

Discourse Analysis of Web Texts: initial results from a telementoring project for middle school girls

BRIAN DRAYTON & JONI FALK, TERC, Inc., USA

ABSTRACT *The article analyzes data from two small web-based communities created as part of the educational project 'Eyes to the Future.' This telementoring program for girls and women creates teams of three middle school students, one high school student, and one woman scientist. Teams last for 10–15 weeks, and explore issues of transition to high school, the life of working scientists, and various other science, educational, and social themes. Project data from two contrasting teams are analyzed, and the analysis suggests the value that discourse-analytic techniques can have for understanding some aspects of the dynamics of electronic communities. Notions such as register, voice, cohesion, participant patterns, and participant style provide a theoretically based way to describe and analyze both role constitution and interactions within web communities, which extends the kinds of analysis hitherto usually applied to web texts.*

*Sender: JustinTLover18
Subject: Deep Sea, and LavaLamp*

*Hey KT,
Thanks for those great letters! they were very helpful. Well, now I wanna tell you about what we did last week. We had to make Balloon Rockets!!!! It sure was the time to put on your thinking caps! Iff you take a look at our picture we are on the floor getting ready to shoot off our rocket ... I hope we do something like that again. I really felt like a scientist. It must be really kewl. Do you do any experiments that*

you do daily. Well I gotta go check it out. By the way I am the one near the baby blue balloon,. Peace write back! ~!!!!

Sender: Deep Sea

Date 21-Jan-00 2:56 PM

Subject: JustinTLover18

Hi! That balloon experiment sounds great! It sounds pretty similar to what I do on a daily basis. I use what's available to create a device or experiment to get my objective done ...

For example, I had to grow some purple bacteria that are killed by air and eat explosive hydrogen. So I gerryrigged a glass bottle with a bunch of tubing, hooked up the appropriate gas cylinders, and let it rip! Now I have a bunch of purple bacteria!

Congrats on getting second prize! KT

This exchange between a middle school girl and her mentor, a woman marine ecologist, makes the reader feel that he or she is listening in on a good conversational relationship, carried on by e-mail, but augmented by some visual media. Although it seems that they have never met each other in person, the girl knows the mentor's real name, and she feels free to express enthusiasm in a casual, lively style. The mentor's answer shows a similarly lively style, and a desire to speak in such a way as to build a link between the girl's fun and engaging experience and her own absorbing work.

In conducting a mentoring program for girls, we seek evidence that the mentorships that we have created are 'working,' that the teams of girls and mentors are engaged in an exchange that is both personally and intellectually rewarding. In the early stages of Eyes to the Future, our National Science Foundation (NSF)-funded project (NSF/HRD 9906153), much of our evaluation of the quality of the experience could be based upon our presence in the after-school clubs in which the middle school girls communicated with their mentors, and talked about the relationships. As the program has expanded, however, the record of the discourse among the members is the primary source for information about relationships formed. How much can we learn from this source about the quality of the mentorships and teams that the program rests upon?

Discourse analysis provides a way to explore the structure as well as the themes of talk. In other words, it enables us to look at *how* we talk, *who* we are as we talk, and *what* we talk about. It has developed a range of analytical techniques for examining participant structures and turn-taking, identifying roles and status among interlocutors among other social elements of the exchange, and the patterns of theme introduction and development (e.g. Schiffrin, 1994; Sacks, 1995; Gee, 1999).

Discourse tools have provided important insights into the dynamics of

learning situations, whether formal or informal, and have been applied extensively to classroom learning in particular (Cazden *et al.*, 1972; Philips, 1972; Au, 1980; Cazden, 1988; Edwards, 1993). The analysis of classroom talk has cast light on the power structures in the classroom (which determine who sets the agenda, who sets the standards for achievement or valuable contribution, what kinds of questions are permissible, and from whom [Lemke, 1993]), and how the cultures of the student and the teacher may contribute to the social dynamics of the learning situation. Close transcriptions and other analyses can provide evidence about the voices (in Bakhtin's sense) and registers present (Meehan, 1978; Philips, 1983; Gee, 1990).

Increasingly, there is 'discourse' on the World Wide Web, and communities of practice and interest are being formed and are carrying on many kinds of exchanges. In what ways can the discourse-analytic approach be applied fruitfully to this 'pre-transcribed' corpus of texts? Many of the kinds of markers and information present in spoken (transcribed) language are absent from electronic exchanges. Non-verbal cues are also absent, and the asynchronous nature of much web-based discourse precludes data such as patterns of interruption, back-chatter, many discourse markers, and other performance features of 'live talk.'

In this article, we explore the use of some techniques of discourse analysis in a study of two small electronic communities created as part of Eyes to the Future, a web-mediated mentoring program for middle school girls, linking them in small teams with high school and adult female mentors. In effect, each of the several mentor-mentee teams created for the program constitutes an ephemeral community of five members, and the web text provides data about the whole life cycle of each team.

In this article we explore two major questions:

1. What are important characteristics of the communication in this project, when considered as discourse? What discourse tools can be plausibly brought to bear on such texts?
2. What can such an analysis of the communication tell us about the nature of the relationships among participants? That is, what qualities of the teams and mentorships emerge from an analysis of the discourse?

We suggest that several discourse-analytic concepts can be used to provide rich information about the constitution and dynamics of these web communities. This article first explores the research questions in the context of one Eyes to the Future team. Having selected analytical approaches in this context, and having provided *prima facie* evidence for their applicability and usefulness in the analysis of one team's discourse, we then show that these tools can point up significant contrasts with another team, by

comparison, and hence that the approaches we suggest do in fact provide new ways of understanding such communities of discourse.

