INTERNATIONAL SUMMER SCHOOL OF DOCTORAL CANDIDATES IN EDUCATIONAL TECHNOLOGY, BEIJING, CHINA, JULY 15, 2011

CSCL2011

Research in CSCL: Two Case Studies

Gerry Stahl

"Seeing what we mean: Co-experiencing a shared virtual world"

Gerry Stahl, Nan Zhou, Murat Perit Cakir, Johann W. Sarmiento-Klapper

Overview

- This paper is based on the Virtual Math Teams project, including the 3 dissertations of the co-authors
- We present an alternative to the view of Common Ground based on convergence of mental models
- We present a case study from VMT Spring Fest 2006, Team C, Session 3.
- We analyze how 3 students establish and maintain intersubjective understanding of a math problem, which they solve as a group

An infant & adult share a meaningful gesture at a shared object

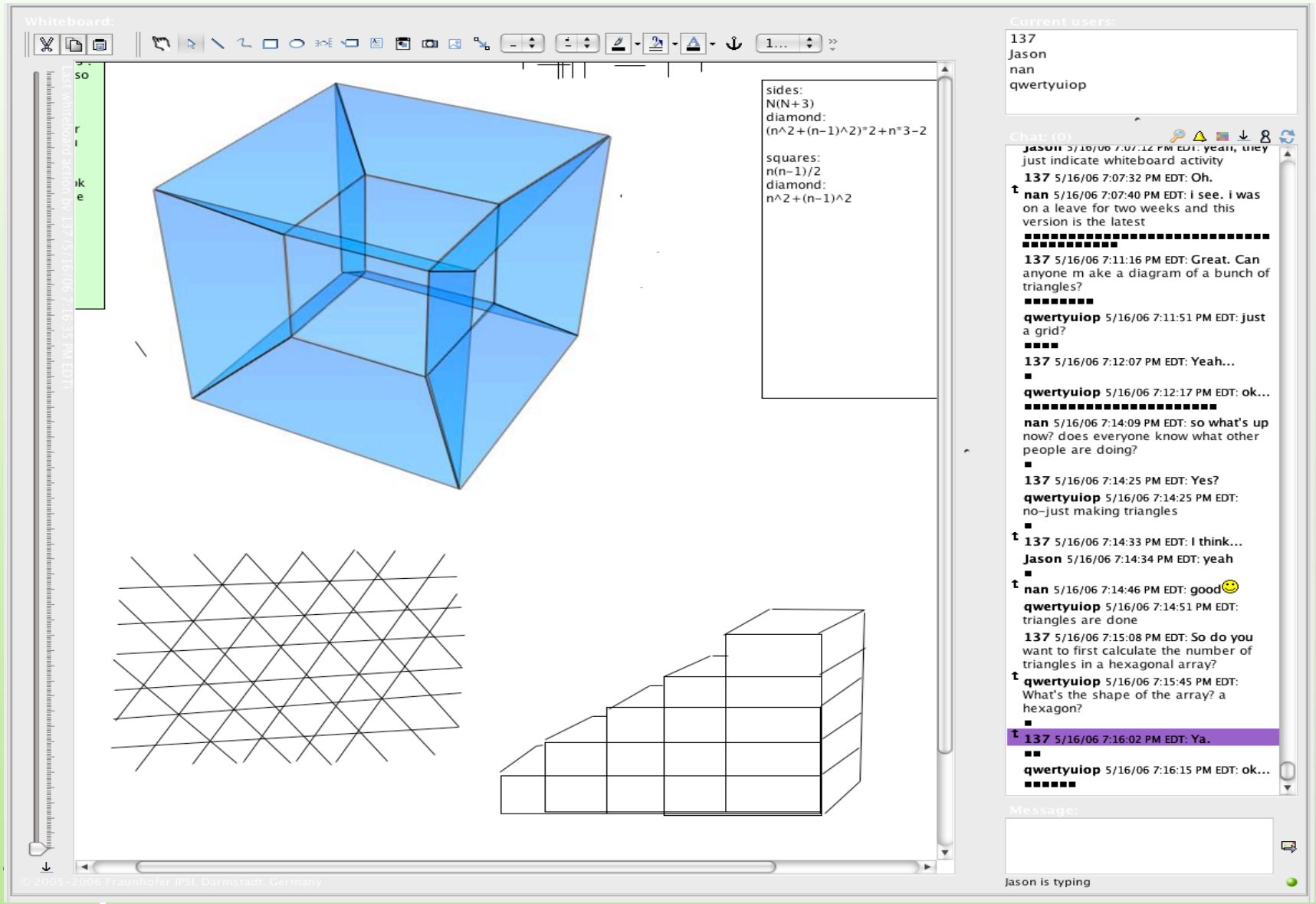
The Problem of Intersubjectivity and Common Ground

- **The precondition of collaborative learning is that the participants understand each other enough to accomplish their work**
- **This includes tacit background knowledge and explicit shared understanding of the current topic**
- **In cognitive science, grounding of shared understanding is treated as the explicit comparison of mental models or internal opinions; in our analysis, it is the result of interactional work in which a shared world is created and various methods are used to ensure a sharing of this world**

The Grounding of Intersubjectivity : Physically Embodied Being-in-the-World

- **We all find others and ourselves within one world.**
- **We learn about and experience the many dimensions of this world together, as we mature as social beings.**
- **The "problem" of establishing intersubjectivity is a pseudo-problem in most cases.**
- **Human existence is fundamentally intersubjective from the start.**
- **We understand the world in which we are embodied with other people and cultural artifacts as a shared world.**

