Awareness, Trust, and Tool Support in Distance Collaborations

David Redmiles

Department of Informatics

University of California, Irvine

Thank you to the organizers, especially

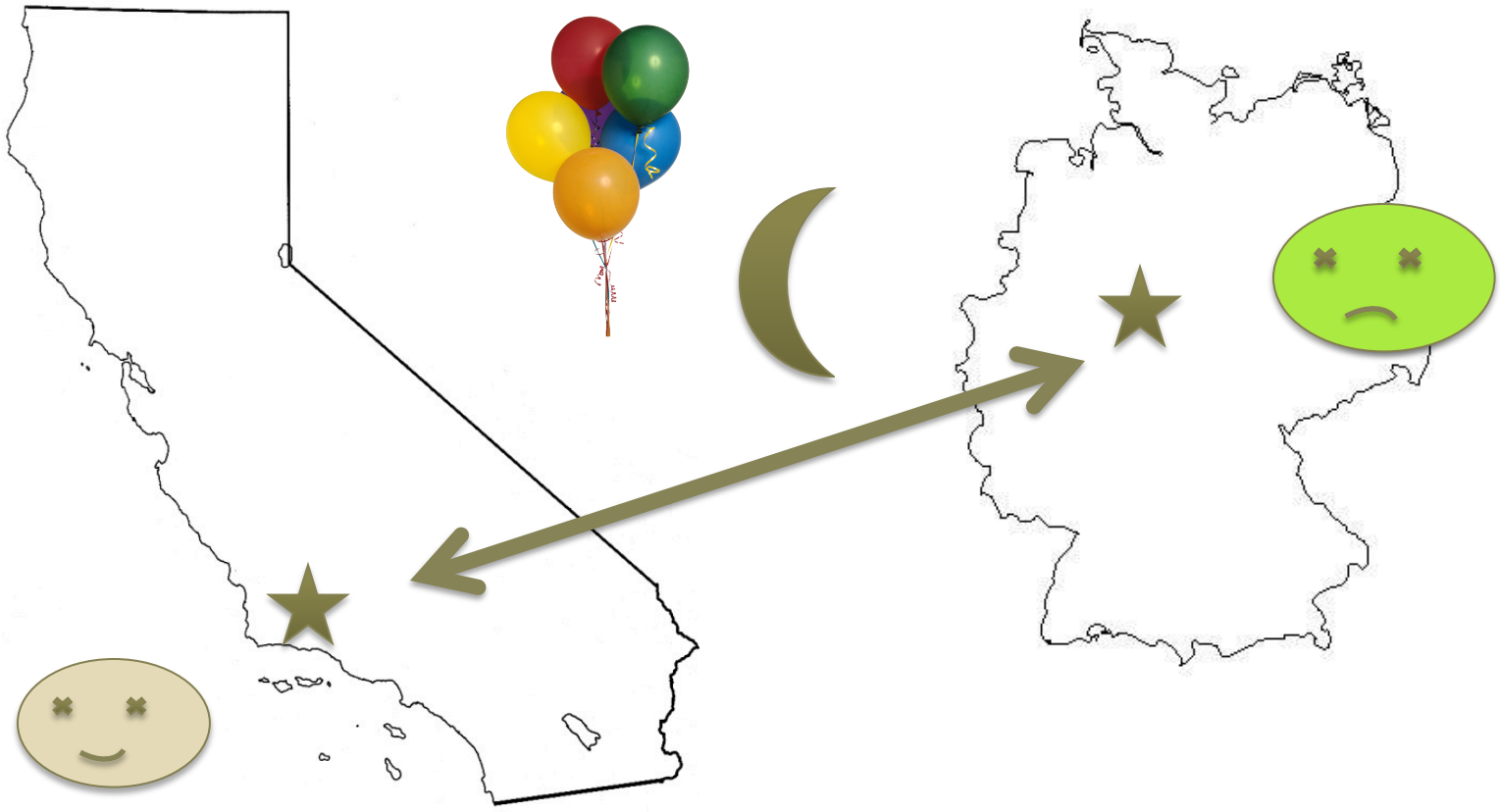
Cleidson de Souza, Hugo Fuks, and Marco Gerosa.

Acknowledgements since 2004

- National Science Foundation under grants 534775, 0808783, 0943262, 1111446
- Department of Informatics and Donald Bren School of Information and Computer Sciences, UC Irvine
- Institute for Software Research, UC Irvine
- Center for Organizational Research, UC Irvine
- IBM, Hitachi, Intel
- Brazilian Government under grant CAPES BEX 1312/99-5

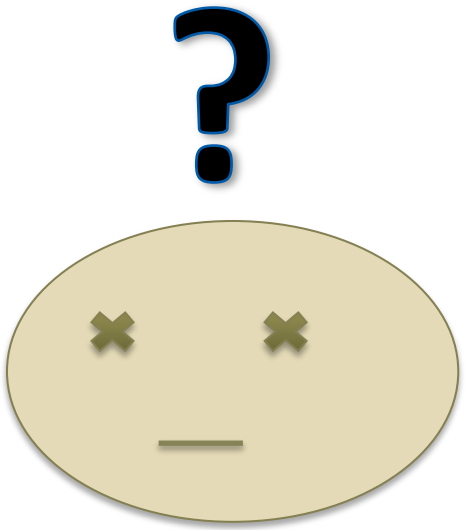
the team in 2011

Example: Working at a Distance



Some of the problems in our Example

- Isolation prevents knowing what others are doing
- Lack of awareness also prevents knowing why they are doing or not doing something.
- Distance prevents familiarity – both professional and personal



Distance Matters for Common Ground and Effects of Isolation

- Olson, G., Olson, J. *Distance Matters,* Human-Computer Interaction, V. 15, N. 2, September 2000, pp. 139-178.
  - Seminal and highly cited paper on the research of geographically distributed teams.
  - "four key concepts: common ground, coupling of work, collaboration readiness, and collaboration technology readiness."
- Koehn, B., Shih, P., Olson, J. Remote and Alone: Coping with Being the Remote Member on the Team, ACM Conference on Computer-Supported Cooperative Work (CSCW 2012, Seattle, WA), February 2012, pp. 1257-1266.
  - Isolated (remote) workers develop individual coping strategies involving ICT and social practices.
  - E.g. participants developed mentorship relationships and communication strategies to remain visible in the team and to leave visible trails for performance evaluations.

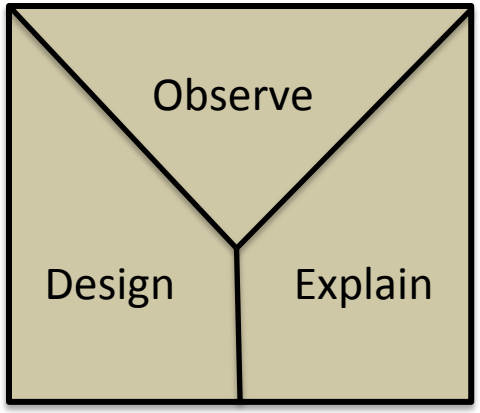
And just about time zones …

- Tang, J., Zhao, C., Cao, X., Inkpen, K. *Your Time Zone or Mine? A Study of Globally Time Zone-Shifted Collaboration,* ACM Conference on Computer-Supported Cooperative Work (CSCW 2011, Hangzhou, China), March 2011, pp. 235-244.
  - Explores how team members work across global time zone differences and strategize to find time for interaction.
  - E.g., selecting a time zone delegate and sharing-the-pain strategies
- Segalla, M. *Why Mumbai at 1pm Is the Center of the Business World,* Harvard Business Review, October2010, pp. 38-39.
  - Amazing statistics and visualizations about the lack of overlap of working days and times
  - E.g., "only 15 workweeks (29%) are uninterrupted by a holiday" [p. 38].

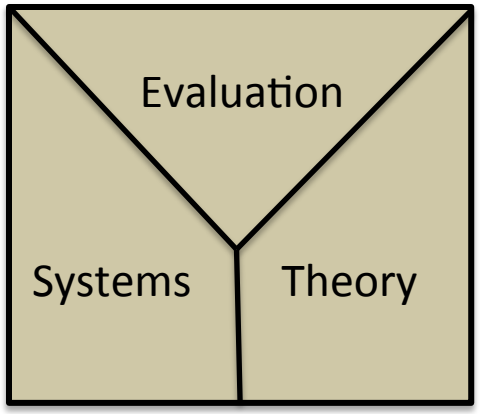
Can we make distance matter a little less?

- Awareness
- Trust
- Software Tool Support

Research Approach



- Observe and collect data
  - Workplace
  - Research literature
- Hypothesize and build systems
- Evaluate systems
  - Controlled settings and
  - Not so controlled settings – professionals
- Link back to the data



Why this approach?

- Computer Science
  - From 1976 – 1982 learned about the mechanics of doing things with the computer
- Human-Computer Interaction
  - Around 1980 onwards learned about the real way people used computer software
  - Formal training from 1987-1992 in human-computer interaction
- Personally
  - Pragmatic
  - Open-minded
  - Seeking “bigger” picture and meaning

Roadmap to this talk

- Research Themes
  - Awareness and trust and, more generally, distance collaboration
- Literature
  - Citations and brief summaries
- Experiences
  - Observations, software tools, and evaluations → Lessons learned!
- Conclusion
  - Immediate and long-term challenges

Awareness

Knowing others' activities

- Dourish, P., Bellotti, V. *Awareness and Coordination in Shared Workspaces,* Conference on Computer-Supported Cooperative Work (CSCW '92, Toronto, Canada), 1992, pp. 107-114.
  - "awareness is an understanding of the activities of others, which provides a context for your own activity"
  - "awareness information is always required to coordinate group activities, whatever the task domain"

Work practices for coordination

- Schmidt, K. The Problem with 'Awareness' - Introductory Remarks on 'Awareness in CSCW'. Journal of Computer Supported Cooperative Work, 2002. 11(3-4): p. 285-298.
  - Many definitions of awareness, but …
  - Monitoring others' and displaying your own actions as part of work

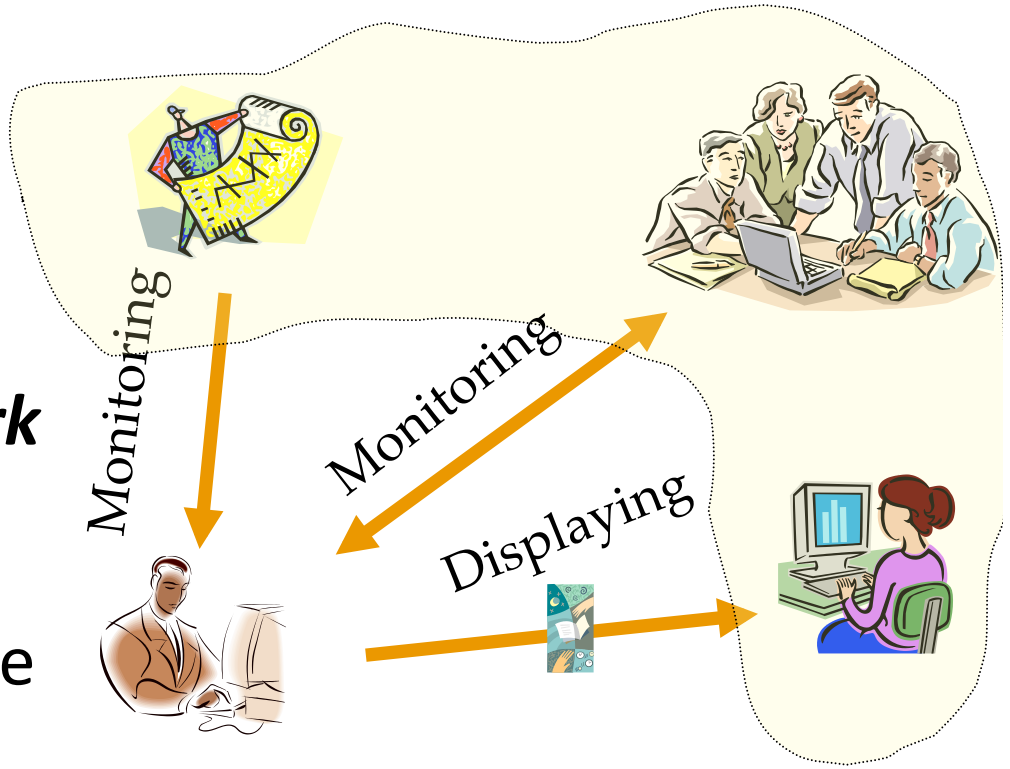
Work practices that maintain awareness

- de Souza, C.R.B., Redmiles, D.F. The Awareness Network, To Whom Should I Display My Actions? And, Whose Actions Should I Monitor?, IEEE Transactions on Software Engineering, V. 37, N. 3, May/June 2011, pp. 325-340.
  - Following on Schmidt … who should I be **monitoring** and to whom should I be **displaying** actions.

[de Souza Redmiles 2011]

The Awareness Network

- How do social actors know **to whom** they should display actions and **whose** actions should they monitor?
- The ***awareness network*** is the set of actors whose actions need to be monitored and those to whom one needs to make one's own actions visible.



[de Souza Redmiles 2011]

How is it achieved?

