# Collaboration and Chat: Recipiency in Online Math Problem Solving

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**Abstract:** In this paper, we examine ways that participants in online math problem-solving chat sessions dis-attend and attend to postings by other participants and the ways that participants design their postings to elicit responses from recipients. This is consequential in terms of the design of CSCL systems that use chat as the basis of participant interaction. By developing a proper understanding of the affordances of chat systems and the structural constraints they place on the moral organization of interaction, we can begin to anticipate and address issues related to the achievement of collaboration.

## Introduction

As Koschmann has noted, Computer-Supported Collaborative Learning (CSCL) is "…centrally concerned with meaning and practices of meaning making in the context of joint activity and the ways in which these practices are mediated through designed artifacts" (Koschmann, 2002). When students come together in online environments to work on math problems, they are faced with the challenge of presenting their ideas, making proposals, offering suggestions with respect to what the problem is on which they are working, what might be appropriate solution strategies and what might constitute actual solutions to the problems on which they are working. We have found in an examination of a particular corpus of data from the Virtual Math Teams (VMT) Project that there are frequent instances where students present possibilities that are not taken up by other recipients. In some cases, math educators associated with the VMT Project recognized that students had put forward likely solution candidates or strategies to the problems the students were trying to solve, but these candidate solutions or strategies were never taken up or discussed in the chats (see Stahl, 2006).

CSCL takes as a foundational assumption the idea that collaboration is an important if not essential feature of learning. Collaboration is considered to involve building a "joint problem space" (Roschelle & Teasley, 1995) or achieving coordination among participants (Barron, 2000). Barron (2000) has looked at two triads of students engaged in problem solving in face-to-face situation with noticeable different interactional patterns. The analyses identified three dimensions in group interaction, i.e., the mutuality of exchanges, the achievement of joint attentional engagement, and the alignment of group members' goals for the problem-solving process. At VMT, we also consider it important that students share and collaboratively develop their ideas when engaged in math problem solving. However, we have observed that chat participants frequently dis-attend to the postings of others. What would account for students presenting ideas and not addressing them? This is the question we take up in this paper.

In this paper, we consider how middle-school children engaged in math problem solving in the VMT online chat environment present ideas for others to consider. The data consist of time-stamped chat logs and whiteboard displays of math problem-solving sessions among middle-school students. The chats were sponsored and conducted by the Math Forum of Drexel University as part of its participation in the Virtual Math Teams (VMT) research project, an NSF funded project at Drexel University (1). The specific excerpts we use were taken from chat sessions of Team C in the VMT Spring Fest 2006. This event featured four teams who each participated in four consecutive sessions over a two-week period. They worked on the same set of problems where they were asked to find out the pattern of growth of a sequence of squares made of sticks by figuring out the total number of squares and sticks each stage, until the Nth stage. In latter sessions, they were asked to generate their own problems by coming up with other geometric patterns and figure out their patterns of growth

We use Conversation Analysis (CA) as the analytical methodology in this paper. This approach, developed by Sacks (1992) and his students, is ethnomethodological in nature. CA investigations presume that the analytical task is to identify the shared methods and procedures of language use and embodied action by which people engage in interaction. In CA, the analyst presumes that actors routinely and competently perform these shared methods in the ongoing conduct of ordinary interactions. The analytical task is descriptive. In other words, the analysts' task is to describe in detail the sequential organization of

the procedures actors use in the conduct of their interaction. In this case, we are interested in how postings get ignored or dismissed and how they get attended by the recipients in the conduct of math problem solving in an online chat environment.

## Online Chat

The first thing to note is that a chat environment is a very different kind of interactional environment in which the expected rules of turn-taking in face-to-face interaction do not apply or do not apply in the same ways (Garcia & Jacobs, 1999; Zemel & Cakir, forthcoming). The affordances of chat systems (see Gibson, 1979; Hutchby, 2001) constrain participants in different ways than face-to-face interaction and also offer possibilities that are not available in face-to-face interaction. The introduction of shared workspaces into chat systems, or Dual-Interaction Spaces (DIS)—such as a shared whiteboard with drawing functions in the VMT Chat environment along with explicit referencing tool and awareness information—also brings significant interactional consequences for interactants (Stahl et al, 2006; Muhlpfordt, 2006). Participants in VMT problem-solving sessions orient to these affordances in the way they conduct their online interactions.