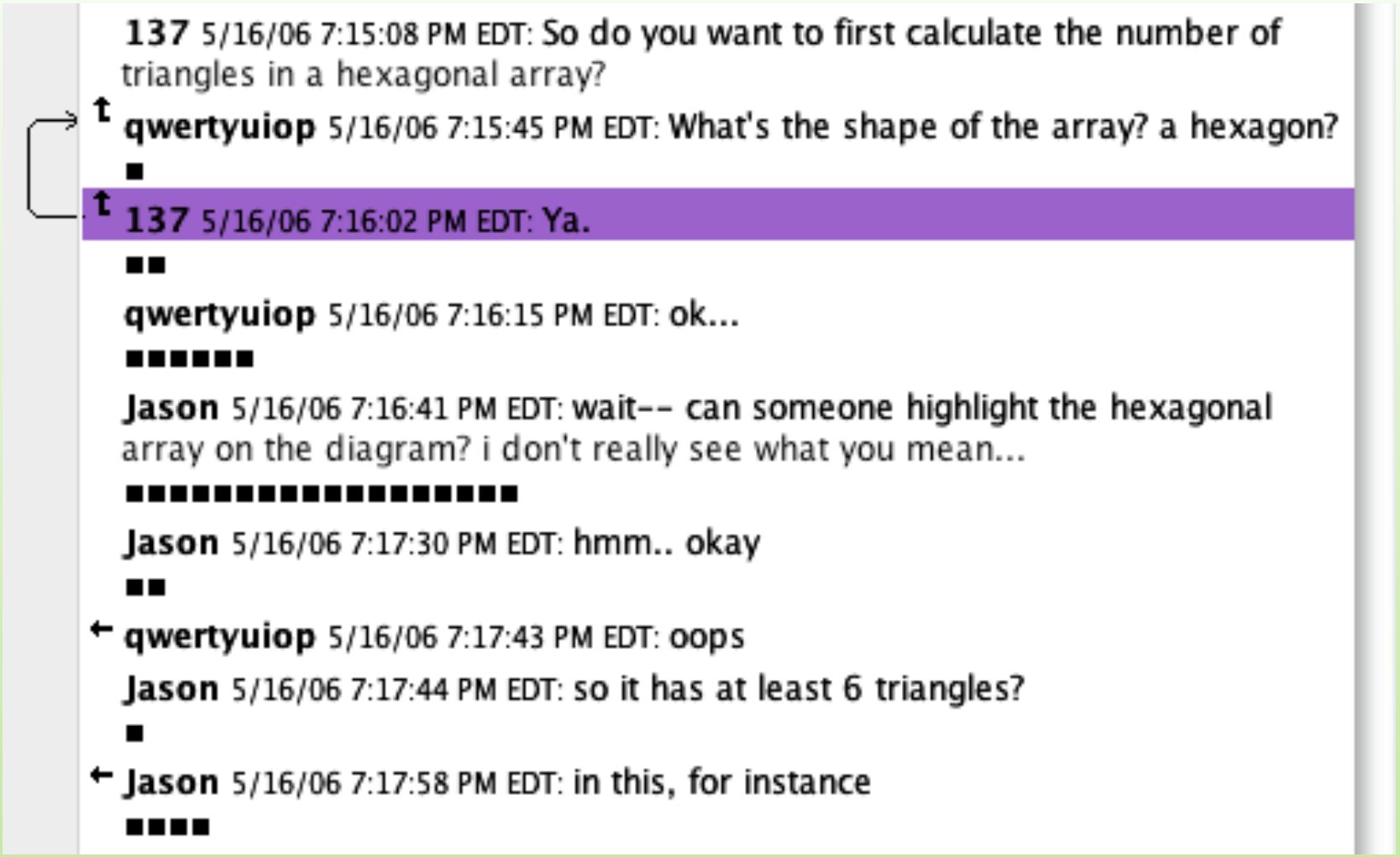
The Issue of Intersubjectivity in Virtual (CSCL) Worlds



