Can We Make “Distance Matter” Less?

Gina Venolia

Senior Researcher

Microsoft Research

http://research.microsoft.com/~ginav/

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Distance Matters

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

ABSTRACT

Giant strides in information technology at the turn of the century may have unleashed unreachable goals. With the invention of groupware, people expect to communicate easily with each other and accomplish difficult work even though they are remotely located or rarely overlap in time. Major corporations launch global teams, expecting that technology will make “virtual collocation” possible. Federal research money encourages global science through the establishment of “collaboratories.” We review over 10 years of field and laboratory investigations of collocated and noncollocated synchronous group collaborations. In particular, we compare collocated work with remote work as it is possible today and comment on the promise of remote work tomorrow. We focus on the sociotechnical conditions required for effective distance work and bring together the results with four key concepts: common ground, coupling of work, collaboration readiness, and collaboration technology readiness. Groups with high common ground and loosely coupled work, with readiness both for collaboration and collaboration technology, have a chance at succeeding with remote work. Deviations from each of these create strain on the relationships among teammates and require changes in the work or processes of collaboration to succeed. Often they do not succeed because distance still matters.

Gary Olson is a psychologist interested in computer supported cooperative work; he is Professor in both the School of Information and the Department of Psychology. **Judy Olson** is a psychologist interested in computer supported collaborative work; she is Professor in the School of Business Administration, the School of Information, and the Department of Psychology.

What can we do to make geographically-distributed team work easier?

There are several economic and practical pressures leading to increased distributed work

However distributed teamwork is known to be harder in many ways than collocated

“Radical collocation” (aka “team rooms”) may be easier still

I’m drawing from several studies that we’ve done of software development at Microsoft.

LaToza, Venolia and DeLine. Maintaining mental models. ICSE ’06.

- Pilot survey (28 MS-internal responses) → Recruitment survey (157) → 60-minute **interviews** (11) → Validation survey (187)

Ko, DeLine and Venolia. Information needs in collocated software development teams. ICSE ’07.

- Recruitment survey (55) → 90-minute **observations** (17) → Validation survey (42)

Cherubini, Venolia, DeLine and Ko. Let’s go to the whiteboard: How and why software developers use drawings. CHI ’07.

- Recruitment survey (60) → 45-minute **interviews** (9) → Validation survey (427)

Hemphill and Begel. Adopting distributed development: Case studies in onboarding a first remote team member. In submission.

- 15-90-minute interviews (95; 26 unique people) → **Observations** (15 hours total)

Umarji, DeLine and Venolia. Communication and separation: An observational study of distributed work. In submission.

- Recruitment survey (1882) → 90-minute remote **observations** (24)

Brush, Meyers, Scott and Venolia. Exploring awareness needs and information display preferences between coworkers. In submission.

- **Survey** (549 MS and external)

We've identified four key differences between collocated and distributed teamwork.

1. Communication in planned meetings
2. Ad-hoc conversations
3. Staying aware of teammates and their work
4. Building trust relationships between teammates

