Co-Orientation Without Co-Presence: Collaboration in Computer Chat

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1. Introduction

This paper draws from data collected as part of a larger case study on conversation in computer-mediated team meetings (see also Markman, 2007, 2009, 2010). A group of five undergraduate students at a large, public university in the southwest United States were recruited for a summer-semester (five and one-half weeks) independent study course under the supervision of the director of the Science, Technology, and Society program. All students were given the option to enroll in the course and not participate in the research project. The participants were told that they would be working as a virtual team to conduct research on innovative student uses of technology in and around the university. The course was structured so that instead of attending regular class meetings, the students would conduct the bulk of their work as a team using CMC tools, and they would hold virtual meetings using the collaboration tools in the Blackboard course management system.

The team held four virtual meetings using the collaboration tools provided on the Blackboard course management system. For the first meeting, the team used the Lecture Hall tool, which included a virtual whiteboard in addition to the chat interface, but this was found to be cumbersome by some participants because they could not resize the chat window. The subsequent three meetings were held using the Lightweight Chat interface, a feature new to Blackboard at the time these data were collected. The first, third, and fourth meetings averaged 52 minutes in length; the second meeting lasted for one hour and 18 minutes. With the exception of one member, Sidney, the team had generally equal rates of attendance in the four virtual meetings. The researcher was

also present for at least part of all four virtual meetings. Table 1 shows the demographic breakdown of the team. All names have been changed to protect confidentiality.

Table 1
Virtual Team Membership

Pseudonym	Sex	Major
Evan	male	sociology
I-Fang	female	advertising
Rebeca	female	English
Sidney	male	geography
Thadine	female	geography

Data were gathered by providing each team member with screen recording software in order to produce a video recording of each person's screen activities. Because of technical difficulties, miscommunications, and schedule conflicts, not all team members were present and recording during all virtual meetings. Meetings three and four offer the most complete data record, with screen recordings for all six participants available. The screen recording data were supplemented by the automatically-generated chat logs provided by the Blackboard system.

The analysis presented here is situated within the computer-mediated discourse analysis (CMDA) (Herring, 2004) approach to the study of online interaction. Rather than being a specific theory or method, CMDA is an approach to the study of CMC that is grounded in the empirical observation of text-based verbal interaction. Herring notes that CMDA adapts a variety of methods, both quantitative and qualitative, from various language-focused disciplines. The data presented in this paper will be examined from a perspective derived from conversation analysis (CA). Although CA was developed in sociology as a way to document the organization of talk-in-interaction (ten Have, 1999) it has since been used by scholars in a number of different fields for different purposes. Specifically, CA-derived methods have been used since the late 1990s to further our understanding of text-based conversations.

Although CA has generally been used to examine spoken interaction, research on text-based CMC has long shown it to have conversational properties as well (Baron, 2008). Early language-focused research on CMC noted that text-based interaction exhibited features of both written and oral communication (Ferrara, Brunner, & Whittemore, 1991; Murray, 1991; Wilkins, 1991) and could be approached as a new type of textual conversation using the CA toolkit (Murray, 1989). Research on text-based conversation from a conversation analytic standpoint has yielded insights into turn taking and turn organization (Garcia & Jacobs, 1998, 1999; Markman, 2006b; Panyametheekul & Herring, 2003; Simpson, 2005), interactional coherence and ambiguity reduction (Herring, 1999; Rintel, Pittam, & Mulholland, 2003), openings and closings (Markman, 2009; Rintel, Mulholland, & Pittam, 2001; Rintel & Pittam, 1997; ten Have, 2000) and repair (Schonfeldt & Golato, 2003; Markman, 2010). This paper furthers this line of research by focusing specifically on how team members developed the joint attention needed to coordinate task decisions.

2. Chat structure and the problem of joint attention

The focus of this paper is on how participants in computer-mediated meetings orient to a shared task. The task-based nature of their interactions necessitates that participants develop co-orientation. However, the computer chat medium used for their team meetings presents certain constraints on the development of joint attention. In face-to-face (FtF) settings, participants have a variety of resources available to establish co-orientation, including gesture, gaze, body orientation and shared physical resources (Diessel, 2006; Gardner & Levy, 2010), most of which are absent in chat interaction. More importantly, the production and reception of talk and action occur simultaneously in FtF settings, whereas in many chat systems, such as the one under study here, the production of turns is separate from their reception. Therefore, in order to discuss how the use of synchronous chat affected this team's accomplishment of joint attention, it is first necessary to discuss the salient features of the chat interface and how they change the organization of

conversation. Figure 1 shows the chat interface used in the team's second, third, and fourth meetings. Although the exact features and arrangement of chat interfaces will vary based on the software package being used, they generally share some version of the features discussed below.