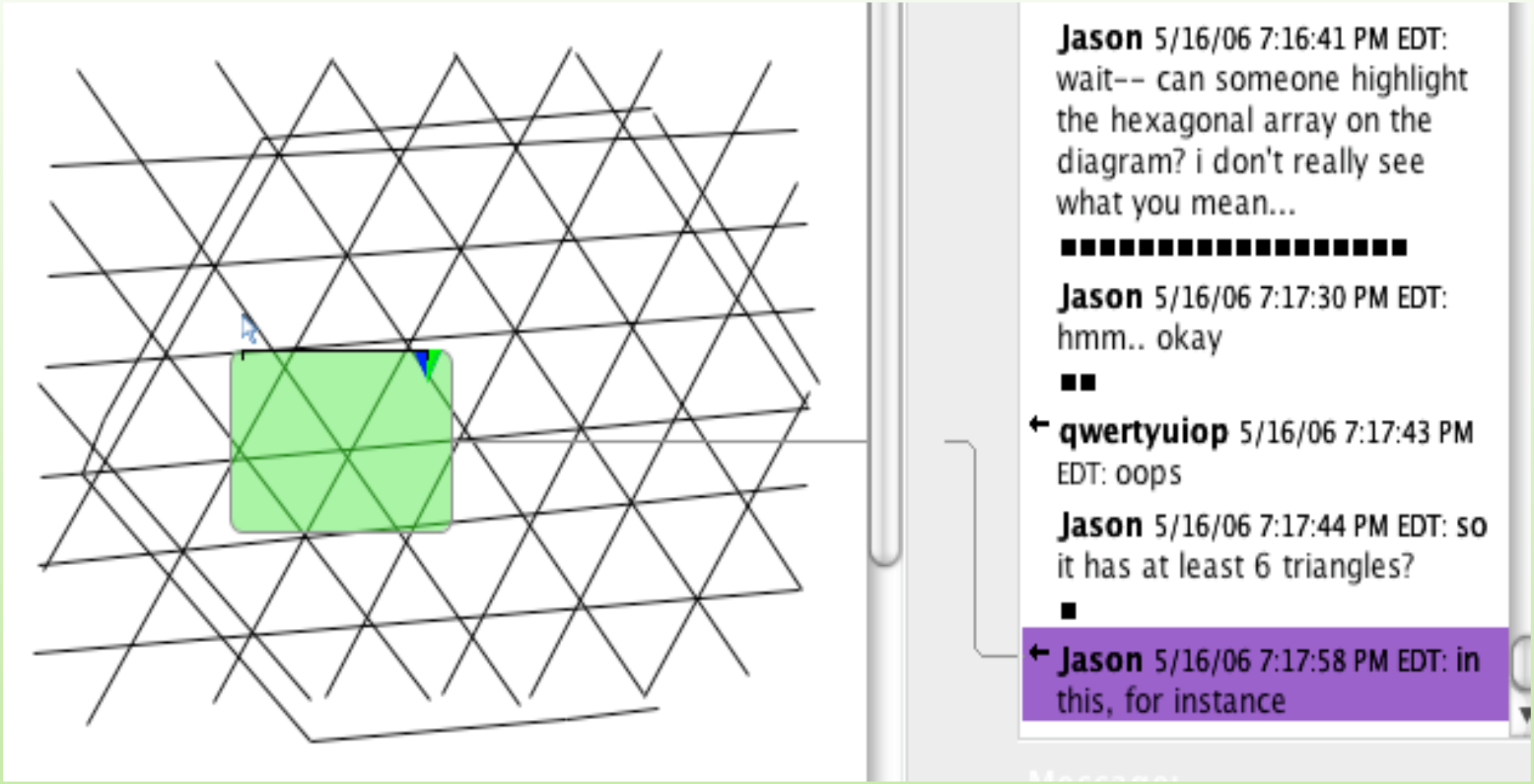
The Practical Issue of Intersubjectivity Online

- **How do people who meet online create a shared world in which they can understand things the same?**
- **How do their online actions (chat and drawing) build a joint problem space of actors, places, times, social relations, semantics, artifacts and group members?**
- **How do they raise issues of understanding, repair misunderstandings, share perspectives?**
- **How does the group interaction establish a shared discourse context to support intersubjectivity without physical embodiment?**

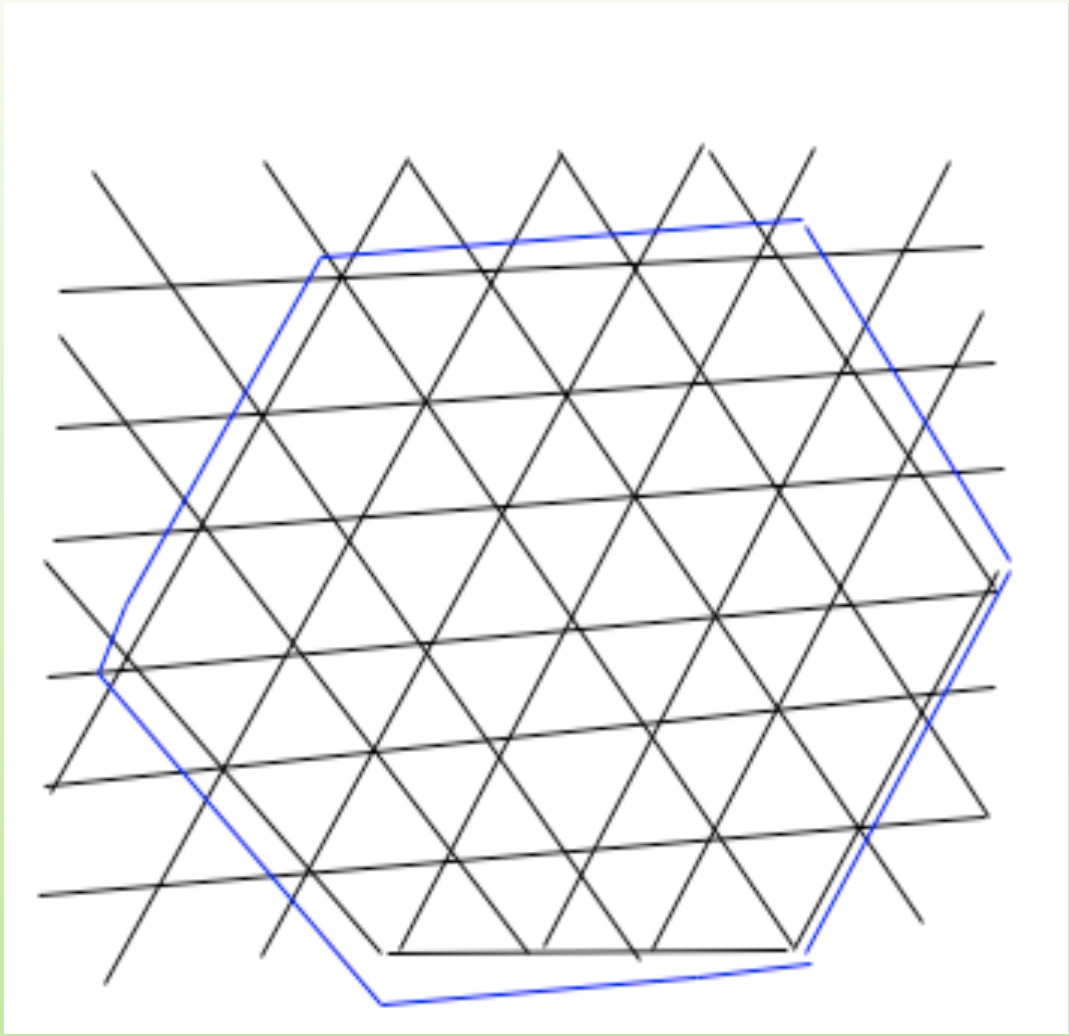
Opening a Shared World



Opening a Shared World



Orienting to a Shared Object



137 5/16/06 7:18:53 PM EDT: How do you color lines?

