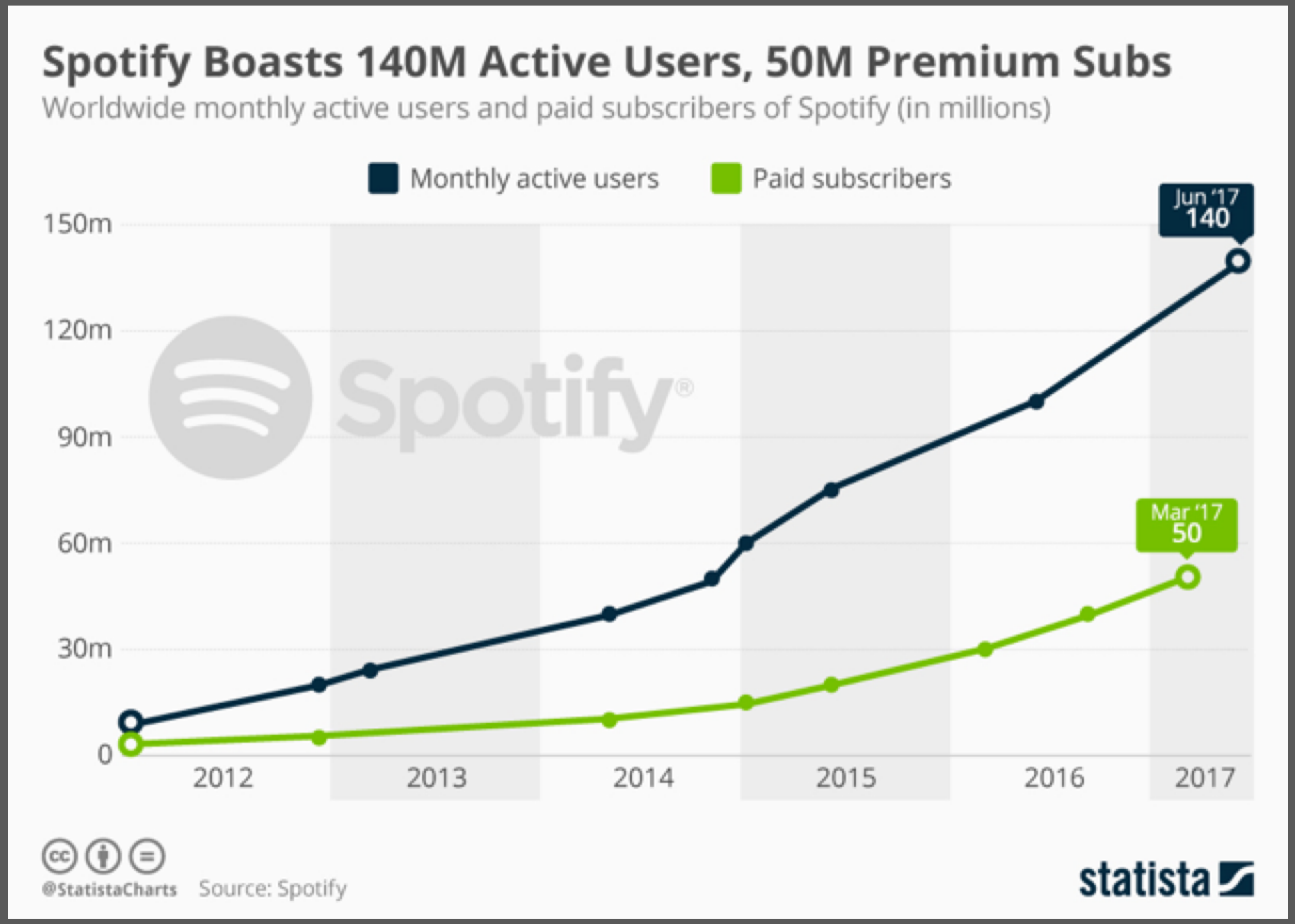
GETTING INTO PRODUCTION



DECOUPLE TEAMS AND RELEASES



CONTEXT


Spotify Boasts 140M Active Users, 50M Premium Subs
Worldwide monthly active users and paid subscribers of Spotify (in millions)
Monthly active users
Paid subscribers
150m
120m
90m
60m
30m
0
2012
2013
2014
2015
2016
2017
Jun '17
140
Mar '17
50
Spotify
@StatistaCharts
Source: Spotify
statista

DISCUSSION

Benefits?