- Read everything!
  - E.g. emails, design documents, problem reports, change records
- Employ a personal network!
  - E.g., emailing friends who might know etc.
- Ad hoc tools
  - E.g., a discussion database identifying who can answer what questions

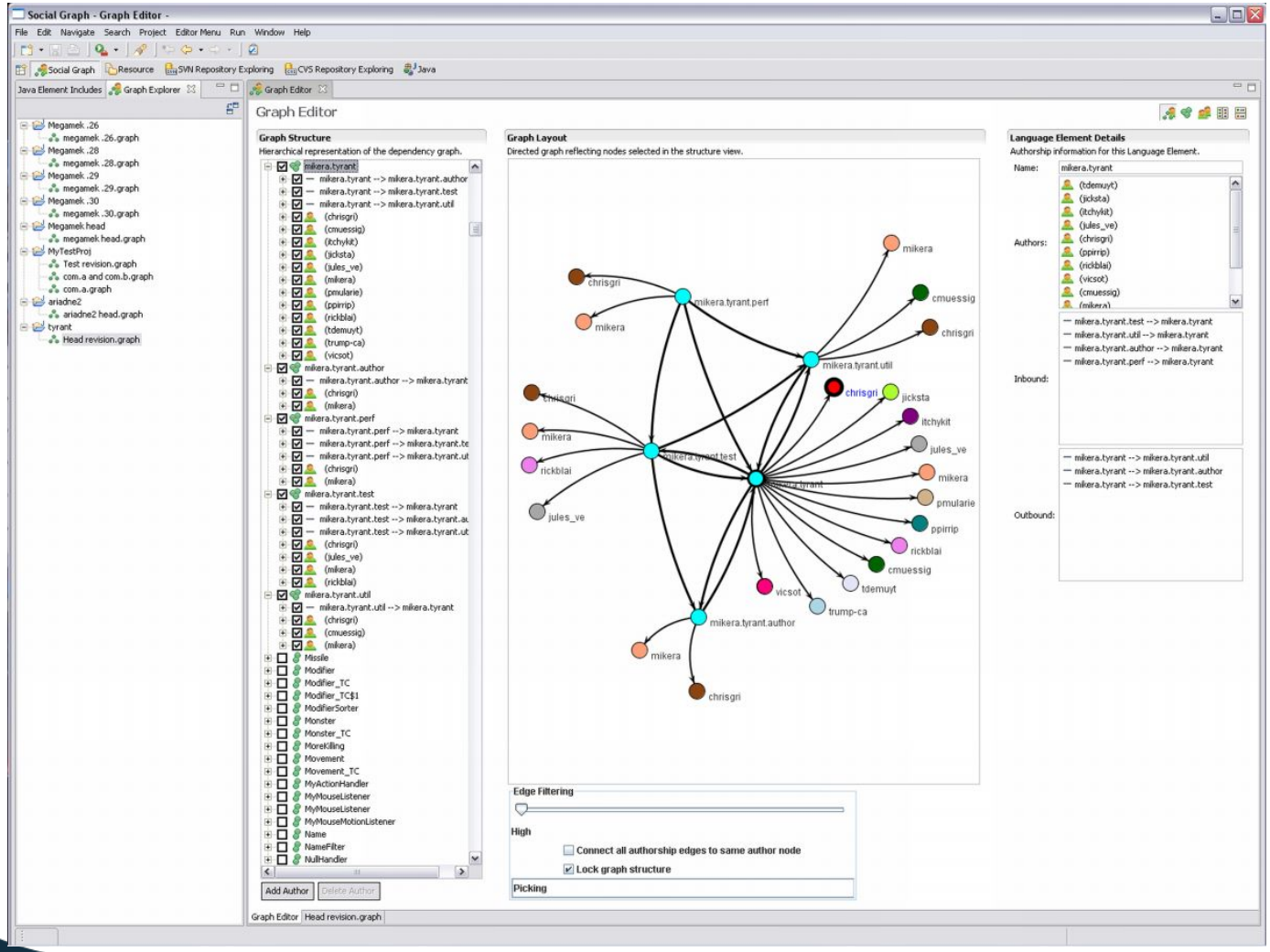
[de Souza Redmiles 2011]

Where is our data from?

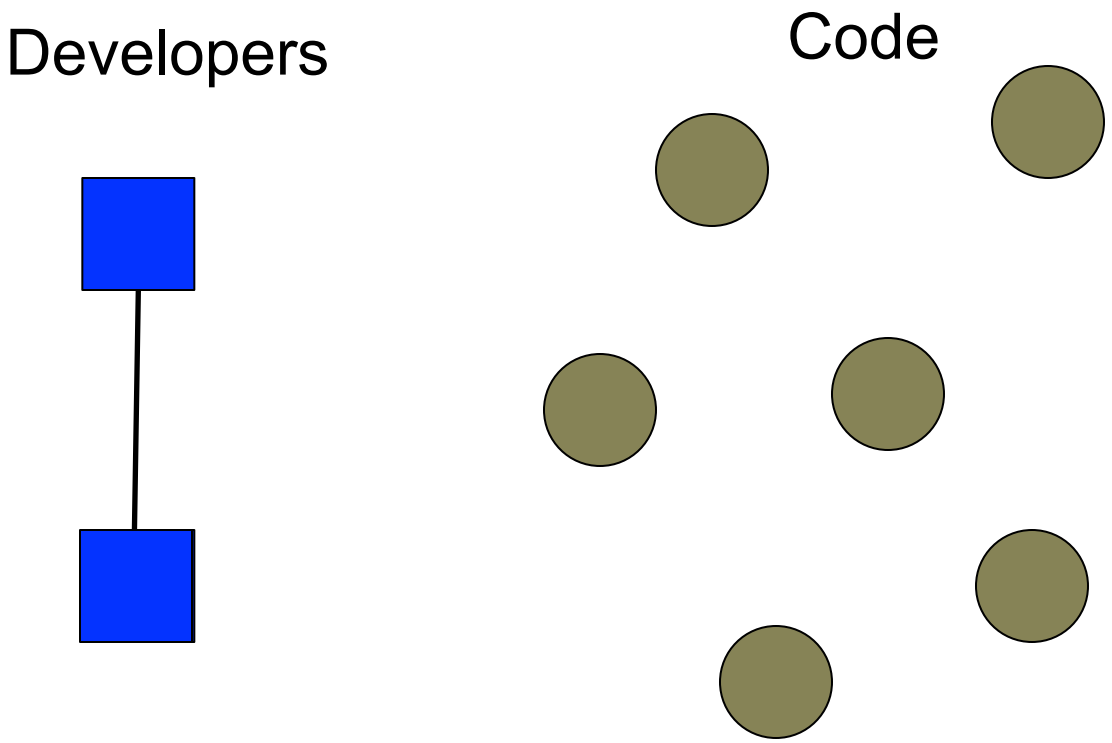
- 3 Software Development Projects
  - Non modular legacy software
  - Highly modular following reuse and reference architecture
  - Adapting software for mobile devices
- Data Collection
  - 51 semi-structured interviews
  - Participant and non-participant observation
- Data analysis
  - Grounded theory methods

[de Souza Redmiles 2011]

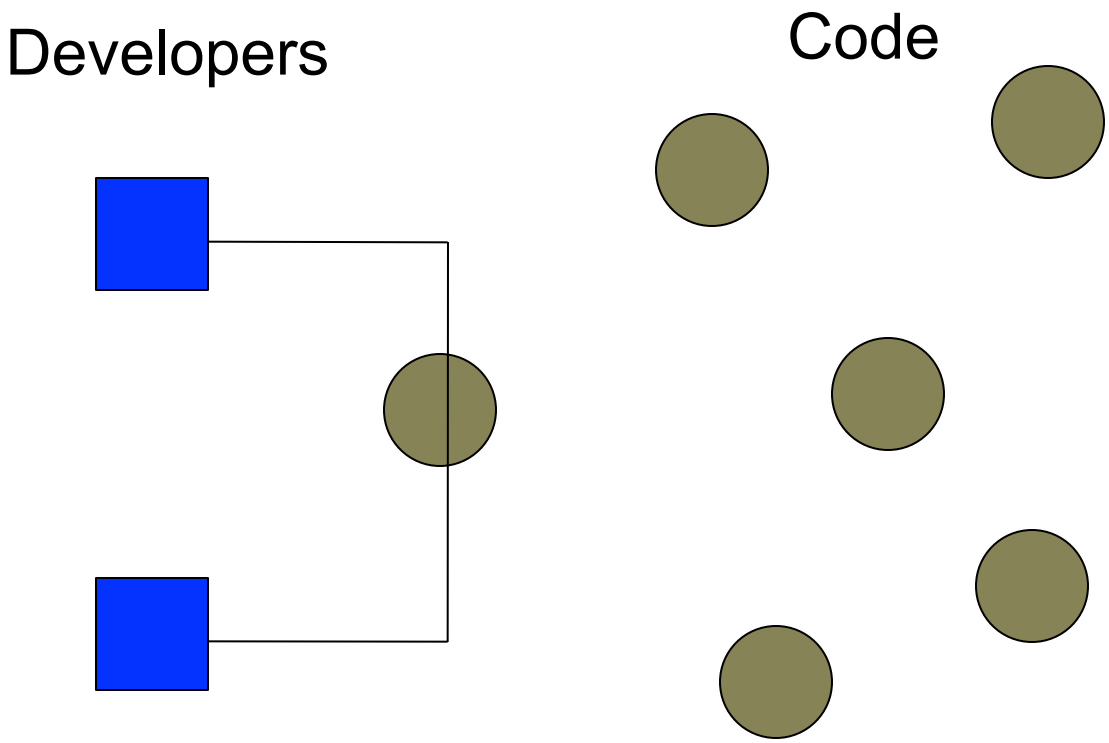
Ariadne 1.0 - Social and Technical Dependencies among Developers and Components



Progression of Graphs to Brackets (1)