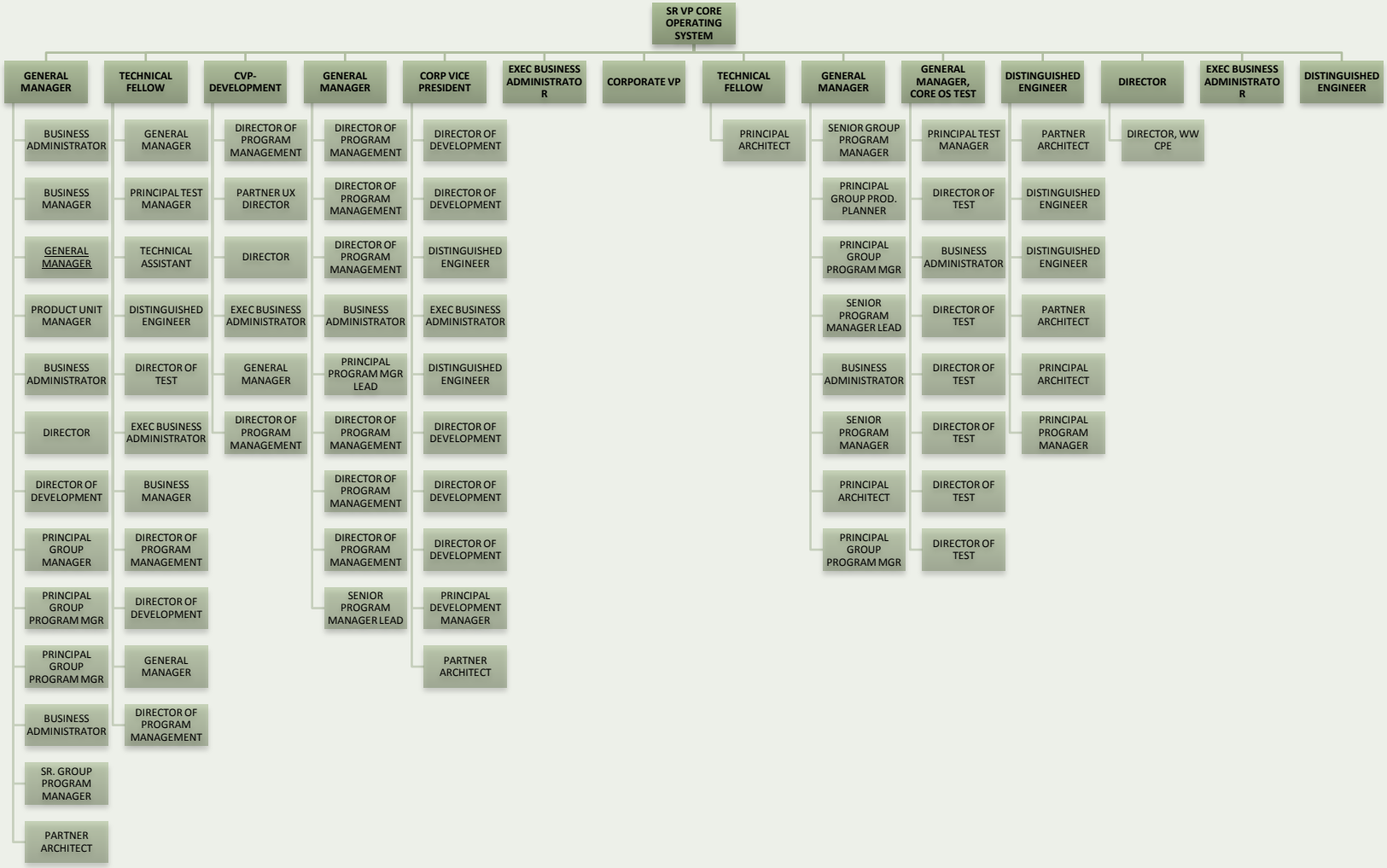
But first…

What is a Distributed Team?