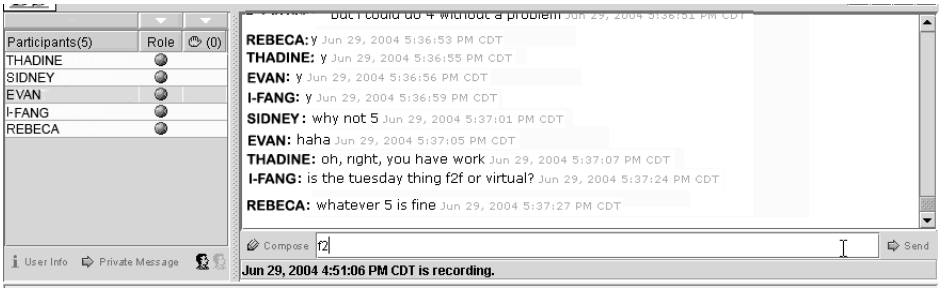

Figure 1. Chat Interface

Chat tools are distinguished from other synchronous CMC channels such as instant messaging primarily by the number of participants. Instant messaging tools are designed for the exchange of real-time text-based interaction by two people; chat systems allow for three or more people to share the same virtual conversational space. There are three main components of the chat interface. The left-hand pane shows the list of participants who are currently logged in to the chat room. The main box is the chat window, which displays all posts sent to the chat server in the order they were received. In the case of this interface the server also included an automatic timestamp at the end of each post, although not all chat systems include this feature. The chat server automatically included the name of the author to the left of each post (the irregular margins in the chat window are a result of obscuring the participants' real names). Below the chat window is the text entry box where individual participants type their posts.

All participants who are logged in to the chat room have access to the same information in the chat window, however, the information typed into a given participant's text entry box is only available to that person during the composition process. Pressing the enter key or clicking on "Send" sends the post to the server and thus makes it available to the rest of the group. This separation of turn composition from turn reception is one of the biggest differences between chat

conversation and spoken interaction. In spoken conversations, the listener has access to the speaker's turn as it is being uttered, thereby allowing the listener to project the possible end of the speaker's turn. This allows for the sophisticated turn-taking exchange system that has been well-documented in the CA literature, whereby one person talks at a time, with little gap or overlap, and the current speaker generally selects the next (Sacks, Schegloff, & Jefferson, 1974). Instead, in chat discussion the system allows for any person to type at any time, promoting a turn allocation system of any person self-selects. Turns are composed in private, and arrive at the server all at once (as opposed to while they are being typed). In addition to separating the production from the reception of turns, the chat interface does not allow participants to choose how their turns will be placed in the chat window, thereby making it impossible to ensure that a turn will be placed adjacent to the post it is responding to. Instead, turns are posted in strict chronological order based on when they were received by the server.

As a result of the technical constraints imposed by chat technology, the flow of conversations in this medium is not regulated by the linear turn-taking exchange system present in spoken conversation. Rather, discussions in chat are additive, in that each new post contributes to the ongoing evolution of the conversation, but is not necessarily responsive to the immediately preceding post. Thus chat conversations are characterized by disrupted turn adjacency (Herring, 1999). In addition, because chat promotes any-person-self-selects turn allocation, chat discussions can, and often do, have multiple ongoing topics, or threads, of conversation. These two features of chat, disrupted turn adjacency and multiple conversational threads, require participants to adapt new turn organization practices to restore coherence to the evolving conversation. In these data, the team members relied on constructing turns so that they were sensitive to the specific topic of conversation as their primary means of organizing turns (see also Greenfield & Subrahmanyam, 2003; Markman, 2006b; Simpson, 2005). In addition, they sometimes used address terms to make it

clear who the intended recipient was (see also Herring, 2003; Panyametheekul & Herring, 2003; Werry, 1996). Two examples will help illustrate these turn organization features.

Example 1

5:35:38	I-FANG: so when tuesday?
5:35:40	EVAN: So has everyine else...we can just meet on campus, or soemthing
5:35:48	THADINE: 5?
5:35:53	EVAN: y
5:35:57	I-FANG: i though we r meeting virtually tuesday?
5:36:15	REBECA: Can we do it earlier on Tuesday?
5:36:21	EVAN: that is fine with me
5:36:23	EVAN: 4
5:36:24	EVAN: 3
5:36:28	REBECA: how about 3?
5:36:29	I-FANG: i can meet on campus..anyday 2:30 to 6
5:36:40	EVAN: Thadine?
5:36:40	THADINE: I can't do 3. Class til 3:45
5:36:49	EVAN: how bout 4
5:36:51	THADINE: but i could do 4 without a problem

Example 1 takes place towards the end of the team's fourth meeting. Prior to this excerpt the team had been discussing the scheduling of various meetings, including a possible face-to-face meeting with their professor, and another meeting, either virtual or face-to-face, to go over their final presentation before turning it in. The left column of the example indicates the server's time stamp. A full transcript of this example based on the screen recording data is shown in Figures 2 and 3. A key to interpreting the full transcripts is in the Appendix.