One well-known affordance of chat is that the sequencing of postings is done differently in chat than in face-to-face interactions. For example, when a question is asked in a face-to-face encounter, a response is expected to follow as the immediately next turn (Schegloff, 2007). However, in chat interaction, a response is not necessarily expected as the very next posting (Garcia & Jacobs, 1999). Other participants may insert postings in a chat before a response to a question is actually posted (Zhou et al, 2008). Occasionally, no response is produced. This has led us to recognize that sequencing in chat is organized as a reading practice (Livingston, 1995) through the work of threading, i.e., producing and reading text postings for how they are sequentially related. This differs from the procedures of turn taking that rely on action adjacency in face-to-face interaction. In the VMT environment with chat and shared whiteboard as two interactional spaces, sequencing becomes an even more problematic matter since the actions on the whiteboard and chat postings can sometimes interact and inform each other. Such dual-interactions spaces also bring the question of how attention is allocated across the two spaces and how joint attention can be coordinated and achieved.

One of the more interesting differences between online chat interactions and face-to-face interaction is that that chat participants can and occasionally do simply "ignore" the postings of others without consequence. In other words, postings are not always taken up or attended to by other participants in chat. In a metaphorical sense, they become orphaned. In these VMT chats, we find that it is not always so easy for participants to get noticed, to have their proffered ideas and suggestions taken up and considered by other participants. By inspecting VMT chat logs, we have found that there are particular ways that postings can become orphaned and particular ways of designing postings so that they are noticed and taken up by other participants. Some of these are described below.

In order to account for what we have observed in the data, we have had to consider what, in terms of the structural affordances of chat interaction, might account for this phenomenon. To understand how this happens and the underlying interactional systematics that make the differential treatment of chat posting possible will provide some insight into the problems participants sometimes face when they post messages in chat. We will identify some chat-based procedures of interaction that are regularly used to ignore or dismiss prior postings and interactional methods in the design of chat posts to elicit responses from others. Finally, we consider the implications of using chat systems as means of fostering collaborative action given the affordances of chat.

## Recipiency in Chat

When considered from the point of view of talk-in-interaction, the notion of recipiency is a complicated matter. According to Waring (2002, p. 454) "when broadly defined, *recipient behavior* can take into account virtually any next move in a conversation. This broad view of recipiency is in consonance with the premise of conversation analysis, in which opportunities to talk are viewed as 'understanding display' devices (e.g., Schegloff, 1991, p. 167)."

Goodwin, in his discussions of Goffman's participation frameworks (Goodwin & Goodwin, 2004; Goodwin, 2007), calls for investigations of recipient action as essential for understanding the complex ways that actors engage in the production of talk. Insofar as talk-in-interaction is concerned, Goodwin argued that both speaker and recipient are co-implicated in the actual production of a spoken utterance. In

the analysis of face-to-face talk-in-interaction, this presents opportunities and challenges. As Waring goes on to observe, "Given this intertwined nature of speakership and hearership, it is extremely difficult, if not impossible, to decide what exactly counts as a recipient action" (2002, p. 454).

Recipient action in chat is a different thing altogether. In chat interaction, there is no intertwined "speakership" or "hearership" because the production of chat postings is not open to inspection by other participants in the chat. Recipients can only read "finished" postings. Recipients cannot witness the work done by the author to produce a text, all they can do is read a text once it is posted to and delivered by the chat server. Thus, recipient action in chat is always post hoc. This is a highly consequential difference between chat and talk-in-interaction. In particular, in chat, recipients have no stake in or accountability for the production of a posting. In face-to-face interaction, because speaker and recipient mutually monitor each other during the production of talk and can thereby shape the production of that talk, both have a stake in and accountability for the production of that talk. This provides for the moral organization of turn-taking in talk-in-interaction and the sense of accountability associated with interactional sequences.

For example, when it comes to talk-in-interaction we hold that what makes the turn immediately following a question the appropriate location for a response to that question is the fact that both speaker and recipient are co-implicated in the production of the question in the first place and thus are accountable for what happens next. However, in chat interactions, a recipient has no access to the production of chat postings and is not linked to an author as a co-producer of a chat posting. Thus recipients are not accountable for what happens following the posting of a chat message. It is this fact, we contend, that makes it possible, among other things, for chat participants to:

- Engage in the production of postings without regard for the fact that other participants may also be producing postings at the same time,
- Dis-attend in various ways to the posting of other participants, and
- Sustain concurrently produced but unrelated threads or streams of postings

This leaves us with two analytical questions we bring to the data:

1. How do actors dis-attend to prior postings?
2. What, if anything, can a chat participant do to design a posting so that others will take it up in subsequent postings?