That should be easy…

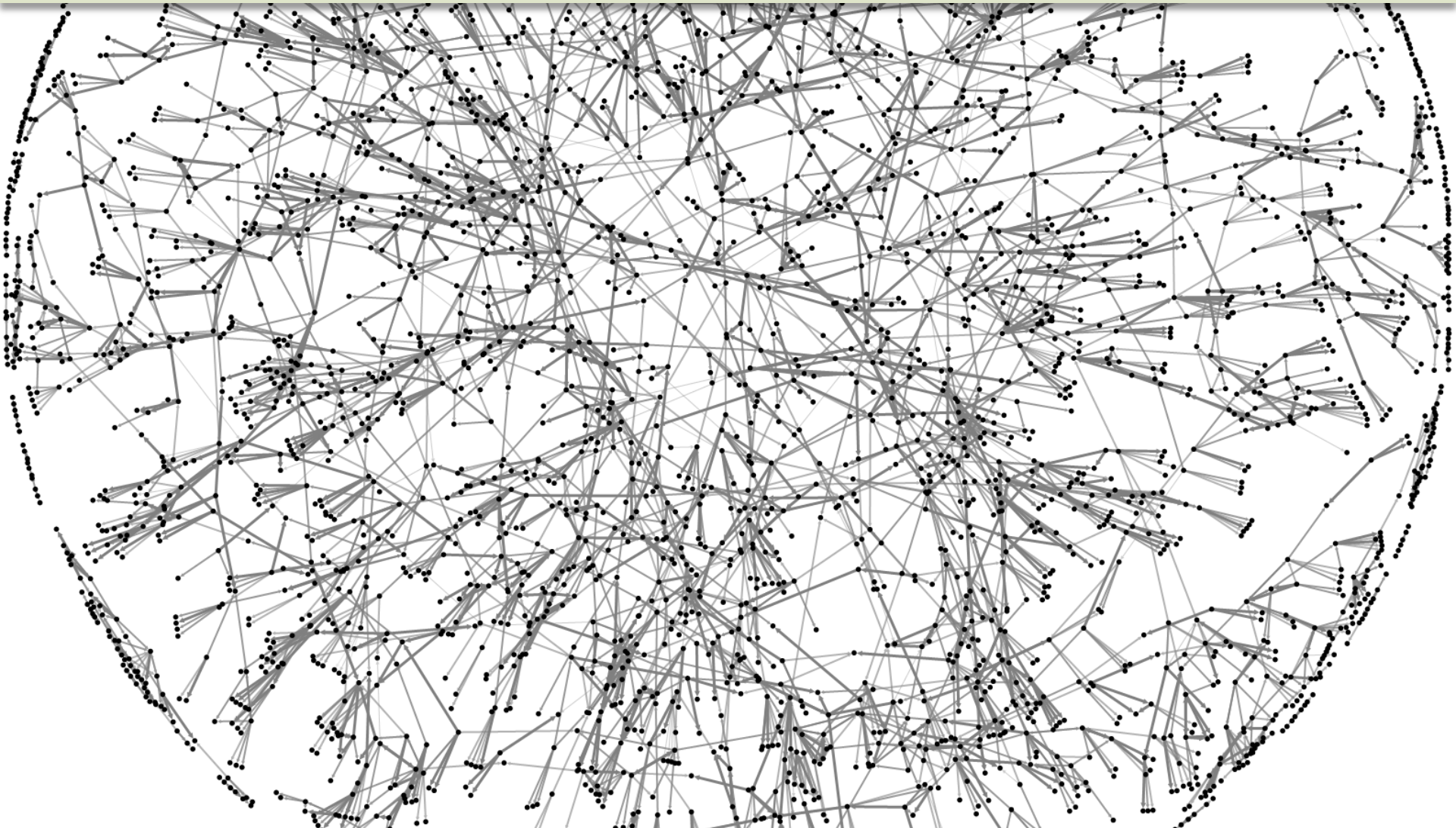
It depends on how you define *team*.

→ *The organizational structure?*



It depends on how you define *team*.

