# Collaboration

CS 347
Michael Bernstein

# Last time

Our default is to replicate offline social interaction; instead we ought to aim to go **“Beyond Being There”.** Create social spaces that could **only** thrive online

We struggle with **Grudin’s Paradox**, where the people needed are those with the least incentive to contribute, and we struggle with **cold start**

Social media’s effect on us depends on use:

- Directed interactions increase friendships and wellbeing, but liking does not
- Social media use does increase social capital in our communities
- We take in a broader news diet, but democracies struggle with polarization under social media

# Today

CSCW and the Johansen Matrix

Distance Matters

The Socio-Technical Gap

Coordination at Scale

# CSCW: Computer-supported cooperative work

The traditional definition...

**Computer-supported**: technology is mediating the conversation

**Cooperative**: typically teams or groups of coordinating people

**Work**: tasks, as opposed to play or socializing

# Johansen's time-space matrix

[Johansen 1988]

**Time**

| **Space** | Same time | Different time |
| --- | --- | --- |
| Same place |  |  |
| Different place | zoom | |

**Implication**: the design will need to look very different depending on the quadrant that you're in

# Design considerations differ by quadrant

| Space | Time: Same time | Time: Different time |
|---|---|---|
| Same place | Managing shared, simultaneous ownership<br>Backchannels | Visibility and permissions controls |
| Different place | Awareness indicators<br>Presentation controls | Tools for managing inbox overload<br>Filters, tools for managing your self-presentation |

Match your design to the quadrant

# Distance Matters

# Coworker communication

[Kraut et al. 1988]

Studied communication between collaborating researchers at Bell Labs

**Distance between offices and probability of research collaboration**

| Office location | Total pairs | % collaborating |
|---|---|---|
| same corridor | 243 | 10.3 |
| same floor | 1038 | 1.9 |
| different floor | 1736 | .3 |
| different buildings | 1261 | .4 |

**Result**: Very significant falloff in collaboration as people get further apart. Even between same corridor and same floor.

# Distance matters

[Olson and Olson 2000]

"If, as it is said to be not unlikely in the near future, the principle of sight is applied to the telephone as well as that of sound, earth will be in truth a paradise, and distance will lose its enchantment by being abolished altogether."
– Arthur Mee, 1898

But...**colocated software engineering teams outperformed the company average by 2x**. Why?

YOU READ THIS

# Distance matters

[Olson and Olson 2000]

The big idea behind this paper: why is distance collaboration so much worse?

> This paper is the face that launched a thousand ships in CSCW—analogous to The Computer for the 21st Century in interaction—cited as motivation for nearly every study of remote collaboration

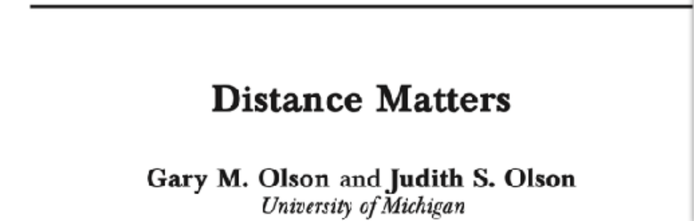
The Olsons's identified failures:

> **Common ground:** knowledge that people have in common and know they have in common
>
> **Coupling:** how complex the work interdependencies are

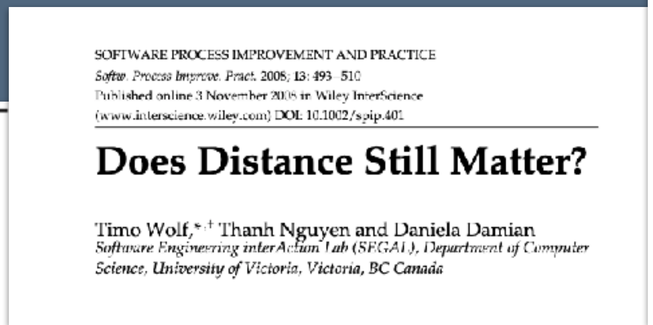
# Surely not even today?

The tools have improved – Zoom, GitHub, Slack, Asana — does distance really still matter?