Challenges?

Implementation pitfalls?

GENERAL GUIDELINES

HINTS FOR TEAM FUNCTIONING

Trust them; strategic not tactical direction

Reduce bureaucracy, protect team

Physical colocation, time for interaction

Avoid in-team competition (bonuses etc)

Time for quality assurance, cult of quality

Realistic deadlines

Peer coaching

Sense of elitism

Allow and encourage heterogenity

DeMarco and Lister. Peopleware. Chapter 23

TEAM FUSION

Forming, Storming, Norming, Performing

Preserve existing teams, resist project mobility

ELITISM CASE STUDY: THE BLACK TEAM

Legendary team at IBM in the 1960s

Group of talented ("slightly better") testers

- Goal: Final testing of critical software before delivery

Improvement over first year

Formed team personality and energy

- "adversary philosophy of testing"
- Cultivated image of destroyers
- Started to dress in black, crackled laughs, grew mustaches

Team survived loss of original members

DeMarco and Lister. Peopleware. Chapter 22

TROUBLESHOOTING TEAMS

Cynicism as warning sign

Training to improve practices

Getting to know each other; celebrate success; bonding over meals

“A meeting without notes is a meeting that never happened”

HOW DO TEAMS WORK TOGETHER?

DEVELOPER TURNOVER

LOCAL AND REMOTE TEAMS?
POST-COVID TEAMS?

institute for SOFTWARE RESEARCH | Carnegie Mellon University School of Computer Science

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

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

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

see also DeMarco and Lister, Peopleware, Chapter 19

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.

