Collaboration

CS 278 | Stanford University | Michael Bernstein

Exam

Closed-book exam on paper

Questions sampled from the question bank of top questions from voting. Question bank posted in advance.

- Roughly 1/4 Easy questions, 1/4 Medium questions, 1/4 Hard questions…
- And 1/4 staff-written questions

Study groups OK, but no collaboration on or sharing notes or answers

Details on the website

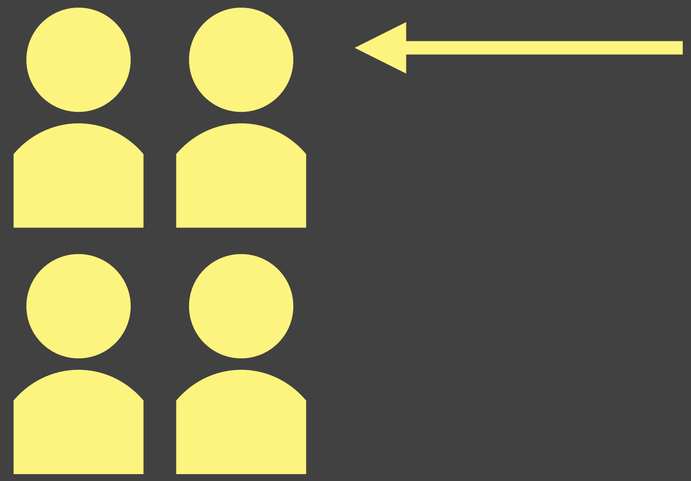
Last time

Shifting from simple wisdom-of-the-crowd tasks requires much more than just a scaling up of ambition: it requires designing for interdependence.

Peer production — the term encompassing shared open work (e.g., Wikipedia, open source) is one powerful method for volunteer coordination. Workflows and algorithms offer another approach. Both have their issues.

Aiming higher means we will need to solve issues of convergence and coordinated adapatation.

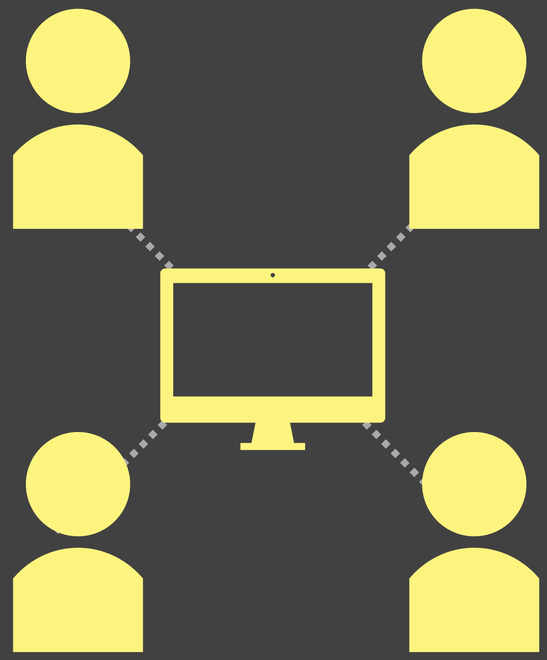
Which team is more effective?



Colocated team
has: a room

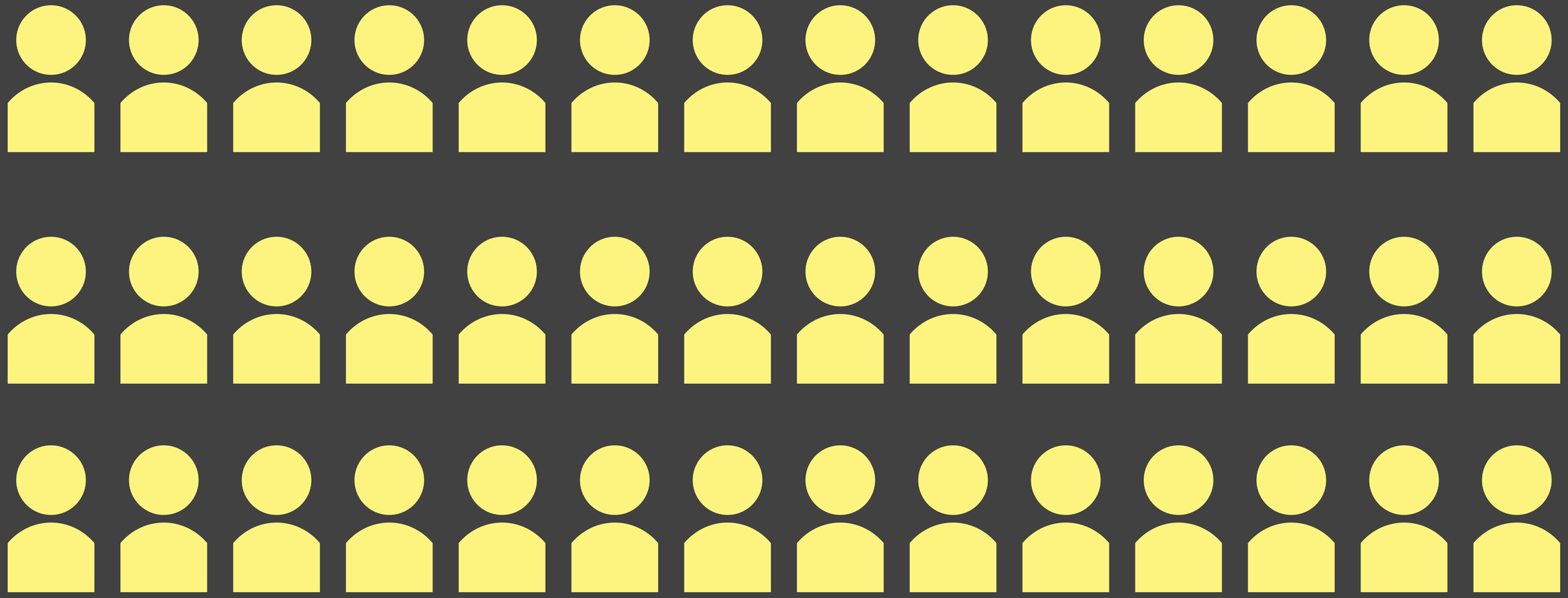
2:1 more effective
[Olson and Olson 2000; Espinosa 2011; Björn 2014; Hu et al. 2022]

Why? And what can we do about it?