Example 1 illustrates the disrupted turn adjacency in chat caused by the inability to monitor the ongoing composition of others' turns. Prior to this excerpt Evan has proposed Tuesday as a possible time for a face-to-face meeting. I-Fang's follow-up, posted at 5:35:38, is separated by five other turns from the post it is referring to. For the participants in the chat, there appears to be a lull in the conversation after I-Fang's turn at 5:35:38 and Evan's turn two seconds later. In response to this lull, Thadine types a response at 5:35:47 that posts one second later. What Thadine cannot know, however, is that I-Fang is using this apparent lull to type a new turn that seeks further

clarification (see Figure 2). While I-Fang is typing, both Thadine's turn at 5:35:48 and Evan's response at 5:35:53 are posted. Although I-Fang posts a question at 5:35:57, which would in its sequential placement in spoken conversation generally call for a response (Schegloff & Sacks, 1974), she is unable to attract her teammates' attention, and a subsequent question, posted by Rebeca at 5:36:15, supplants I-Fang's request. The next rapid sequence of posts illustrates how disrupted turn adjacency also leads to redundancies in the conversation. Evan responds to Rebeca at 5:36:21, and then immediately suggests two additional meeting times, four or three o'clock. Rebeca starts typing "how about 3?" at the same time that Evan's suggestion of 4 is posted, which means that what appears in the chat to be a ratification of his suggestion of three o'clock is in fact a follow-up to Evan's first candidate meeting time. Similarly, I-Fang's turn that posts at 5:36:29 appears to be implicitly ratifying the previous suggestions. However the screen recording (see Figure 2) reveals that I-Fang began typing her turn at 5:36:05, before Rebeca began her post that led to this sequence.

In looking at example 1 thus far, the disrupted turn adjacency of chat has produced some slight redundancies in the evolving conversation, but no fundamental misunderstandings or problems. However, the most salient structural characteristic of chat, the inability to monitor other participants' turns in progress, poses additional interactional challenges. In spoken conversation, silences have been shown to have interactional significance (Pomerantz, 1984), and in the linear turn-taking system can in fact function as turns themselves. Additionally, in the context of meetings silences can even be taken as a sign of implicit agreement (Boden, 1994). However, in chat, silences are really best understood as non-responses (Rintel et al., 2003), in that the participants lack the audio/visual cues necessary to tell if others have stopped participating (and are therefore silent), walked away from their computers, or are in the process of composing a turn. Thus non-responses in chat are inherently ambiguous, and it is left to the participants to work out the meaning of non-responses on the fly.

Example 1 Full Transcript Part 1

Chat Time	Chat Window	THADINE	EVAN	Chat Time	I-FANG	REBECA
5:35:38	I-FANG: so when tuesday?	((pause))	↵	5:35:38	((pause))	((pause))
5:35:39			((pause))	5:35:39		
5:35:40	EVAN: So has everyine else...we can just meet on campus, or soemthing			5:35:40	i though	
5:35:41				5:35:41	we	
5:35:42				5:35:42	r	
5:35:43				5:35:43	me	
5:35:44				5:35:44	eting vi	
5:35:45				5:35:45	rtul	
5:35:46				5:35:46	((pause))	
5:35:47		5? ↵		5:35:47	~~tu~~	
5:35:48	THADINE: 5?	((pause))		5:35:48	ally	
5:35:49				5:35:49	n	
5:35:50				5:35:50	~~n~~	
5:35:51				5:35:51	tuesd	
5:35:52			y↵	5:35:52	((pause))	
5:35:53	EVAN: y		((pause))	5:35:53	ay?	
5:35:54				5:35:54	((pause))	
5:35:55				5:35:55		
5:35:56				5:35:56	↵	
5:35:57	I-FANG: i though we r meeting virtually tuesday?			5:35:57	((pause))	
5:35:58				5:35:58		
5:35:59				5:35:59		
5:36:00				5:36:00		
5:36:01				5:36:01		
5:36:02				5:36:02		
5:36:03				5:36:03		
5:36:04				5:36:04		
5:36:05				5:36:05	i	I
5:36:06				5:36:06	can mee	~~=I~~
5:36:07				5:36:07	t i~~e~~	Can w
5:36:08				5:36:08	o	e do i
5:36:09				5:36:09	n cam	t ea
5:36:10				5:36:10	pus	rlie
5:36:11				5:36:11	..an	r on
5:36:12				5:36:12	y d	Tu
5:36:13				5:36:13	ay	esday
5:36:14				5:36:14	((pause))	? ↵
5:36:15	REBECA: Can we do it earlier on Tuesday?			5:36:15		((pause))
5:36:16				5:36:16		
5:36:17			that is	5:36:17		
5:36:18			fine	5:36:18		
5:36:19			with	5:36:19		
5:36:20			me ↵	5:36:20	2:	

Figure 2.