You're not the first one to ask this question…

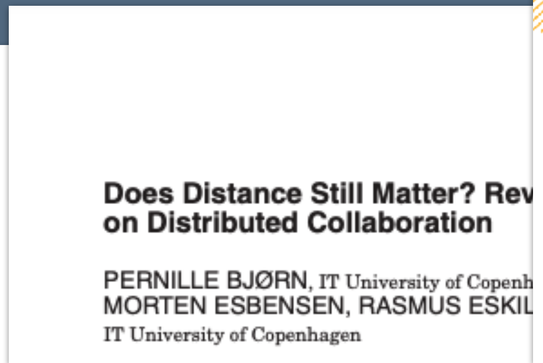

Distance Matters

Gary M. Olson and Judith S. Olson
*University of Michigan*

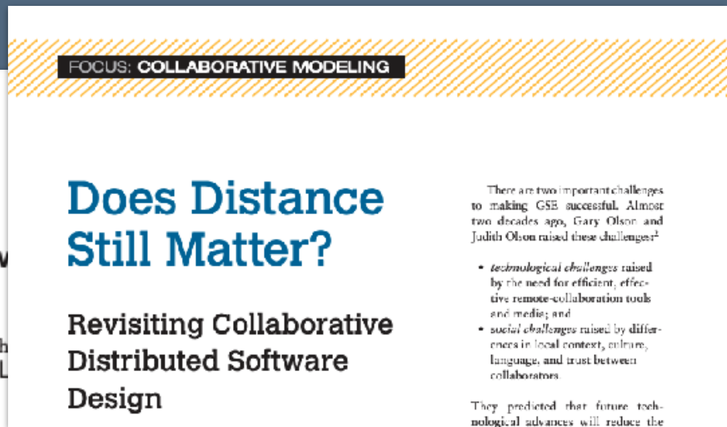

SOFTWARE PROCESS IMPROVEMENT AND PRACTICE
*Softw. Process Improve. Pract.* 2008; 13: 493–510
Published online 3 November 2008 in Wiley InterScience
(www.interscience.wiley.com) DOI: 10.1002/spip.401

Does Distance Still Matter?

Timo Wolf,*,† Thanh Nguyen and Daniela Damian
*Software Engineering interActions Lab (SEGAL), Department of Computer Science, University of Victoria, Victoria, BC Canada*


Does Distance Still Matter? Rev
on Distributed Collaboration

PERNILLE BJØRN, IT University of Copenh
MORTEN ESBENSEN, RASMUS ESKIL
IT University of Copenhagen


FOCUS: COLLABORATIVE MODELING

Does Distance Still Matter?

Revisiting Collaborative Distributed Software Design

There are two important challenges to making GSE successful. Almost two decades ago, Gary Olson and Judith Olson raised these challenges[1]

- *technological challenges* raised by the need for efficient, effective remote-collaboration tools and media; and
- *social challenges* raised by differences in local context, culture, language, and trust between collaborators.

They predicted that future tech-
nological advances will reduce the

# Surely not even today?

**THE UPSHOT** | Do Chance Meetings at the Office Boost Innovation? There's No Evidence of It.

At the same time, technology — like Zoom, Slack and Google Docs — has made idea generation as effective online, researchers said. Judith Olson, a professor of computer science at the University of California, Irvine, has studied the effect of distance on teamwork for three decades. Distance matters much less now, she said: "Because of the technology these days, we're actually inching closer and closer to replicating the office."

[New York Times 2021]

# Yes, even today. [Hu et al. 2022]

Ten month ethnography of a large national laboratory during COVID remote work

Team collaboration is now somewhat fluid using remote collaboration technology…

> But the same tools **are breaking collaboration across teams**.
>
> The collaboration tools and practices that help individual teams thrive (e.g., custom tools) make it harder at the organizational level (e.g., inability to share or interoperate)…and visa versa

# The Socio-Technical Gap

Why are collaboration and social tools resiliently difficult to get right? Will distance ever not matter?

# The intellectual challenge of social computing [Ackerman 2000]

"The social-technical gap is **the divide between what we know we *must* support socially and what we *can* support technically**."