1. Background on the Electronic Communities Studied

Eyes to the Future links middle school girls, who meet in after-school clubs for 10–15 weeks, with high school and adult female mentors. The project's aim is to increase the girls' sense of confidence and competence as learners of science and technology, and to encourage them to consider future paths through high school into adulthood that include continued science and technology learning. The middle school girls in each club are grouped into teams of three; to each team are added one high school mentor and one woman who is employed in some field of science or technology. Communication with the mentors takes place primarily on the project's website, on which each team has a private and dedicated area for asynchronous discussion. We draw the data for this study from these discussions.

In order to understand the range of choice available to participants in the way they communicate, the following should be noted.

- All messages remain on the site for the duration of the program, so a participant can in fact read back as far as she likes to the beginning.
- The high school and adult mentors are asked to read and answer mail at least once a week, but they are free to choose when to do so within that guideline.
- The website at the time of the study had no facility to structure the conversations automatically, e.g. by threading or grouping all messages thematically. Therefore, the between-message links are quite weak, so that participants construct chains of connected messages according to their interests. In fact, even the 'reply' function does not provide much structure for content tracking, as a participant may choose to hit 'reply' only because she wants to write to the originator, not because she wants to follow up on something in the message. Hence, there is much freedom with respect to participant structure, and the participants' choices about whom to answer, what to ignore, and whether to introduce content. Thus, in effect, *de facto* threads develop, as 'response chains' (see Fig. 1).
- Messages in electronic communities tend to be multiplex. One message can contain many topics (Ruopp *et al.*, 1993). Participants are free to reply to all the message elements, or to be selective about what they choose to reply to. In Fig. 1, the adult mentor gives the girls several potential conversational points; her answer picks up strands from a previous exchange between the middle school and high school members about high school, so she models reading the whole stream of messages, rather than those directly addressed to a particular person.

[4]
 Date: 3/30/99 2:44PM
 From: Ruff Ryder
 Subject: Wassup ya'll

Hey, cerise and Lil' Kim. I'm Ruff Ryder cuz DMX iz one and that's my DAWG!!!!!! I luv him! N-e-way, to Cerise- how's high school? I really wanna know from u cuz all the teachers and guidance counselors keep tellin us how SCARY and HARD it is. But my friends say it's not all that bad. Type back soon

[6]
 Date: 3/30/99 7:16PM
 From: cerise
 Subject: Reply: Wassup ya'll

I can't believe that teachers and counselors would tell you that high school is scary and hard! Geez, scaring ppl like that. Well, high school isn't that scary. It will be at first, with all the classes being all over the place and the huge seniors pushing people around ...

Now, the work being hard or difficult really depends on you and your classes. If you do the homework and pay attention in class, you should find that it's easy. If you have trouble, there are still teachers that are nice and give help. Don't give up if it's too hard either!!! Any more questions? ^_^

[9]
 Date: 4/1/99 2:43PM
 From: Ruff Ryder
 Subject: thanx, cerise

thank u sooo much cerise, 4 clearin that up 4 me. I wuz really startin 2 think that the high skool would be mad hard. It wuz hard 2 tell who wuz fruntin; the teacherz or my friendz, who could really care less about skool. thanx again

[14]
 Date: 4/2/99 8:07AM
 From: fifi coquette
 Subject: hs

lil kim, roaddog & ruff ryder, i totally agree with cerise about high school. i remember that it was soooooo much easier if you paid attention in class and kept up with homework. it was almost comfortable then. when you fall behind, it seems so personally demeaning. like you're 'bad' because you didn't do your homework last night. at least that's how it was for me. also, i don't like to write (except email! :-), so english was particularly tedious—sigh!

FIG. 1. Multiplex messages between middle school, high school, and adult members of Team D.

2. Possible Characteristics of Web-mediated Discourse

What kinds of evidence might we look for, in exploring the nature of discourse in a corpus derived from exchanges on a website? We suggest that we can at least collect evidence of *role establishment* (how a member presents herself) and *interactions*, that is, characteristics of the interactions among team members.

In terms of *role establishment*, we might look for individual variation in at least the following, which are addressed in more detail in section 3.

- *Individual voice*. Who is speaking to whom, and for what purpose? 'Voice' (Bakhtin, 1981) can be characterized by stylistic features, such

as the use of specific linguistic register, but more by the themes stressed, the issues that preoccupy the speaker. These might reflect a specific attitude towards the enterprise they are engaged in, its purpose from their point of view, and assumptions about their limitations, requirements, and permissions. For example, in the Eyes to the Future project, not all the web activity grows from the girls' personal interests—for example, the program in which these girls are communicating has a schedule of events, including the development by the girls of a web page about their mentors. Any of the participants may speak 'on behalf' of the program, and the program speaks about certain repetitious topics.

- *Register*. By register, we mean a mode of speech (or in this case written language) which is characteristic of members of a specific social group (Trudgill, 1983; Cazden, 1988). Register in speech is often indicated by multiple factors such as intonation and pronunciation, formality/informality of sentence structure, and the repertoire of speech acts. (Are questions allowed? Are contradictions permitted? Are orders given?) Register, and change of register, is one way of signaling solidarity/distance from one's addressee. It can thus provide some evidence about the attitude of the speaker (writer) to the subject matter and to addressees. In the written format of a website, register may be indicated by orthography, sentence structure, and vocabulary.
- *Participant style*. A person's participation style might be characterized by her idiosyncrasies as a web persona: self-identification, thematic characteristics (e.g. themes written about, issues avoided), and participation patterns (e.g. intermittent presence or participation, number and type of brevity or prolixity, typical turns of phrase, emoticons, exclamations, orthographic style).

In terms of *interactions*, we might hope to get information from variation around at least the following.