→ *The communication structure?*



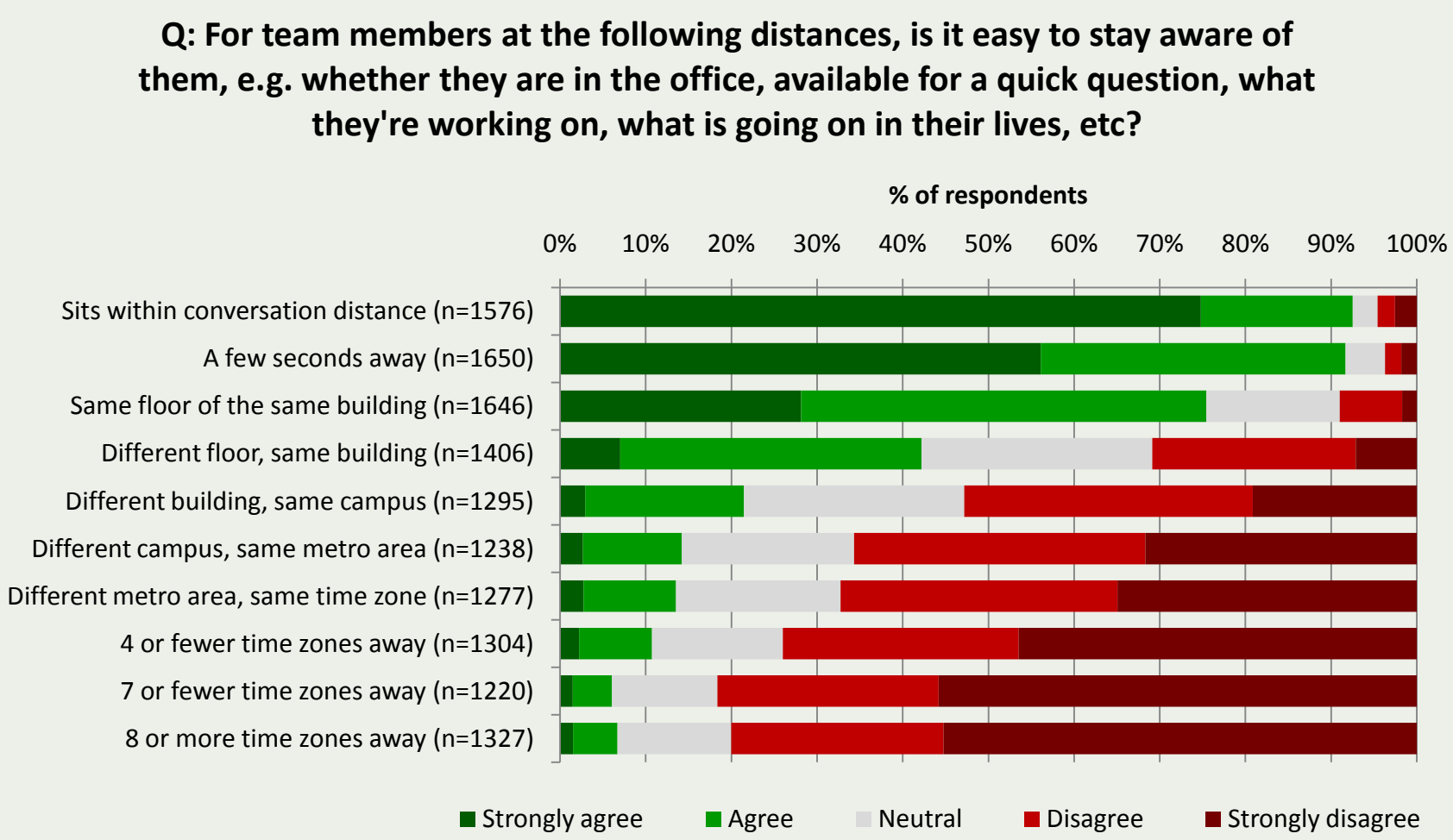
It depends on how you define *team*.

→ *The functional structure?*

Feature crew

- 2-3 developers
- 1-2 testers
- About 1/3rd of a program manager

It depends on how you define *distributed*. [Umarji]



The effectiveness of collaboration degrades with physical distance.