## Ignoring Chat Postings

One reason these question are consequential for math problem solving is that participants need to work out how to present matters for others to consider. In our data, Team C consists of three middle school students from different parts of the US using the VMT Chat environment. They were engaged in multiple sessions and considered a wide range of ideas and approaches as they tried to describe patterns of growth of sticks and squares in certain geometrical figures over stages (see a representation in Figure 1).

Excerpt1

**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.
**Jason** 5/16/06 7:22:23 PM EDT: but then we're assuming just regular hexagons
**qwertyuiop** 5/16/06 7:22:29 PM EDT: the "each polygon corrisponds to 2 sides" thing we did last time doesn't work for triangles
**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)
**137** 5/16/06 7:25:07 PM EDT: or n^2
**Jason** 5/16/06 7:25:17 PM EDT: yeah

**Parallel posting.** There are two basic procedures by which actors dis-attend to chat postings. The simplest and most prevalent way that participants dis-attend to a given posting occurs when a participant submits a posting that is designed in a way that does not provide a way to read it as related to the immediately prior posting. This may occur when two postings are being produced during the same time interval, i.e., two people are writing at the same time, or when there is a separation in time between postings.

For example, in Excerpt 1, the students, qwertyuiop, Jason and 137, are all working on the same problem. At 7:22:29 PM, qwertyuiop produces the posting: "the 'each polygon corresponds to 2 sides' thing we did last time doesn't work for triangles." 137's immediately subsequent posting occurring at 7:23:17 PM, "It equals 1+3+…+(n+n-1) because of the rows?", follows 38 seconds after qwertyuiop's immediately prior post and provides no resources for a reader to link it to qwertyuiop's prior post. Rather than solicit interest in his initial posting, qwertyuiop's posting at 7:24:00 PM attends to 137's posting and his earlier posting is abandoned. Furthermore, there is no indication of an interactional problem arising from 137's actions and the abandonment of qwertyuiop's posting. No effort is made to call for or offer any account for this. Thus, one way to dis-attend to a prior posting is to simply 'ignore' it in an unmarked way.

Another example of dis-attending is given in Excerpt 2, shown below. In this case, members of Team C produced a set of parallel postings, where actors treat each other's postings as different threads. At 6:26:21 PM, Jason produced a question that solicited from other participants descriptions of growth patterns in the number of sticks in the problem: "so do we see how the number of sticks grows in a sequence?" The lexical phrase "…grows in a sequence?" is made evidently relevant by his prior descriptions about having examined sequences in math class the week before (see Excerpt 3, below). By using the first person plural pronoun "we" that refers to the group members themselves, the question serves as a task opener that orients the group to the particular task and solicits participation from the members.

Excerpt 2

**Jason** 5/9/06 6:26:21 PM EDT: so do we see how the number of sticks grows in a sequence?

**davidcyl** 5/9/06 6:26:25 PM EDT: ok i've drawn n=4,5,6

**Jason** 5/9/06 6:26:29 PM EDT: 4(+6) = 10

**Jason** 5/9/06 6:26:36 PM EDT: 10(+8) = 18

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**Jason** 5/9/06 6:26:48 PM EDT: i'm guessing 18(+10) = 28 for the next one, according to this pattern

**davidcyl** 5/9/06 6:27:32 PM EDT: the nth pattern has n more squares than the (n-1)th pattern

**davidcyl** 5/9/06 6:27:55 PM EDT: basically it's 1+2+..+(n-1)+n for the number of squares in the nth pattern

**137** 5/9/06 6:28:16 PM EDT: so n(n+1)/2

**davidcyl** 5/9/06 6:28:24 PM EDT: and we can use the gaussian sum to determine the sum: n(1+n)/2

**davidcyl** 5/9/06 6:28:36 PM EDT: 137 got it

**137** 5/9/06 6:28:43 PM EDT: and 2(1+2+3...n-1) overlaps

**137** 5/9/06 6:29:05 PM EDT: so n(n+1)/2-n(n-1)/2?

**davidcyl** 5/9/06 6:29:31 PM EDT: well to find the number of sticks:

**davidcyl** 5/9/06 6:29:39 PM EDT: let's look on the board

■■■

However, the next posting is not a response to Jason's query. Instead, it is a post that reports davidcyl had completed a set of whiteboard drawings that presumably were now available as resources for inspection and use in arriving at part of the solution to their problem, (see Figure 1). While davidcyl's report at 6:26: 25 PM does not explicitly attend to Jason's prior post, it could be seen as possibly relevant to the question Jason posed as an insertion marking the availability of a relevant resource for answering Jason's question.