The social sciences teach us mechanisms that are important for effective social interaction. But we lack designs that facilitate those mechanisms.

Intuitively: we know how to throw parties IRL, but generally not how to provide those same mechanisms online.

# Socio-technical gap in collaboration tools

Social sciences: effective collaboration requires that people be aware of what on the team others are up to [Mathieu et al. 2000]

But how do we support awareness, in practice, with technology?

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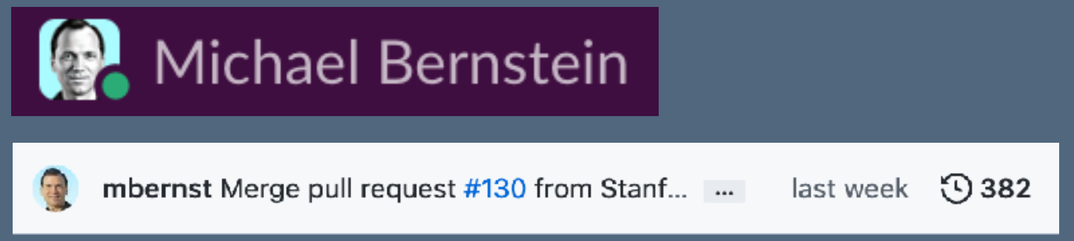
Live feeds?
[Dourish and Bly 1992]




Activity indicators? [Biehl et al. 2007; Roseman+Greenberg 1996; Dabbish et al. 2012]

**Gap**: between the awareness we need, and what we know to build

# Socio-technical gap in social media

Social sciences: social activity is nuanced, and people handle the details with remarkable fluidity and agility [Ackerman 2000; Garfinkel 1967; Heritage 1984; Suchman 1987]

The focused totality of decades of design & technological progress

…but what is a specific design that can better enable what we know to be effective interpersonal interaction?

# Socio-technical gap in virtual reality

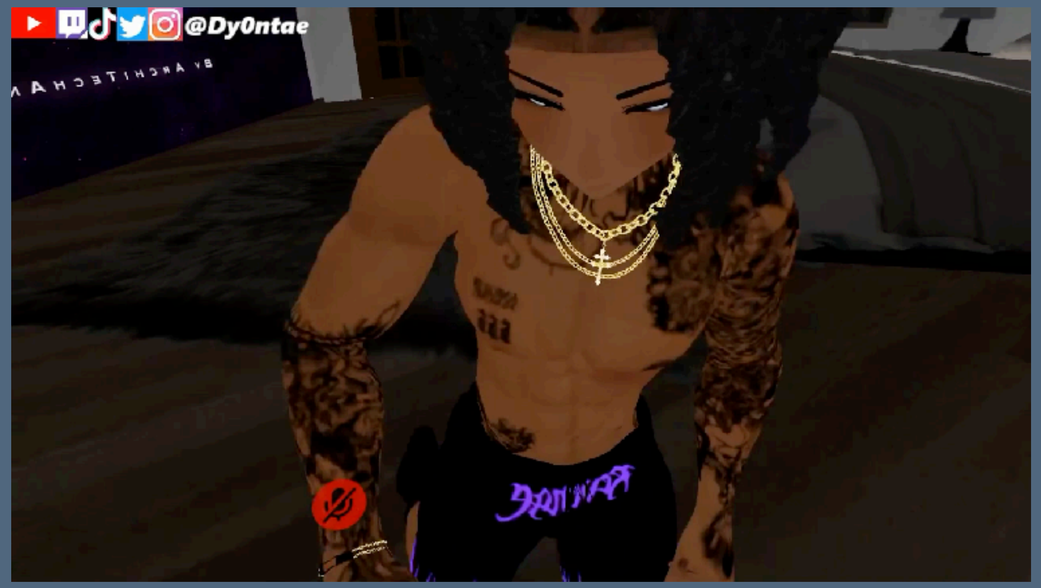
Social sciences: interpersonal distance carries meaning — intimate 1.5ft, personal 1.5–4ft, social 4–12ft, public 12-25ft [Hall 1966]