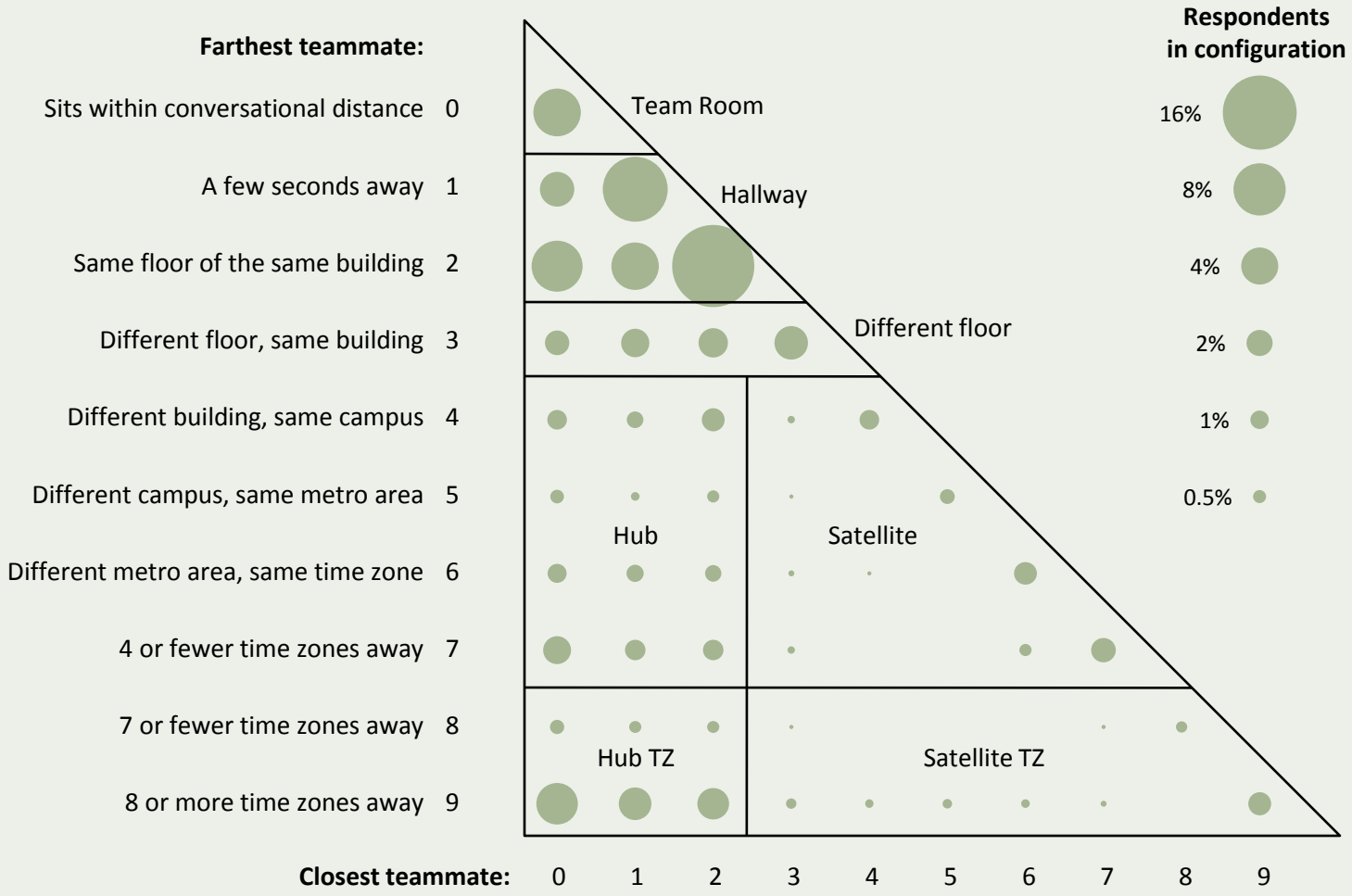
People located closer in a building are more likely to collaborate [Kraut, Egido and Galegher 1990]

A distance of 100 feet may be no better than several miles [Allen 1977]

Even at short distances, 3 feet vs. 20 feet, there is an effect [Sensenig & Reed 1972]

Distributed teams come in many shapes.

Q: How far are the team members' primary work location from your primary work location? (check all that apply) [Umarji]



Distributed and *team* are both dynamic. [Umarji]

Work-at-home days, meetings in other buildings, site visits, business travel, …

72% of PMs have been a member of multiple teams in a month (49% of testers, 39% of devs)

Feature teams last a median of 1 year

Aren’t you forgetting about inter-team work?

Yes.

OK, now let's get back to the four key differences between collocated and distributed teamwork.

1. Communication in planned meetings
2. Ad-hoc conversations
3. Staying aware of teammates and their work
4. Building trust relationships between teammates

1. Communication in Planned Meetings

Meetings come in many sizes and shapes – each with unique characteristics.

Type of meeting	Frequency	Number of participants	Order vs. chaos	Use of whiteboard	Use of Projector	…
Weekly status						
Daily standup						
Bug triage						
Ship-room						
Brainstorming						
Presentation						
Spec/design/code review						
Manager/lead 1:1						
Pair programming						

Just like teams, distributed meetings come in different topologies.

Two-hub 

Hub and satellite 

Fully-distributed 

…

One size *does not* fit all!

Meetings are harder for remotes – though they have some mitigation strategies. [Umarji]

Problem	Mitigation
Time zones	Shift work hours
Teleconference setup problems [Hemphill]	Revert to most-reliable technology
A/V quality problems	Remind politely [Hemphill]
	IM backchannel
Gaze direction and eye contact	–
Can't use or see the whiteboard	–
Last in the "circle" – or even forgotten	–
Difficult to interject or have fast-paced exchanges	–

2. Ad-hoc Conversations

Ad-hoc conversations are initiated primarily to fulfill an information need.