- *Cohesion (linguistic cohesion)*. Messages can give evidence that they are mutually constructed texts, the evidence being drawn from a range of devices which constitute cohesion within a text (pronouns, conjunctions, substitutions, lexical cohesion, etc.) (Halliday & Hasan, 1976). These formal evidences of textuality, along with the thematic cohesion that we are labeling 'engagement' below, can provide a window onto the quality of attention with which the community members are interacting, and a way to describe how themes develop and diverge from initial openings—or not, depending on the nature of the exchange.
- *Engagement (thematic cohesion)*. The content of messages provides material with which the participants can build up models of their unseen interlocutors: they learn about each other as persons to a certain extent, in addition to learning about specific science content. Written communication differs importantly from oral communication in this respect, since

each message may contain multiple topics, some linked to previous messages, some unrelated, that arrive essentially simultaneously, so that even in a conversation between two people, multiple sub-conversations can be maintained. The number of topics and subtopics may be evidence of engagement, but this evidence is interpretable only in reference to other qualities. For example, how long do themes persist? Are they maintained across time, and with some elaboration? In this case, where a few topics are developed richly, one can see strong engagement. By contrast, topics introduced may be present for only very short exchanges, and not elaborated. Thus, a few topics poorly elaborated are a sign of little engagement. Where a conversation maintains many topics, and they persist, with some elaboration, the messages reflect this growing dimensionality of knowledge, whether by reference to previous parts of the conversation, or by other devices, such as the adoption of stylistic features or vocabulary. Finally, engagement may be signaled by intensity of communication (number of messages exchanged between two participants), or duration of communication (the length of a connected series of messages). This is closely allied to the characteristic we are calling 'participant structure.'

- *Science vocabulary.* One purpose of the project was to help the girls learn some science from their mentors. Much of this learning must be mediated through the network discourse, since few face-to-face encounters are possible. One indicator that some knowledge is being acquired is in the use of scientific vocabulary. Obviously, it is impossible on the basis of this evidence alone to know if the concepts are understood by the girls, but we suggest that if terms are introduced by the scientist, and used appropriately later by the girls (even if in follow-on questions), there is weak evidence for learning, which might be confirmed (or denied) with reference to other evidence, such as web pages produced by the girls to describe their experience.
- *Participant structure.* Participant structure in an asynchronous, e-mail environment will have quite different characteristics than a 'real-time' multiparty conversation. Turn-taking and related behaviors (Philips, 1983; Cazden, 1988; Sacks, 1995) are not relevant here. There is no way to make a 'bid' for a turn to speak, and, furthermore, there is no need to, since simultaneous contributions do not drown each other out, as in an oral conversation. There can be no interruptions. Simple frequency of participation, used in the analysis of e-mail groups for many years, can be used as a first indicator of 'presence' in the discussion. However, more complex observations can help understand the interactivity on the site. Do members write inclusively, making connections to the other participants, incorporating responses to messages sent to others? Do some people initiate themes frequently, or tend to respond to prompts and questions from others? Do people tend to direct messages to one person at a time, or to the whole group?

3. Looking at Web Discourse

We now apply the notions developed above in analyzing one team's messages with respect to role establishment within this ephemeral community, and interactions which constitute its qualities. We then use the same approach to characterize another, very different team, in section 4. The team we will first examine was called Team D; we examined a corpus of 47 messages.

3.1. Role Establishment

Voice. We can distinguish four voices in Team D's texts: the middle school, the high school, the adult mentor, and the program. The participants speak to each class of teammate in characteristic ways, but in addition, we occasionally hear the voice of the program 'ventriloquially,' in the messages of one or another teammate, typically as they articulate the requirements of the program.

The voices of the age-classes can be distinguished by content, by style of participation, and by linguistic register. However, since all participants share a core group of interests, the various voices are perhaps best characterized by the way they extend or interact with this set of interests. The four voices can be described as follows.

- *Middle school* is generally characterized by informal register (see below), general questions (what is your job like? What is high school like?), and content that focuses on the experience of their age group (most prominently music and other topics of popular culture). Middle school tends not to generalize on the basis of others' answers, nor to be attentive to multiple topics in messages to them. Their answers tend to be short, refer to previous messages more rarely than do other voices (in 43% of messages in this team), and do not refer far back in the conversations (average distance between a reply and its referent message is 2.3 messages).
- *High school* uses formal and informal registers to speak from the high school experience (about classes, extracurriculars, future careers, boyfriends). It speaks of strategies for coping with high school, tends to refer across greater distances in the sequence of messages (average distance in this team is 4.6), and to tie messages more closely to previous messages (in this case, none of the eight post-intro messages lacks a reference to a previous message from a middle school girl).
- *Adult voice* uses formal and informal language, and obviously speaks from greater experience (including college, career, and family/relationship experience). Adult tends also to be more inclusive of all participants (only 7% of messages, 1/15, in this team do not include explicit reference to previous messages), and look back across the messages as the high school voice does (average distance 4.4). The adult voice also

will maintain the science thread of the relationships more consistently, and with more sophistication (e.g. exploring hypotheses, methodology, and scientific reasoning).

- *Program voice* may be cast in any of the registers, as the team members ventriloquate this voice. (Program staff may articulate directly, but they do not do so in this forum, using other areas on the site, or face-to-face conversations in the girls' club meetings or private e-mail.) This voice speaks of formal requirements of the program ('We have to find out about your usual schedule,' 'We need to get some information from you for our web page'), and appears as an external demand or 'rhetorical question' whose information is not further valued, rather than a genuine question. For example:

Date: 3/15/99 8:21AM

From: Tiger

Hey, we had to write about 2 women we admire because ... hold on a moment ... because ... because Claire and Ms. Quackenbush [program facilitators] told us to.

I don't know why.

Tiger

Fig. 1 gives an example of an exchange in which we hear the voices of four participants, and the content of each is characteristic of the middle school, high school, and adult voice.

Ruff Ryder (a middle school girl) seeks advice from her high school mentor, Cerise, about the high school experience. Lil Kim, another middle school girl, does not participate although she is invited to by message 4. Although the structure of the program requires that the middle school girls ask questions of the high school mentors, in this case Ruff Ryder seems to be expressing genuine interest, first because she adduces her own observations (distinguishing different sources of authority, i.e. teachers and friends), and second because she follows up on Cerise's reply.