VR:

# Socio-technical gap in virtual reality

Social sciences: interpersonal distance carries meaning — intimate < 1.5ft, personal 1.5–4ft, social 4–12ft, public 12-25ft [Hall 1966]

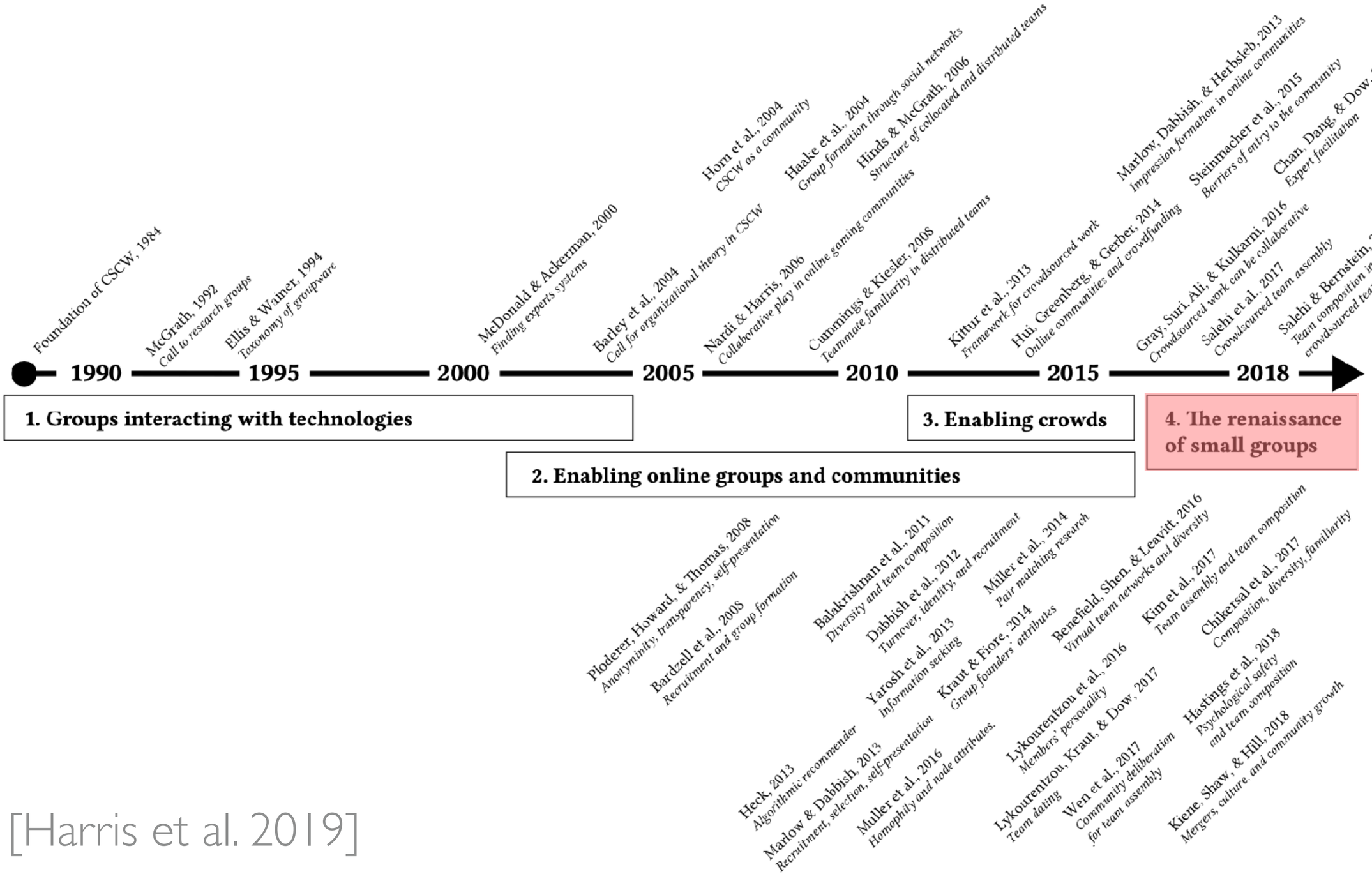
VR:




How do we smoothly trigger personal space cues in VR?