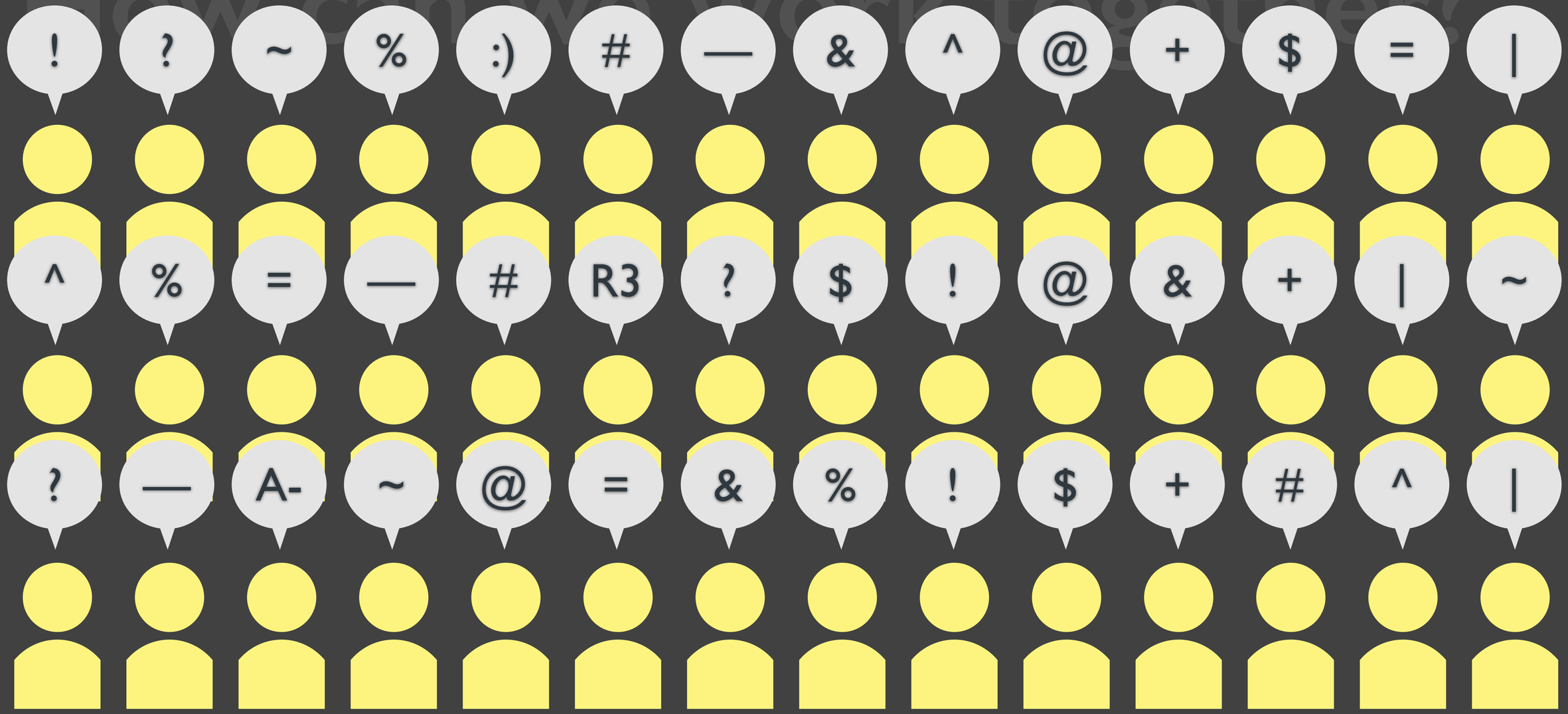


Distributed team
has: Zoom, Slack, Trello, Dropbox, GitHub, Asana, Google Docs, Jira

How can we work together?



How can we work together?



COORDINATION NEGLECT: HOW LAY THEORIES OF ORGANIZING COMPLICATE COORDINATION IN ORGANIZATIONS

Out of Sight, Out of Sync: Understanding Conflict in Distributed Teams

The Mutual Knowledge Problem and Its Consequences for Dispersed Collaboration

The team scaling fallacy: Underestimating the declining efficiency of larger teams

Who's in Charge Here? How Team Authority Structure Shapes Team Leadership

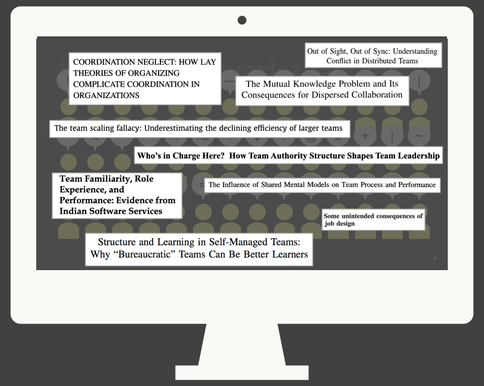
Team Familiarity, Role Experience, and Performance: Evidence from Indian Software Services