Cerise (message 6) replies attentively, tying her answer to key words that Ruff Ryder has used ('hard' and 'scary'), and then elaborating a response on each. Her comments clearly come from her personal experience, and provide nuance about factors that might affect the experience (the students' work habits and attitude, the teachers, and the subject matter). Ruff Ryder (message 9) ties her expression of relief to her uncertainty about whom to believe, clearly accepting this first-hand report as authoritative; the topic is thereafter dropped.

Fifi, the adult mentor, chimes in later, with a retrospective answer that supports Cerise's advice, but with some distance of time ('I remember ...') and generality, but also adducing personal affective notes which build solidarity with the younger women ('personally demeaning,' 'like you're

“bad” because you didn’t do your homework last night,’ ‘i don’t like to write’).

By contrast, in two later messages, Lil Kim makes a request for information from Fifi, which appears to reflect the program voice more than her own, despite her use of her characteristic linguistic register. She asks for information, but never acknowledges the reply, or continues any exchange with the mentor; some weeks later she issues a very similar request, with no reflection of the conversations that have been under way in the intervening time:

From: Lil Kim #1

Subject: whats up

Hi waz up as you can see im only 13 years old and i wanna know is it easy being an astronomer or do you lik your job.

From: Lil Kim #1

Subject: Reply !!!.

Waz up um i don’t know that much about astronomer and i will like to no much about.Peace out.

Register. A full analysis of linguistic register or ‘social language’ in this web community would be strengthened by a systematic comparison of oral speech among the various classes of participant. We have not done such an analysis. However, our data suggest that in the discourse in this community, three registers can be distinguished, which can provide information about the roles taken by the participants, especially in relation to their addressee (Fisher, 1964). There are two basic registers, formal and informal; under ‘informal’ we can distinguish two types. Some members use only the formal register, and some move between formal and informal depending on the topic, the addressee, or aesthetic preference (‘the mood at the time’), e.g. for humorous effect or affective emphasis.

The formal register is characterized by standard spellings and punctuations (allowing for typographical errors and *lapsus mentis*), complete sentences, and few colloquialisms. This is most often the register of adults, and high school mentors, sometimes also of middle school girls (Fig. 2).

[15]

Date: 4/6/99 11:19AM

From: cerise

Subject: la di da

... So, we have an astronomer among our mists ... fifi, did you go into college knowing you were going to do astronomy? Do any of the middle schoolers know what you want to be when you go into college? Me? I think I’m going into computer science. It was a fun subject, but my teacher warned me that the other classes that come with it like engineering are tough. Anyway, this is getting too long. Hope you hear from everyone soon! Take care!

A middle school girl reports on her team’s science project:

Date: 4/29/99 3:29PM

From: Roxygrrl

Figure 2—continued

Subject: we've almost got it ...

we have started building our bridge out of the gum drops and linguini ... it is a very sticky subject ... literally!!! we have also run into some difficulties: the linguini is very fragile and breaks very easily ... the gumdrops are very sticky and can't fit too many pieces of pasta in them ... maybe we should have tried a different technique, but this one was pretty creative ... it is a real challenge. we are gonna finish it up next week hopefully.. .bye 4 now!!!

A mentor gives advice to a high school girl about college strategy:

Date: 5/10/99 2:25PM

From: Puddle

Subject: Reply: How's it goin'?

Ah Foong, without getting too long I know I have an unpopular view but this is my suggestion. It is OK to start college with an idea of what to study, but I think you should be open to everything. there is a good chance that you will be introduced to a subject/career that you have never known about.

FIG. 2. Examples of 'formal' register from high school, middle school, and adult members of Team D.

The informal register is characterized by unorthodox/quasi-phonetic spellings ('alwayz'), many abbreviations (e.g. '2' for 'two' or 'to,' 'u' for 'you,' 'cuz' for 'because' or 'cause'), and colloquial/humorous word choices, and sometimes emoticons or other graphical comments. It is most often used by middle school girls, but high school and adult mentors sometimes also use variants of it, and their use can be seen as evidence of a desire to establish solidarity with the middle school girls. An example from another team's exchanges makes this clear.

A middle school girl asks some questions of a high school mentor:

here are some questions i have: 1. what skool did u go 2? 2. iz it really hard 2 find ur way around the skool? 3. do u all u highskool gurlz meet 4 eyes to the future like us or do u just work on ur own. -angel

The high school mentor replies:

I go to B.H[igh].S[chool] ... and it's not very hard 2 find ur way around the skool. All the classes r n order so it's not very difficult. I luv ur shorthand b/c it's soooooo cute. I am sitting here printing out all of ur messages b/c i luv ur shorthand.

The adult mentor in this team also loves the shorthand, and adopts it early on in the conversation. Her messages suggest that in switching 'codes' she has not quite adopted all the rules for this game; for example, she uses pseudo-phonetic abbreviations that do not appear in the girls' messages ('coz,' 'wot,' 'hullo') but do appear in literary representations of dialect (as in, for example, *Winnie-the-Pooh*).

Hi Tiger, lele, angel and Smurf, I'm BugsRcool (this is a name my

husband made up). I'm joining ur group as a scientist mentor. Some of u said u like science and math but might not have a career in science. I'm curious wot u think about that. I like ur shorthand. It's really cute. U can also visit my page now if u like, w/b (write back) OK?

-BRc (BugsRcool)

In Team D, one girl adopts a consistent set of spelling conventions that seem to reflect speech dialectal features. Thus, in understanding how this girl constitutes her persona in this community, a distinction should be made between the lively, abbreviation-filled 'informal' register, and another register, which might be called *Informal/dialectal*. In this case, this shows up in some spellings (final 'in' instead of '-ing'; cf. the informal messages above) and also in vocabulary. The girl who seemed to use this most consistently evinced some consciousness that her written language was related to her use of Black English ('ebonics') at least in some informal settings:

Date: 4/1/99 3:30PM

From: Ruff Ryder

Subject: hey, fifi coquette

Hi,fifi. So what's up? Am i allowed 2 talk 2 u like that or should I talk like an astronomer. If so, I don't know if I can cuz I'm used 2 ebonics.