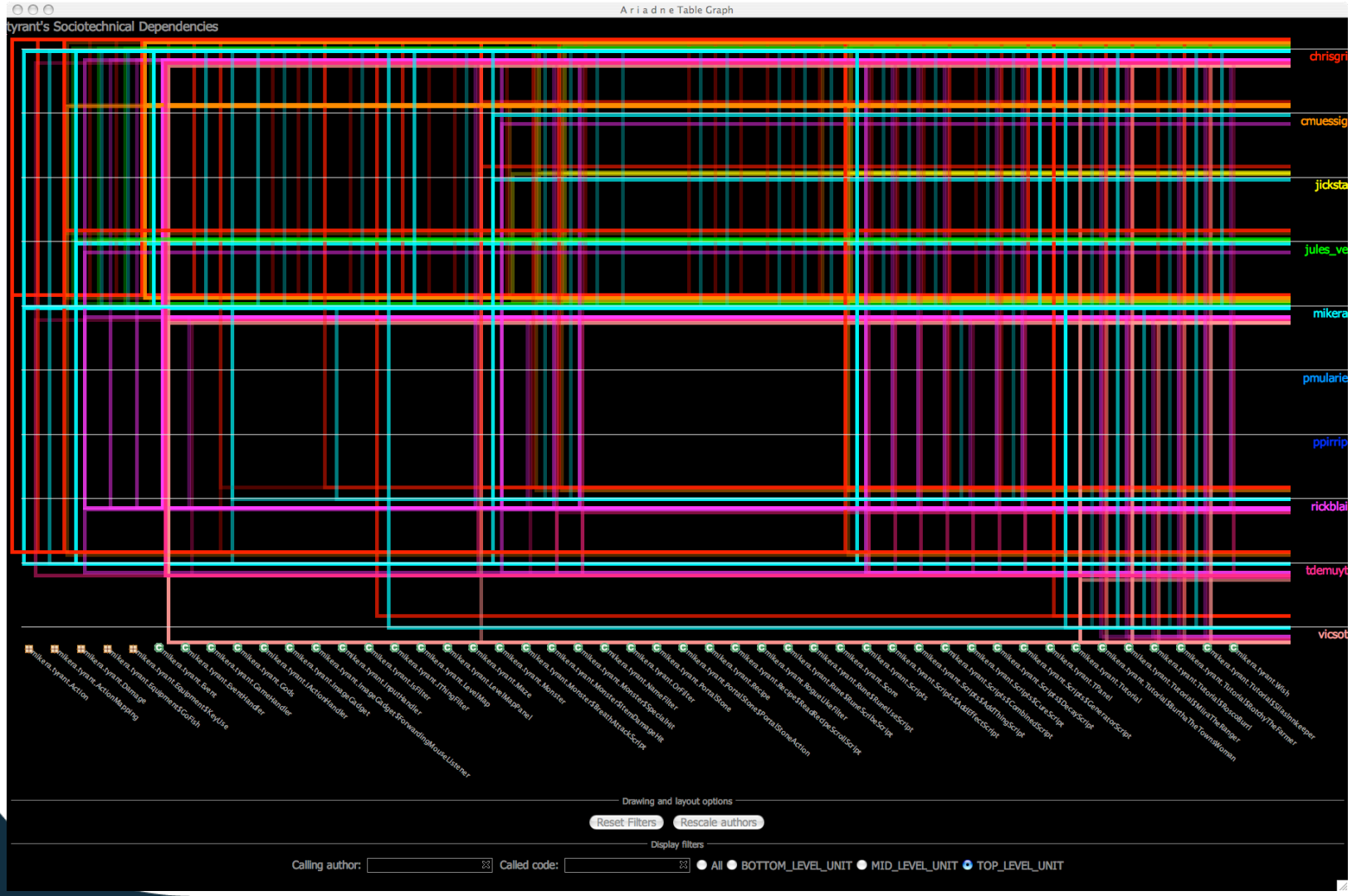


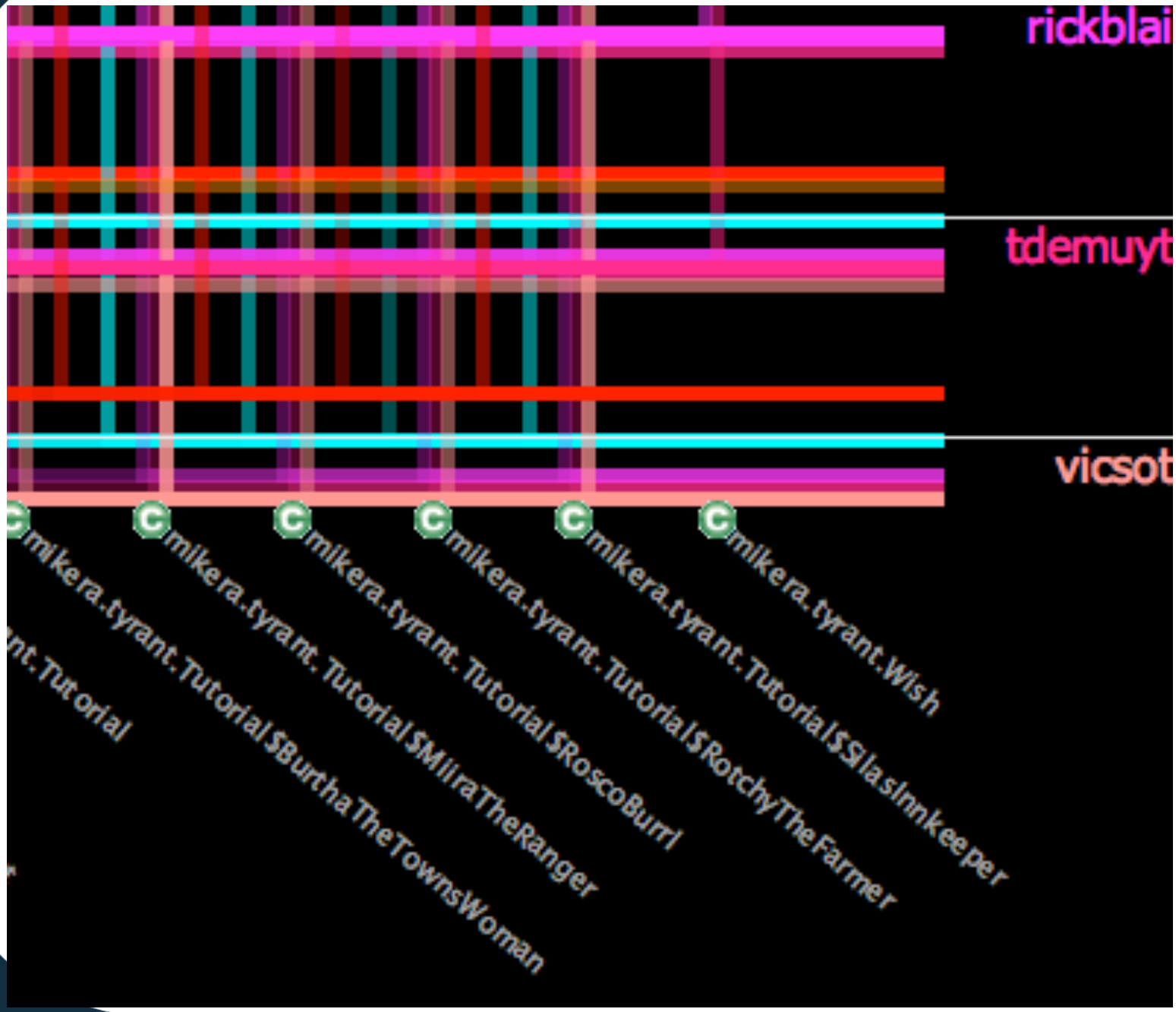
Progression of Graphs to Brackets (2)



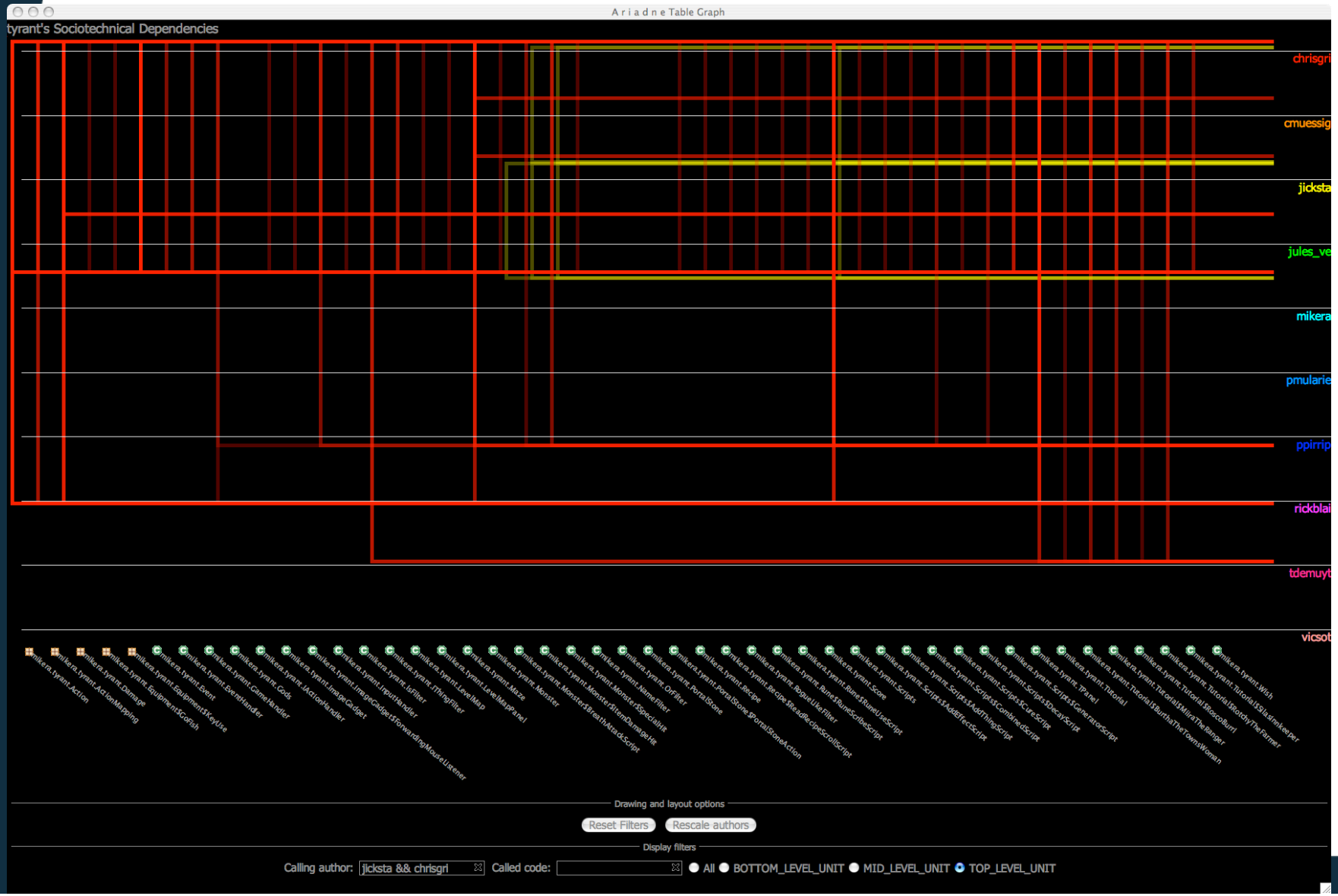
Ariadne 2.0

Grand Overview – many variables

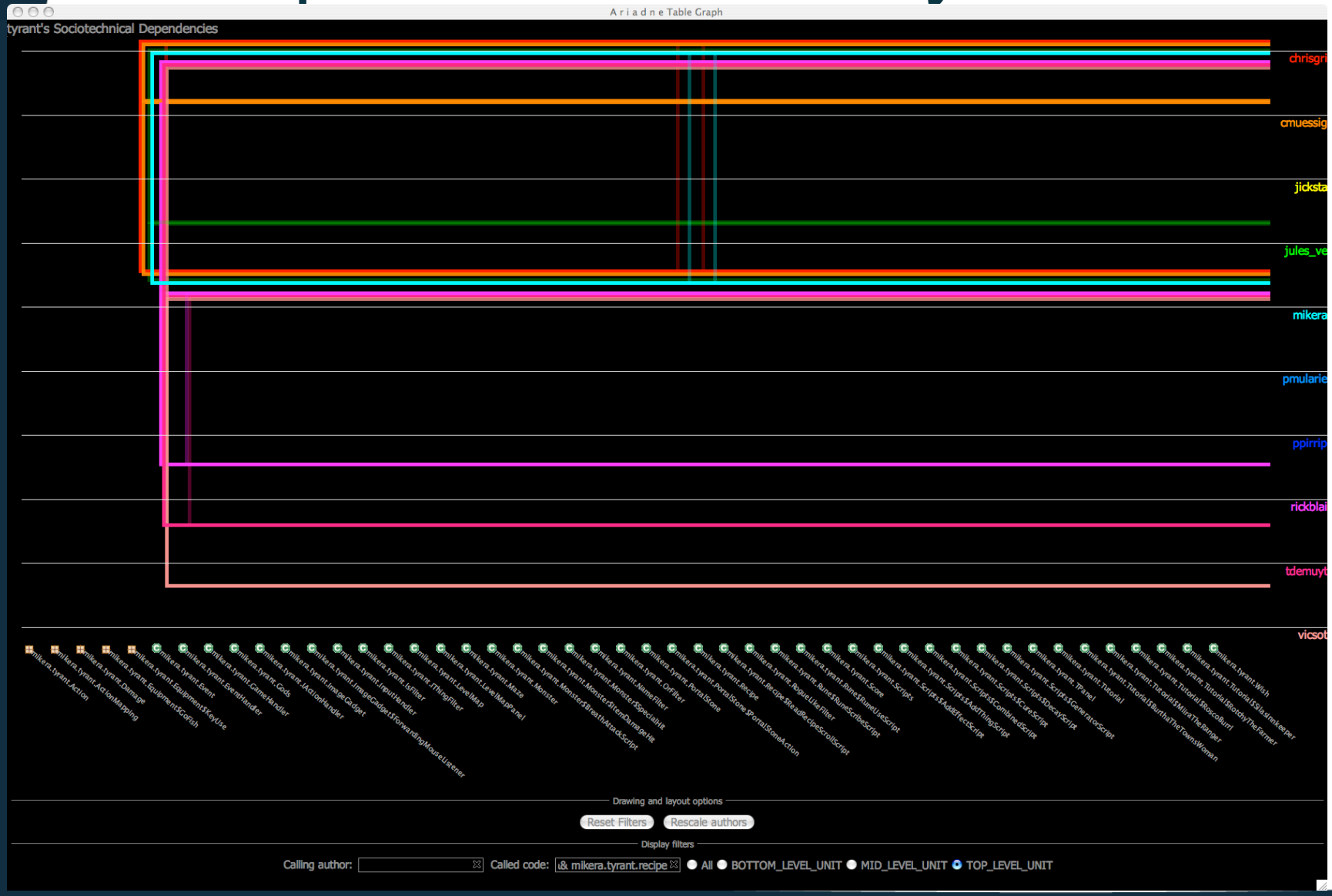



rickblai
tdemuyt
vicsot
mikera.tyrant.Wish
mikera.tyrant.Tutorial$SilasInnkeeper
mikera.tyrant.Tutorial$RotchyTheFarmer
mikera.tyrant.Tutorial$RoscoBurrl
mikera.tyrant.Tutorial$MiiraTheRanger
mikera.tyrant.Tutorial$BurthaTheTownsWoman
mikera.tyrant.Tutorial

Comparisons / Filter by Author



Comparisons / Filter by Artifact



Awareness – Lessons Learned - Tools

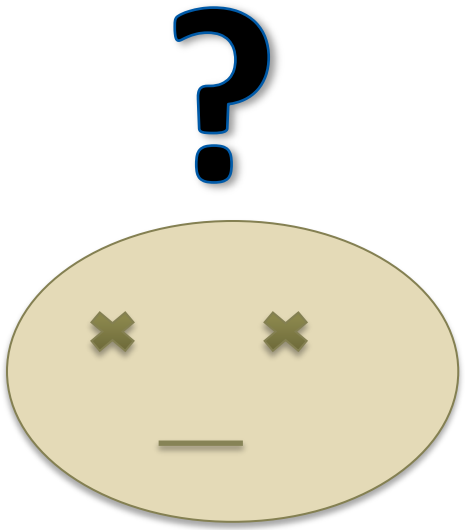
- Socio-technical systems
  - Ariadne (and other systems) integrate both the social and technical elements
- Visual user interface
- Software tools can help awareness
  - E.g., in identifying colleagues
  - E.g., in perceiving situations such as bottlenecks
  - E.g. in avoiding conflicts

Awareness – Lessons Learned - Behavior

- Awareness is key to coordinated work
- Yet awareness and common ground is hard to achieve at a distance
- There are practices that are a part of work that anticipate awareness
  - Specifically, to establish and maintain an *awareness network*

Some of the problems in our Example

- Isolation prevents knowing what others are doing
- Lack of awareness also prevents knowing why they are doing or not doing something.
- Distance prevents familiarity – both professional and personal



Trust

Trust emerging as a theme

- Al-Ani, B., Redmiles, D. In Strangers We Trust? Findings of an Empirical Study of Distributed Development, IEEE International Conference on Global Software Engineering (ICGSE, Limerick, Ireland), July 2009, pp. 121-130.
  - Re-examining data from open-ended interviews at a Fortune 500 company on distributed collaboration
  - The emergence of *trust* as a theme

[Al-Ani, Redmiles 2009]

Definitions of trust …

- Jarvenpaa, S. L., Knoll, K., and Leidner, D. E. *Is anybody out there? antecedents of trust in global virtual teams,* J. Manage. Inf. Syst. V. 14, No. 4, March, 1998, pp. 29-64.
  - Rational trust – willingness to be less "self-protective" and take risks
  - Social trust – a *duty* or *right way* to behave creates the willingness to take risks
- Wilson, J.M., Straus, S.G. & McEvily, W.J. *All in due time: The development of trust in computer-mediated and face-to-face groups,* Organizational Behavior and Human Decision Processes, 99, 2006, pp. 16-33.
  - Cognitive trust – beliefs about others' competence and reliability
  - Affective trust – beliefs about reciprocated concern, emotional ties and such

[Al-Ani, Redmiles 2009]

The Role of Trust

One party's positive expectations of another

- Trust:
  - Enhances team productivity
  - Helps teams manage uncertainty and complexity of working remotely
  - Promotes influential information exchange
  - Fosters innovation