The Influence of Shared Mental Models on Team Process and Performance

Some unintended consequences of job design

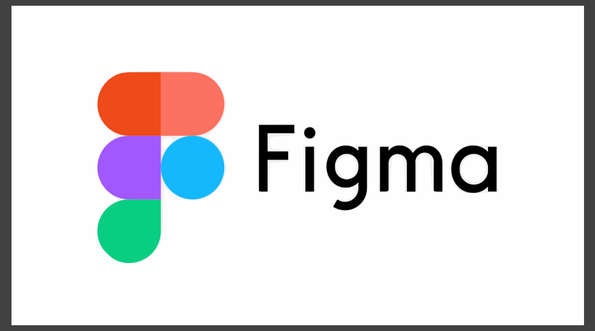
Structure and Learning in Self-Managed Teams: Why "Bureaucratic" Teams Can Be Better Learners

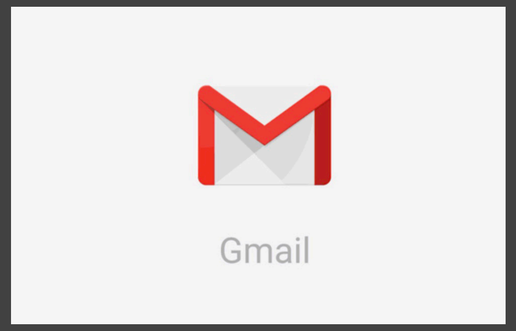
How might computing augment us in working together?



What tools do we use?

Others?





What design patterns make them successful? [2min]

"Crowdsourcing" example submitted by Steven Le

In 2014, over a million people on Twitch played Pokémon Red by typing commands into chat. They beat the game in 16 days. Because the game was turn-based and included voting between "Anarchy" and "Democracy" modes, the crowd could self-organize

0.5% extra credit for examples relevant to recent or upcoming lectures. Submit on Ed under the "Extra Credit" category

Attendance

Today

How do we design tools for effective remote collaboration?

Topics

- Beyond being there
- Social translucence
- Grudin's paradox
- Remote work

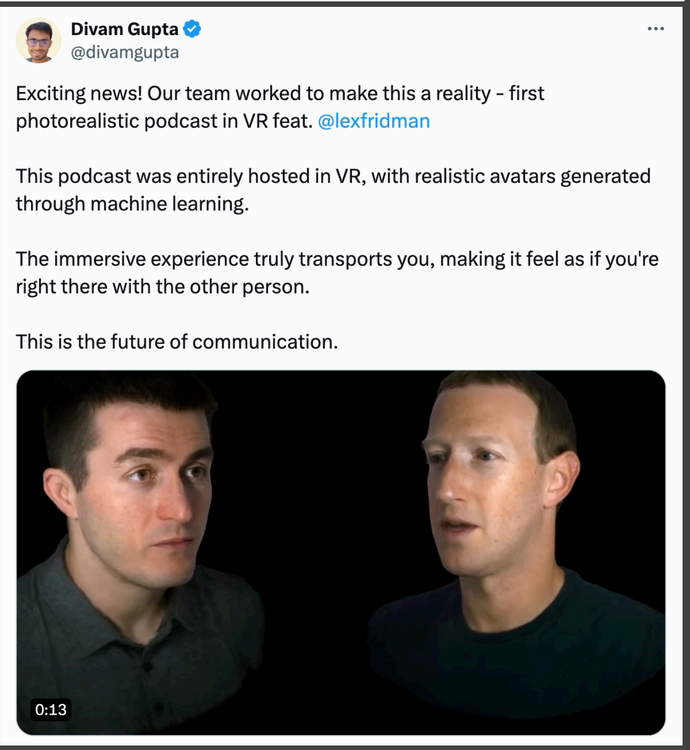
Beyond being there

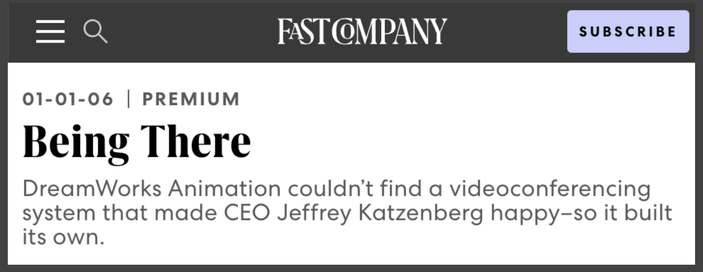
Goal: being there

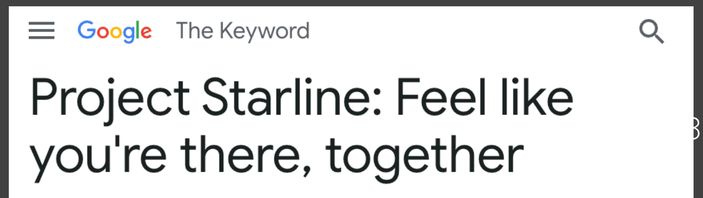
Our main goal is to increase fidelity: to try and make the channel have increased richness, allowing for more and more social cues. [Daft and Lengel 1986]

- Let's make Zoom and FaceTime have lower delays, higher resolution, and 3D VR or AR scenes
- Let's make coding collaboration tools as effective as if we were pair programming

Collaborate online as easily as you do in person







Beyond being there

[Hollan and Stornetta 1992]

"Being there" is the wrong goal.

We will never fully recreate the face-to-face experience. There are too many subtle cues for us to fully model or recreate them, even with hypothetical future technology.

> Network lag, immersion and comfort issues in VR, lack of shared physical context, …
>
> So, stop trying.

Beyond being there

[Hollan and Stornetta 1992]

Instead of tilting at windmills to design experiences that are as good as being there, design for beyond being there: experiences that could never have been created face-to-face.