see also DeMarco and Lister, Peopleware, Chapter 19

MOTIVATING PROGRAMMERS

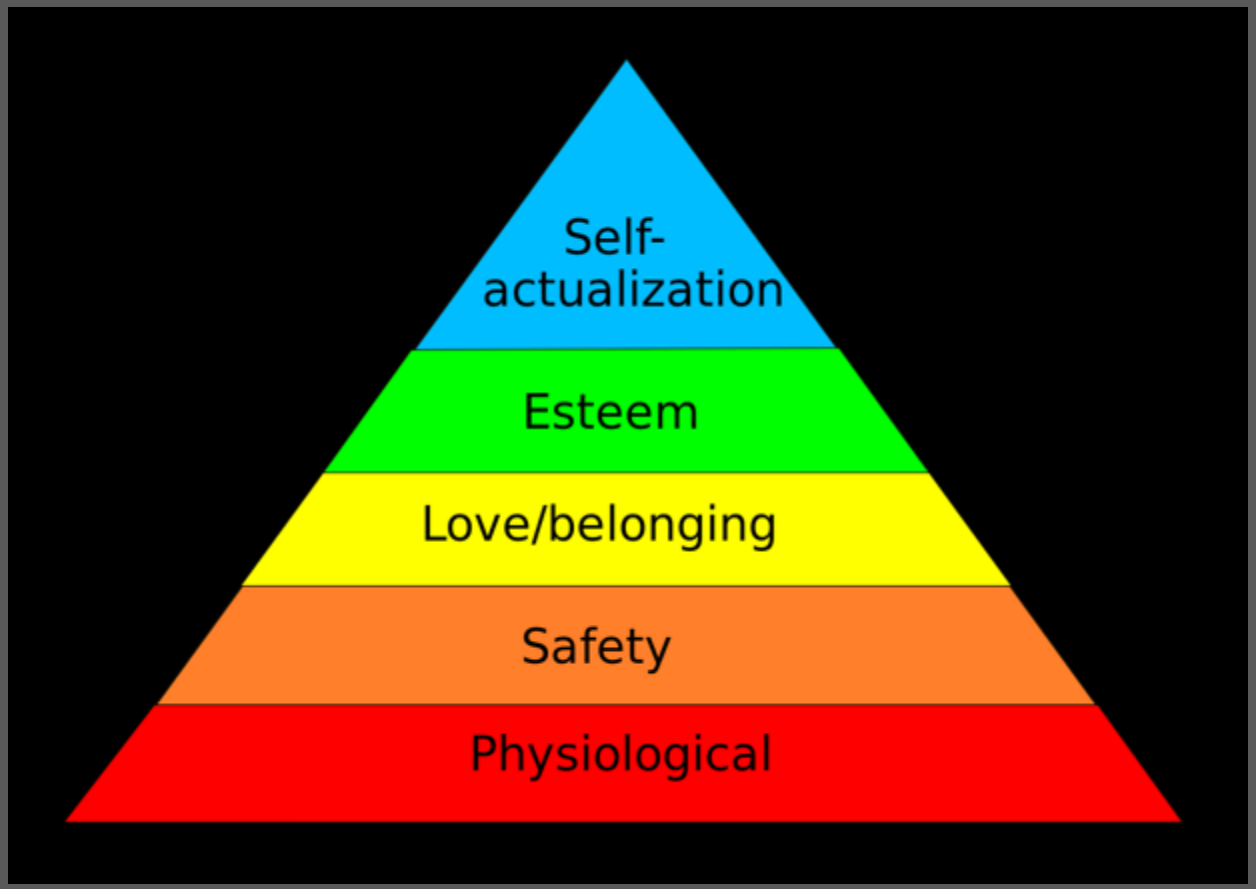
THEORIES

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)

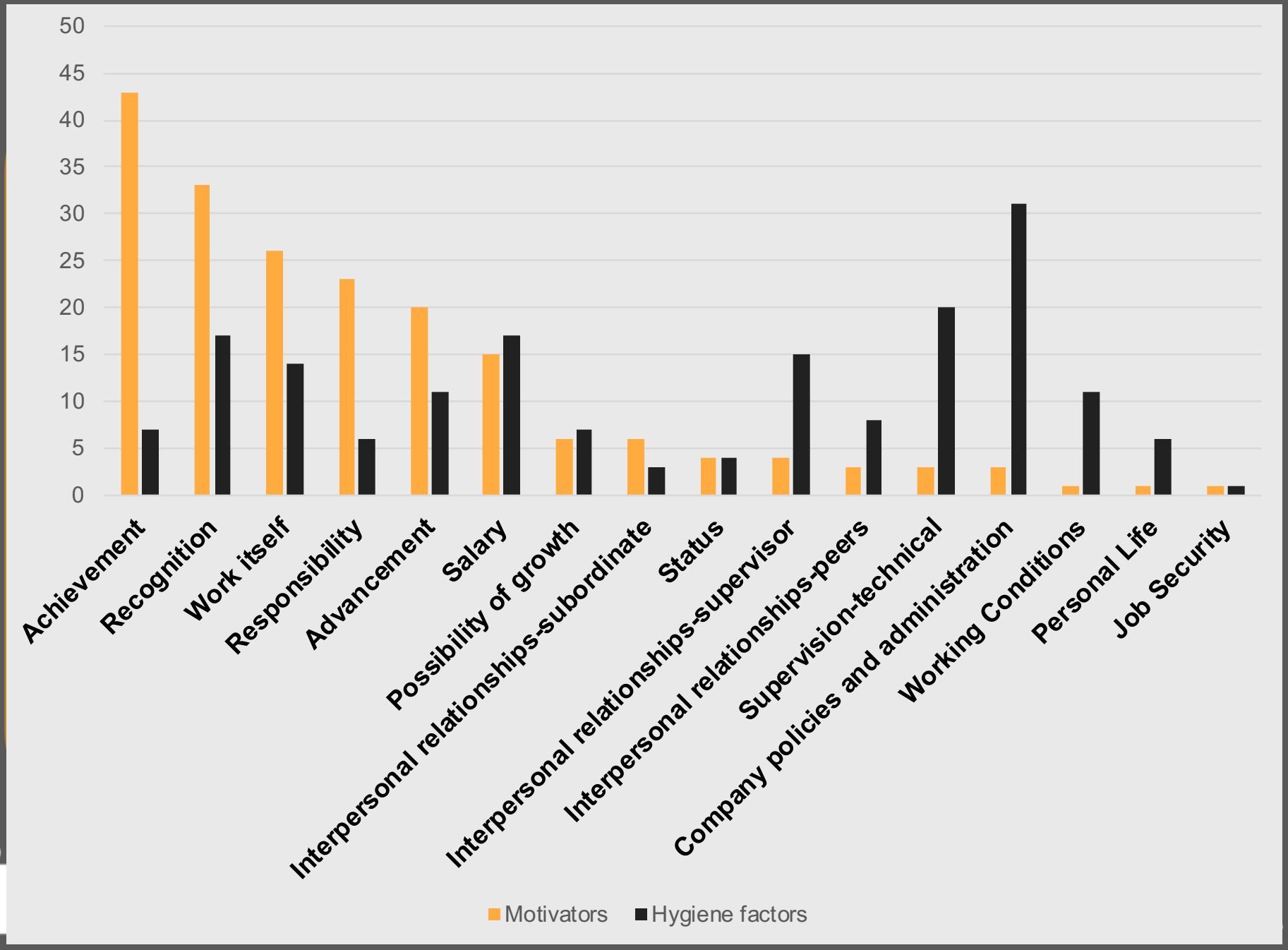
Different factors for satisfaction and dissatisfaction