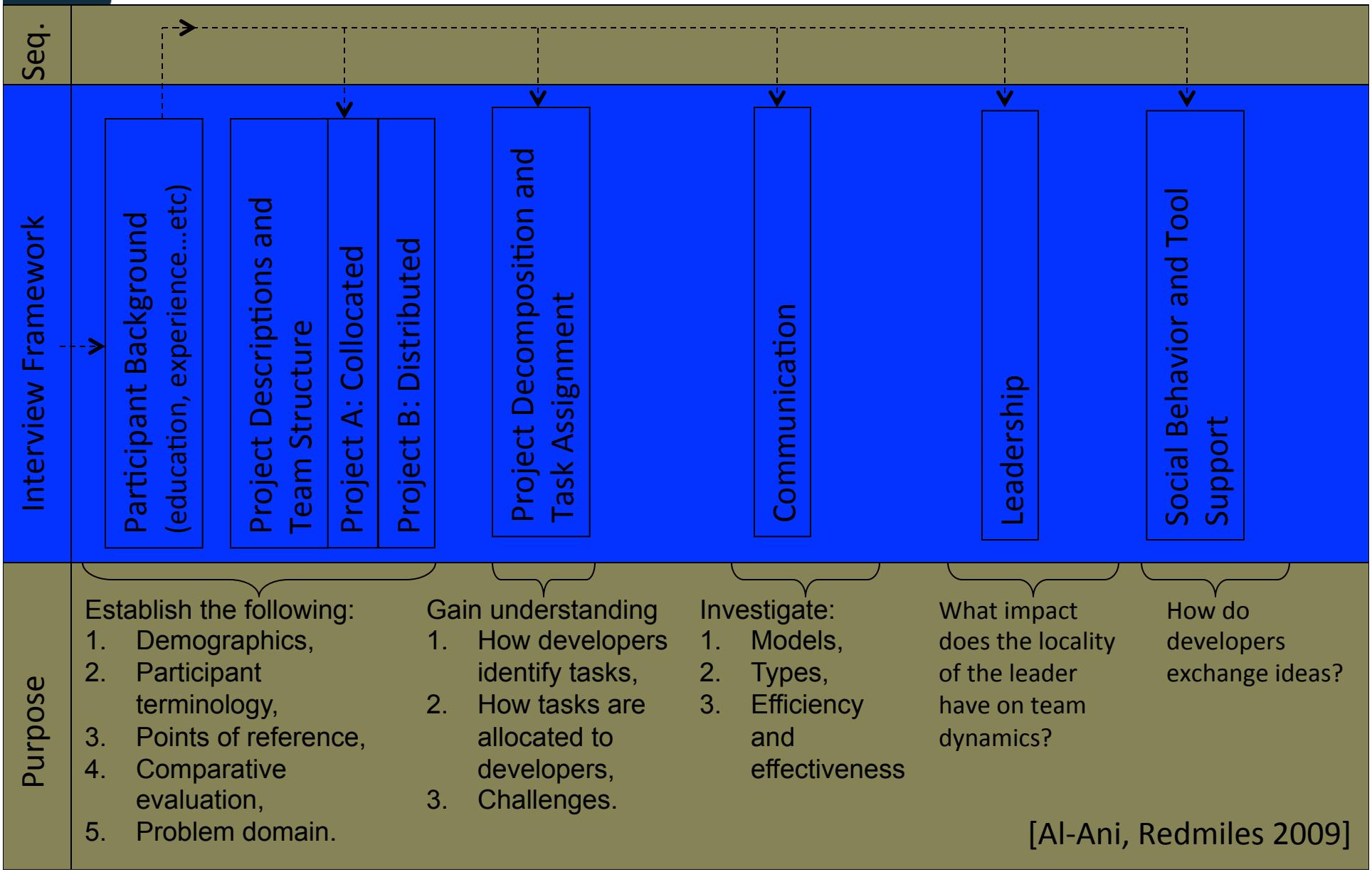
[Al-Ani, Redmiles 2009]

First Field Study: examining distributed collaboration

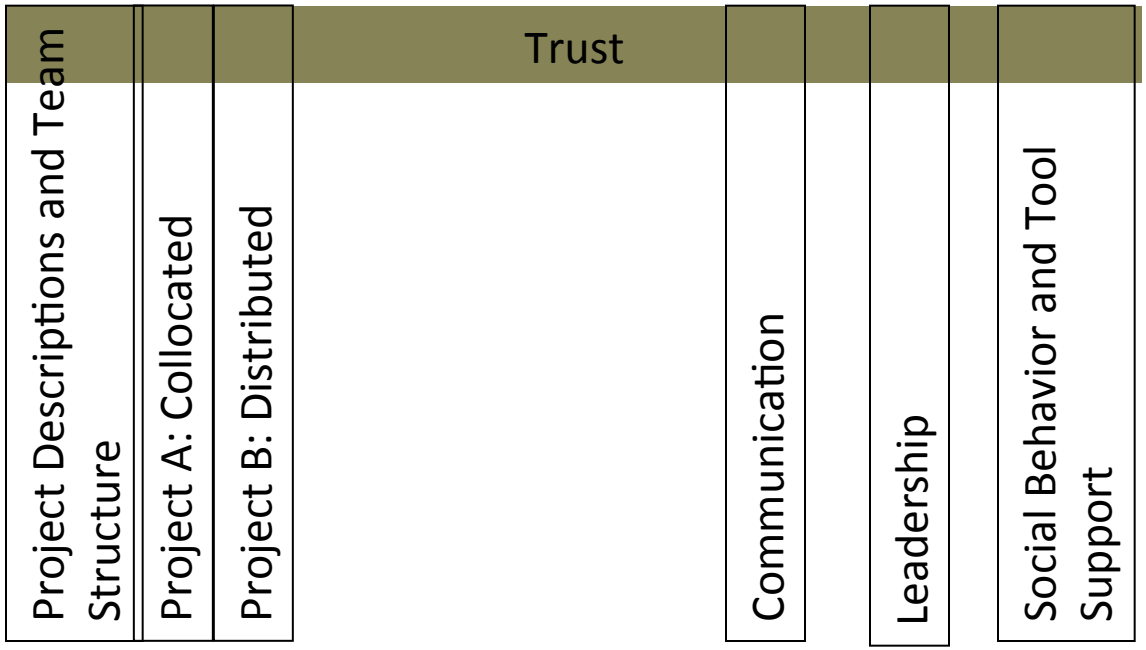
- Interviews were conducted with employees of a large multi-national organization.
- USA with 16 participants.
- Respondents mentioned a total of 26 different sites.
- Overall there were an average of 4 sites per distributed team.

[Al-Ani, Redmiles 2009]

Study Overview



Common thread: *trust*



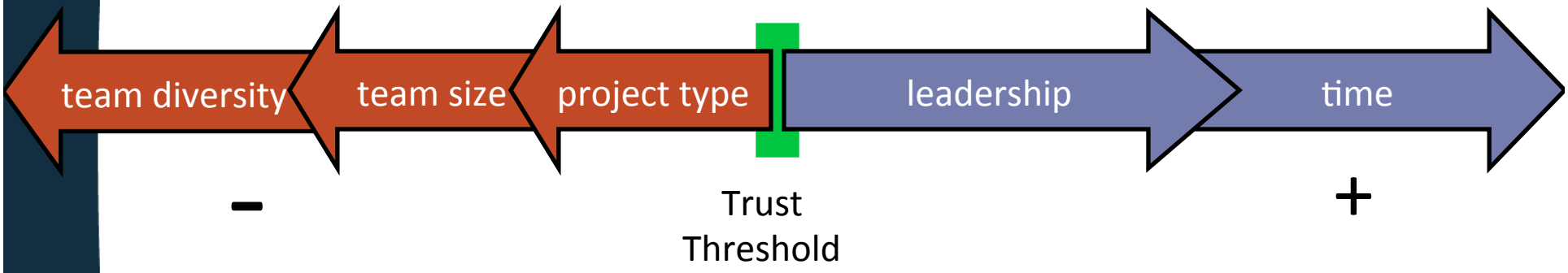
[Al-Ani, Redmiles 2009]

Lessons Learned – Factors Influencing Trust

- The issue of trust was raised by respondents:
  - Team size: larger teams.
  - Project type: innovative new.
  - Team diversity: high diversity.
  - Leadership: strong leadership.

[Al-Ani, Redmiles 2009]

Trust: Competing Facets



[Al-Ani, Redmiles 2009]

Imagine collaboration without trust!

- Double checking.
- Working in isolation.
- Reluctance to share information.

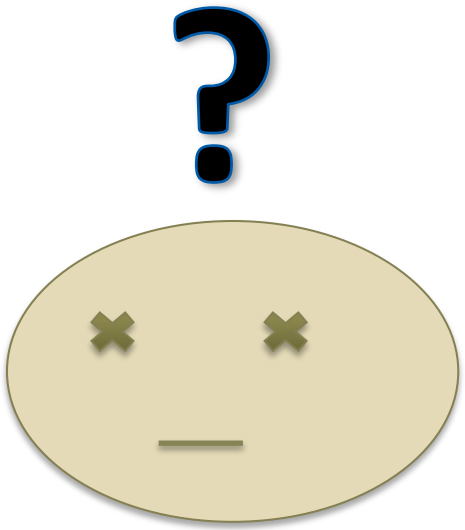
[Al-Ani, Redmiles 2009]

An example

[Al-Ani, Redmiles 2009]

Some of the problems in our Example

- Isolation prevents knowing what others are doing
- Lack of awareness also prevents knowing why they are doing or not doing something.
- Distance prevents familiarity – both professional and personal



Second Field Study: examining trust in particular

- What are the antecedents of trust in distributed teams?
- What are the behaviors and actions that team members engage in that most frequently engender trust?
- What would help developers trust others on their teams?

Interview protocol

- Direct but open ended questions
  - Background and project
- Scenarios (contextualized to interview)
  - You are working on … you need … who would you ask?
- Storytelling
  - Can you tell me and instance when … tell me a story …

Degree of trust “Game” in Protocol

Sought out international collaborators!

- Thanks to …
  - Drs. Rafael Prikladnicki and Sabrina Marczak, both at the Pontifícia Universidade Católica do Rio Grande do Sul – PUCRS in Porto Alegre.

Field sites

- 5 multi-site and multi-national organizations.
- Each organization is considered one of the leaders in the development of computer-based systems.
- Interview subjects were recruited through e-mails sent to a cross-section of the organizations, as well as word of mouth (snowball).

[Al-Ani, Wang, Marczak et al., 2012]

Participants

- 18 female and 43 male employees.
- On average, 11 years' experience working in distributed teams and 12 years' experience in the organization.
- Roles in one of 3 broad categories:
  - managers - 21 (e.g. project manager, portfolio manager),
  - developers - 35 (e.g. tester, software designer, system architect, business analyst) and
  - support staff - 5 (e.g. lawyer, quality assurance).
- Located in the USA (34), Brazil (18), Mexico (2), and Costa Rica, Ireland, Israel, Poland, China, Taiwan, and Malaysia (1 each)

[Al-Ani, Wang, Marczak et al., 2012]

Example Analysis and Result

- Al-Ani, B., Wang, Y., Marczak, S., Trainer, E., Redmiles, D. Distributed Developers and the Non-Use of Web 2.0 Technologies: A Proclivity Model, The 7th International Conference on Global Software Engineering (ICGSE 2012, Porto Alegre, Brazil), August 2012, pp. 104-113.
  - Web 2.0 technologies allow employees to build a familiarity with one another and share information and should improve trust.
  - However, less than 25% of our study participants adopted these technologies and most have a negative view of these technologies
  - Why?

[Al-Ani, Wang, Marczak et al., 2012]

Analysis

- Interviews were transcribed and coded using Atlas.ti (http://www.atlasti.com/index.html)
- Qualitative analysis
  - Examining interviewees comments
  - Identifying themes
- Quantitative analysis
  - Variables derived from coded interviews, including self-reported demographics
  - Various statistical techniques but in this instance, logistic regression

[Al-Ani, Wang, Marczak et al., 2012]

Variables Examined

Variable	Meaning
Usage	The usage of Web 2.0 technologies
Language	Whether an interviewee can speak more than one language.
Education	Whether an interviewee holds a postgraduate degree.
Gender	An interviewee's gender.
AGE	An interviewee's age.
Experience at Distributed Development	An interviewee's experience with distributed software development.
Job - Manager	Whether an interviewee is a manager or not.
Job - Technical	Whether an interviewee's job is technical-oriented or not.
Use of (non Web 2.0) other technologies	The number of communication technologies an interviewee has been used in their work except Web 2.0 technologies.

[Al-Ani, Wang, Marczak et al., 2012]

Results of Quantitative Analysis

Variables	Conclusion
Age	*An increase of age will result the lower probability of using Web 2.0 to support distributed collaboration.*
Experience at Distributed Development	*An increase of experience of distributed development will result the higher probability of using Web 2.0 to support distributed collaboration.*
Use of (non Web 2.0) other technologies	*An increase of using other Communication Technology will result the higher probability of using Web 2.0 to support distributed collaboration.*

[Al-Ani, Wang, Marczak et al., 2012]

Results of Qualitative Analysis

- The alignment between developers' work and their supporting technology is positively associated with developers' trust towards collaboration tools.
- The experience of being exposed to distributed software development is positively associated with developers' trust towards collaboration tools.
- Positive organization policies on collaboration tools are positively associated with developers' usage of traditional collaboration tools.

[Al-Ani, Wang, Marczak et al., 2012]

Lessons Learned – Tool Usage

- Our study indicated paths to better tools / better adoption
  - Experience in tool usage increases everyday – in personal as well as professional use.
  - Knowing the value of "Web 2.0" tools can encourage changed organizational policies.
  - Support for "vertical" integration – value for many participants – can increase adoption.
- Encouragement for tools!

[Al-Ani, Wang, Marczak et al., 2012]

Tool Support Specific to Trust

Knowing personal or professional (expertise) information?