Example 1 demonstrates one tactic the participants used to disambiguate non-responses. After I-Fang's post at 5:36:29, Thadine begins composing a turn that is responsive to the previous suggestions about the meeting time. However, the only information available to her teammates is

that she last posted at 5:35:48. Evan, noticing that Thadine has yet to respond, composes the turn "Thadine?" at 5:36:37 (see Figure 3), and thereby marks the gap since Thadine's last post as a non-response. The form that Evan uses, name + question mark, can be understood as both an invitation for Thadine to contribute to the thread and a request to Thadine to make her presence in the chat known. As it happens, Thadine finishes typing at the same time that Evan does, and they hit enter simultaneously, resulting in both posts arriving at 5:36:40. Thus it appears in the chat transcript that Evan has called on Thadine to respond and she has answered, when in fact her turn was a response to earlier posts. This sequence also illustrates another phenomenon common in chat discussions known as the false adjacency pair (or phantom, see Garcia & Jacobs, 1999), whereby two posts in the chat appear to form an adjacency sequence, such as question/answer or greeting/greeting, when they were in fact typed independently of each other. Because Evan does not have access to Thadine's post in progress, he posts a further turn at 5:36:49, to which Thadine appears to respond two seconds later. In this case, the false adjacency pair serendipitously results in agreement, but this phenomenon also has the potential to cause problems or misunderstandings.

Example 1 Full Transcript Part 2

Chat Time	Chat Window	THADINE	EVAN	Chat Time	I-FANG	REBECA
5:36:21	EVAN: that is fine with me		((pause))	5:36:21	30	
5:36:22			4	5:36:22	((pause))	
5:36:23	EVAN: 4		↵	5:36:23	to 6	how
5:36:24	EVAN: 3		3↵	5:36:24	((pause))	about
5:36:25			((pause))	5:36:25		3
5:36:26				5:36:26		?
5:36:27				5:36:27		↵
5:36:28	REBECA: how about 3?			5:36:28	↵	((pause))
5:36:29	I-FANG: i can meet on campus..anyday 2:30 to 6			5:36:29	((pause))	
5:36:30				5:36:30		
5:36:31		I can		5:36:31		
5:36:32		't do		5:36:32		
5:36:33		3.		5:36:33		
5:36:34		Class		5:36:34		
5:36:35		((pause))		5:36:35		
5:36:36				5:36:36		
5:36:37		til	Thad	5:36:37		
5:36:38		3:45	ine?	5:36:38		
5:36:39		↵	↵	5:36:39		
5:36:40	EVAN: Thadine?		((pause))	5:36:40		
5:36:40	THADINE: I can't do 3. Class til 3:45	((pause))		5:36:40		
5:36:41				5:36:41		
5:36:42		bu		5:36:42		
5:36:43		t i		5:36:43		
5:36:44		could		5:36:44		
5:36:45		do		5:36:45		
5:36:46		4 wi	ho	5:36:46		
5:36:47		thout	w bout	5:36:47		
5:36:48		a	4 ↵	5:36:48		
5:36:49	EVAN: how bout 4	proble	((pause))	5:36:49		
5:36:50		m ↵		5:36:50		
5:36:51	THADINE: but i could do 4 without a problem	((pause))		5:36:51		

Figure 3.

Example 2

5:43:55 RESEARCHER: but the point of this project (part of it) is to work as a virtual team, remember ;)
5:43:57 EVAN: I think in general we can discuss our findings so far
5:44:05 SIDNEY: evidently you cant paste in here
5:44:13 THADINE: that's no good
5:44:24 EVAN: Our findings?
5:44:37 THADINE: yeah, discussing our findings so far seems to be a good place to start
5:44:43 I-FANG: ugh...yes yes...meeting up in person will just be a plus...we'll still have regular virtual meetings

Example 2 comes from the team's second meeting, and illustrates the importance of conversational threads in designing turns for chat. Prior to this excerpt the team had been discussing the research the individual members had done and the different possible directions for

their project as a whole. Along with that, a separate thread concerned the possibility of meeting up in person, either in addition to or in lieu of meeting face-to-face. In addition, during the time that Evan was typing his turn that posted at 5:43:57, Sidney was repeatedly trying to copy and paste some text from another website into his text-entry box. At the same time that Evan's turn posts, Sidney gives up and deletes the incorrect text from his message entry box (see the full transcript in Figure 4). He then starts a new turn expressing his frustration that gets posted at 5:44:05. At the same time that Sidney is typing, I-Fang, who had been in the middle of composing a turn related to the meeting scheduling thread, deletes her turn in progress and instead begins a new turn that is responsive to the researcher's turn at 5:43:55. Some confusion arises at 5:44:13 when Thadine responds to Sidney's most recent post. Based on the screen recordings (see Figure 4), the most likely referent for Thadine's turn "that's no good" is Sidney's complaint that he could not paste in the chat box, given that she began typing this turn four seconds after his post appeared. The substance of the post, along with its timing, makes the most likely interpretation that Thadine is offering sympathy to Sidney. However, due to the lack of a named referent, and the lack of any clear lexical links to Sidney's turn, Thadine's post allows for a possible alternative understanding, displayed by Evan at 5:44:24.