The same girl, Ruff Ryder, replies to her high school mentor in gratitude for the reassuring message she sent about high school. Note 'fruntin,' roughly synonymous with 'bluffing':

Date: 4/1/99 2:43PM

From: Ruff Ryder

Subject: thanx, cerise

thank u sooo much cerise, 4 clearin that up 4 me. I wuz really startin 2 think that the high skool would be mad hard. It wuz hard 2 tell who wuz fruntin; the teacherz or my friendz, who could really care less about skool. thanx again

In teams where there were quite clear register distinctions, there were cases of code switching on the part of the girls as well as the mentors. For example, at one point Ruff Ryder is asked by her mentor for an explanation of the methodology for her team's science project. Ruff Ryder uses the orthography of the informal register, but in fact her message when read aloud fits very well with the formal register that is the norm for school talk:

Date: 4/29/99 2:58PM

From: Ruff Ryder

Subject: Reply: Reply: my science project iz ...

Whut up fifi This iz how I'm doin my science projekt. I sent out data tablez 4 sum of my relativez 2 fill out. 1st, when they wake up naturally (w/o an alarm clock) and they write how well they remember

their dreemz. They do this 4 3 dayz. Then 4 3 more days they wake up w/an alarm klock and write how well they remember their dreamz. then i c which way (naturally or unnaturally) people remembered their dreemz better

Participant style. All of the features being discussed in this analysis are reflections in some way of the persons doing the writing; in that sense, many of the categories overlap others to some degree. What we are calling ‘participant style,’ however, is most easily connected with the idea of ‘personality,’ and includes features not captured by the other views of the exchanges taking place within this community, such as the types of themes that a teammate is interested by, or returns to, or avoids when it is brought up.

The themes brought in, and the way that that each person interacts with them, are important on two levels. Most prominent is that these themes are the *substance* of the conversation. In addition, thematic patterns together with other evidence (e.g. voice) give information about the *purpose* of the communication, in the participant’s eyes (Bruce & Rubin, 1993). A girl’s interpretation of the purpose of the community will have a decisive effect on her experience of it, and the values she can gain from it—what it *means* to communicate with the mentor, what it *means* to participate regularly, and what it *means* to be part of a team.

This insight into purpose is pivotal for an assessment of the program, and the motivations of girls to participate in it. Mentorship programs can have widely divergent purposes, which can be expressed in the recruitment of participants, in design of the program, and in the way a program is evaluated (Faddis *et al.*, 1988). Yet, each participant is likely to develop her own, nuanced interpretation of the intent of the program, and its value to herself, and this interpretation will shape her experience and participation.

Self-identification. Each team member chooses a screen name, and they can keep it or change it as they prefer. This provides participants with some measure of distance and anonymity, and allows them to choose how forthcoming to be about themselves. In many teams, after some initial exchanges, the girls and mentors begin to offer their real names, and sometimes to share personal information about their families, likes and dislikes, and current events in their lives. In Team D, very little of that occurred at all. Roaddogg starts off with an energetic initial message, in which she gives her name right away:

[5]
Date: 3/30/99 3:17PM
From: Roaddogg
Subject: Hey!!!
Hey!!!

My name is Laura!!!!I'm new here in Eyes to the Future! The reason I am late joining this nice lil' thing is because I had basketball games and stuff! Anyways as you can probably tell if you watch wrestling is that I love it soooooooooooooo much and one of my favorite guys is Road Dogg in DX!!! Do you like wrestling??? anyways i should go now write back!!! Lata!!!

Over the course of the rest of the program, no other team member reveals her name. Two of the team members (Cerise and Fifi) make mention of events in their personal lives, but the middle school girls limit themselves to brief comments about music/sports favorites, and school-related topics.

Themes discussed and pursued. In the team we are analyzing, many themes are discernible, but relatively few are followed up on. The following were taken up in the conversation at least for one exchange:

High school. Both Ruff Ryder and Lil Kim request information about what high school is like. Cerise gives full and careful answers to each of the two queries; Fifi adds supportive and additional comments. The girls wonder if it's hard, and if it's scary, and the mentors provide a nuanced reply: there are certainly hard and scary parts to it, but you can get help and with patience and care you'll be fine. In an exchange quoted above, Ruff Ryder acknowledges Cerise's answer, and says it's been helpful. By contrast, Roaddog and Lil Kim do not acknowledge the replies, and Fifi's message goes unanswered by anyone.

Career paths. The middle school girls make initial inquiries about Fifi's career, as an astronomer, and Fifi gives a friendly initial reply:

[13]
i love my job, and i've had tons of different ones in astronomy, like studying comets, planets, star formation, galaxies, clouds in space (yes, there are) and now i'm doing education in the whole boston area working with the museum of science.

Cerise follows up with a question about Fifi's college experience, and its relation to her career, and Fifi tells her story briefly.

[15]
Date: 4/6/99 11:19AM
From: cerise
Subject: la di da
... So, we have an astronomer among our mists ... fifi, did you go into college knowing you were going to do astronomy? Do any of the middle schoolers know what you want to be when you go into college? Me? I think I'm going into computer science. It was a fun subject, but my teacher warned me that the other classes that come with it like engineering are tough. Anyway, this is getting too long. Hope you hear from everyone soon! Take care!