- Schumann, J., Shih, P., Redmiles, D., Horton, G. Supporting Initial Trust in Distributed Idea Generation and Evaluation, The 2012 International ACM SIGGROUP Conference on Supporting Group Work (GROUP 2012, Sanibel Island, FL), October 2012, in press.
  - Effects of **cognitive** and **affective** trust on collaborative brainstorming and evaluation.
  - Open to gender effects (as inspired by Professor Margaret Burnett, Oregon State).

[Schumann, Shih, Redmiles, Horton, 2012]

Innovation and Trust

- Cognitive Trust
  - Judgment of competence, reliability, and professionalism
  - Deliberate assessment of benefits of trusting over risks
- Affective Trust
  - Emotional ties among individuals, beliefs about interpersonal care and concerns
  - Sincere concern for the well-being of the others
- Innovation Process
  - Idea Generation
  - Idea Evaluation

[Schumann, Shih, Redmiles, Horton, 2012]

Trust Information Elements

Personal information	**#**	**Expertise Information**	**#**
Hobbies	14	Experience (projects)	15
Gender	13	Specific skills	15
Honorary activities	12	Specialization/interests	14
Age	11	References (awards)	14
Nationality	8	Degree (years in the program)	12
Taste of music	7	Companies	8
TV shows	6	Department	7

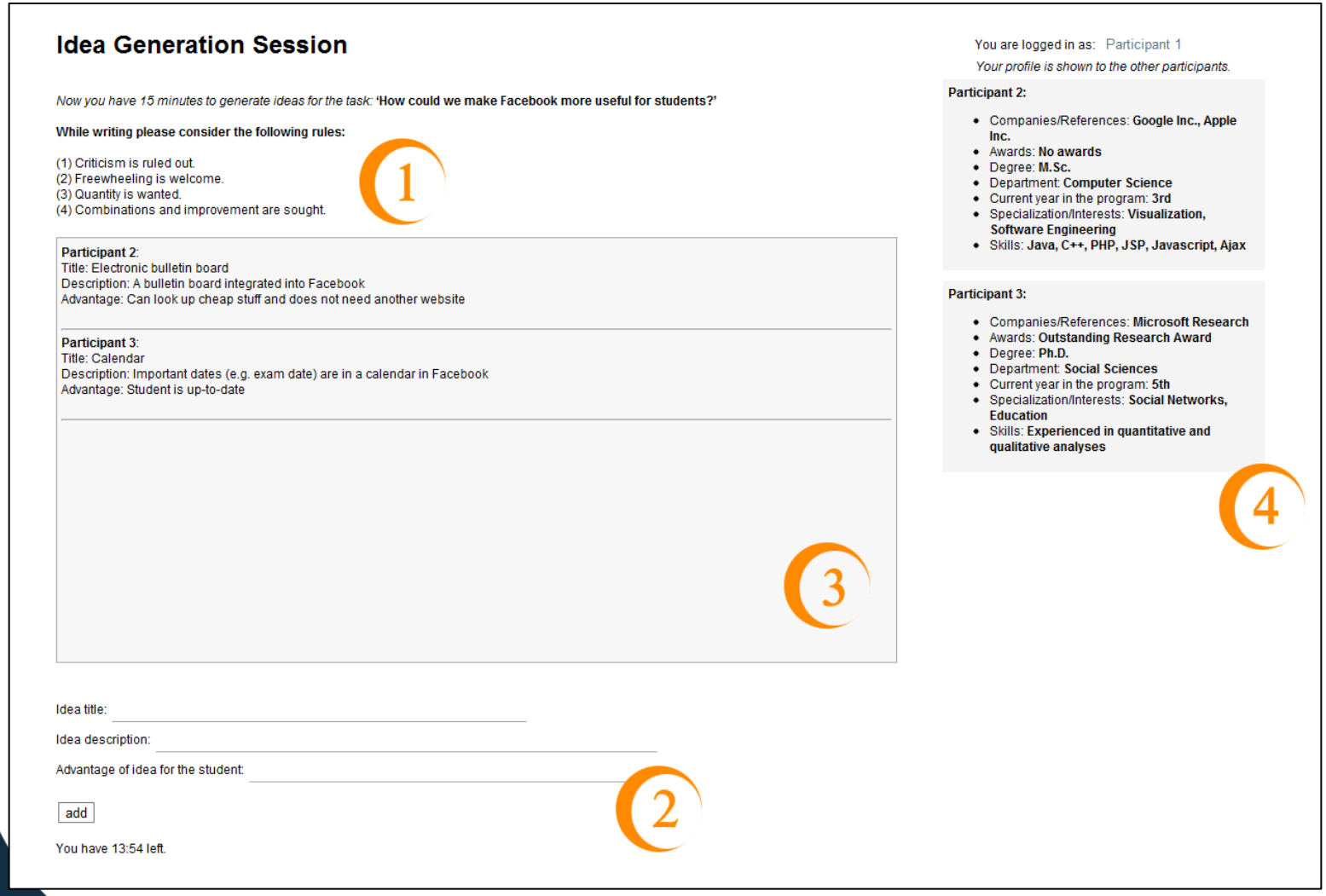
[Schumann, Shih, Redmiles, Horton, 2012]

The Experiment

- Idea Generation
  - Participants work to generate ideas
  - Simultaneously, 2 remote confederates produced 10 pre-compiled ideas in the 15-min session.
- Idea Evaluation
  - Each participant rated 6 ideas.
  - Originality and feasibility ratings of the confederates were pre-compiled.
- 36 Subjects
  - 18 Male
  - 18 Female

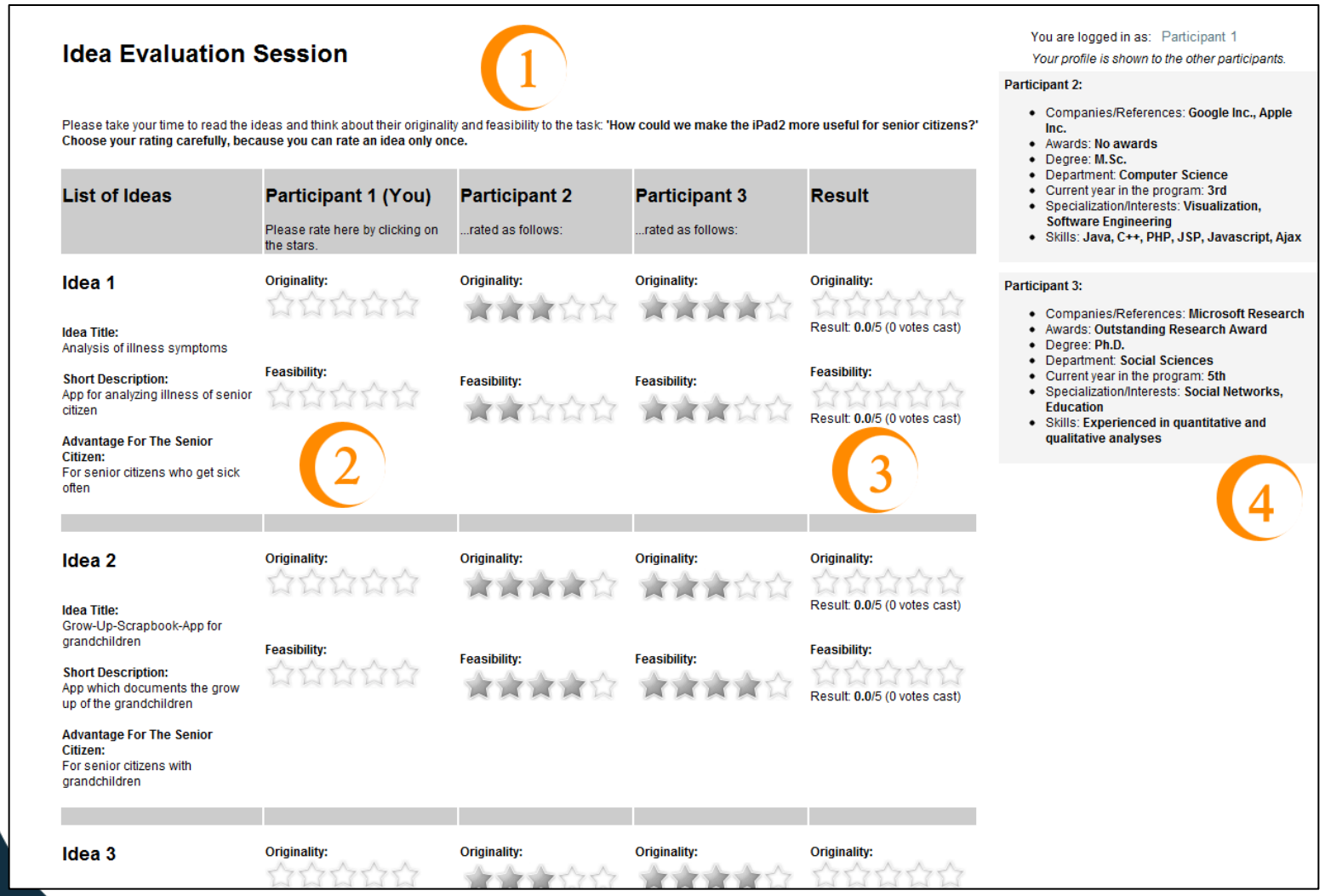
[Schumann, Shih, Redmiles, Horton, 2012]

Idea Generation Screen



[Schumann, Shih, Redmiles, Horton, 2012]

Idea Evaluation Screen



Idea Evaluation Session

1

Please take your time to read the ideas and think about their originality and feasibility to the task: **'How could we make the iPad2 more useful for senior citizens?'**
Choose your rating carefully, because you can rate an idea only once.

List of Ideas	Participant 1 (You) Please rate here by clicking on the stars.	Participant 2 ...rated as follows:	Participant 3 ...rated as follows:	Result
Idea 1 **Idea Title:** Analysis of illness symptoms **Short Description:** App for analyzing illness of senior citizen **Advantage For The Senior Citizen:** For senior citizens who get sick often	Originality: Feasibility: 2	Originality: Feasibility:	Originality: Feasibility:	Originality: Result: 0.0/5 (0 votes cast) Feasibility: Result: 0.0/5 (0 votes cast) 3
Idea 2 **Idea Title:** Grow-Up-Scrapbook-App for grandchildren **Short Description:** App which documents the grow up of the grandchildren **Advantage For The Senior Citizen:** For senior citizens with grandchildren	Originality: Feasibility:	Originality: Feasibility:	Originality: Feasibility:	Originality: Result: 0.0/5 (0 votes cast) Feasibility: Result: 0.0/5 (0 votes cast)
Idea 3	Originality:	Originality:	Originality:	Originality:

You are logged in as: Participant 1
Your profile is shown to the other participants.

Participant 2:

- Companies/References: **Google Inc., Apple Inc.**
- Awards: **No awards**
- Degree: **M.Sc.**
- Department: **Computer Science**
- Current year in the program: **3rd**
- Specialization/Interests: **Visualization, Software Engineering**
- Skills: **Java, C++, PHP, JSP, Javascript, Ajax**

Participant 3:

- Companies/References: **Microsoft Research**
- Awards: **Outstanding Research Award**
- Degree: **Ph.D.**
- Department: **Social Sciences**
- Current year in the program: **5th**
- Specialization/Interests: **Social Networks, Education**
- Skills: **Experienced in quantitative and qualitative analyses**

4

[Schumann, Shih, Redmiles, Horton, 2012]

Results – Support for Trust

- Knowing personal information leads to higher affective trust and knowing expertise information leads to higher cognitive trust – expected.
- However, knowing *either* personal or expertise information boosted both trust levels – participants did not make distinctions.

[Schumann, Shih, Redmiles, Horton, 2012]

Results – Gender Effects

- Gender differences have little effect on trust in idea generation and idea evaluation sessions.
- Female participants created more feasible ideas while male participants created more original ideas in the experiment

[Schumann, Shih, Redmiles, Horton, 2012]

Lessons Learned – Tool Support for Trust

- Evidence that information provided by tools can engender trust.
- Further encouragement towards tool support.
- See also work by Filippo Lanubile and colleagues on *Augmenting Social Awareness in a Collaborative Development Environment*

Design Space for Collaboration Tools

- Trainer, E.H., Redmiles, D.F. Foundations for the Design of Visualizations that Support Trust in Distributed Teams, International Working Conference on Advanced Visual Interfaces (AVI 2012, Capri Island, Italy), May 2012, pp. 34-41.

[Trainer, Redmiles, 2012]

Further tool support for trust

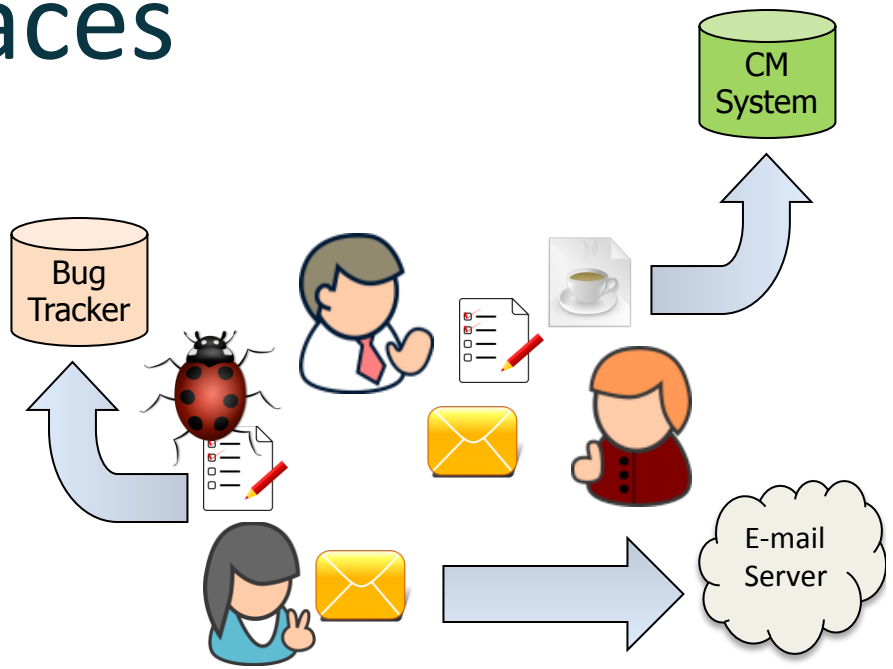
A software tool can usefully provide information that engenders perceived trustworthiness among distributed team members.