> How could remote video bring you closer in ways that face-to-face collaboration never could?
>
> How could online coordination tools help us be more effective planners than we ever could with whiteboards and gantt charts?

Examples

Skype translating between languages in real-time and producing foreign language speech in your own voice

Tools that help teams quickly identify if they should be flat or hierarchical, encouraging or critical, and enforcing equal turn-taking [Zhou, Valentine and Bernstein 2018]

Finding just the right person to answer the hard question you are facing, immediately [McDonald and Ackerman 2000]

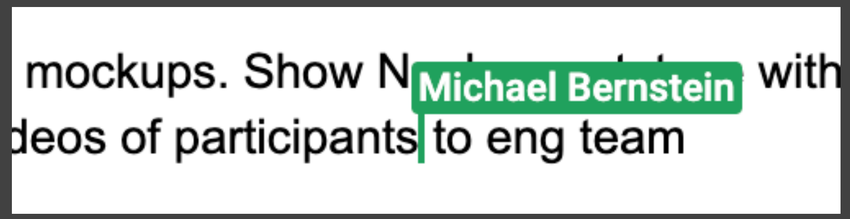
What are some collaborative superpowers you have or could have?

Social translucence

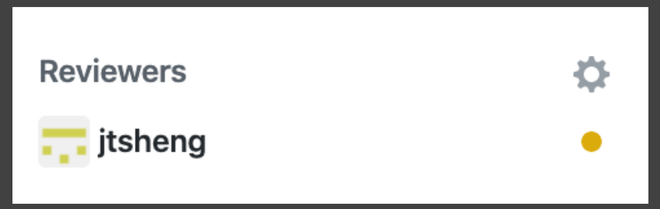
Awareness [Dourish and Bellotti 1992]

Design must allow people to understand each others' state and coordinate accordingly, to coordinate interdependencies.

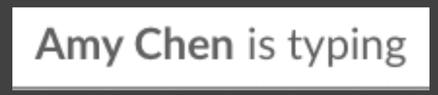
This goal is typically achieved through the design pattern of awareness: visualization of others' activities.



Google Docs



GitHub



Messaging apps

Slack

But awareness can go too far

You don't want collaborators to know everything…

- Whether you're working at every moment
- Draft emails you wrote when you were angry but didn't send
- Dumb bugs that you introduced into your code but fixed quickly before you made a git commit

So how do we walk this line?

Social translucence

[Erickson and Kellogg 2000]

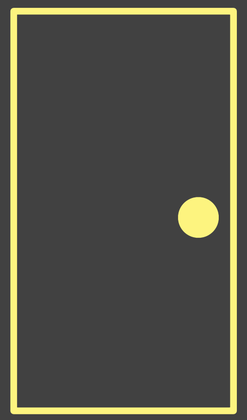
Aim for socially translucent systems: give enough information to let natural social cues take over.

Opaque systems:
no information

More transparency

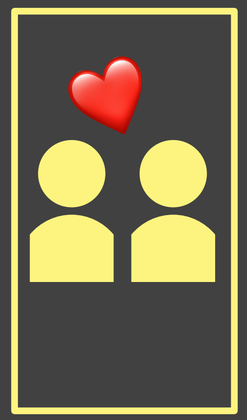
Less transparency

Transparent systems:
total information



Solid door
to a trafficked
stairwell

Door-in-the-face situation



Glass door
to a trafficked
stairwell

Everybody feels awkward

Social translucence

[Erickson and Kellogg 2000]

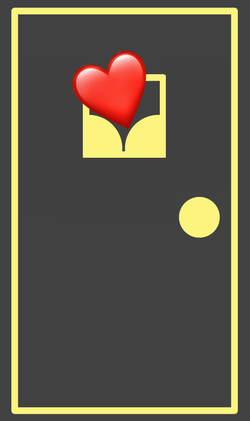
Aim for socially translucent systems: give enough information to let natural social cues take over.

Opaque systems: no information

Solid door to a trafficked stairwell

Door-in-the-face situation

Translucent systems



Windowed door

Social cues prevail

Transparent systems: total information

Glass door to a trafficked stairwell

Everybody feels awkward

Social translucence: example

[Erickson and Kellogg 2000]

Aim for socially translucent systems: give enough information to let natural social cues take over.

Opaque systems:
no information

Code isn't pushed yet…

More transparency

Less transparency

Transparent systems:
total information

Michael Bernstein is editing `importantfile.py`. He's typing `I am stupid I am stupid I am stupid I am stupid` over and over into his code editor.

Social translucence: example

[Erickson and Kellogg 2000]

Aim for socially translucent systems: give enough information to let natural social cues take over.

Opaque systems: no information

Code isn't pushed yet…

Translucent systems

Michael is working on `importantfile.py`

Transparent systems: total information

Michael Bernstein is editing `importantfile.py`. He's typing `I am stupid I am stupid I am stupid I am stupid` over and over into his code editor.

Social translucence

[Erickson and Kellogg 2000]

Two requirements for social translucence:

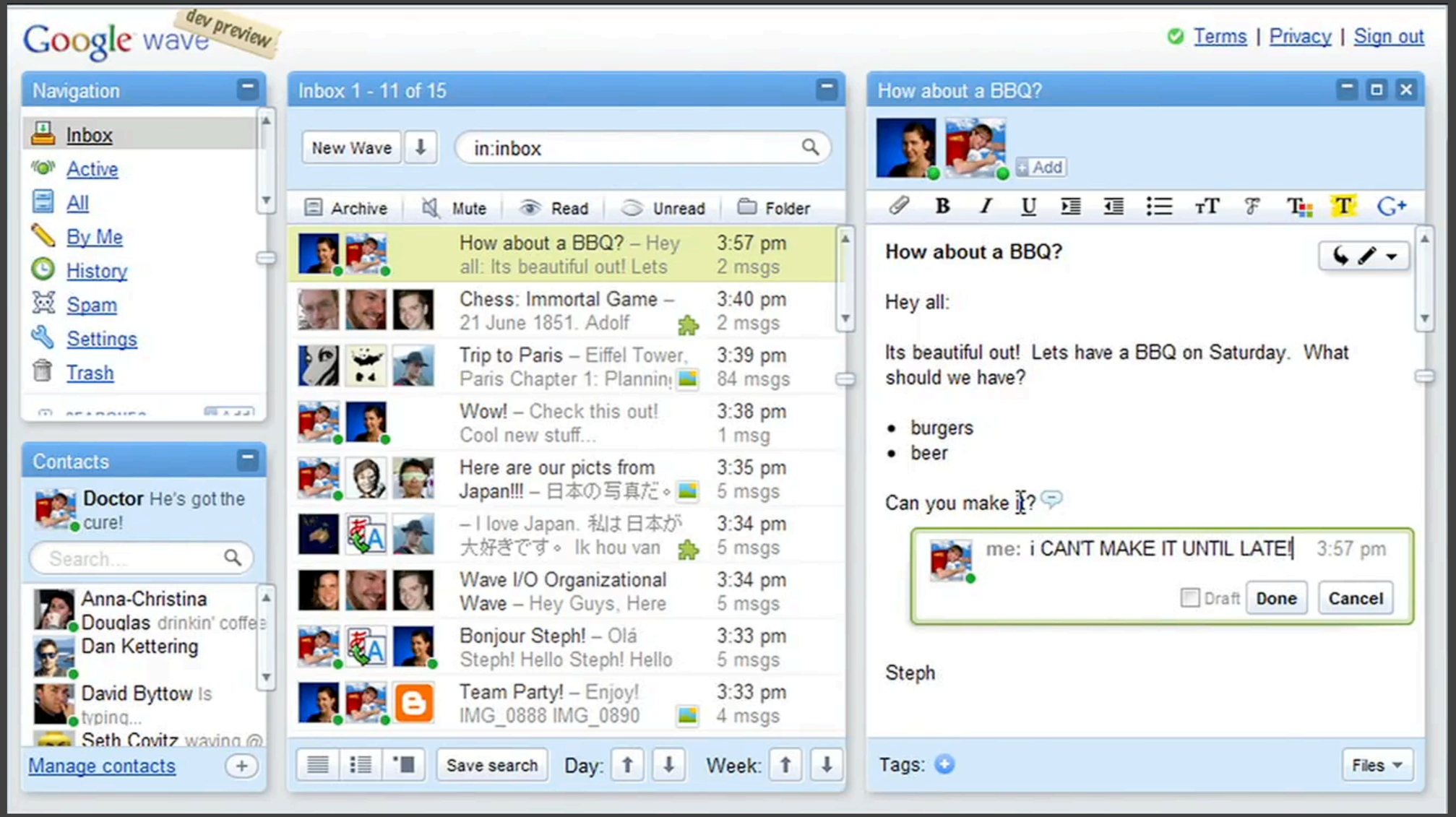
1) Awareness: others' activity can be seen — to an extent

2) Accountability: others know that their activity can be seen

If done correctly, social translucence supports interdependent work while maintaining plausible deniability when necessary.

If there's no plausible deniability in the system, people will abandon it.

Too transparent



Google Wave: Imagine if the person receiving your email could see all your drafts as you compose them, as if the email thread were a Google Doc

Grudin’s paradox

Why do so many collaborative software systems get abandoned?

Dead wikis and documentation at work

Calendars not reflecting actual person or room availability

“Oh, I don’t use that. Just send me a text instead.”

…even though these systems may even provide social translucence and go beyond being there.

Grudin's paradox [Grudin 1994]

The socio-technical system may be benefiting everyone except the people who are expected to create the information that powers it.

> What is in the product manager's interests may not be in the team members' interests. [Halverson and Ackerman 2003]

Examples:

> The manager wants everybody's calendars to be up-to-date…but the programmers don't care, and just want to work on the project.
>
> We want an API to be documented and kept up-to-date, but the people who write and actively use the software don't need the documentation.
>
> Being on Slack is distracting for the people who need to be reached

Grudin's paradox [Grudin 1994]

When a system falls prey to Grudin's paradox, it gets abandoned or circumvented.

How to avoid this? The system needs to provide benefit to all users, not asymmetric benefits.

…And not just perfunctory benefit — enough benefit to justify the work and distraction that using the system might entail.

Hate ‘em, then love ‘em

Irene Greif, who founded the field — and was the first woman to earn a PhD in CS from MIT — spent much of her career in industry research labs working on collaboration tools.

She notes that with each new generation of collaboration technology, companies are extremely wary: all they can see are the risks and the lawsuits. Even with something as simple as voicemail!