Here, the inability to precisely coordinate turns, along with the inability to monitor others' turn construction results in both disrupted turn adjacency and some confusion. As shown in the full transcript, Thadine beings typing another turn almost immediately after posting her turn at 5:44:13. This turn, which gets posted after some minor edits at 5:44:37, is clearly responsive to Evan's turn at 5:43:57. Thadine uses an agreement token, "yeah," and recycles Evan's phrase "discuss our findings so far" into "discussing our findings so far" as a way of ratifying Evan's proposal and at the same time clearly linking her turn to his. In addition, the timing of her turn construction lends further support to the conclusion that her turn at 5:44:13 was in response to Sidney, and not Evan, because she began her second turn well before Evan displayed his confusion

at 5:44:24. Therefore although Thadine's turn at 5:44:37 may appear to form an adjacency pair with Evan's post at 5:44:24, and thereby clear up his confusion, it is in fact just a serendipitous placement.

Example 2 Full Transcript

Chat Time	Chat Window	THADINE	EVAN	Chat Time	I-FANG	SIDNEY
5:43:57	EVAN: I think in general we can discuss our findings so far	((pause))	((pause))	5:43:57	((pause))	((deletes text in
5:43:58				5:43:58		entry box))
5:43:59				5:43:59		evid
5:44:00				5:44:00	~~taht erofeb~~	ently
5:44:01				5:44:01	~~teem tnac~~	you can
5:44:02				5:44:02	~~os..yadi.r~~	t past i
5:44:03				5:44:03	~~f mretdim~~	n ~~ni~~
5:44:04				5:44:04	~~evah llew~~	=e in he
5:44:05	SIDNEY: evidently you cant paste in here			5:44:05	ugh	re↵
5:44:06				5:44:06	...ye	((pause))
5:44:07				5:44:07	((pause))	
5:44:08				5:44:08	s yes	
5:44:09		tha		5:44:09	...	
5:44:10		t'		5:44:10	but	
5:44:11		s no		5:44:11	((pause))	
5:44:12		good↵		5:44:12		
5:44:13	THADINE: that's no good	((pause))		5:44:13	mee	
5:44:14				5:44:14	t ((pause))	
5:44:15		well,		5:44:15	~~teem tub~~	
5:44:16		((pause))		5:44:16	~~r~~ ((pause))	
5:44:17				5:44:17	.	
5:44:18		~~,lle~~		5:44:18	meeti	
5:44:19		~~w~~		5:44:19	ng	
5:44:20		((pause))	Ou	5:44:20	up in	
5:44:21		yeah,	r findong	5:44:21	pers	
5:44:22		discuss	~~gno~~ing	5:44:22	on wi	
5:44:23		ing our	s?↵	5:44:23	ll	
5:44:24	EVAN: Our findings?	fini	((pause))	5:44:24	((pause))	
5:44:25		((pause))		5:44:25		
5:44:26		~~i~~ding so		5:44:26	just be	
5:44:27		~~os~~ s		5:44:27	((pause))	
5:44:28		so far s		5:44:28		
5:44:29		eems		5:44:29		
5:44:30		t		5:44:30	a plus	
5:44:31		o be a		5:44:31	...	
5:44:32		good		5:44:32	that	
5:44:33		place		5:44:33	~~taht~~	
5:44:34		to sta		5:44:34	we	
5:44:35		rt		5:44:35	'll s	
5:44:36		↵		5:44:36	till have	
5:44:37	THADINE: yeah, discussing our findings so far seems to be a good place to start	((pause))		5:44:37	re((pause))	
5:44:38				5:44:38	gular	
5:44:39				5:44:39	v	
5:44:40				5:44:40	irtual	
5:44:41				5:44:41	meeti	
5:44:42				5:44:42	ngs↵	we n
5:44:43	I-FANG: ugh...yes yes...meeting up in person will just be a plus...we'll still have regular virtual meetings			5:44:43	((pause))	eed

Figure 4.

Thus, in this 48-second slice of the conversation there are three separate conversational threads at play, as illustrated below. Shading has been used to indicate linkages in the threads.

Example 2 Thread 1

5:43:55	RESEARCHER: but the point of this project (part of it) is to work as a virtual team, remember ;)
5:44:43	I-FANG: ugh...yes yes...meeting up in person will just be a plus...we'll still have regular virtual meetings

Example 2 Thread 2

5:43:57	EVAN: I think in general we can discuss our findings so far
5:44:37	THADINE: yeah, discussing our findings so far seems to be a good place to start

Example 2 Thread 3

5:44:05	SIDNEY: evidently you cant paste in here
5:44:13	THADINE: that's no good
5:44:24	EVAN: Our findings?