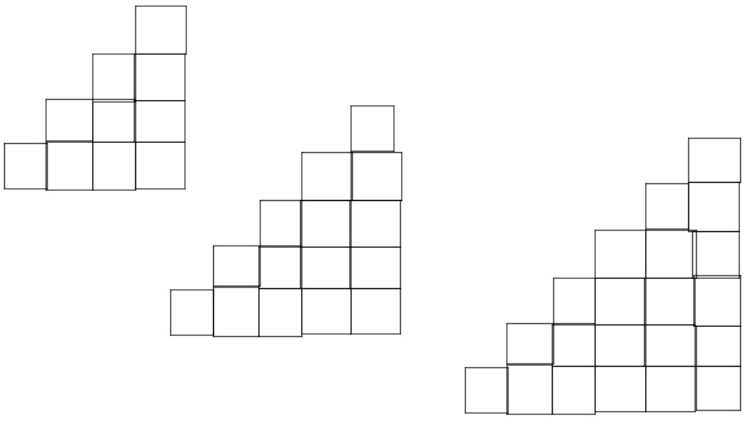

Figure 1. Whiteboard representations.

In the subsequent postings (6:26:29 PM through 6:26:48 PM), Jason offers his observations on the pattern of growth in the number of sticks in response to his initial question. The observations are delivered in three separate postings, organized in the order of the stages of the sequence, making the steps of how the observations developed available for other participants to examine. Upon completing his report, there is a forty-four second lag before a next posting is produced. At 6:27:32 PM, davidcyl reports his own findings, but this time the report is with respect to the growth in the number of squares, not sticks as addressed by Jason. The report is taken up by 137 who offers a simplified formula: "so n(n+1)/2." The use of "so" suggests that the subsequent content of the posting is built upon some previously available resources, in this case, davidcyl's report. Davidcyl's report and its uptake by 137 constitute a rather independent thread of interaction in parallel to Jason's.

This example shows that parallel threading of postings afforded by chat can be used to dis-attend to postings put forward for consideration without interactional consequence. Because there are no structural constraints (2) on the production of chat postings, sequential coherence in chat systems is a reader's matter. It is up to recipients to do the work of sorting out, or threading, postings into coherent sequences. Thus the sequentiality of postings is a recipiency issue in chat and is manifest in this chat by the fact that one proposal from a different member and its response follow the unaddressed question.

**Dismissive assessment.** Another way that participants dis-attend to prior postings is to dismiss them. In the interaction that follows in Excerpt 3, we show how the contrast marker "well" is used to avoid uptake of a prior posting. At 6:28:43 PM and 6:26:05 PM, 137 produces a post as a continuation of his prior post at 6:28:16 PM, without specifying to what the formulae refer. He offers a rather elaborated symbolic math expression with a question mark, "so n(n+1)/2-n(n-1)/2?", which elicits assessments from members of the group. Rather than receive an explicit assessment, davidcyl posts, "well to find the number of sticks:" and "let's look on the board" (6:29:31 PM and 6:29:39 PM, respectively). By offering an alternative course of action to the assessment called for by 137, davidcyl manages to avoid making an assessment by suggesting an alternative action. In order to have the proposal reconsidered and discussed, 137 would need to do additional work, such as make a counter proposal to davidcyl's proposal. Thus in dismissing the projected or called for action by proposing an alternative, an actor can dis-attend to a prior posting.

Excerpt 3

**davidcyl** 5/9/06 6:27:55 PM EDT: basically it's 1+2+..+(n-1)+n for the number of squares in the nth pattern

**137** 5/9/06 6:28:16 PM EDT: so n(n+1)/2

**davidcyl** 5/9/06 6:28:24 PM EDT: and we can use the gaussian sum to determine the sum: n(1+n)/2

**davidcyl** 5/9/06 6:28:36 PM EDT: 137 got it

**137** 5/9/06 6:28:43 PM EDT: and 2(1+2+3...n-1) overlaps

**137** 5/9/06 6:29:05 PM EDT: so n(n+1)/2-n(n-1)/2?

**davidcyl** 5/9/06 6:29:31 PM EDT: well to find the number of sticks:

**davidcyl** 5/9/06 6:29:39 PM EDT: let's look on the board

**Attention allocation.** A very different procedure used by participants to dis-attend to a posting involves producing a posting for others to read when their attention is given to actions and activities occurring in the whiteboard area of the VMT system. An example of this is given in Excerpt 4. In this case, Jason opens at 6:25:44 PM with a self-oriented declarative report about having examined problems in his math class that were similar to the one on which they were working. It opens with "ooh," a change of state token (Heritage, 1984) that (a) suggested he recognized their shared problem as one which he had addressed earlier in his math class, and (b) projected that he had more to contribute about what he had covered in class. However, the other participants, davidcyl and 137, were working and continued to work on whiteboard representations of the problem, as evidenced in the chat by the string of squares following Jason's postings. (The representations are shown above in Figure 1.) The question we examine is this. What about the design of Jason's postings and their location in the ongoing stream of chat and whiteboard activity allowed davidcyl and 137 to not take up Jason's invitation that they elicit a description of the work he and his class had done on these or similar problems?