■

Jason 5/16/06 7:19:06 PM EDT: there's a little paintbrush icon up at the top

■

Jason 5/16/06 7:19:12 PM EDT: it's the fifth one from the right

■■

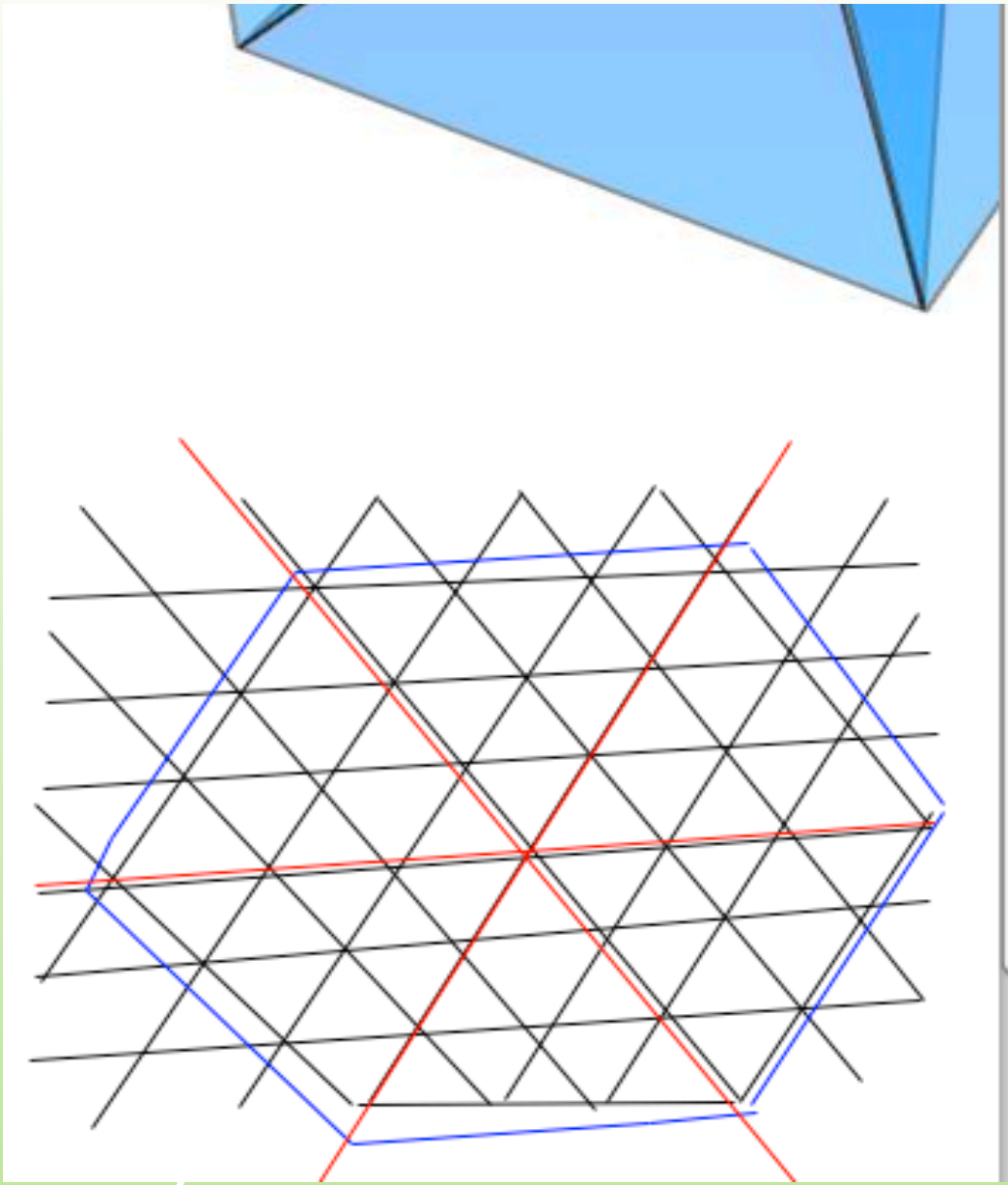
137 5/16/06 7:19:20 PM EDT: Thanks.

Jason 5/16/06 7:19:21 PM EDT: there ya go

■■■■

137 5/16/06 7:19:48 PM EDT: Er... That hexagon.

Seeing “As” a Shared Pattern



Jason 5/16/06 7:20:02 PM EDT: so... should we try to find a formula i guess

Jason 5/16/06 7:20:22 PM EDT: input: side length; output: # triangles

qwertyuiop 5/16/06 7:20:39 PM EDT: It might be easier to see it as the 6 smaller triangles.

137 5/16/06 7:20:48 PM EDT: Like this?

■■■

qwertyuiop 5/16/06 7:21:02 PM EDT: yes

Jason 5/16/06 7:21:03 PM EDT: yup

■■

qwertyuiop 5/16/06 7:21:29 PM EDT: side length is the same...

Jason 5/16/06 7:22:06 PM EDT: yeah

Jason 5/16/06 7:22:13 PM EDT: so it'll just be x6 for # triangles in the hexagon

137 5/16/06 7:22:19 PM EDT: Each one has 1+3+5 triangles.

Building Knowledge Together

137 5/16/06 7:23:17 PM EDT: It equals 1+3+...+(n+n-1) because of the "rows"?

qwertyuiop 5/16/06 7:24:00 PM EDT: yes- 1st row is 1, 2nd row is 3...