In these meetings, the use of lexical repeats to indicate threading was by far the most common way of organizing turns, as illustrated by example 2, threads 1 and 2. Less commonly used were address terms to indicate turn organization. It is worth reiterating that the lack of either of these two elements contributed to the confusion found in thread 3.

To review, the nature of the synchronous chat interface results in conversation that is characterized by disrupted turn adjacency, with the concordant potential for false adjacency pairs, multiple concurrent conversational topics, and ambiguous non-responses. To cope with these constraints, the team members adapted their turn construction to be sensitive to threading by including lexical and structural cues in their turns that linked them to the appropriate topic. This, along with the small size of the group, allowed them to maintain coherence with relatively infrequent use of address terms to designate specific recipients.

One consequence of the disjointed nature of chat that is particularly salient to group collaboration is that courses of action are also disrupted. From the CA standpoint, actions are built out of sequences of interaction, and these actions are revealed in the data by examining what "co-participants in the interaction took to be what was getting done, as revealed in/by the response they make to it" (Schegloff, 2007, p. 8). The difficulty with chat, for both the analyst and the

participant, is that responses are often delayed, if they are present at all. The implication for group work is that creating/sustaining the joint attention necessary for producing collaborative work (Boden, 1994) is more difficult to do. Thus not only do participants in virtual meetings lack the nonverbal cues present in spoken conversations, but they also cannot rely on the sequential implicativeness of talk, that is that one turn follows another and each turn is responsive to the immediate prior turn, as a locus for orienting their attention. Thus, it is not just that chat conversations can be difficult to follow and understand, but it may also be more difficult to coordinate actions in a group task setting. A few additional examples from the team's meetings will illustrate these coordination challenges. Screen recordings are discussed when appropriate, but full transcripts have been omitted for space considerations.

As documented in previous research on chat in educational settings (e.g. Cox, Carr, & Hall, 2004; Davidson-Shivers, Muilenburg, & Tanner, 2001; Johnson, 2006), these team meetings were marked by the frequent intrusion of the technology into the conversation. This "tech talk" (Markman, 2006a) included accounts for being late or dropping out of the meeting due to technical glitches, questions about the technology (including the software used to generate the screen recordings), and expressions of frustration about the particular interface. Example 3, from the team's first meeting, illustrates how tech talk could interrupt the flow of the conversation, thereby disrupting the action that talk sought to accomplish. Relevant turns are indicated by shading.

Example 3

10:14:27	THADINE: Yeah, we probably should start without him.
10:14:39	SIDNEY: so what shall we talk about
10:14:45	RESEARCHER: Ok, now that most of you are here, let me ask about the meeting next week
10:14:52	THADINE: does anyone know how I can minimize the whiteboard and make our chat session larger
10:15:19	REBECA: hit the big sqaure/maximizer button
10:15:25	REBECA: square
10:15:32	RESEARCHER: Thadine,
10:15:45	RESEARCHER: It doesn't appear to change on mine
10:16:17	THADINE: Ok, thanks Researcher. I have a Mac Rebeca, so there isn't a maximizer button, but thanks for your help.
10:16:18	RESEARCHER: you used to be able to click and drag the box, but it won't let me click now
10:16:19	I-FANG: mine is disabled too..
10:16:43	THADINE: So the meeting next week?

10:16:47	RESEARCHER: they've changed the look of virtual classroom quite a bit in the new release
10:16:48	REBECA: sorry :(
10:16:54	RESEARCHER: sorry..meeting with Dr. K[.....]
10:17:03	RESEARCHER: she needs to meet after 5pm
10:17:28	RESEARCHER: she just want to get a feel for how thinga are going & talk abotu research methods

Example 3 takes place towards the beginning of the meeting, and four out of the five team members have shown up to chat room. Prior to this excerpt Rebeca proposed that the meeting could start without the fifth member, Evan, and it is to her suggestion that Thadine's turn at 10:14:27 is responding. Taking advantage of the fact that the meeting discussion has not really begun, the researcher attempts to introduce the first topic, a scheduling matter, into the conversation at 10:14:45. However, the next turn to post to the chat is from Thadine, who is asking how to modify the virtual classroom display. Although the chat system allows for participants to engage in multiple conversational threads, Thadine's turn has the effect of orienting all of the team members' attention away from the researcher's scheduling message and towards Thadine's technical issue. Rebeca, I-Fang, and the researcher all join Thadine's thread, and although Sidney does not reply in this exchange, his screen recording indicates he is trying various buttons and tools on the chat interface, presumably to see if he can suggest a solution for Thadine. Although the issue is marked as resolved by Thadine at 10:16:17, other turns-in-progress are posted after hers, thus adding to the sequence. Thadine attempts to return the conversation to its prior track with her turn at 10:16:43, providing an opportunity for the others to reorient themselves to the researcher's turn at 10:14:45. However, the researcher is also engaged in turn composition, and it not able to reorient to the task of scheduling the meeting until 10:16:54. Thus it took two turns, one from Thadine and one from the researcher, to reorient the group to the proposed task of scheduling a meeting. It is interesting to note also that tech talk was the one topic whose presence effectively interrupted the prior talk, rather than simply adding a new concurrent thread to the conversation. It may be that because the conversations are being mediated through a technology, participants are more

sensitive to technical issues than to other "interrupting" threads, and therefore more likely to put the rest of the conversation on hold while the technical problems are being worked out.