A constraining affordance (Hutchby 2001) of online quasi-synchronous interaction systems that offer both chat and whiteboard technology is that chat and whiteboard activity occur in different screen locations and make it relevant that participants decide where to give their attention. A design feature of the

VMT chat system recognized this affordance by including as part of the presentation of chat data, iconic representations (the small squares seen in Excerpt 4) that indicate the achieved performance of activity on the whiteboard. Curiously, participants who are working on the whiteboard are not afforded an equivalent system generated awareness marker of chat activity. Thus, even as Jason posted his comments, it was evident to Jason that davidcyl and 137 were both engaged in whiteboard activity. It may not have been reciprocally evident to davidcyl and 137 that Jason had written postings to the chat area. This asymmetrical allocation of attention is evidenced by Jason's posting at 6:23:03 PM, "anyhow" which served to acknowledge that his bid to invite other participants to inquire about what he had learned in class the prior week had been passed over. This suggests that recipiency is done differently in chat.

Excerpt 4

**Jason** 5/9/06 6:25:44 PM EDT: ooh we just did this in math class about a week ago!

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**azemel** 5/9/06 6:25:54 PM EDT: if you have any questions, just ask

**Jason** 5/9/06 6:25:55 PM EDT: well, not the exact thing, but sequences and series

■■

**Jason** 5/9/06 6:26:03 PM EDT: anyhow

■■■■■■■

**Selection.** When there are multiple posts, recipients can elect which post to respond to. This is another way to ignore a post in a chat without interactional consequence. Excerpt 5 illustrates how this is achieved. Both participants, qwertyuiop and 137, provide a formula for the number of squares with a few seconds lap in between. However, the other participant, Jason takes up only one formula and ignores the other, withholding any form of uptake. Let's look at the interaction in detail.

At 7:30:07, qwertyuiop presents his formula for the number of squares in a question form, "would that be: a(n)=n2-1", presumably calling for assessment from the group members. However, this question is not taken up in any way. Instead, Jason takes up 137's proposal at 7:30:15 PM and 7:30:18 PM ("so a(1)=1…" and "For squares…" respectively). The response explicitly refers to 137's posting using the referencing tool offered by the chat system (as indicated by the arrow in front of the message at 7:30:39). Jason endorses 137's formula and proposes a task for the group, "lets check for a few values of N". Both Jason and 137 check the formula.

Excerpt 5

**Jason** 5/11/06 7:28:07 PM EDT: so a recursive formula relies on the value of a previous function

t **137** 5/11/06 7:28:09 PM EDT: Ah, I see.

**Jason** 5/11/06 7:28:19 PM EDT: thus, you must specify something first, like a(1) = 4

t **qwertyuiop** 5/11/06 7:28:29 PM EDT: i get it

**Jason** 5/11/06 7:28:54 PM EDT: great

**qwertyuiop** 5/11/06 7:30:07 PM EDT: for the number of squares, would that be: a(n)=n2-1

t **137** 5/11/06 7:30:15 PM EDT: so a(1)=1, a(n)=n+a(n-1)...

**137** 5/11/06 7:30:18 PM EDT: For squares...

■■

t **Jason** 5/11/06 7:30:39 PM EDT: it looks right... lets check for a few values of N

**Jason** 5/11/06 7:31:06 PM EDT: when N = 1, #squares = 1

This excerpt reflects a particular affordance of chat systems mentioned earlier, that turn-taking is organized through the work of threading rather than adjacency, as it is in face-to-face conversation. Qwertyuiop's question at 7:30:07 PM would, in face-to-face interactions, call on recipients to produce a response as the next action and any next would be seen in light of that expectation. However, in this chat, no response is provided and it is not expected that the very next post will in fact attend to the immediately prior one. This is a feature of threading. Organizing posts in terms of threading allows a chat posting, even in question form, to go unaddressed without breaching the progressivity of the interaction.