- Questions:
  - What information affects distributed team members perceptions of others' trustworthiness?
  - Can this information be delivered in a software tool?

[Trainer, Redmiles, 2012]

Collaborative Traces

- A term that refers to data visualized by "awareness" tools
- Representations of past and current activity of a group of developers manipulating software development artifacts



[Trainer, Redmiles, 2012]

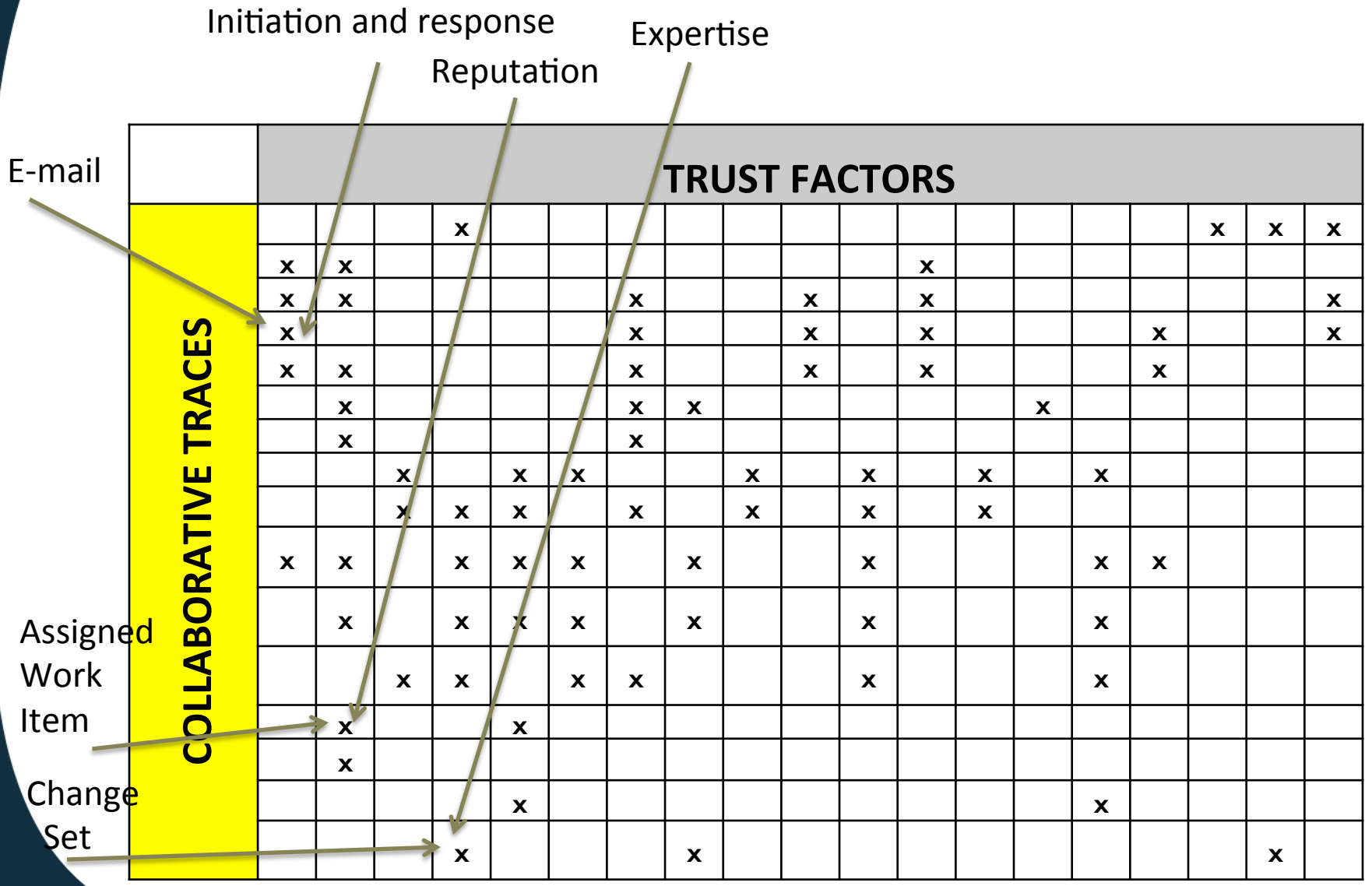
Collaborative Traces for Trust

- (RQ) "What information….."
- As shown by a matrix…..
- Columns:
  - Trust factors, i.e. information that affects trust, from the literature on trust
- Rows:
  - Collaborative traces + other data (e.g., time zone, org. chart)

<see figure on next slide>

[Trainer, Redmiles, 2012]

Collaborative Traces for Trust



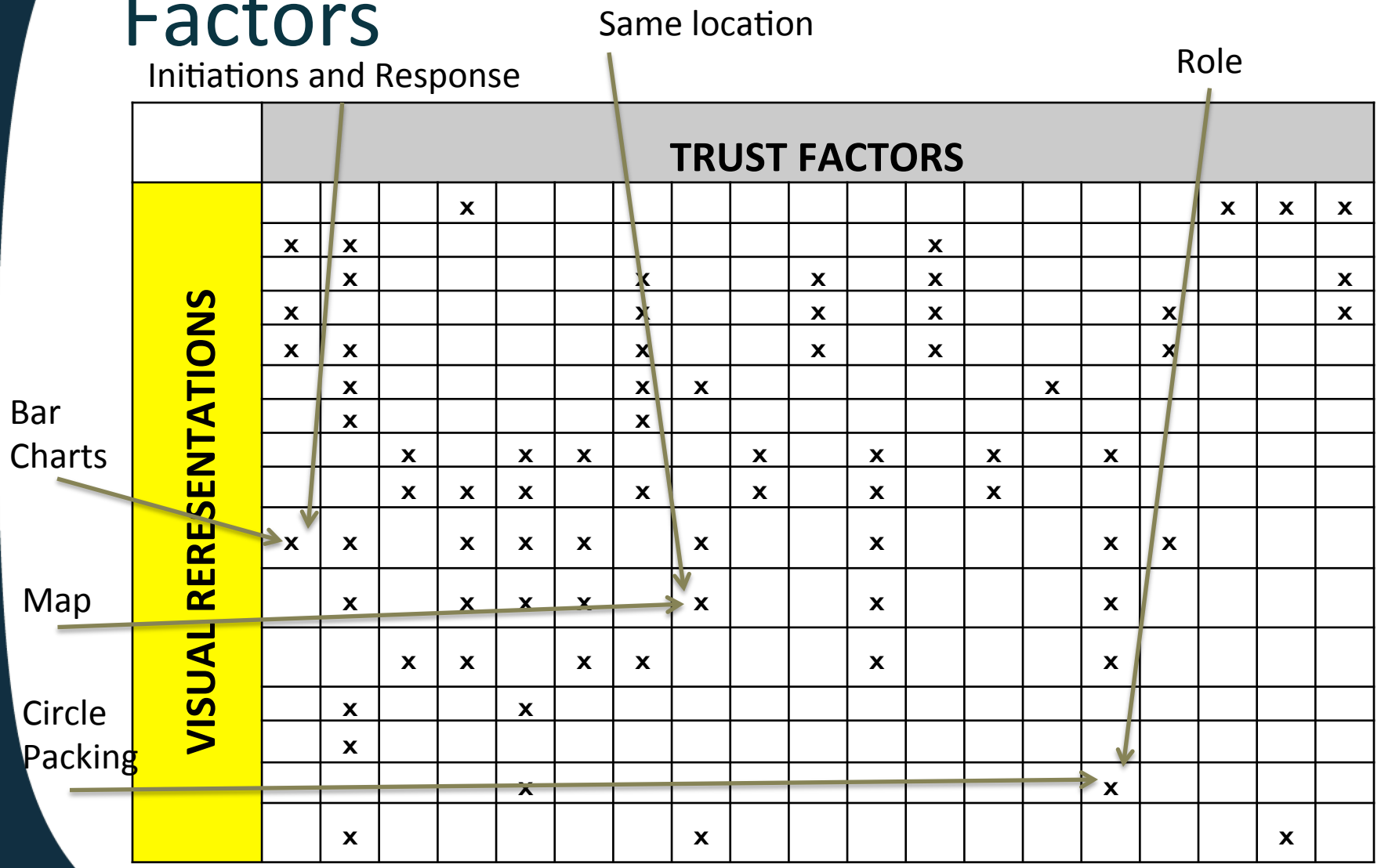
[Trainer, Redmiles, 2012]

Visual Representations for Trust

- Visual representations summarize information provided by CTs
- How to choose appropriate visualizations?
  - Web-based advice (e.g., ManyEyes, Swivel, Google Chart Tools) organized by task:
    - Show relationships (node-edge, matrices)
    - Show hierarchy (trees, circle packing)
    - Compare numerical values (bar charts)

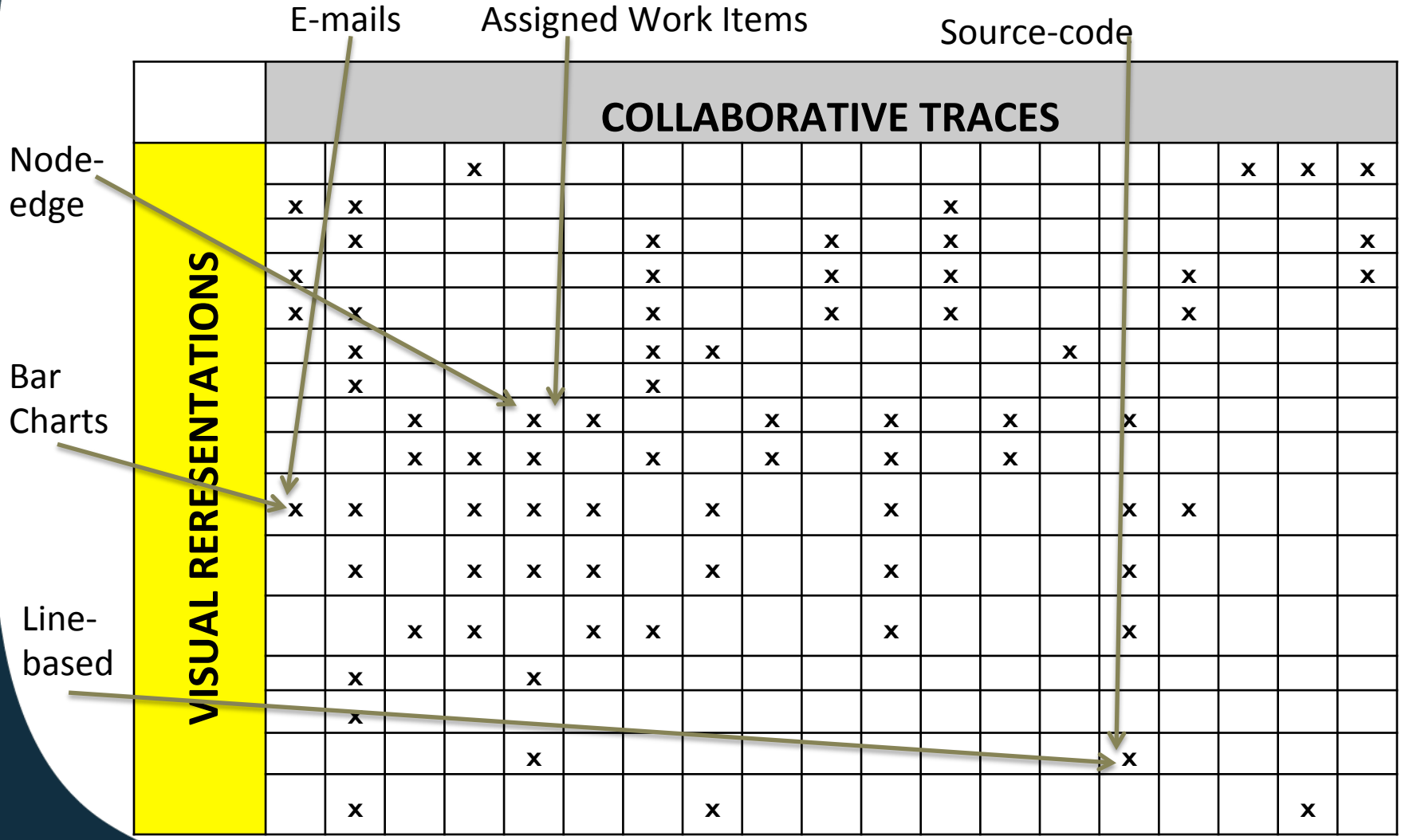
[Trainer, Redmiles, 2012]

Visual Representations and Trust Factors



[Trainer, Redmiles, 2012]