Thus, as example 3 shows, the problem with coordinating actions in chat discussions is not that it is impossible, but that it may be more imprecise and take longer to accomplish, in part due to the potential for overlap and the inability to assess passive agreement through body language or silence (Boden, 1994). In the case of this team, decisions were often arrived upon without any explicit consensus, but rather through the repetition and uptake of ideas by one or more team member. Explicit verbalized agreement by an individual team member was also taken as a sign of general agreement in the group.

Example 4

5:46:15	EVAN: Mp3, computers and PDAs is what Rebeca said, right?
5:46:24	REBECA: Like for example: Evan studies wireless future past and present or with another member and then Me and someone else study different uses of something else?
5:46:33	EVAN: Cell phone...sorry
5:47:04	REBECA: like how useful wireless internet is for PDA's versus lap tops
5:47:05	I-FANG: so we are essentially having 2 topics?
5:47:08	THADINE: we can probably organize the research part however we want
5:47:29	EVAN: I think 3 topics and the two that produce the most information are what become the final presentation
5:47:35	REBECA: well, maybe 2 or maybe more we can work individually on things related to sum it all up at the end.
5:47:59	I-FANG: i think team work might be better
5:48:01	REBECA: We need like a general topic say, WIRELESS
5:48:04	EVAN: I think breaking it down is fine, but doing 5 distinct projects that come together at the end is too hard
5:48:09	I-FANG: wireless sounds good
5:48:16	REBECA: then we each pick areas to look at under that topic
5:48:24	SIDNEY: do we have our wireless innovator?
5:48:25	EVAN: what data do we have so far in our tree about wireless
5:48:34	THADINE: Sid and Evan have good points
5:48:42	I-FANG: i got wireless home networking

The excerpt in example 4, from the team's second meeting occurs after the team has evaluated the research collected since their last meeting. They have moved on to a discussion about how to focus their project, and are specifically trying to address how many topics to pursue for more research and what those topics should be. After proposing that the team move on rather than collect more data (not shown), Evan moves to introduce specific candidate technologies for further study, based on the prior discussion, in his post at 5:46:15. The next turn, from Rebeca at 5:46:24,

does two things: explicitly it is a proposal for a way of organizing the final project, based on assigning specific topics to specific team members. At the same time, Rebeca's turn implicitly suggests "wireless" as a possible research topic, which is then repeated in her turn at 5:47:04. The next few turns concern the matter of how many topics the team should choose, but a specific proposal for how to organize the project is not agreed upon. What happens instead is that Rebeca's turn at 5:48:01 again serves two functions: to suggest a strategy for organizing the project (a general topic), *and* to explicitly suggest a candidate topic, wireless. Interestingly, while the problem of the *number* of topics is still up in the air, Rebeca's suggestion of wireless *as* a topic is taken up by I-Fang at 5:48:09 with an explicit agreement token, and then implicitly by Sidney at 5:48:24 and Evan at 5:48:25. That is, by asking how wireless can be used as a topic given their existing information, Evan and Sidney appear to be accepting wireless as a topic worthy of further exploration. It is also interesting to note that the ambiguity surrounding the number of topics the team will pursue allows Thadine, two minutes after this exchange, to introduce a second possible topic for their project, in this case, computer animation/computerized art. The unresolved nature of the issue of the number of topics is made clear by Evan towards the end of the meeting, nearly 20 minutes after the exchange in example 4, when he posts "I know it is late...but we need to have a second or even third direction."

Coordinating decisions in the chat environment was aided, to an extent, by the introduction of a strategy for eliciting explicit agreement. In meeting two, the researcher, in an attempt to verify a future meeting between the team and their instructor posted the following: "Wednesday at 5pm, STS conference room (FAC 17)? Please say Yor N." The Y/N convention was subsequently used by the team for some of their own decisions, and it proved to be an effective tool. Consider the following two examples.

Example 5

6:23:32	RESEARCHER: virtually?
6:23:43	THADINE: Tues?
6:23:45	REBECA: Tuesday at 5?
6:23:48	EVAN: Y
6:23:51	REBECA: y
6:23:52	THADINE: Y
6:23:59	SIDNEY: virutal you mean
6:24:05	REBECA: we'll let ifang know
6:24:16	REBECA: y
6:24:20	SIDNEY: Tuesday at 5pm Virtual meeting; Wednesday at 5pm FAC 17
6:24:27	THADINE: sounds good
6:24:27	REBECA: this whole Y or N thing works great

Example 6

5:38:45	REBECA: ok UGL 2nd floor
5:38:52	REBECA: Tues. 5
5:38:52	EVAN: Meet in the lobby?
5:38:56	EVAN: Of the second floor
5:38:57	REBECA: sure
5:38:58	EVAN: ?
5:39:01	SIDNEY: so were meeting in the UGL 2nd floor Tuesday the 6th
5:39:07	REBECA: in the lobby
5:39:07	EVAN: Yes
5:39:09	EVAN: at 5:00
5:39:15	EVAN: In the lobby of the second gfloor
5:39:18	I-FANG: ok, all set
5:39:22	THADINE: sounds good
5:39:24	REBECA: yeah!!!!