Addressing dissatisfaction does not lead to satisfaction

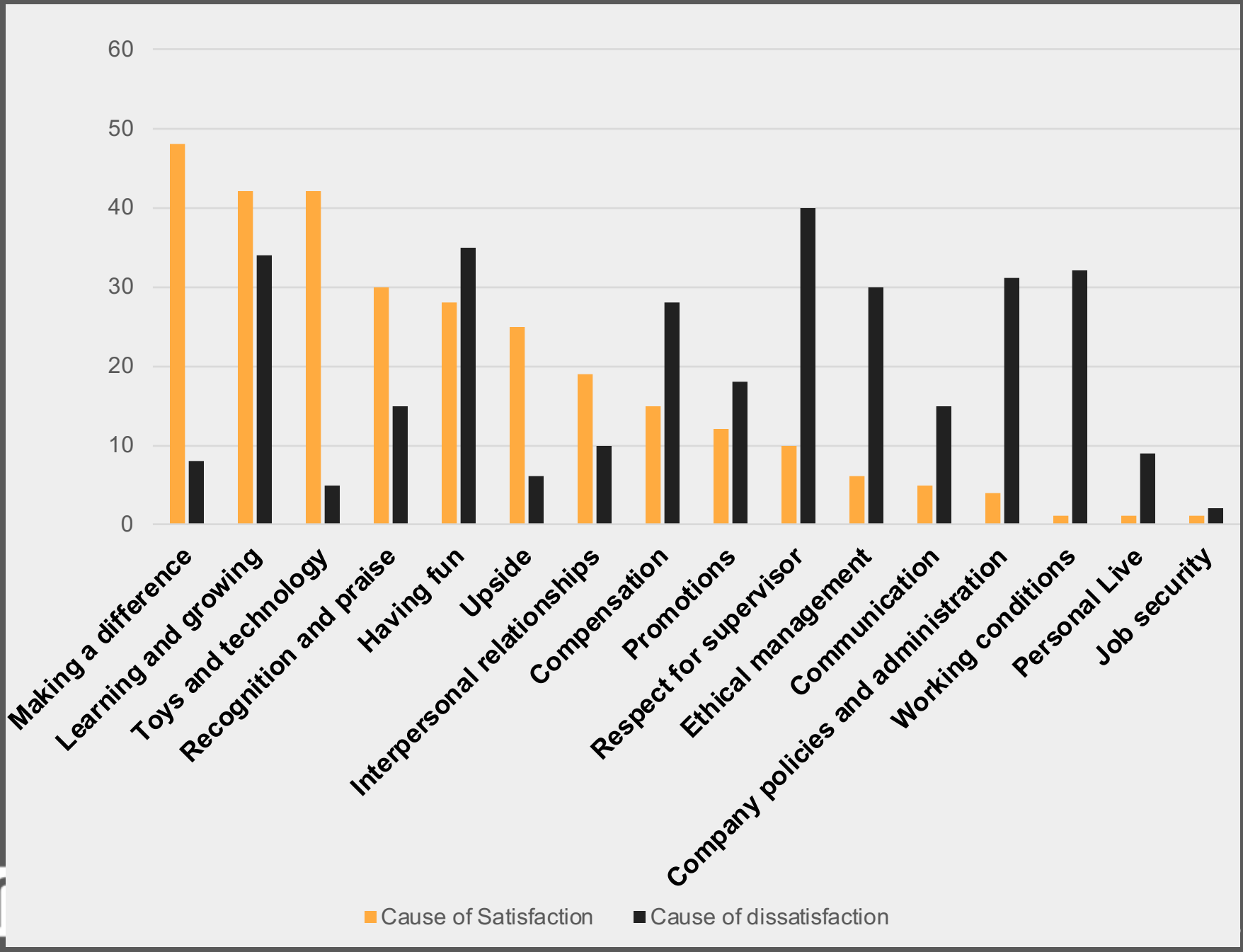
Step 1: Eliminate dissatisfaction

Step 2: Create condition for satisfaction

(Observation by Mantle and Lichty, not empirical data)