In this case, Jason responds to only one of the two proposals. The uptake of 137's proposal together with the actions performed subsequently make "ignoring" qwertuiop's proposal unproblematic because (a) the alternative is endorsed as "looks correct" and (b) actions are taken to check the initial assessment. Uptake of qwertyuiop's proposal is not necessary for the interaction to progress.

**Starting a new activity.** In Excerpt 6, we show that a so-prefaced activity initiation can be used to dismiss a post without uptake or reference. At 7:43:51 PM, Jason uses a lexical resource from a prior post

to initiate a new topic for the group. Despite the lexical linkage, the construction using a "so" prefaced declarative statement allows Jason to avoid uptake of qwertyuiop's post at 7:42:54 PM.

As we can see, qwertyuiop at 7:43:41 PM puts forward the candidate conclusion that n(1+n)+n2 is the same thing as n*(N+3), a formula they had considered earlier in their interaction. From a math educator's perspective, recognizing something and being able to connect to what has been learned before are important learning activities for students. In this particular case, recognizing the formula is the same thing they had discussed previously and considered a correct solution implies that the approach that leads to the formula could also be right. At this point, it would add credibility to the post and lead to its possible acceptance. What is notable in this case is that qwertyuiop's observation is not taken up by any of the other participants at this point. Even qwertyuiop at 7:48:37 PM abandons his own implicit inquiry and asks, "are there other problems to do?" Our interest is to discover what there is in the production and presentation of qwertyuiop's posting at 7:43:41 PM that allows for his observation to be orphaned, left unexamined and without uptake. This would be an example of what Stahl (2006, pp. 445-451) considers a "failed proposal." In Stahl's analysis, the failure of a proposal can be attributed to "its lack of clarity and its bad timing" (p. 448). In Excerpt 4, however, issues of placement in the chat and the organization of the posted text itself do not suggest that the candidate conclusion would be particularly problematic for recipients to understand or that there were problems of timing. What can we say about this stretch of chat interaction?

Excerpt 6

**qwertyuiop** 5/11/06 7:42:54 PM EDT: we already have the square formula; just include it: n(1+n)+n2

**Jason** 5/11/06 7:43:16 PM EDT: yup

**qwertyuiop** 5/11/06 7:43:41 PM EDT: that looks like the same thing as n*(N+3) at a glance...

**Jason** 5/11/06 7:43:51 PM EDT: so speaking of formulas, we got both explicit and recursive definitions for sticks/squares; explicit is easier while recursive shows how each step grows from the previous

**qwertyuiop** 5/11/06 7:45:40 PM EDT: how do i type on the white board?

**Jason** 5/11/06 7:45:55 PM EDT: click the text box (icon with A and lines in it)

**137** 5/11/06 7:46:01 PM EDT: Use the text box option, next to the camera.

**137** 5/11/06 7:46:13 PM EDT: Oops, two over.

**Jason** 5/11/06 7:46:13 PM EDT: two away from camera

**qwertyuiop** 5/11/06 7:46:23 PM EDT: see it

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**137** 5/11/06 7:48:12 PM EDT: Er... Am I lagging or is nobody typing?

**qwertyuiop** 5/11/06 7:48:21 PM EDT: nobody is typing

**Jason** 5/11/06 7:48:21 PM EDT: typing now :)

**qwertyuiop** 5/11/06 7:48:37 PM EDT: are there other problems to do?

**137** 5/11/06 7:48:51 PM EDT: I do not think so...

Careful examination of the excerpts presented leads to the following noticings. First, postings are not addressed to anyone in particular. Second, the consequentiality of the postings for other participants in terms of their ongoing activity is not explicitly provided for in their text. When a participant makes multiple posts regarding a matter, recipients may treat the matter as adequately addressed and the matter could be considered as already closed. Third, the affordances of the chat system itself do not place recipients in the position of having to respond to any given post. Thus, there are at least three structural/procedural possibilities for explaining the lack of uptake, assessment or discussion of dis-attended postings.