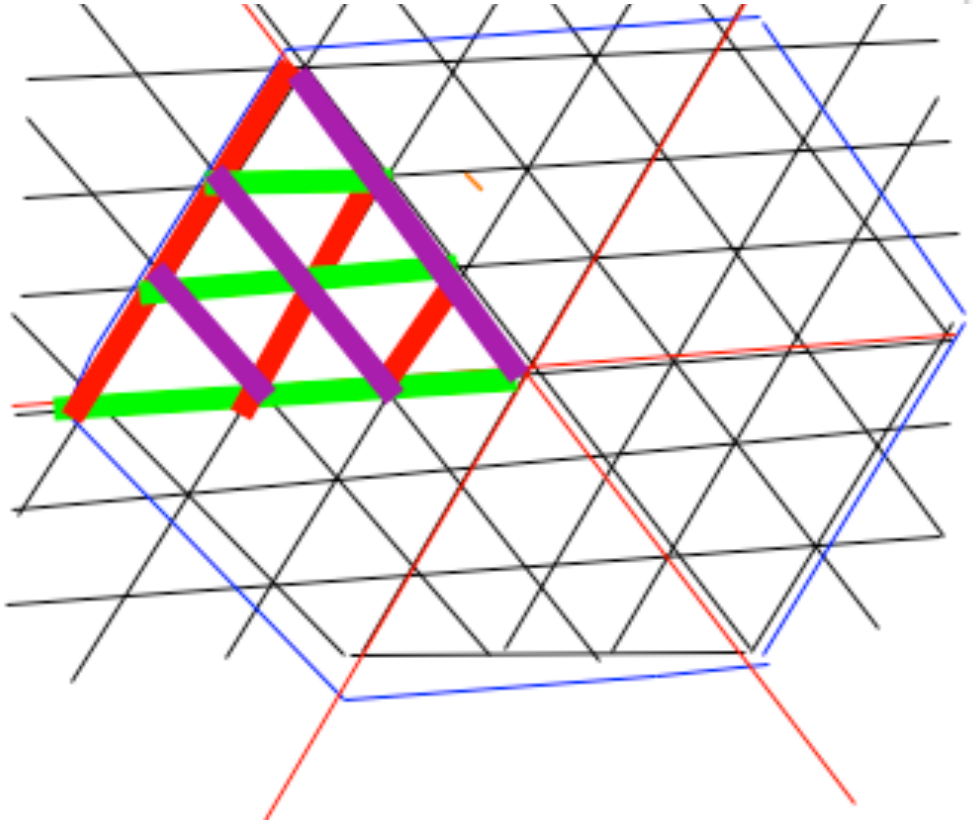
137 5/16/06 7:24:49 PM EDT: And there are n terms so... n(2n/2)

t **137** 5/16/06 7:25:07 PM EDT: or n^2

Jason 5/16/06 7:25:17 PM EDT: yeah

Jason 5/16/06 7:25:21 PM EDT: then multiply by 6

t **137** 5/16/06 7:25:31 PM EDT: To get 6n^2



Group Cognition in Math

- **Open a shared world with an external representation – establish a joint problem space that is visually shared**
- **Orient everyone to a specific object for mutual discussion**
- **Make a particular pattern visually relevant**
- **Discuss the pattern in words**
- **Signify the pattern in mathematical symbols and manipulate them**
- **Indicate that everyone is together at each step**

Conclusions about Group Cognition in this CSCL Case

- **The group works on maintaining a shared view of a joint problem space**
- **They use questions, proposals, requests, repairs, pointing, outlining, visual emphasis, verbal description, terminology, math symbols**
- **They confirm mutual understanding by agreement or by demonstration**
- **The problem solving is accomplished by the group**
- **Each participant understands the resources, methods and steps well enough to potentially use them individually in the future**
- **They learn effective ways of "seeing-as"**

Implications for CSCL

- **It is possible to observe and analyze in chat logs how groups establish and maintain intersubjectivity and accomplish group-cognitive tasks**
- **Analysis can show how features and affordances of the CSCL media and environment are used to support intersubjectivity and group cognition: persistent text chat, shared drawing board, line color & thickness, pointing tool, etc.**
- **CSCL environments can support virtual Being-in-the-World-Together in modes different from physical embodiment**

"The Structure of Collaborative Problem Solving in a Virtual Math Team"

Gerry Stahl

How does (group) cognition take place (and how can it be analyzed) in a (paradigmatic) CSCL setting?

1. Cognitive accomplishments can be achieved by small groups, mediated by technological media, tools, resources
2. Cognition can take place primarily as textual discourse
3. Research can now capture adequate traces of meaning making, problem solving, knowledge building, group cognition

Talk overview: show social construction of mathematical meaning through collaboration and argumentation

1. The hierarchy of levels of temporal structure for online collaboration
2. The sequential structure of collaborative math discourse
3. Virtual Math Teams case study
4. 10 discourse moves (in detail)
5. Group cognition in math

Let there be meaning

Hierarchy of structural layers

1. Group event: E.g., Team B's participation in the VMT Spring Fest 2006.
2. Temporal session: Session 4 of Team B on the afternoon of May 18, 2006.
3. Conversational topic: E.g., determining the number of sticks in a diamond pattern. (A longer sequence.)
4. Discourse move: A sequential accomplishment built on an elementary interchange.
5. Adjacency pair: A base interaction involving two or three utterances, which drives a discourse move.
6. Textual utterance: A text chat posting by an individual participant, which may contribute to an adjacency pair.
7. Indexical reference: An element of a textual utterance that points to a resource in the context.