(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

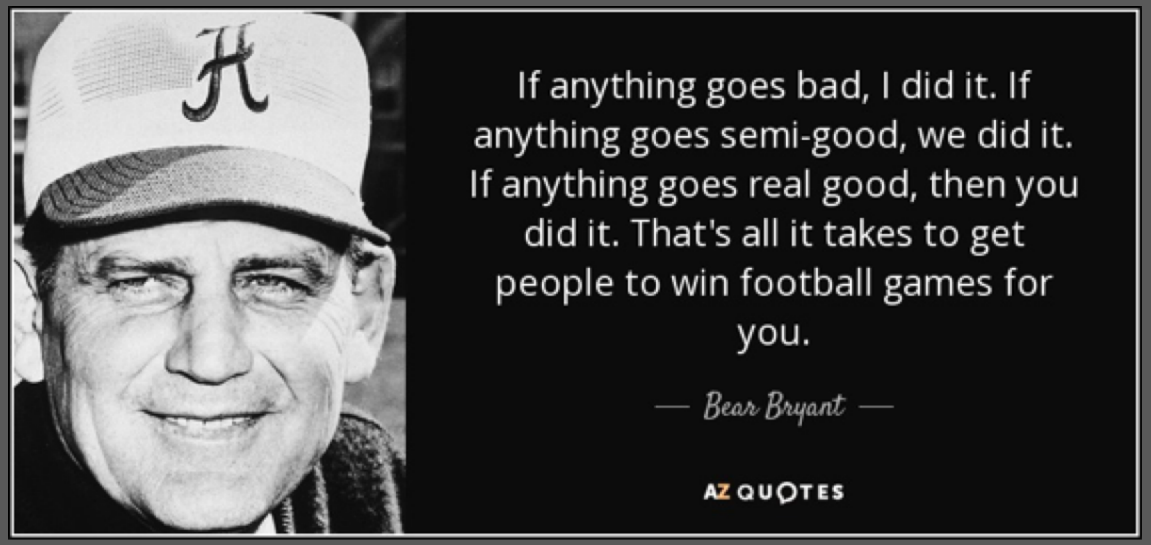
- Making a difference
  - worthy goals, longterm vision
  - Steve Jobs when recruiting John Scully from Pepsi: “Do you want to sell sugar water or change to world”
- Toys and technology
  - modern hardware, large screens, phones, ...

ADDRESSING MOTIVATING FACTORS SELECTIVE

Recognition and praise

praise loudly and specifically, blame softly/privately

celebrate success



WHY DO ENGINEERS CHOOSE TO JOIN PARTICULAR TEAMS?