[16]

Date: 4/6/99 7:35PM

From: fifi coquette

Subject: Reply: la di da

oh cerise—what a question!! in fact i entered college as a chemistry major since my mom was a chem teacher. but i was also premed. then i decided that i didn't want the lifestyle of a doctor, and i'd always liked sewing and designing, so i became a studio art major and planned on fashion design with it. by the time i finished college, my sister was in the fashion industry and had tons of horror stories, sooo, exit stage left! i sat down one day and said, look, when i was LITTLE i wanted to be an astronomer, and everyone talked me out of it. so i set some goals for myself; if i passed them, i'd get to go into astronomy. and i did! harumph!

part of my problem was that i liked too many things, but in the end i'm really happy. do what you WANT to do and it won't seem like work! hope that helps! fifi

Again, there is no acknowledgement from the middle school girls of this exchange, or from Cerise. In addition, no one pursues Fifi's work further, not even Fifi, so that the conversation never provides any concrete picture of what she does, what she loves about her work, how it fits into 'being an astronomer.'

Science projects. In their after school clubs, the teams of girls developed short investigative projects to do. It was hoped that these would not only enrich the girls' experience of hands-on science, and but that it would provide a good topic for conversation among the team members. Ruff Ryder and Roaddogg report their project topics, Lil Kim never does. Fifi and Cerise both persist in asking for reports from the girls, but the conversations are mostly very brief. The girls do not ask for help, and Roaddogg does not answer Fifi's question about her procedure. As quoted above, Ruff Ryder does describe her methodology for her project to see 'which way people remember their dreams better,' but we are left without a payoff—what did she find? Did the method work? Results were not reported.

Other themes were introduced (work habits, boyfriends, sports and musical favorites, science classes, the Walk for Hunger), but these were not pursued. The impression left is of a group of busy people who do not feel a strong involvement with the team or the opportunities it could present. What does this say about the purpose which the team served for the team members? The girls might have seen it as an instrumental aid in their school work, or an opportunity to explore possible future lives. The themes of careers, college, high school, or science projects, for example, were all treated in an inviting fashion by the mentors; the lack of response on the girls' part—both in not following up on answers to their questions, and in

their lack of reciprocity in sharing from their own lives—suggests that the girls did not see the program as a learning opportunity, or a chance to develop a relationship with role models. The messages exchanged did not provide more than a modicum of the kind of knowledge of the other that would allow such relationships to develop. As will appear from the discussion that follows, this element of ‘participant style’ is one dimension along which teams vary widely.

Science vocabulary. In this team, very few science terms were introduced by the mentor at all. In her introduction, she mentions ‘comets, planets, star formation, galaxies, clouds in space’ as phenomena she found particularly interesting in her work. These terms were never used again, by the mentor or the girls on the team. In later messages, girls mention school projects they are doing on dreams, and on the possible effects on water’s density that may result from distillation; the mentor asks questions about these projects, but introduces no new content.

3.2. Interactions

In this section, we include two main points, cohesion and participant structures. In a sense, the division here is arbitrary, since these interact strongly with role definitions. Yet these two aspects are useful in identifying the attention and engagement present in particular interactions, building on the roles established by voice, register and participant style.

Cohesion (linguistic cohesion). Halliday and Hasan (1976) articulated seven general types (with many subtypes) of cohesive devices, by which a series of utterances are made into a coherent text, by indicating cross-referencing within the text, and thus the building up and interweaving of information assumed within the discourse: (1) Pronominals; (2) Demonstratives; (3) Comparatives; (4) Substitutions; (5) Ellipsis; (6) Conjunction; and (7) Lexical.

Fig. 3 shows a selection from our corpus; in it, most of Halliday and Hasan’s cohesion types can be seen, in both direct and mediated ties between the participants; text examples elsewhere in this article show remote unmediated and mediated ties.

We suggest that these devices can be used as part of an analysis of the mutually constructed texts of an electronic community, and take them as evidence about the attention participants pay to each other, the intertextuality of the web discourse, and hence some evidence about the depth or quality of solidarity in the team interaction. First, one can look at the density of the ties between messages (e.g. number of ties per line or sentence) as a first indicator of the responsiveness of the reader/responder to the sender: in this case, the average number of ties per line is about 1, and about 45% of lines are tied. Second, there are the kinds of ties made. Although a full analysis of the implications of different kinds of cohesive devices remains to be done, it appears that when a writer uses a high

Line	Text selections	Cohesion type	Tied to line
1	[39]		
2	Date: 5/6/99 10:03AM		
3	From: fifi coquette		
4	Subject: confused		
5	ok, i am a bit confused (that's cuz i'm blond :-)	6	(prev.msg)
6	who is doing what project? are you all doing	1, 7	(prev)
7	shadows? and what about dreams? and what's lil kim #1 doing? all the same?	3,1	(prev)
8	can i call you just lil kim so i don't have to - gasp - use the shift key??		
9			
10	[45]		
11	From: cerise		
12	Subject: my bad		
13	Ok, ok, my bad! I thought the shadows and dreams were	7	7
14	science fair projects for school! Does the shadows experiment for Hyes to the	7,6,7	7
15	Future ever get displayed then? Does anyone else get to		
16	take a look see?		
17	If Ruff Ryder is doing dreams for the school science fair, what does Roadlogg	2,7	7, prev
18	and Lil Kim #1 have? (I know it's probably late to ask, and sorry!)	7	(prev), 8
19			
20	[46]		
21	Date: 5/10/99 1:35PM		
22	From: fifi coquette		
23	Subject: Reply: my bad		
24	right, ditto to those questions for me! cerise, are you	2	11,13-18
25	blond, too?? there are some serious shadows out there	2,7	5, 13-18
26	today!! i love it!		
27	cheers - fifi		

FIG. 3. Sketch of cohesiveness analysis between high school and adult mentors, Team D. Cohesion types: 1. Pronominals; 2. Demonstratives; 3. Comparatives; 4. Substitutions; 5. Ellipsis; 6. Conjunction; 7. Lexical.

proportion of comparative (type 3), lexical (type 7), and substitution (type 4) ties, this is an indicator of careful attention and thematic responsiveness. This then provides an additional line of evidence to examine, along with what we are calling 'engagement,' or thematic cohesion.