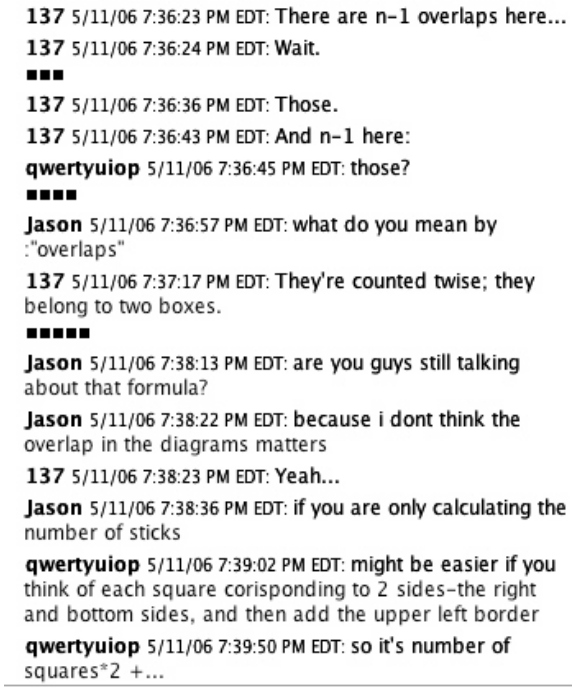
## Getting Noticed

As the prior examples show, dis-attending to postings is easy to accomplish in chat. Much of it has to do with the structural affordances of chat and the dual interactional spaces. In particular, the fact that sequencing is achieved through threading and that recipients are not co-participants in the production of postings creates an environment in which participants are subject to a very different moral order of action. Actors have greater discretion with regard to what they take up and how that uptake is achieved. So, what then does a participant have to do to get noticed in chat?

**Being specific.** In Excerpt 7, Jason asks questions (7:36:57 PM; 7:38:13 PM), 137 answers (7:37:17 PM) and responds (7:38:23 PM), Jason offers explanations for his own questions (7:38:22 PM) and qwertyuiop produces counter-suggestions (7:39:02 PM). What makes this different from the prior

examples? How are these questions, suggestions, ideas, etc., produced so that recipients attend to them, take them up, respond to each other?

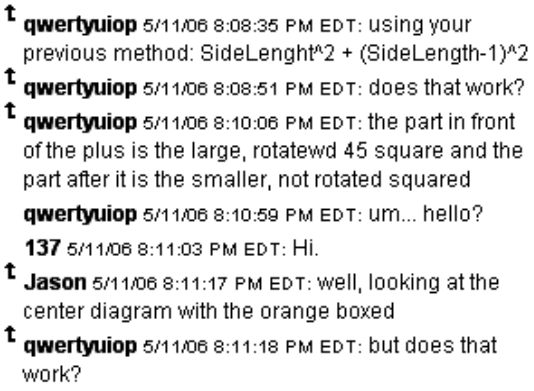
Excerpt 7




The postings in this sequence identify a particular respondent. For example, at 7:36:57 PM, Jason asks "what do you mean by 'overlaps'." There are a number of features of this question that make the response by 137 at 7:37:17 PM both relevant and expected. First of all, even though he is not called by name, Jason nonetheless addresses his question to 137. This is accomplished using the second-person pronoun "you" combined with the lexical term "'overlaps'," set off in quotation marks by Jason. This locates the source of Jason's trouble in the prior posting authored by 137 at 7:36:23 PM, "There are n-1 overlaps here…"

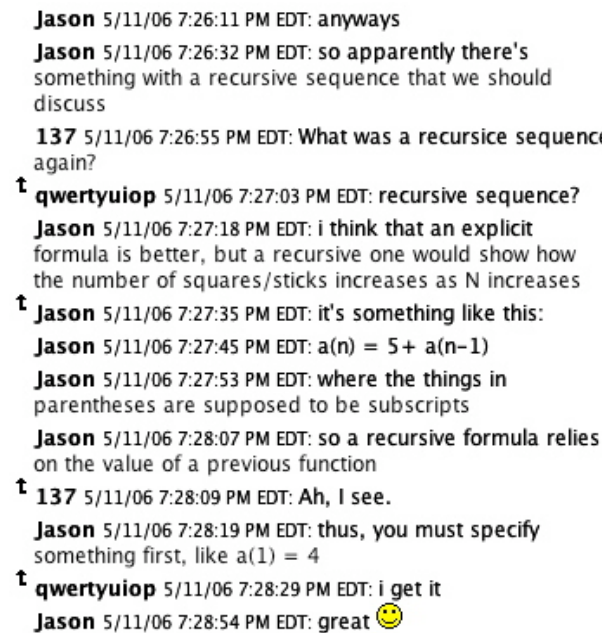
**Being persistent.** Another way to make one's voice heard in chat is to be explicit on making a request calling for attention and repeat the request when no response is received. In Excerpt 8, qwertyuiop puts forward his result and uses explicit reference to point to 137's previous post (at 8:08:35). He also articulates that he re-uses 137's "previous method". No response is given in the next 15 seconds or so when qwertyuiop follows up with an explicit question: does that work? He then adds explanation on how he got the formula he puts out for the group's consideration. Nothing observable from other members is going on at this point: no posts and no activities on the whiteboard. Nearly one minute's time has elapsed, a noticeable, significant gap in a chat, when qwertyuiop starts voicing he is really looking for attention: "um… hello?" (8:10:59). In the following posts, we finally see responses from both 137 and Jason. Qwertyuiop repeats his question, which is specific on the action it demands from the recipients as some checking work to see if his formula works. In this case, the original idea put forward becomes hard to ignore since not taking it up would result in significant interactional trouble that is noticeable thus needs to be worked out. In the interaction that follows, the participants conduct checking work together. After it is proved to "work", the formula is accepted by the group as the correct solution. There are questions posed from both Jason and 137 regarding how the formula is derived and qwertyuiop produces an elaborated explanation. The two participants finally indicate they got it. These learning activities would not have happened if qwertyuiop's idea did not get taken up by the group.