The Problem of Intersubjectivity and Common Ground

- **The precondition of collaborative learning is that the participants understand each other enough to accomplish their work**
- **This includes tacit background knowledge and explicit shared understanding of the current topic**
- **In cognitive science, grounding of shared understanding is treated as the explicit comparison of mental models or internal opinions; in our analysis, it is the result of interactional work in which a shared world is created and various methods are used to ensure a sharing of this world**

"Longer sequences" in CSCL

The sequential structure of collaborative math discourse

The problem of longer sequences

Between CA (conversation analysis – e.g., Sacks, Schegloff) and DA (discourse analysis – e.g., Gee)

Between utterances or adjacency pairs & identity or ideology issues

Science of small-group cognition between individual unit of analysis & communities of practice

"Longer sequences" in CA

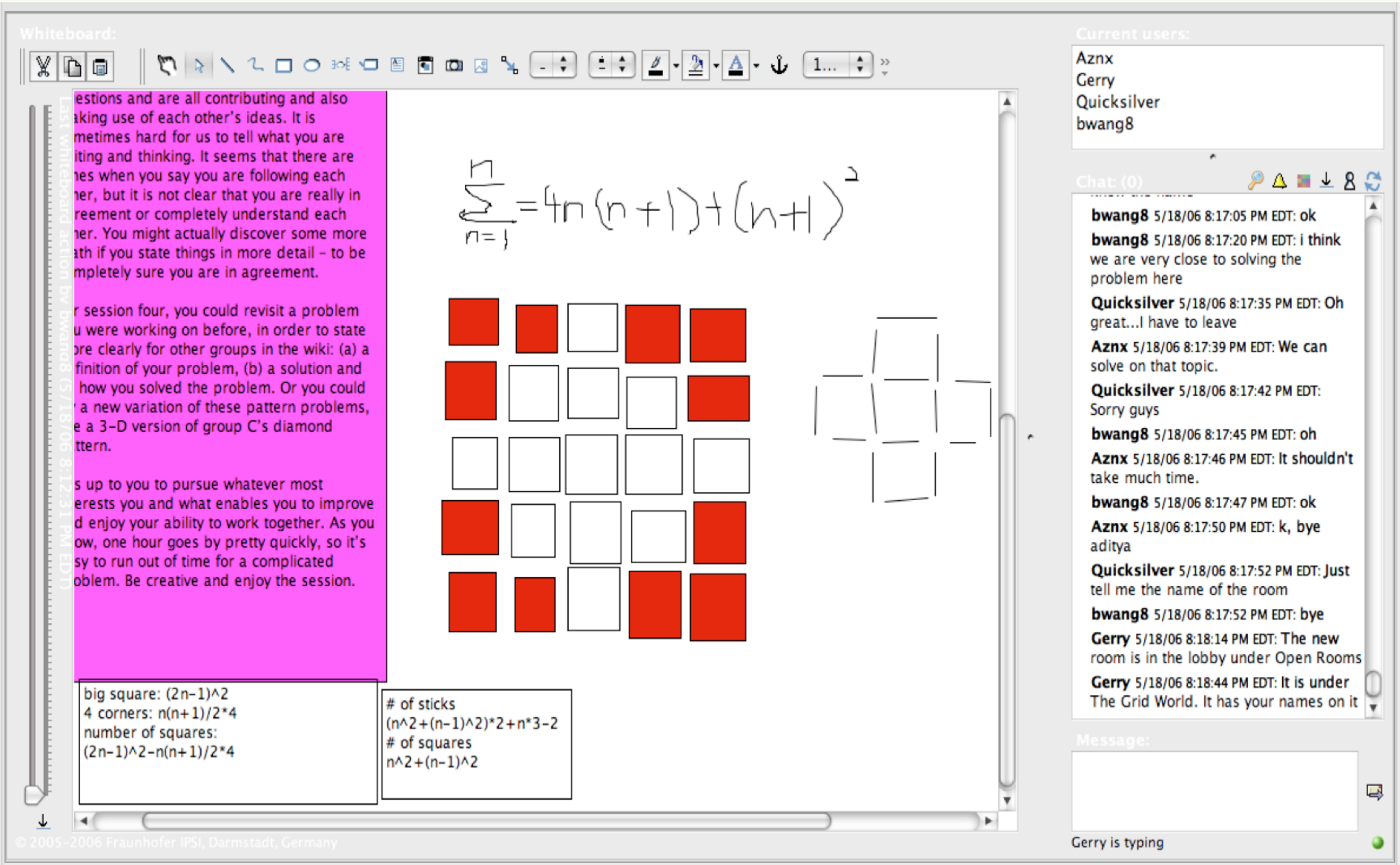
Conversation Analysis (CA): Sacks (1962), Schegloff (2007), etc. looks at how people construct their interactions, e.g., with turn taking and adjacency-pair responses