[Dy0ntae on YouTube]

# Collaboration beyond being there: modern frontiers



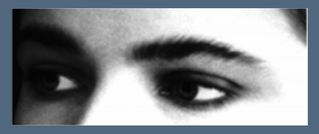
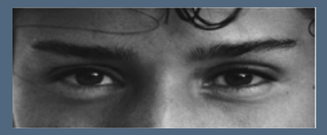

[Harris et al. 2019]

# What's in team performance?

[Woolley et al. 2010]

Across tasks—ranging from brainstorming to execution to coordination—there exist stable factors predicting over 40% of the variation in team performance: a "collective intelligence factor". Guess what they are?

Nope, <u>not</u> the average/max intelligence of group members

The average social sensitivity of group members  

Equality of conversational turn-taking

**↑% of women in the group**: mediated by social sensitivity

# This lecture could have been an email [Cao et al. 2021]

Microsoft researchers investigated their own employees' own multitasking during remote meetings: e.g., are they using Outlook while in a Microsoft Teams meeting?

> Consistently ~30% of meetings involve email multitasking. The odds go up by 2x if the meeting is at least ten people and by 3x if the meeting is ~1hr long
>
> Multitasking does not mean disengagement: often, it's communication with colleagues or finishing other work: "It needs to happen or you can't get all your work done"

# Open questions

Can we bring the right people together, given the task?

- People initially say they want experts and sociable teammates, but ultimately are likely to choose prior social connections [Gómez-Zará 2019]

Can we help them flag potentially explosive meltdowns early?

- As little as one minute of text chat can enable an algorithm to flag teams that may want to break up later [Cao et al. 2020; Zhang et al. 2018]

Can we aid effective organization strategies?

# What is the best way for teams to organize?

[Zhou, Valentine and Bernstein 2018]

Should teams be flat or hierarchical? Encouraging or critical? Enforcing equal turn-taking?

Unfortunately, organizational behavior research has demonstrated that **there exist no universal answers** to these questions. They are contingent on the people and the task.

What if you could continuously give feedback on how the team is going, and a system helped your team identify better strategies?

<feedback>

## Hierarchy

None, Centralized, Decentralized

## Interaction Patterns

Emergent, Round-robin, Equally distributed

## Norms of Engagement

None, Professional, Informal

## Decision-Making Norms

None, Divergent, Convergent, Informed, Rapid

## Feedback Norms

None, Encouraging, Critical

Time

# The resulting teams outperform managers, collective decision making, and traditional multi-armed bandits by 40%.

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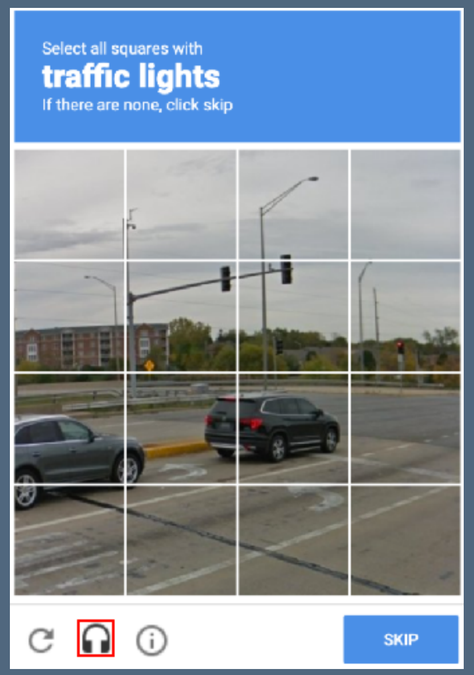
# Coordination at scale: crowdsourcing

# Large-scale contributions

"Well, If we can't coordinate in small groups, instead let's highly structure our activities and open them up to massive scale."