Excerpt 8




**Obstacles to progressivity.** In Excerpt 9, we see a posting that leads to participant questions that might be considered 'show stoppers.' In this example, Jason puts forward in the form of a description a task for the group that calls for them to consider "something with a recursive sequence" (7:26:32 PM). The explicit design features of this posting are not that dissimilar from the descriptive postings discussed in Excerpts 2 and 4. However despite the fact that Jason used the first person plural pronoun "we" in Excerpt

Excerpt 9




definition of recursion needs to be put forward.

4, the report described something in which he participated with a different set of partners, and because it does not include the other participants in the chat, it can be considered a self-oriented descriptive report. This contrasts with Jason's report in this excerpt where the first person plural pronoun "we" refers to the chat participants themselves. It is a collectively oriented report that describes something they all should take up. Furthermore, Jason's posting was based on his reading of comments made by VMT staff that discussed the work of their team in their prior session and offered suggestions for work they might consider doing in the current session.

Both 137 and qwertyuiop call for clarification or explanation of recursive sequence at 7:26:55 PM and 7:27:03 PM. It is important to note that Jason, 137 and qwertyuiop are the only student participants logged into the chat at this point and that, based on 137's and qwertyuiop's questions, only Jason seems to know what the term means. If they are to proceed with Jason's suggestion, a

## Collaboration: A Social Achievement or a Technological Affordance?

In this paper, we investigated the phenomenon in online math problem-solving chat sessions that students present ideas and frequently some ideas do not get taken up by the group. From examining our data corpus at VMT, we have identified and explicated ways that chat participants in VMT sessions dis-attend to prior postings. Participants can simply "ignore" a prior posting in an unmarked way by producing parallel postings or by initiating a different thread of discussion. By focusing on the whiteboard, participants may not pay attention to what is happening in chat. Participants can also provide a dissmissive assessment of a proposed idea, elect one among a number of alternative proposals to respond to while ignoring the rest, or start a new activity by using a "so" prefaced declarative statement. These procedures allow prior postings to be dis-attended without interactional consequence. We have also analyzed and shown what a participant can do to get a post noticed and attended to. These include addressing a post to a specific recipient, being persistent in eliciting a response, or creating obstacles to progressivity of the ongoing interaction such as asking a specific question.

We share Gibson's (1979) view of affordances as possibilities for action. Along these lines, Hutchby holds that "[a]ffordances are *functional* in the sense that they are enabling, as well as constraining, factors in a given organism's attempt to engage in some activity" (2001, p. 199). In examining ways that participants do math problem solving using the VMT system, we noticed that *the affordances of chat-based systems are not particularly supportive of collaborative interaction*. In short, we found that chat-based systems of interaction make it incredibly easy to ignore what others are doing. If there is to be collaborative interaction among chat participants, people need to pay attention to what others are doing. In other words, collaboration can only occur when participants themselves engage in specific reading practices, practices that involve noticing and attending to each posting for its relevance to the ongoing interaction. In future research, we will examine how participants' reading practices change over time as they produce and achieve an emergent history of their interaction.

## Endnotes

(1) "The Math Forum is a leading center for mathematics and mathematics education on the Internet. The Math Forum's mission is to provide resources, materials, activities, person-to-person interactions, and

educational products and services that enrich and support teaching and learning in an increasingly technological world" (The Math Forum@Drexel, 2006).

(2) In face-to-face interaction, hearability and intelligibility emerge as structural constraints on interaction, for example, when two speakers talk at the same time. Overlapping speech is possible in face-to-face, but overlapping postings is not possible in chat.

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