A specific question to a specific person

A specific question to a community of practice

“Another pair of eyes”

Ad-hoc conversations are the #1 resource for answering a variety of questions. [Ko]

What have my coworkers been doing?	[20 times]
What are the implications of this change?	[13]
Is this problem worth fixing?	[12]
In what situations does this failure occur?	[8]
What code could have caused this behavior?	[5]

Face-to-face is generally the preferred medium for ad-hoc conversations. [LaToza]

Face-to-face: Preferred unless not possible or the question is low priority – sometimes using secondary media: [27% of communication time]

- Shoulder-to-shoulder at the computer screen
- Whiteboard – just enough to support the conversation [Cherubini]

IM or phone: For simple Q&A [4% + 3%]

Email: The communication workhorse [22%]

→ Conversations often migrate between media

Opportunistic ad-hoc conversations piggyback on other interactions.

Various opportunities

- Hallway, kitchen, lunch, ...
- Before or after planned meetings
- After another ad-hoc conversation

Also reporting status or progress [Ko]

Ad-hoc communication is harder for remotes – though they have some mitigation strategies. [Umarji]

Problem	Mitigation
Face-to-face: Not possible	Rely on other media
IM and phone: Time zones	Shift work hours
	Rely on emails
IM and phone: Lack of secondary media	–
Email: Time zones cause 24 (or more) hour response lag	Shift work hours
	Monitor email in the evening
Email: Time zones make a back-and-forth conversation drag out for days	Over-specify the initial message
Opportunistic: Far fewer opportunities	–
General: Fewer opportunities and harder to do ad-hoc conversations	Save emails to self-answer questions
	Multitask to keep working despite blockage
	(More frequent or deep investigations to self-answer questions?)
General: Out-of-sight, out-of-mind	–

3. Staying Aware of Teammates and Their Work

Workspace awareness takes many forms. [Gutwin and Greenberg 2002]

Who: Presence, presence history, identity, authorship

What: Action, action history, intention, artifact

Where: Location, location history, gaze, view, reach

How: Artifact history

When: Event history

Like any team-workers, developers stay aware of their shared resources and their teammates activities. [Ko]

What have my coworkers been doing?

- 2nd most common of 21 info needs (43 instances)
- Max time: 11 minutes
- Observed in 88% of participants
- No answer found in 14% of observed instances

How have resources I depend on changed?

- 6th most common (25 instances)
- Max time: 9 minutes
- Observed in 59% of participants
- No answer in 24%

→ Interestingly, engineers underestimate the importance and difficulty of getting this information

They actively monitor many online sources to maintain awareness. [Ko]

Team- and topic-oriented email lists

Check-in and bug-edit notification emails

Bug database

Bug count watcher

Teammates' IM status

Teammates' online calendars

Group schedule

Teammates actively emit and absorb awareness signals.

Meetings: Status, daily stand-up, ship-room, …

Status mails

Teammates passively emit and absorb awareness signals.

Side-effect of ad-hoc communication

Overheard conversations, whiteboards, printouts, …

Passive awareness is harder for remotes – though they have some mitigation strategies. [Umarji]

Problem	Mitigation
Far fewer opportunities for passive absorption of awareness signals	(Monitor of online sources more?)
Far fewer opportunities for passive emission of awareness signals	Push status in email, blog or wiki

4. Building Trust Relationships Between Teammates

The formation of trust relationships has been well-studied.

Face-to-face time

Multiple successful interactions

Visible personal life

Common ground

…

→ “Trust needs touch” [Handy 1995]

Trust relationships are harder to build between remote pairs – though they have some mitigation strategies. [Umarji]

Problem	Mitigation
Lack of face-to-face time	Videoconference [Hemphill]
	Visit other site [Hemphill]
Culture and language differences	Isolate through liaisons
Lack of common ground [Hemphill]	–
Out of sight, out of mind	*Intentionally* build relationships

Remotes suffer many deficits, which can be seen as opportunities for new tools or practices.