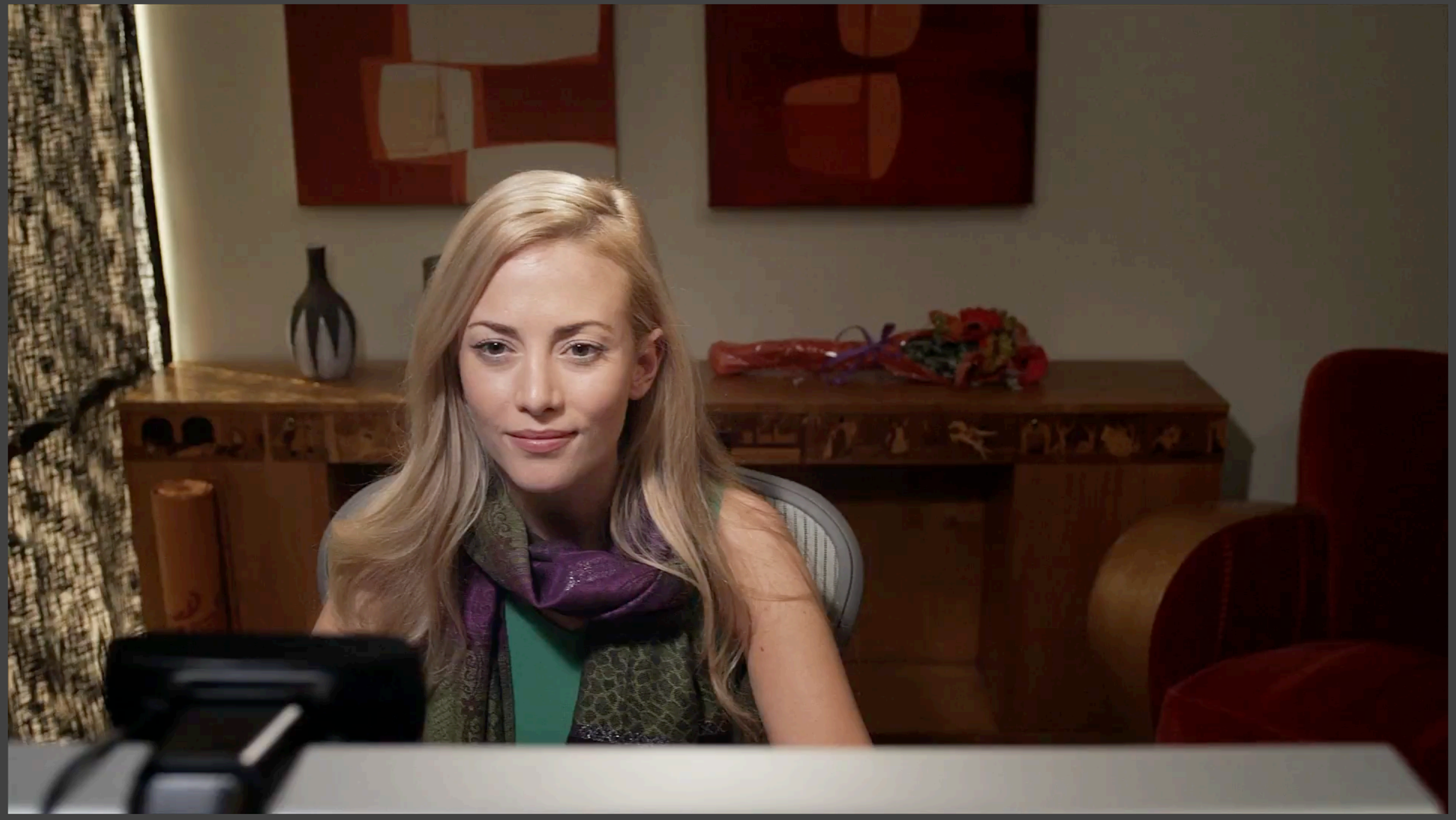
Collaboration benefits are much harder to quantify and put into dollar amounts, to balance against the risk. Only later do companies see the value and buy in.

So where are we going?

Meta Horizon Workrooms: VR remote conversations

Using today's concepts: will this succeed? [1min]

So where are we going?

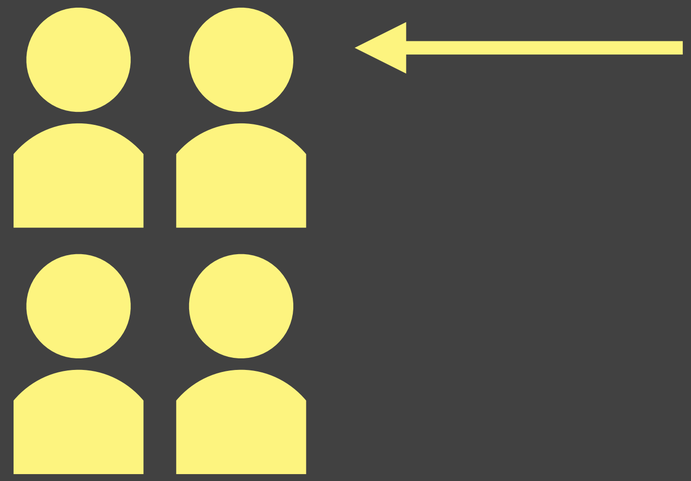


Beam: robot telepresence robot

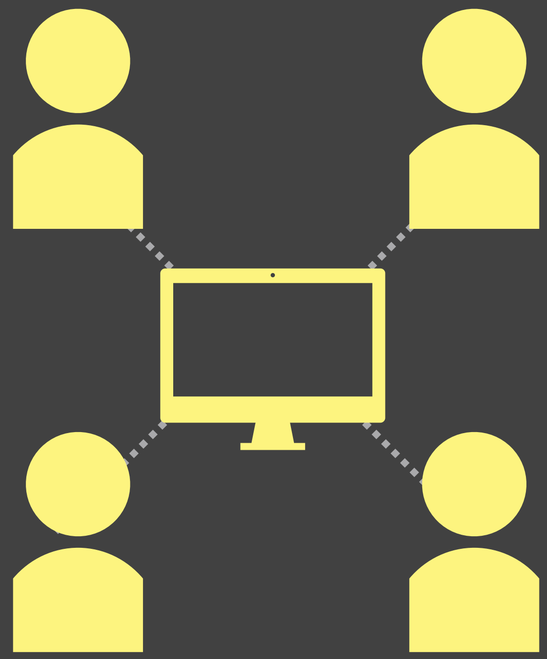
Using today's concepts: will this succeed? [1 min]

Remote work

Back to the remote team…



2:1 more effective [Olson and Olson 2000; Espinosa 2011; Björn 2014; Hu et al. 2022]



Colocated team
has: a room

Why? Under what conditions?