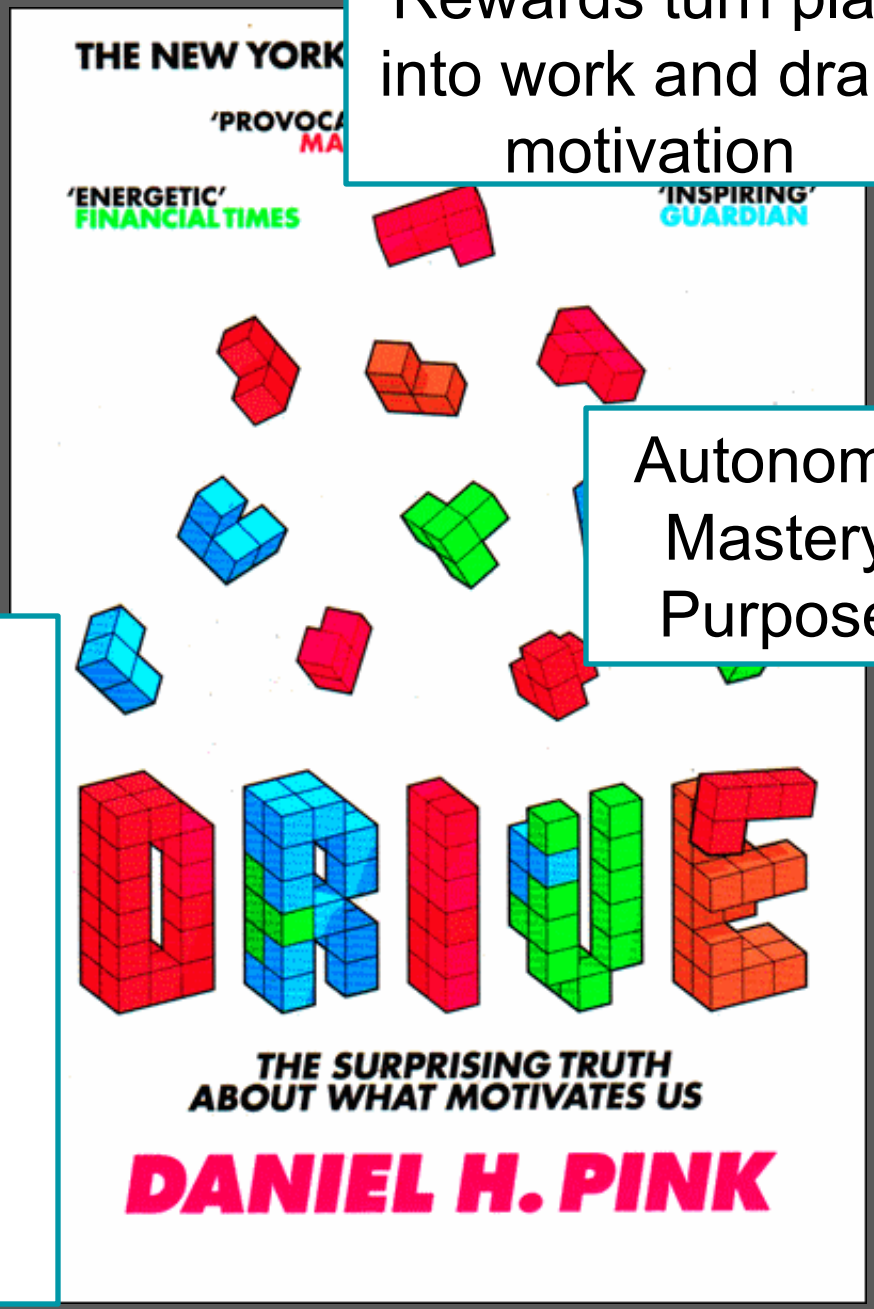
Reasons grouped by clustering analysis	Percent
Liked new team and/or technology (exciting, manager)	**85.8%**
Coworker asked me to join (new team, old team)	**37.8%**
Joined for better opportunities (location, domain, lack of other options)	**24.5%**
Followed my manager (former or current)	**14.6%**

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

REWARDS AKA GRINDING

TUCKMAN, 1965: FORMING, STORMING, NORMING, PERFORMING

Forming: team meets and learns about challenges, agrees on goals, begins to work.

- Team members: (1) Behave independently. (2) May be motivated, but relatively uninformed about goals, (3) usually on their best behavior (albeit self-involved)

Storming: participants form opinions about one another, possibly leading to conflict.

- May voice opinions or question leader, especially if someone shirking responsibility or attempting to dominate.
- Disagreements and conflicts must be resolved before team can progress; may regress if new challenges arise.
- Stage can be destructive, but can lead to a better team in the long run if effective resolution tactics established.

Norming: Resolved conflicts leads to a spirit of co-operation.

- Team shares a common goal for which everyone takes responsibility.
- Tolerate one another, move on from individual challenges.
- Danger: too much avoidance of conflict can lead to avoidance of controversial ideas.

Performing: group members focus on achieving common goals.

- Everyone is now competent and can make decisions without supervision. Dissent is allowed if it's through acceptable channels.
- Supervisors are almost always participating.

Upshot: Preserve existing teams, resist project mobility.

- Tradeoffs? Compared to practices you've seen in companies?

FURTHER READING

Mantle and Lichty. Managing the Unmanageable. Addison-Wesley, 2013

Very accessible and practical tips at recruiting and managment

DeMarco and Lister. Peopleware. 3rd Edition. Addison Wesley, 2013

Anecdotes, stories, and tips on facilitating teams, projects, and environments

Pink. Drive: The Surprising Truth About What Motivates Us. Riverhead 2011

Detailed discussion of motivating factors for creative people

Sommerville. Software Engineering. 8th Edition. Chapter 25