Teleconference

- Setup problems
- A/V quality problems
- Gaze direction and eye contact
- Last in the “circle” – or even forgotten
- Difficult to interject

No whiteboard for meeting or ad-hoc conversations

Fewer opportunities and harder to do ad-hoc conversations

Less exchange of awareness signals

Time zones

Lack of face-to-face time

Culture and language differences

Out of sight, out of mind

A Tool Opportunity:
Embodied Social Proxies

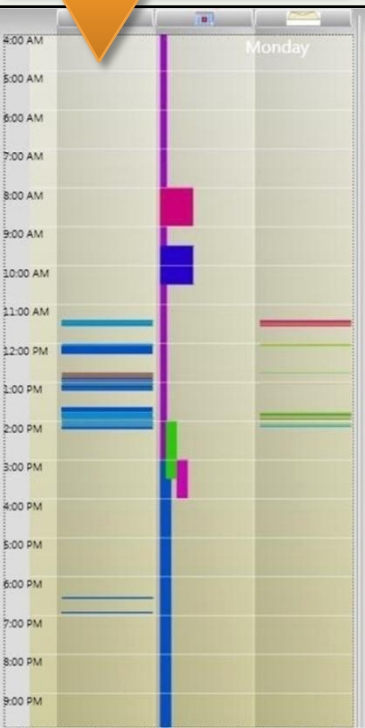
An *Embodied Social Proxy* is a device at a team's hub location representing a satellite teammate.

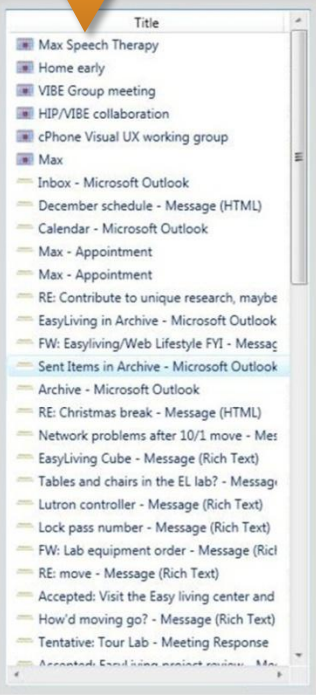
It has two functions:

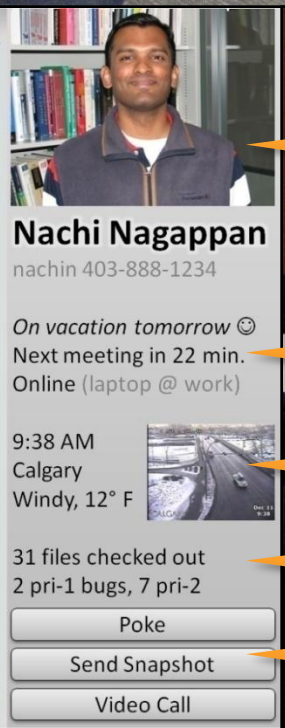
- Ambient display of the remote worker's state and activity
- Videoconferencing head for 1:1 or group meetings

Timeline

Work activity







The timeline of work activities is the aggregate of several RSS feeds.

Code check-ins

Bug edits

Document repository edits

Online calendar

Blog

Micro-blog

…

ESP addresses several of the problems faced by hub-and-satellite teams.

Teleconference

- **Setup problems**
- A/V quality problems
- **Gaze direction and eye contact**
- **Last in the "circle" – or even forgotten**
- **Difficult to interject**

No whiteboard for meeting or ad-hoc conversations

Fewer opportunities and harder to do ad-hoc conversations

Less exchange of awareness signals

Time zones

Lack of face-to-face time

Culture and language differences

Out of sight, out of mind

There are many reasons this could fail.