Visual Representations and Collaborative traces

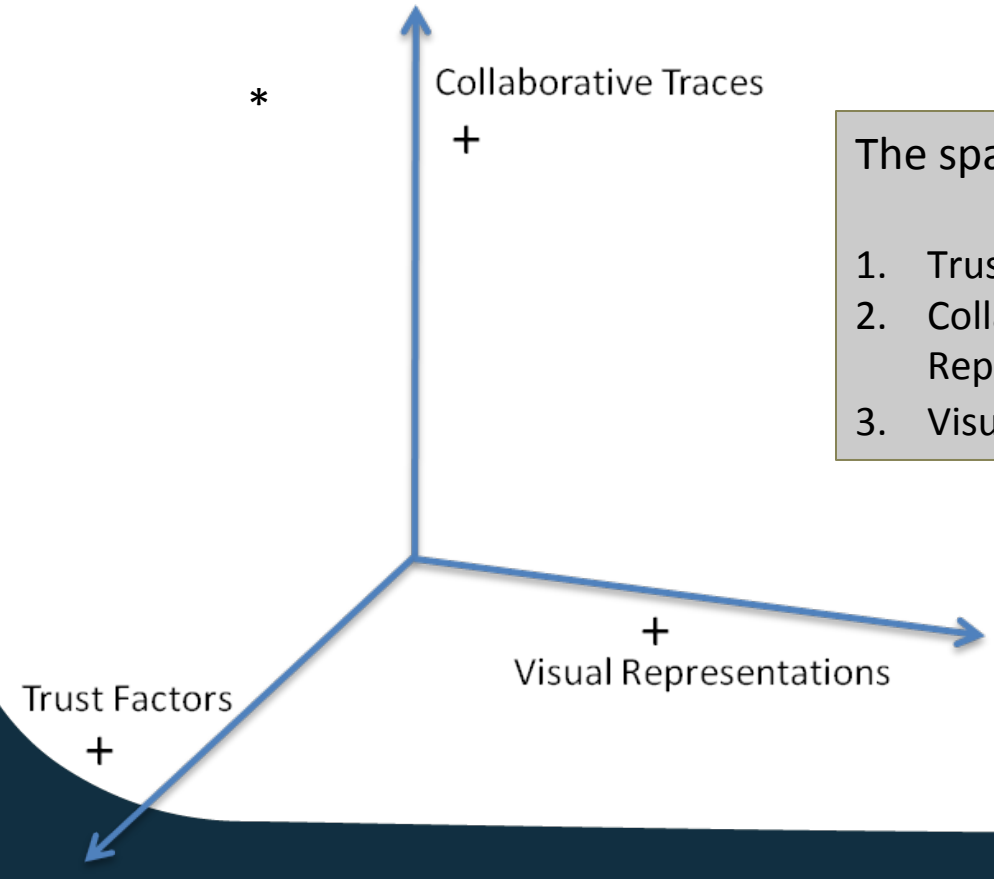


[Trainer, Redmiles, 2012]

A Design Space

- **Model of Design Space** =

{ Trust factors, Visual representations, Collaborative traces }



The space is comprised of 3 matrices:

1. Trust Factors x Collaborative Traces
2. Collaborative Traces x Visual Representations
3. Visual Representations x Trust Factors

[Trainer, Redmiles, 2012]

Lessons Learned

- The design space presented here:
  - Is a first step toward exploring whether visual interfaces can engender perceived trustworthiness
  - Can be of value to designers of visual interfaces…and ultimately to distributed software developers
  - Will be empirically validated in an upcoming human subjects experiment

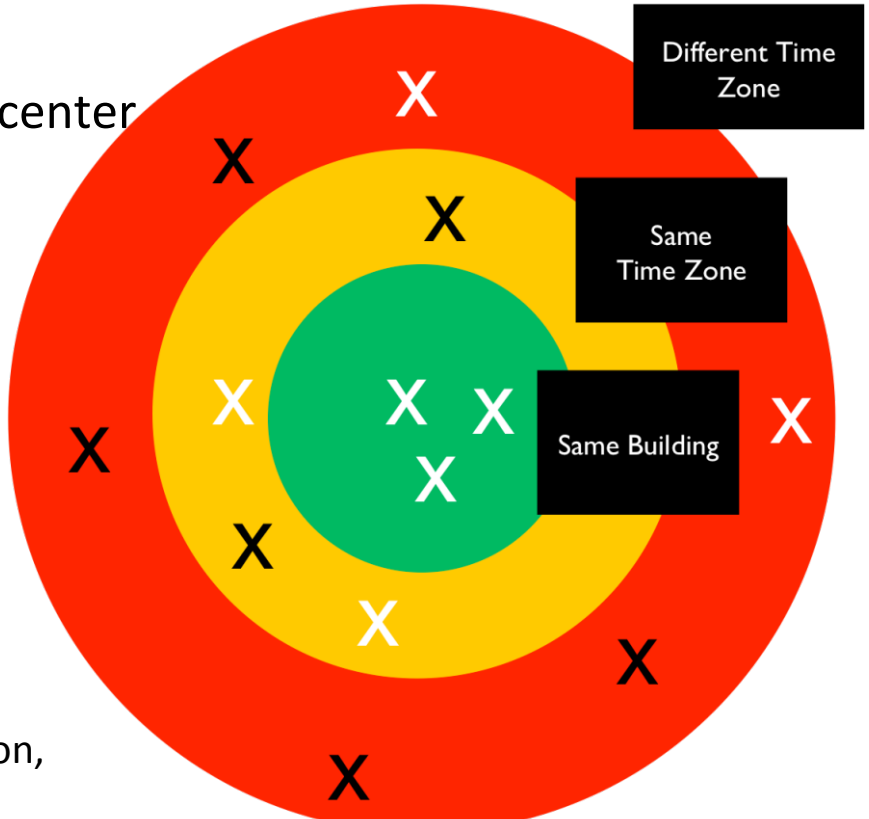
[Trainer, Redmiles, 2012]

1. Availability Radar

- Groups developers by their proximity to the current user

Further horizontal distances from center indicate greater physical distance.

•White x = non-manager
•Black x = manager

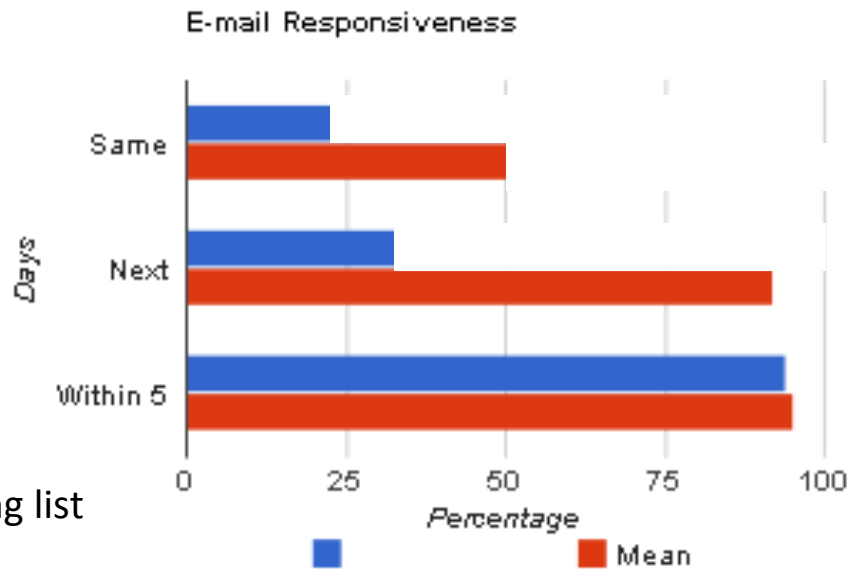


Visual Representation: CirclePacking (flattened)
CTs (data): Org. Chart, Work site location, time zone

[Trainer, Redmiles, 2012]

2. Responsiveness Bars

- "Bins" developers' reply times to e-mails based on time to reply observed in in org. literature
  - Same day
  - Next day
  - Within 5 days

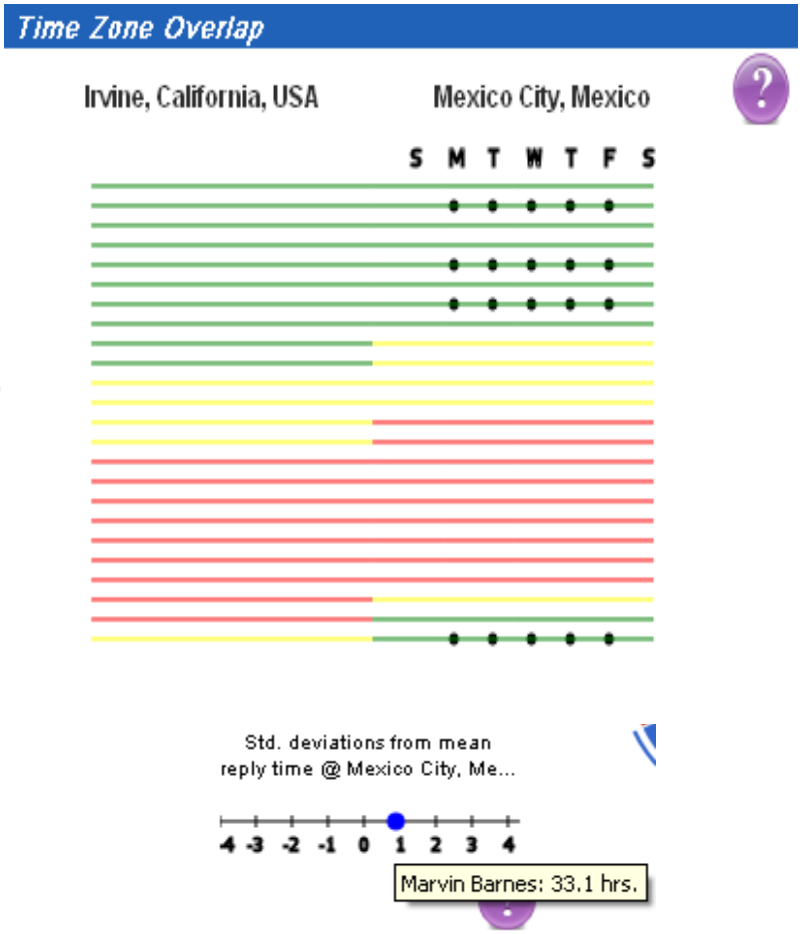


Visual Representation: Bar charts
CTs: E-mail, (instant messages, mailing list postings)

[Trainer, Redmiles, 2012]

3. Time Zone Overlap (2)

- Show overlap in times of the day
  - Green (8am-5pm)
  - Yellow (6pm-9pm, 7am)
  - Red (10pm-6am)
- Time on e-mail (black dots)
  - "Day laborers"
  - "Email-aholics"



[Trainer, Redmiles, 2012]

Scenario: Consider a Remote Co-worker's Failure to Deliver on Time

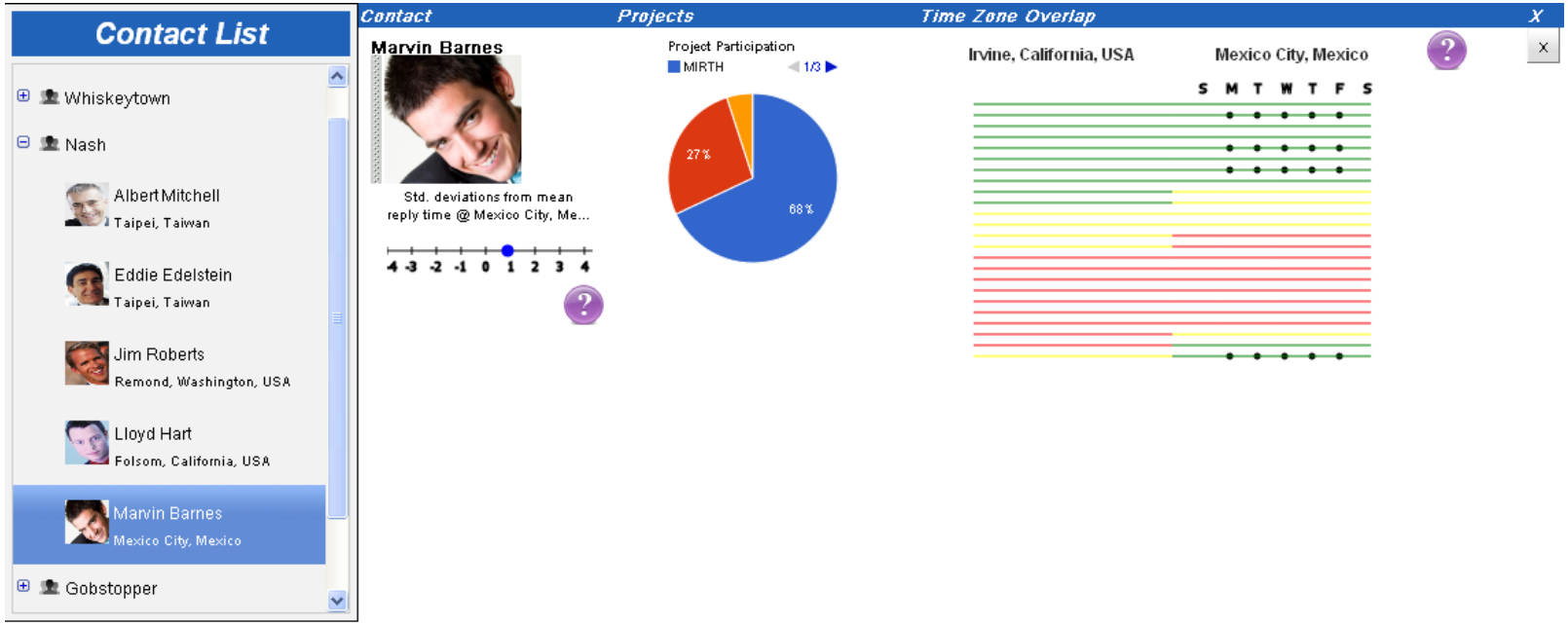
You have to come into the office this weekend to work on the "MIRTH" project. Victor Ward, a software engineer on your team, failed to check in his source-code changes on time, and has not been responsive over e-mail. As a result, you are not able to integrate your new changes into the build, and the project has slipped a week behind schedule.