Engagement (thematic cohesion). To what extent does one member of this community continue, repeat, or extend a theme in a message to which she is replying? To what extent do other members use or participate in the same theme, or a development from it? One way to answer these questions is to note the length of 'threads,' that is, messages that share a common theme or themes. In Team D, the adult and high school mentor typically reply to most or all of the themes introduced in middle school messages, but the thematic threads are almost all two messages long: query (from middle school girl) followed by reply (by mentor); in very few cases is there either an acknowledgement of the reply ('thanks for that message') or a follow-on question or comment from the middle school girls. We return to this below as we 'characterize' the team.

Participant structure. Participant or exchange structure has received extensive attention in the discourse literature, and has been used very fruitfully

in the study of educational settings (for example, see Stubbs, 1983; Lemke, 1990; Rosebery *et al.*, 1992; and, long before, Philips, 1972). Who gets the floor, and how do they get it? Who is interrupted and who is inviolable? What types of utterances are present or absent in whose participation? How much silence is tolerated?

This approach to discourse analysis has perhaps been most widely applied to the analysis of electronic communities, in combination with thematic analysis. Participation patterns have been used in the analysis of telecommunication exchanges (see Ruopp *et al.* [1993] and references there for analyses that predate the World Wide Web). Such analyses examine variables such as the kinds or topics of threads, number of participants in threads, number of messages in a thread, and duration of thread (e.g. in terms of number of days). These formal characteristics are in fact revealing about the engagement between members of a community (Bruce & Rubin, 1993): who communicates with what intensity with whom? The differences between spoken and written discourse (e.g. the possibility of simultaneity, the impossibility of back-chatter, the absence of non-verbal cues) are evident: the written channel in many respects is quite impoverished compared to spoken communication.

3.3. Characterizing the Team's Community

In what has preceded, we have drawn primarily from one Eyes to the Future team's exchanges in order to establish some *prima facie* validity for the use of some discourse techniques. In what follows, we apply the tools discussed above to characterize aspects of the community of discourse constituted by the team's messages over the course of their program, between 11 March 1999 and 12 May 1999. The corpus shows the beginning, development, and end of a community, and the nature of this growth and development are important to the goals of the project, which occasioned the creation of the community in the first place. The team here studied would not be seen by the project staff as the most successful team in the program; there were certainly also teams that were far less functional, and a few that might seem more so. Yet, it provides a useful case to begin the application of discourse analysis techniques, and to develop a body of analyses that allow an increasingly rich characterization of such communities. We begin by characterizing the participation of the five members, with reference to the criteria discussed earlier, and then consider the team as a whole.

(a) *The members.* The five participants are Ruff Ryder, Lil Kim #1, and Roaddogg, all middle school; Cerise, high school mentor; Fifi Coquette, adult mentor.

Lil Kim contributes three messages to the discussion. She uses the

informal/dialectal register. It appears that she speaks with a middle school and program voice: while her questions are appropriate for middle school, she does not ever follow up on or acknowledge answers, giving the impression that her engagement is distant or perfunctory, as though out of duty (the facilitator is urging her). Her messages show very few ties to previous messages from other teammates. For example, in message 3 she asks about high school, but her message is not a reply to one posted by Cerise a week before, nor does she refer to any of the content of Cerise's initial message. Thus, the only tie is to the general notion of high school, rather than to the actual high school message posted. Lil Kim's two messages to Fifi (11 and 42) show similar lack of engagement, as do her low participation rate, and her failure to refer to the other middle school team members at all. She does not offer much information about herself, except a sentence that suggests she is not engaged academically in other settings either (message. 3).

Roaddogg contributes 10 messages to the discussion, and thus seems at first a more engaged member than Lil Kim, but the voices she uses, and the low cohesiveness between her messages and others suggests a low level of engagement. She uses a formal register (as defined for this corpus), though with plenty of exclamation points and some colloquialisms ('anyways'). We would judge her voice to be largely the program voice, on the basis of her participation patterns and the lack of cohesion between her messages and those of her teammates. For example, a high proportion of her messages conclude with statements suggesting that she has barely any time to spare, and pressing engagements elsewhere; some of these seem addressed to some generic audience (represented in Fig. 4 as 'Air').

She does not refer to any other teammates' messages. She does reply to messages from Cerise and Fifi five times, but in most of these messages the cohesion is very weak, with the exception of message 40, where she answers a direct request for information clearly and fully. More typical, however, is message 23, in which she mentions her science project, with no specific clear reference. Others have talked about science projects, but she has not participated in those exchanges, nor described her topic; her team hears abruptly:

[23]

Date: 4/15/99 2:31PM

From: Roaddogg

Subject: Reply: sci proj

Hey ... I'm already finished with my science experiment and the research. All I have to do now is my board and stuff. I'm doing this distillation stuff. I have to find out if the density of water changed after distillation. It takes so damn long for it to distill though!!! It was so annoying!!!