Distributed team
has: Zoom, Slack, Trello, Dropbox, GitHub, Asana, Google Docs, Jira

Remote work

Remote work does not harm individual execution outcomes

- Productivity outcomes go up or at least stay flat [Bloom et al. 2015; Bloom et al. 2024], possibly due to 40% of saved commute time being redirected to work [Aksoy et al. 2023]

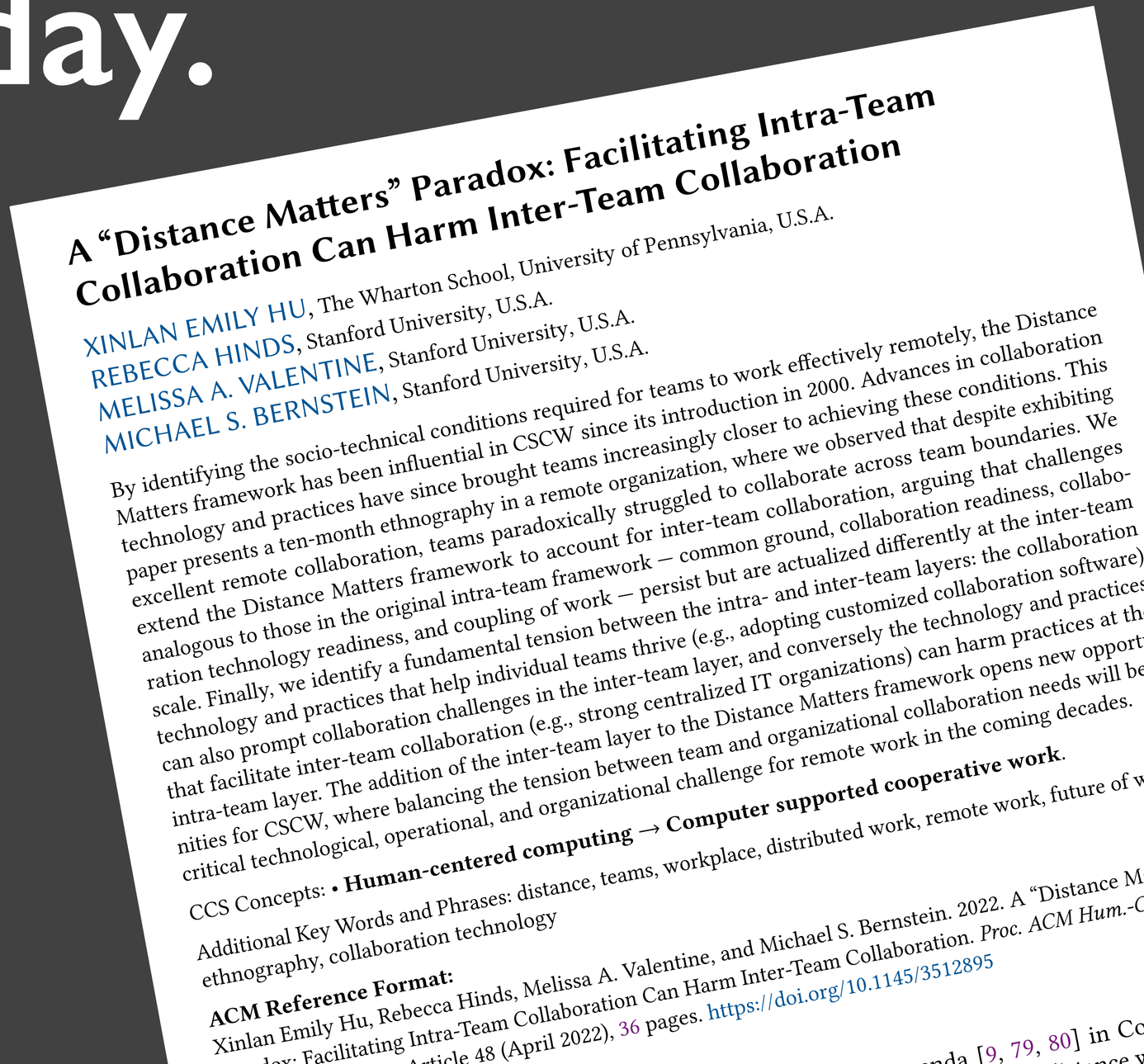
Remote work harms creative and social outcomes

- Firm-wide remote work makes collaboration networks more static and siloed [Yang et al. 2021], makes it less likely that teams find solutions to hidden profile tasks [Javalagi et al. 2023], reduces the creativity of ideas generated [Brucks and Levav 2022], and is associated with fewer breakthrough ideas [Lin, Frey, and Wu 2023]

Yes, even today.

Even as improved remote work tools have made collaboration smoother within teams, they paradoxically make coordination worse across teams [Hu et al. 2022]

Example: what if this course forced everyone to use the same Slack/GroupMe/iMessage platform for your projects?



A "Distance Matters" Paradox: Facilitating Intra-Team Collaboration Can Harm Inter-Team Collaboration

XINLAN EMILY HU, The Wharton School, University of Pennsylvania, U.S.A.
REBECCA HINDS, Stanford University, U.S.A.
MELISSA A. VALENTINE, Stanford University, U.S.A.
MICHAEL S. BERNSTEIN, Stanford University, U.S.A.