Traditionally focused on adult, American, face-to-face, informal speech

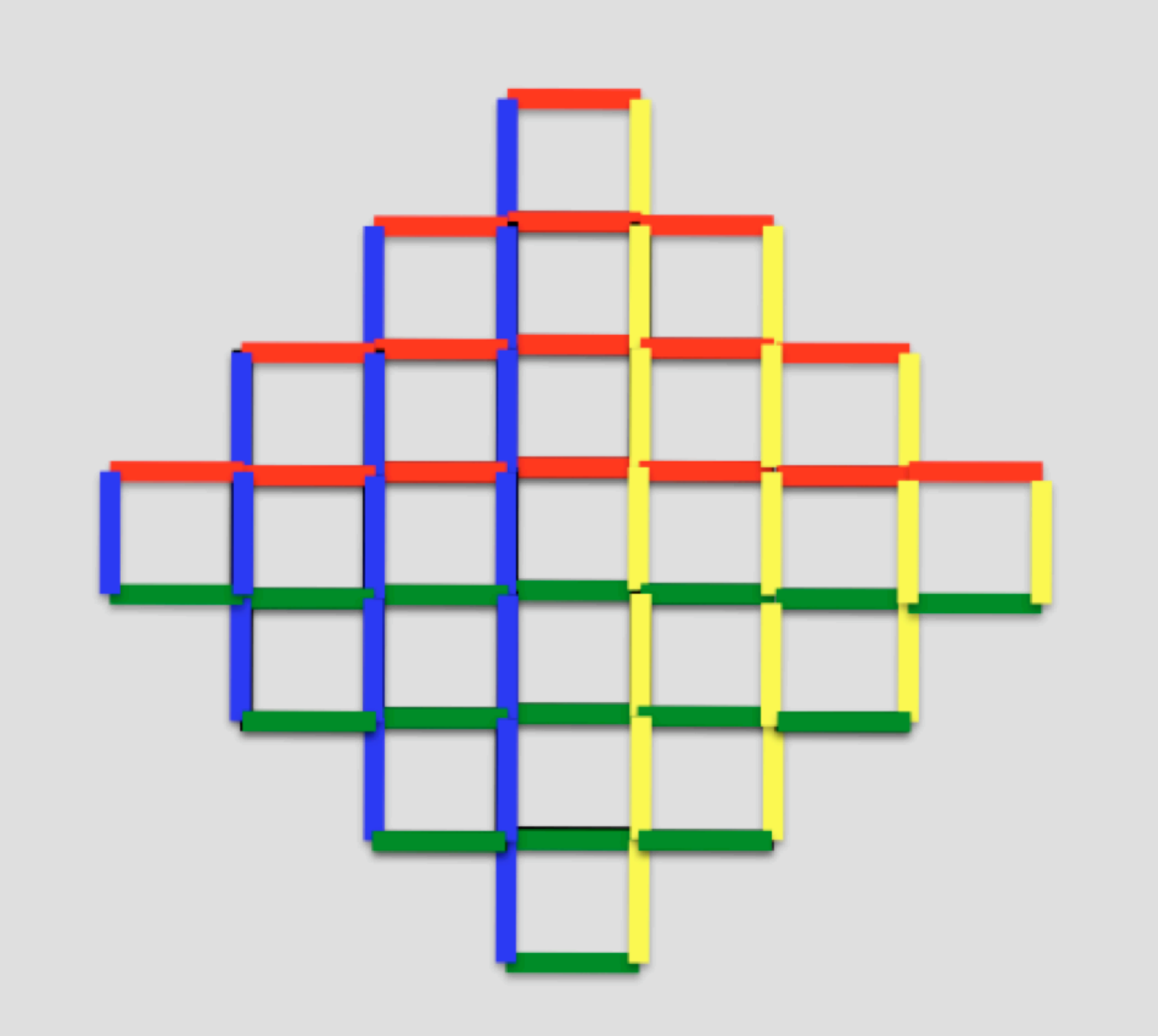
Needs to be adapted to online text

Needs to be extended from adjacency pairs to longer sequences that accomplish cognitive tasks by groups

The VMT environment



Case study topic



Select a problem

LINE	TIME	AUTHOR	TEXT OF CHAT POSTING
1734	**08.17.20**	**bwang8**	**i think we are very close to solving the problem here**
1735	08.17.35	Quicksilver	Oh great...I have to leave
1736	**08.17.39**	**Aznx**	**We can solve on that topic.**
1737	08.17.42	Quicksilver	Sorry guys
1738	08.17.45	bwang8	oh
1739	08.17.46	Aznx	It shouldn't take much time.
1740	08.17.47	bwang8	ok
1741	08.17.50	Aznx	k, bye Quicksilver
1742	08.17.52	Quicksilver	Just tell me the name of the room
1743	08.17.52	bwang8	bye
1744	08.18.14	Gerry	The new room is in the lobby under Open Rooms
1745	08.18.44	Gerry	It is under The Grid World. It has your names on it
1746	08.18.49	Quicksilver	leaves the room
1747	08.19.00	Aznx	Alright found it.
1748	08.19.04	Aznx	Thanks.

Decide to start

1749	08.19.12	Aznx	I guess we should leave then.
1750	**08.19.34**	**bwang8**	**well do you want to solve the problem**
1751	08.19.36	bwang8	i mean
1752	08.19.39	bwang8	we are close
1753	**08.19.48**	**Aznx**	**Alright.**
1754	08.19.51	bwang8	i don't want to wait til tomorrow
1755	08.19.53	bwang8	ok

Pick an approach

1756	**08.19.55**	**Aznx**	**How do you want to approach it?**
1757	**08.20.14**	**bwang8**	**1st level have 1*4**
1758	08.20.20	Gerry	You can put something on the wiki to summarize what you found today
1759	08.20.29	bwang8	2st level have (1+3)*4
1760	08.20.32	Aznx	bwang you put it.
1761	08.20.35	Aznx	for the wiki
1762	08.20.37	bwang8	ok
1763	08.20.42	Aznx	we actually did quite a lot today
1764	08.20.53	bwang8	3rd level have (1+3+5)*4
1765	08.21.05	bwang8	4th level have (1+3+5+7)*4
1766	08.21.10	Gerry	This is a nice way to solve it

Identify the pattern

1767	**08.21.12**	**Aznx**	**So it's a pattern of +2s?**
1768	08.21.15	Aznx	Ah ha!
1769	**08.21.15**	**bwang8**	**yes**
1770	08.21.20	Aznx	There's the pattern!