(From our field observations [Al-Ani et al., 2011])

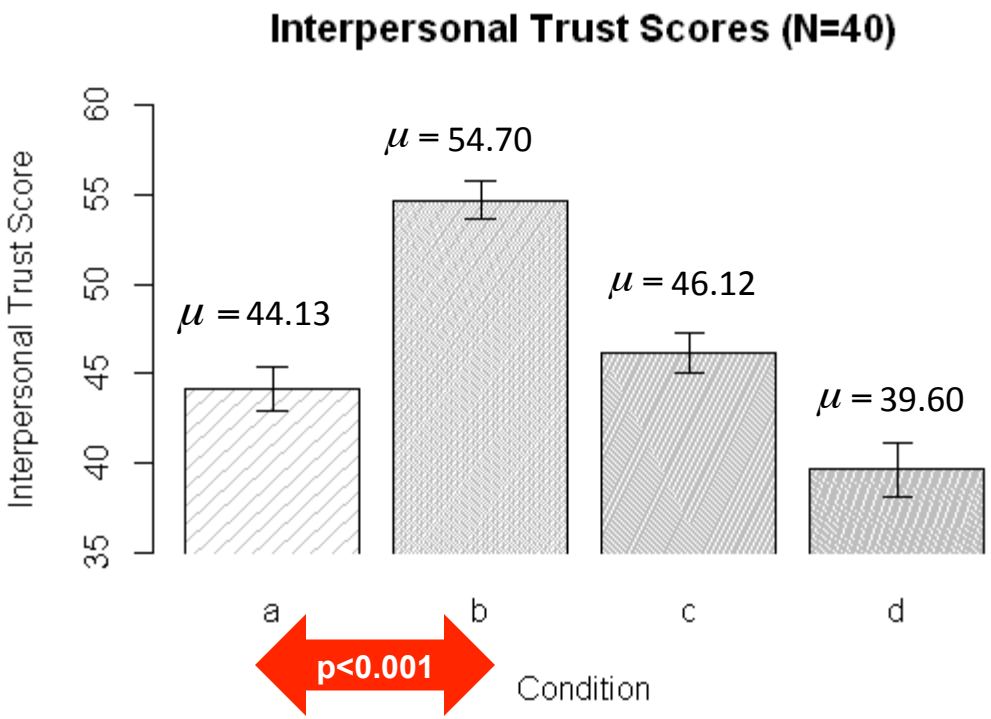
Measuring Trust

- Attribution Ranking
  - *Given what you know about how people behave, which explanation do you think most likely describes why Victor was unable to deliver on time?* (example)
  - **Situational attributions** reflect high perceived trustworthiness. **Dispositional attributions** reflect low perceived trustworthiness.
- Standardized Questionnaire
  - **Standard specific interpersonal trust** (Johnson-George & Swap, 1982), measures one's perceived trustworthiness toward a specific individual (5-pt. Likert items)

A software tool can usefully provide information that engenders perceived trustworthiness.



THESEUS and Interpersonal Trust



Legend	
a	No Theseus
b	Theseus situational
c	Theseus moderate situational
d	Theseus dispositional

Scores range from 15 (low trust) to 75 (highest trust), with a neutral score or midpoint of 45.

Figure 1. Standard Deviation of Interpersonal Trust Scores.

Technique	Result
One-way repeated measures ANOVA	Significant effect of Theseus on interpersonal trust score [$F(3, 117) = 27.03$, $p<0.001$, partial $\eta^2 = 0.41$].

THESEUS and Attributions

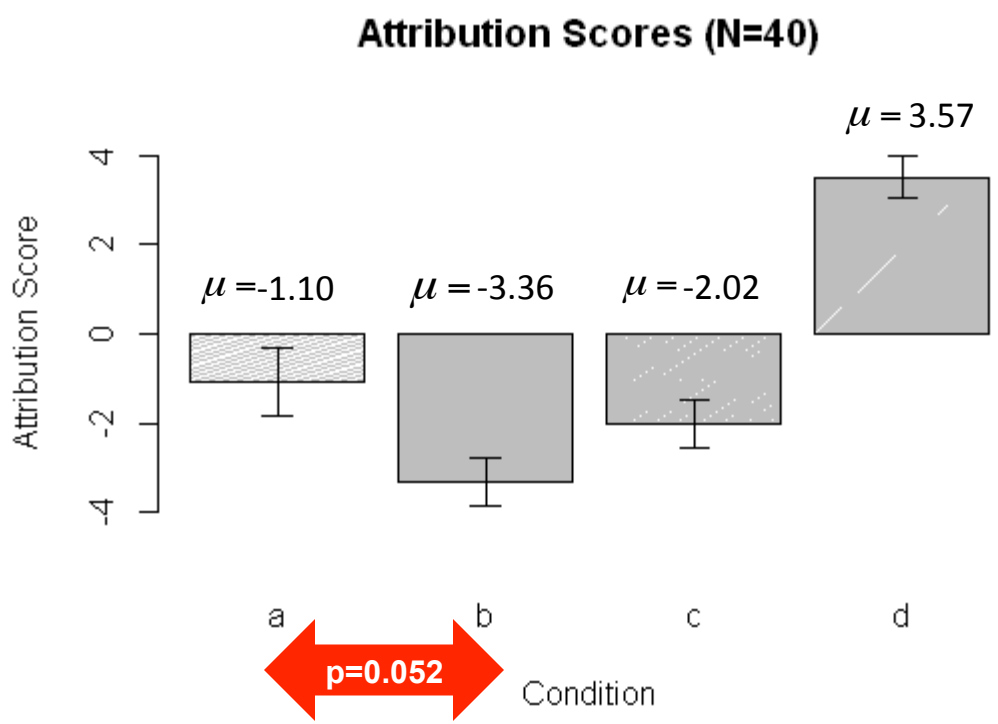


Figure 2. Standard Deviation of Attribution Scores.

Legend	
a	No Theseus
b	Theseus situational
c	Theseus moderate situational
d	Theseus dispositional

Scores range from -7 (highly situational) to 7 (highly dispositional), with a neutral score or midpoint of 0.

Technique	Result
One-way repeated measures ANOVA	Significant effect of Theseus on attribution type [$F(3, 117) = 25.96$, $p<0.001$, partial $\eta^2 = 0.40$].

Lessons Learned – Tool Support

- Theseus results in higher perceived trustworthiness compared with no Theseus
- Theseus results in more situational attributions compared with no Theseus (marginal support)
- Based on subject feedback, the tool is usable
- Subjects quickly became immersed in the data

Conclusions

A progression in research

- Awareness
  - And tool support for collaboration
- But while we studied teams in the field
  - Trust emerged as a major concern
- We suspected the awareness tools we previously research could help …
  - But exactly how?

Arriving at Support for Trust

- We realized from our field data that
  - Typical Web 2.0 tools should help …
  - But in many cases went unused.
  - But some team member characteristics and some teams using Web 2.0 showed promise

Pursuing tools further …

- What kinds of tools could support trust?
  - What kind of information would they need to provide?
    - Cognitive and affective trust … but with a revelation about the impact of each.
    - Situational and dispositional information for making accurate attributions.

Providing a design space for tools

Table 1. Collaborative traces and other data (rows) mapped to trust factors identified in the literature (column).

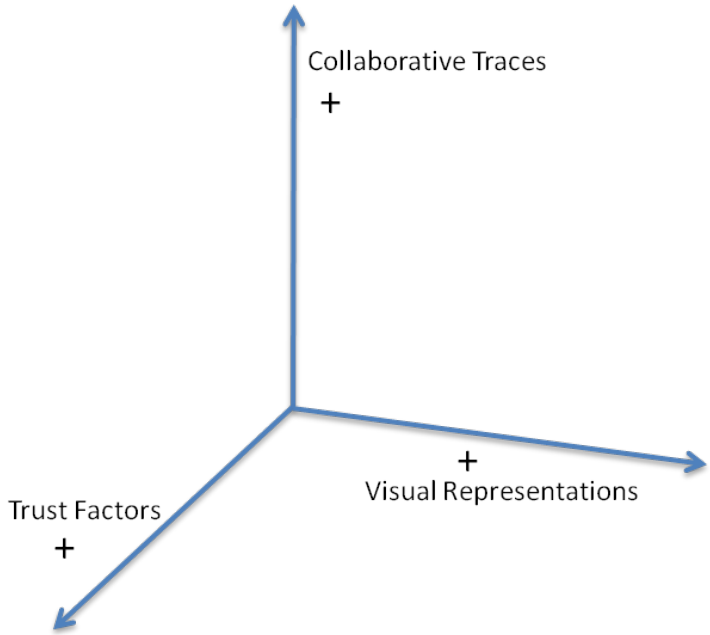
	Initiations and Response	Same Location	Role	Expertise	Reputation	Availability	Leadership	Years Experience	Communication Media	Homophily	Shared Information	Shared Photographs	Frequency of Meetings	Team Diversity	Project Updates	Team Size	Project Size/Type	Monitoring
Project descriptions			X			X	X			X						X	X	X
Chat thread	X										X							
Instant messages						X			X		X							X
E-mail messages	X					X			X		X	X			X			X
Mailing list postings	X					X			X		X				X			
Calendar						X	X						X					
Keyboard input						X												
Time zone		X			X	X				X				X				
Personnel profiles		X	X	X		X	X	X		X		X						
Work items	X		X	X	X					X				X	X			
Source-code			X	X	X					X				X				
Org. chart		X	X		X	X	X			X				X				
Change sets																		

Table 2. Visual representations (rows) mapped to trust factors identified in the literature (column).

	Initiations and Response	Same Location	Role	Expertise	Reputation	Availability	Leadership	Years Experience	Communication Media	Homophily	Shared Information	Shared Photographs	Frequency of Meetings	Team Diversity	Project Updates	Team Size	Project Size	Monitoring
Node-edge				X			X				X			X		X		
Matrix	X				X	X					X							
Scatterplot	X					X												
CirclePacking		X	X	X		X				X								
Sunburst		X	X	X						X								
Treemap		X	X	X						X								
Indented text		X	X	X						X								
Line Chart	X					X			X		X		X					
Bar Chart	X				X			X										
Spreadsheet		X	X	X			X	X	X									
Map	X	X				X								X				

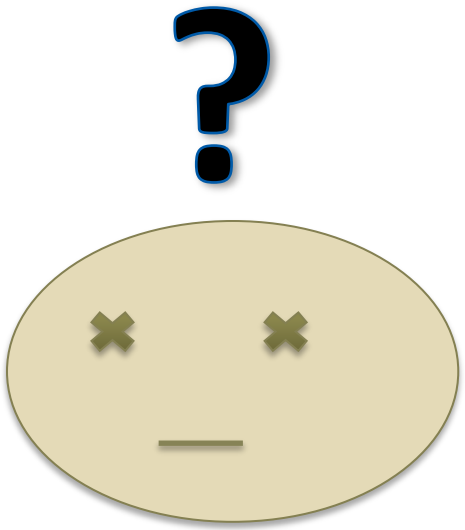
Table 3. Visual representations (rows) mapped to collaborative traces and other data (column).

	Project descriptions	Chat thread	Instant messages	E-mail messages	Mailing list postings	Calendar	Keyboard input	Time zone	Personnel profiles	Work items	Source-code	Org. chart	Change sets
Node-edge		X	X	X	X					X	X		X
Matrix		X	X	X	X					X	X		X
Scatterplot		X	X	X	X	X	X	X		X	X	X	X
CirclePacking								X	X	X	X	X	X
Sunburst								X	X	X	X	X	X
Treemap								X	X	X	X	X	X
Indented text	X							X	X	X	X	X	X
Line Chart			X	X	X					X	X		X
Bar Chart		X	X	X	X		X		X	X	X		X
Spreadsheet	X					X	X	X	X	X	X	X	X
Map		X	X	X	X			X		X	X		X

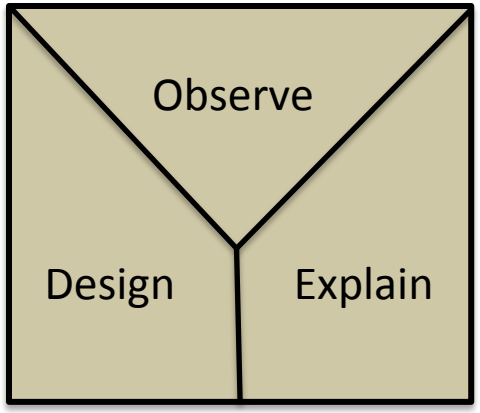


Some of the problems in our Example

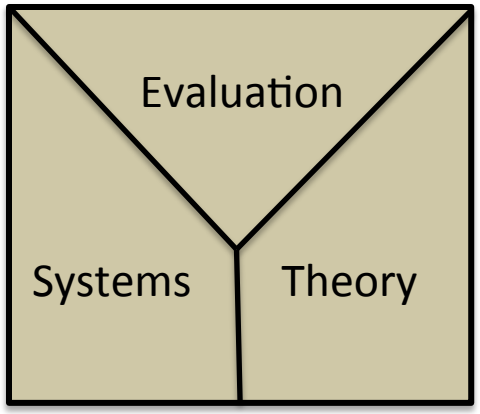
- Isolation prevents knowing what others are doing
- Lack of awareness also prevents knowing why they are doing or not doing something.
- Distance prevents familiarity – both professional and personal



Research Approach



- Observe and collect data
  - Workplace
  - Research literature
- Hypothesize and build systems
- Evaluate systems
  - Controlled settings and
  - Not so controlled settings – professionals
- Link back to the data



Finally

- The problems and facets are
  - Bigger than one person, one approach, etc.
- Hope others will join the pursuit.

Workshop on

Trust in Virtual Teams:

Theory and Tools

http://collab.di.uniba.it/trusttheorytools/

16th ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW 2013) will be held February 23-27 in San Antonio, Texas, USA

Workshop Themes

- factors that engender and inhibit trust.
- overarching trust framework.
- software tools support trust.

Workshop Sessions

- **First session:** participants discuss their work on trust in virtual teams.

  Outcome: Understanding of each others work and interests.
- **Second session** build a framework from participants' existing knowledge of their own work and others.

  Outcome: a theoretical framework that can be used as a starting point and which can be refined further in future work.
- **Third session:** use existing knowledge to develop new collaborative tools to better support trust.

  Outcome: initial draft of requirements which describe desired tool features.

Comments? Questions?

http://cradl.ics.uci.edu

BREN:ICS
INFORMATION AND COMPUTER SCIENCES

UCIRVINE