By identifying the socio-technical conditions required for teams to work effectively remotely, the Distance Matters framework has been influential in CSCW since its introduction in 2000. Advances in collaboration technology and practices have since brought teams increasingly closer to achieving these conditions. This paper presents a ten-month ethnography in a remote organization, where we observed that despite exhibiting excellent remote collaboration, teams paradoxically struggled to collaborate across team boundaries. We extend the Distance Matters framework to account for inter-team collaboration, arguing that challenges analogous to those in the original intra-team framework — common ground, collaboration readiness, collaboration technology readiness, and coupling of work — persist but are actualized differently at the inter-team scale. Finally, we identify a fundamental tension between the intra- and inter-team layers: the collaboration technology and practices that help individual teams thrive (e.g., adopting customized collaboration software) can also prompt collaboration challenges in the inter-team layer, and conversely the technology and practices that facilitate inter-team collaboration (e.g., strong centralized IT organizations) can harm practices at the intra-team layer. The addition of the inter-team layer to the Distance Matters framework opens new opportunities for CSCW, where balancing the tension between team and organizational collaboration needs will be critical technological, operational, and organizational challenge for remote work in the coming decades.

CCS Concepts: • **Human-centered computing** → **Computer supported cooperative work**.

Additional Key Words and Phrases: distance, teams, workplace, distributed work, remote work, future of w
ethnography, collaboration technology

ACM Reference Format:
Xinlan Emily Hu, Rebecca Hinds, Melissa A. Valentine, and Michael S. Bernstein. 2022. A "Distance M
Facilitating Intra-Team Collaboration Can Harm Inter-Team Collaboration. *Proc. ACM Hum.-C*
Article 48 (April 2022), 36 pages. https://doi.org/10.1145/3512895

A word on your own teams

A reminder, given today's topic: effective teamwork requires planning, effort, and maintenance.

To wit:

> Have you had a normsetting conversation yet?
>
> If something is going wrong, have you already talked to the teammate to try and make a plan, rather than being nice while simmering in hatred?

Ultimately, grade will be impacted by whether everyone feels that all team members have contributed equally. Make sure you, and everyone else, have that opportunity.

Summary

Group and team collaboration lead to a distinct set of design constraints and affordances.

Aiming just to replicate the experience of being there is quixotic; better to aim for beyond being there by looking for affordances unique to the digital realm.

Social translucence is a general principle for designing these systems with awareness and accountability.

If incentives are misaligned, these systems will get abandoned.

References

Aksoy, Cevat Giray, et al. Time savings when working from home. No. w30866. National Bureau of Economic Research, 2023.

Bjørn, Pernille, et al. "Does distance still matter? Revisiting the CSCW fundamentals on distributed collaboration." ACM Transactions on Computer-Human Interaction (TOCHI) 21.5 (2014): 1-26.

Bloom, Nicholas, et al. "Does working from home work? Evidence from a Chinese experiment." The Quarterly journal of economics 130.1 (2015): 165-218.

Bloom, Nicholas, Ruobing Han, and James Liang. "Hybrid working from home improves retention without damaging performance." Nature 630.8018 (2024): 920-925.

Daft, Richard L., and Robert H. Lengel. "Organizational information requirements, media richness and structural design." Management science 32.5 (1986): 554-571.

Dourish, Paul, and Victoria Bellotti. "Awareness and coordination in shared workspaces." Proceedings of the 1992 ACM conference on Computer-supported cooperative work. 1992.

Erickson, Thomas, and Wendy A. Kellogg. "Social translucence: an approach to designing systems that support social processes." ACM transactions on computer-human interaction (TOCHI) 7.1 (2000): 59-83.

Espinosa, J. Alberto, Jonathon N. Cummings, and Cynthia Pickering. "Time separation, coordination, and performance in technical teams." IEEE Transactions on Engineering Management 59.1 (2011): 91-103.

References

Grudin, Jonathan. "Groupware and social dynamics: Eight challenges for developers." Communications of the ACM 37.1 (1994): 92-105.

Halverson, Christine A., and Mark S. Ackerman. "Yeah, the Rush ain't here yet-Take a break: Creation and use of an artifact as organizational memory." 36th Annual Hawaii International Conference on System Sciences, 2003. Proceedings of the. IEEE, 2003.

Hollan, Jim, and Scott Stornetta. "Beyond being there." Proceedings of the SIGCHI conference on Human factors in computing systems. 1992.

Hu, Xinlan Emily, et al. "A" Distance Matters" Paradox: Facilitating Intra-Team Collaboration Can Harm Inter-Team Collaboration." Proceedings of the ACM on Human-Computer Interaction 6.CSCW1 (2022): 1-36.

Javalagi, Anoop A., Alexandra M. Harris-Watson, and Leslie A. DeChurch. "Zooming in and Zoning out: Remote Deliberation Impairs Team Decision Quality." Group & Organization Management (2023): 10596011231169590.

Lin, Yiling, Carl Benedikt Frey, and Lingfei Wu. "Remote collaboration fuses fewer breakthrough ideas." Nature 623.7989 (2023): 987-991.

Liu, Fannie, et al. "Significant otter: Understanding the role of biosignals in communication." Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems. 2021.

McDonald, David W., and Mark S. Ackerman. "Expertise recommender: a flexible recommendation system and architecture." Proceedings of the 2000 ACM conference on Computer supported cooperative work. 2000.

Olson, Gary M., and Judith S. Olson. "Distance matters." Human–computer interaction 15.2-3 (2000): 139-178.

References

Yang, Longqi, et al. "The effects of remote work on collaboration among information workers." Nature human behaviour 6.1 (2022): 43-54.

Zhou, Sharon, Melissa Valentine, and Michael S. Bernstein. "In search of the dream team: Temporally constrained multi-armed bandits for identifying effective team structures." Proceedings of the 2018 CHI conference on human factors in computing systems. 2018.

Social Computing

CS 278 | Stanford University | Michael Bernstein

Creative Commons images thanks to Kamau Akabueze, Eric Parker, Chris Goldberg, Dick Vos, Wikimedia, MaxPixel.net, Mescon, and Andrew Taylor.