Complexity of *distributed* and *team*

Technology must work first time and every time [Hemphill] [Umarji]

Increased visibility brings discomfort

- Though only 21% agree with "I would feel uncomfortable with [an ESP representing] me because I would not know who was looking at it" [Brush]

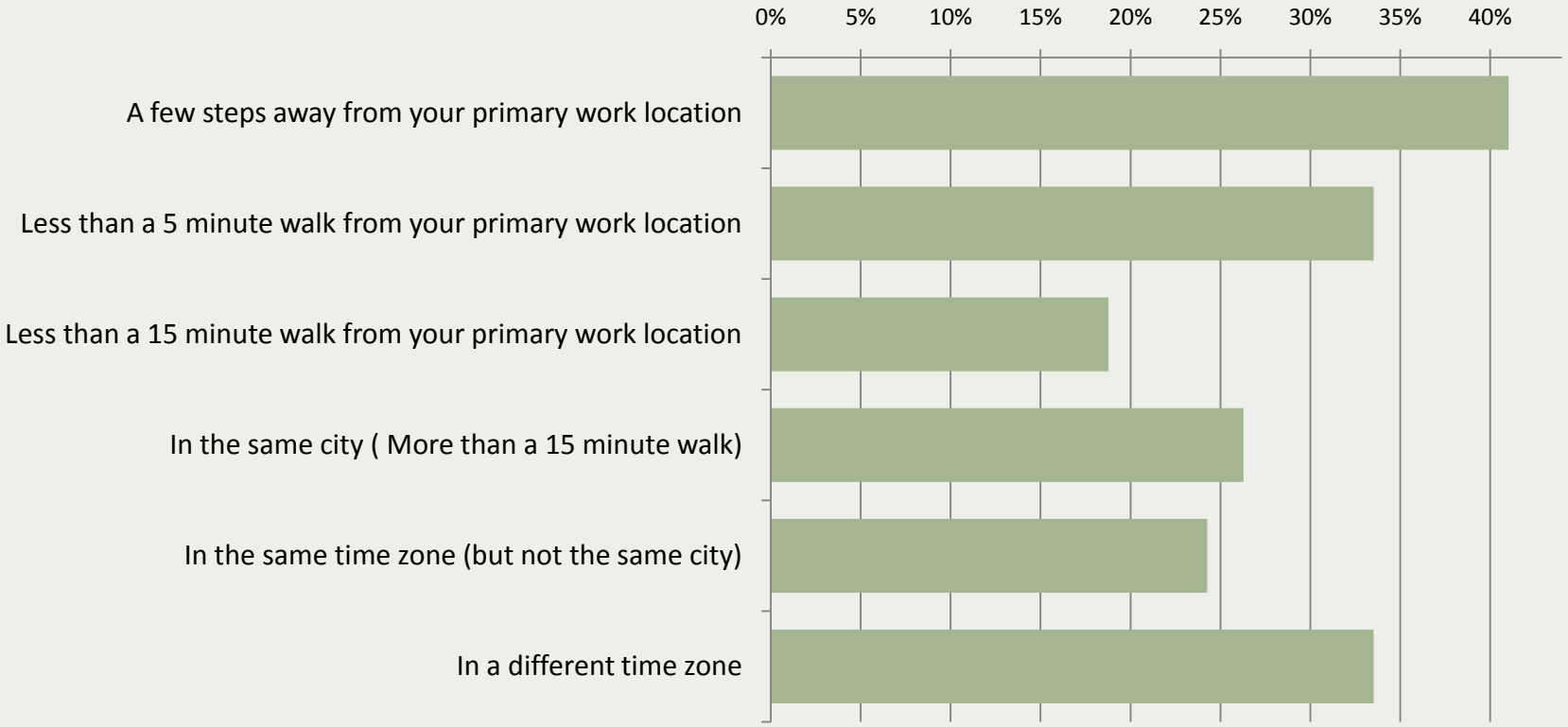
Scalability

- Though most would only give or receive "1-5" ESPs [Brush]

…

ESP might not be for just remote coworkers.
[Brush]

Q: For the coworkers for whom you would like to have [an ESP], where are their primary work locations? (Select all that apply)



There are many other tool opportunities lurking in these requirements.

Better search tools

Team activity awareness

Whiteboarding in ad-hoc communications

Telepresence in other meeting types

- Whiteboard
- Viewing or driving the projector

Some issues may be difficult or impossible to solve.

Relationship-building

Time zones present many challenges

Language barriers impede communication

Cultural differences can confuse communication

Power asymmetries lead to us-versus-them conflicts

- Mother-ship vs. outpost
- Old-timers vs. newcomers
- Hub vs. satellite

All parties must be motivated to appropriate solutions

Thanks! Questions?

Additional References

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