Seek the equation

1771	08.21.39	bwang8	now we have to find a equation that describe that pattern
1772	08.21.49	Aznx	Hold on.
1773	08.21.51	Aznx	I know it.
1774	**08.21.57**	**bwang8**	**what is it**
1775	08.21.58	Aznx	But I'm trying to remember it. =P
1776	08.22.04	Aznx	and explain it as well.
1777	08.22.17	Aznx	try and think of it
1778	08.22.53	Gerry	Maybe Quicksilver can come back here tomorrow or next week to finish it with you
1779	08.23.01	Gerry	I have to go now
1780	08.23.05	Gerry	Bye!
1781	08.23.06	bwang8	ok
1782	08.23.07	bwang8	bye
1783	08.23.23	Gerry	leaves the room
1784	08.23.29	bwang8	ok
1785	08.23.32	bwang8	so
1786	08.23.37	bwang8	i think it is this
1787	08.23.53	Aznx	ok
1788	08.23.55	Aznx	i found it
1789	**08.24.00**	**Aznx**	**n^2**
1790	08.24.01	bwang8	(2*n)*n/2
1791	08.24.09	Aznx	or (n/2)^2

Negotiate the solution

1792	08.24.14	Aznx	I'm simplifying
1793	08.24.30	Aznx	if u simplify urs
1794	**08.24.35**	**Aznx**	**its n^2**
1795	08.24.59	Aznx	bwang
1796	08.25.01	Aznx	you there?
1797	**08.25.03**	**bwang8**	**so that's wrong**
1798	08.25.07	bwang8	yeah
1799	08.25.08	bwang8	i am here

Check cases

1800	08.25.11	Aznx	so
1801	08.25.13	Aznx	the formula
1802	**08.25.22**	**Aznx**	**would be 4n^2?**
1803	08.25.28	bwang8	let's check
1804	08.25.55	bwang8	Yes
1805	**08.26.00**	**bwang8**	**it actually is**
1806	08.26.02	Aznx	So we got it!

Celebrate the solution: the "Aha" moment in math

1807	08.26.02	bwang8	omg
1808	08.26.04	Aznx	yay!
1809	**08.26.08**	**bwang8**	**i think we got it!!!!!!!!!!!!**
1810	**08.26.12**	**Aznx**	**WE DID IT!!!!!!**
1811	08.26.12	bwang8	and it is so simple
1812	08.26.14	Aznx	YAY!!!!
1813	08.26.16	Aznx	i know
1814	08.26.17	bwang8	lol
1815	08.26.18	Aznx	lol

Present a formal solution (proof)

1816	**08.26.34**	**Aznx**	**So you're putting it in the wiki, right?**
1817	**08.26.37**	**bwang8**	**yes**
1818	08.26.41	Aznx	Alright then.
1819	08.26.43	bwang8	ok
1820	08.26.53	Aznx	Give an email to Gery, telling him that we got it. =)
1821	08.26.57	bwang8	ok
1822	08.26.59	Aznx	I meant Gerry
1823	08.27.04	bwang8	are you going to do it
1824	08.27.07	bwang8	or am i
1825	08.27.12	Aznx	You do it.
1826	08.27.14	bwang8	ok
1827	08.27.19	Aznx	Tell him that we both dervied n^2
1828	08.27.29	Aznx	And then we saw that pattern
1829	08.27.37	Aznx	and we got the formula

Close the topic

1830	**08.27.44**	**Aznx**	**when should we meet again?**
1831	08.27.49	Aznx	hat's your email?
1832	08.27.52	Aznx	we should keep in touch
1833	**08.27.57**	**bwang8**	**yeah**

Group cognition in math: The sequential structure

The sequential structure of collaborative math discourse?

Longer sequence is 10 discourse moves, each built on an adjacency pair

Together, they accomplish group cognitive problem solving

Structure of collaborative knowledge building: longer sequence of discourse moves, each at the group (interactional) unit of analysis

Group cognition in math: The longer-sequence structure

Log 1. Open the topic
Log 2. Decide to start
Log 3. Pick an approach
Log 4. Identify the pattern
Log 5. Seek the equation
Log 6. Negotiate the solution
Log 7. Check cases
Log 8. Confirm the solution
Log 9. Present a formal solution
Log 10. Close the topic

Group cognition in math: the learning (knowledge building)

The group solved a math problem that had eluded the larger group and that another group had gotten wrong

They did this through a longer sequence of 10 interactional discourse moves

Each move was a mundane (everyday) practice of discourse

The problem solving took place in the discourse, not in private mental space

Knowledge building could be observed and analyzed in detail

Math facts and procedures were not the focus (happened "between the lines")

Meaning making

Details of how the group co-constructs meaning:

The symbolic expression "$4n^2$" as meaningful to the group

Analyzed from traces of the participants' perspective (ethnomethodology)

Multi-modal movement: visual reasoning, narrative description, symbolic abstraction

Analysis of group cognition

- First detailed analysis of a "longer sequence"
- Showed how it is a sequence of discourse moves each built on an adjacency pair
- Shows how the group – as a group, not as an expression of individual mental acts – accomplished problem solving in a socio-technical environment
- An example of a microanalysis of group cognition in an online team of students discussing math

For Further Information:

"Group Cognition" **(2006, MIT Press)**

"Studying Virtual Math Teams" **(2009, Springer)**

Gerry Stahl's e-Library **(collections of papers free for iPad, Kindle, PDF or low-cost print-on-demand):**
GerryStahl.net/elibrary

- **Paper 1: GerryStahl.net/pub/cscl2011.pdf**
- **Slides 1: GerryStahl.net/pub/cscl2011.ppt.pdf**
- **Paper 2: GerryStahl.net/pub/cscl2011stahl.pdf**
- **Slides 2: GerryStahl.net/pub/cscl2011stahl.ppt.pdf**

The iSchool at Drexel
College of Information Science and Technology

website: GerryStahl.net
email: Gerry@GerryStahl.net