In example 5, taken from the second meeting shortly after the researcher has introduced the Y/N convention to schedule a face-to-face meeting, the team members re-use this convention to quickly and clearly display their agreement to a date and time for their next virtual meeting. Example 6, from the team's fourth meeting, comes shortly after the team has used the Y/N convention to decide on a time for a face-to-face meeting to practice their presentation. However, instead of re-using that convention, the team repeats the same information several times to establish agreement. In spoken conversation repetition is commonly used as one way to show agreement. However, repetition as an agreement strategy can be a disadvantage in the chat medium, because longer turns will take more time to type, thereby increasing the potential for ambiguous non-responses. Although in example 6 the information that was retyped was not extensive, it conveys a sense of redundancy and slightly less clarity than example 5.

3. Conclusion

The examples presented here illustrate the challenge that the chat medium presents to the accomplishment of joint attention. In studies of face-to-face meeting talk (e.g. Boden, 1994; Mirivel & Tracy, 2005), it is often noted that a variety of cues, including physical actions such as paper shuffling and seat-taking, or vocal cues such as throat clearing, can, either alone or in combination with verbal requests, serve to focus participants' attention on the task at hand. Chat-based meetings lack these cues from the physical environment, and thus participants must rely entirely on their verbal interaction to focus joint attention on the task. However, the structural features of most chat systems make it difficult for participants to rely on a single turn to focus attention, because they cannot hold the floor and prevent others from also posting turns to the chat. Thus, what these examples have shown was that the most effective strategy for focusing joint attention was repetition. Indeed, although for length considerations this paper has only presented a few examples, the complete dataset shows that repetition was the primary way in which team members focused others' attention on specific issues, topics, or tasks. Repetition was also the primary way in which team members displayed their own understandings of the task at hand to the rest of the group. Repetition was important not only for decision making, but also for opening and closing the meetings (see Markman, 2009), tasks which also require co-orientation. Repetition works as a strategy for focusing joint attention primarily because it helps to overcome the limitations of the medium by exploiting the visual nature of these conversations. Even a quick scan of the excerpt in example 4 reveals the focus of the conversation is on "wireless." It has been noted that participants in CMC conversations are frequently multitasking and engaging in other activities simultaneously (Baron, 2010), such as watching television or listening music. This can lead to participants losing track of the conversation, particularly if a number of turns have posted in rapid succession. Thus

visual markers will also have a better chance of focusing the attention of any team member who has temporarily glanced away.

Repetition as a strategy for focusing joint attention is not without its drawbacks. Its primary cost is in time. Even the most skilled typists cannot type as quickly as they can speak, which means that by necessity it will take longer to cover the same information in a text-based conversation than in an oral one. Having to repeat the same information two, three, or four times will only add to the length of time it takes to reach a decision or focus the conversation, because participants have to read each post and figure out to what thread it belongs as part of the process of making sense of these conversations. My observation over all four of this team's meetings was that they were only able to get through one major decision topic in a single one-hour meeting. There was very little expressed disagreement in any of the meetings; rather the length of time it took to open meetings, establish a topic of conversation, and reach decisions was the primary reason. In my informal discussion with the team at the end of the project, they, too singled out time as a factor, and expressed the feeling that with more time (as in a longer semester), they could have had more meetings, and thus been able to better organize their project. Thus redundancy in chat is a double-edged sword—it is vital for establishing co-orientation in a medium without any other cues—but at the same time can extend the length of time it takes to reach decisions, thereby reducing the number of action items that can be accomplished in any given time frame. Thus it may be that chat, while perfectly fine as a medium for casual conversations, may be a less effective tool in institutional settings for decision making, and more effective for tasks such as brainstorming where joint attention is less important.

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APPENDIX

Key for interpreting full transcripts:

Participants' screen recordings were aligned to the time stamp provided by the chat server. Individually named columns represent that person's visible screen activities. Text is transcribed exactly as entered on the screen.

The use of double strikethrough (i.e. ~~olleh bob~~) indicates deleted characters or spaces. Deleted characters are shown in reverse order, unless the entire word and/or phrase was selected and deleted in one action, in which case the deleted information is shown in normal order.

Double parentheses are used for transcriber description or comments, for example: ((mouses to menu bar)).

The ↵ symbol represents hitting enter or clicking send.