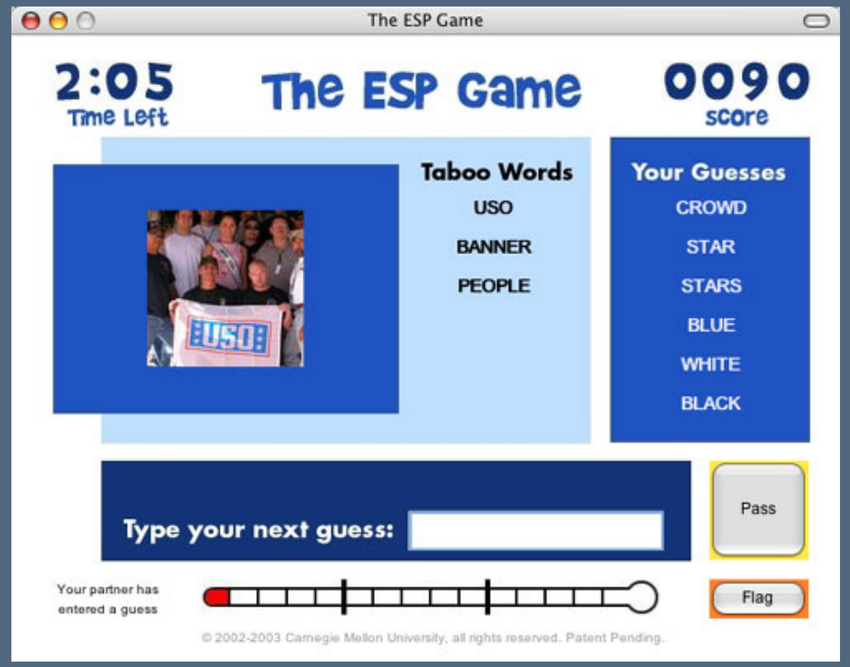
"Let's call that crowdsourcing."



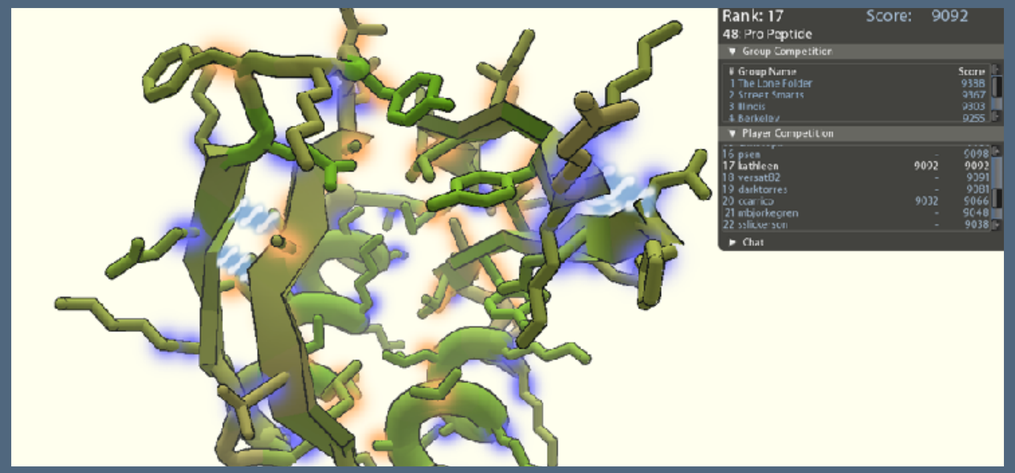

# Large-scale contributions

"What if people don't want to volunteer?"

"Well, we could make it fun or incentivize them."




[von Ahn and Dabbish 2004]




[Cooper et al. 2010]

kaggle

# Crowdsourcing as Beyond Being There

Crowdsourcing gives up on having high common ground and coupling (vis a vis Olson), in favor of structured activities at scale

"Write a complete encyclopedia article" → "Fix this typo"

"Create a complete operating system" → "Try to fix this issue/bug"

"Train a machine learning algorithm" → "Label this image"

What crowdsourcing loses in coordination from in-person collaboration, it gains in sheer scale — going beyond being there

# Summary

Collaboration is hard: **distance matters**.

Tools can try to mitigate the effects of distance, but we are limited by the **socio-technical gap**.

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