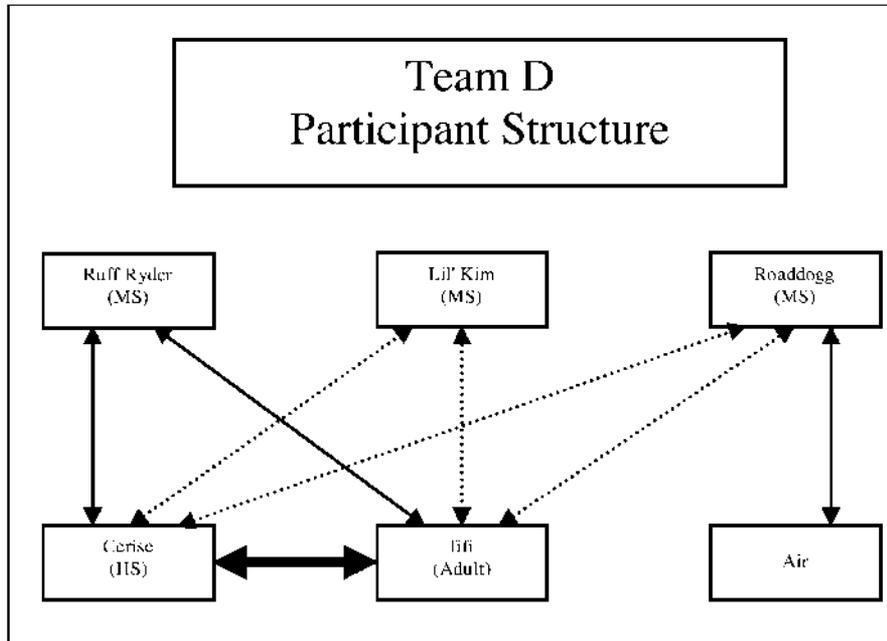


FIG. 4. Team D participant structure, schematized. Thickness of lines represents relative intensity of communication. Dotted lines indicate low-frequency, or poorly connected participants. 'Air' indicates messages with no specific referent within the team.

When Fifi asks about Roaddogg's methodology, after expressing sympathy about the tedium of distillation (message 28), Roaddogg does not reply, as she does not to at least four other themes or questions introduced by Fifi. There is no evidence of her reading other middle school messages; when she introduces herself to the high school and adult mentors, she does not evidence having read any of their previous postings. In one case (message 24), she uses the 'reply' function to a message from Cerise, but the content of the reply is unrelated to Cerise's original. Thus, it appears that Roaddogg is somewhat more engaged than Lil Kim, but her engagement is still quite low.

Ruff Ryder contributes fewer messages than Roaddogg (eight), but the quality of her participation is quite different. She uses the informal/dialectal register consistently, with one exception to be noted later. She speaks with the middle school voice exclusively, not only offering opinions and information about herself, but also following up on answers and questions from the mentors, so that she gives evidence of participating out of some personal interest; unlike the other middle school girls, she often changes the subject lines of reply messages, suggesting that she is aware of the value of extra information supplied even by these small details. Her messages generally show strong cohesion with previous messages from the

mentors. None of her messages is an ‘isolate,’ with no ties to previous messages in the corpus. Even in her introductory message (4), she refers to Cerise by name before asking her questions, and also mentions the other middle school girl who has already posted (though the content of the reference does not reflect Lil Kim’s posting in message 2). In the exchange between her and Cerise about high school, she asks if high school is hard and scary, and cites a conflict in the advice she has received so far (from teachers vs. from friends). Cerise offers a very attentive and careful reply, and Ruff Ryder acknowledges the message, both by explicitly thanking Cerise, and by expressing a response to the advice given, finally referring once more to the ‘conflict of authority’ which Cerise has resolved:

thank u sooo much cerise, 4 clearin that up 4 me. I wuz really startin 2 think that the high skool would be mad hard. It wuz hard 2 tell who wuz fruntin; the teacherz or my friendz, who could really care less about skool. thanx again

One final note about Ruff Ryder’s engagement: as noted previously, in message 31, part of a discourse about her science project, Ruff Ryder replies to Fifi’s question about methodology in what can be seen as formal register: although the spelling is informal, reading the message aloud shows it to be carefully constructed, with minimal colloquialisms, and the basic structure of a careful study. The change of register may represent, first, a reflection of the subject matter, and second, the nature of the exchange with her mentor, and in a sense an assimilation to her style.

Cerise is the high school mentor. She posts nine times during this period. She consistently maintains the high school voice, in a formal register. Her messages are strongly tied to those she is replying to. In message 6, cited earlier, for example, there are lexical ties between her message and Ruff Ryder’s originating message. The reply line provides one automatic linkage, but in her answer she picks up on the ‘teachers and counselors’ theme, and on ‘scary and hard.’ She then composes a short essay on the two themes of ‘scary’ and ‘hard,’ both acknowledging a grain of truth, and suggesting coping strategies (persevere, be nice to teachers who will then help, work hard and pay attention, don’t give up), and then leaves a ‘hook’ for further questions. All of her messages except the first are tied in similar fashion to previous discourse.

Fifi Coquette is the adult mentor. In her 17 messages, she uses a formal register, though she will not use upper case. She speaks in the adult voice, being careful to reply carefully, and to encourage middle school participation. Her style is full of jocular or affective asides, and comes across as enthusiastic. She is careful to reply to almost all themes raised by the middle school girls, and offers many more possible conversational topics as well. In the course of her messages, one can discern at least 22 themes that she introduces which are not taken up by the middle school or

high school participants. Her messages tend to be strongly tied to those she is replying to, and she also is more likely than the other teammates to try to include all the team members. She notes absences and returns of teammates, and sends prompts to keep conversations going.

(b) How well did the team work? The Eyes to the Future project has implemented its vision of a middle school/high school/adult ‘pipeline’ mediated by mentorships by setting the middle school girls into teams, each matched with a high school and an adult mentor. The question, ‘Does the approach work?’ is an important one in the evaluation of this implementation, and in answering it we are also able to see ways of evaluating other electronic communities. What can we say about how this team worked?

The analysis of this team suggests that by looking at voice, register, cohesion, participant structures, and thematic content we can characterize relations in the group with a fair degree of rigor. First, we can say that three members of the team, Ruff Ryder, Cerise, and Fifi show evidence of genuine engagement with each other. Each speaks primarily in her own voice. In communicating with each other, they write messages that are tied together in multiple ways: they acknowledge receipt, they share personal opinions and some personal information, they tie the messages lexically and in other ways, and the linked topics often are developed over more than one message-pair, leading to more depth in some topical areas.

Roadogg and Lil Kim are not so engaged. They speak with more than one voice, and the appearance of the program voice seems to emphasize their detachment from the program. Their messages are less tied thematically and linguistically to their teammates’ messages, there is less evidence of personal relationship (e.g. addressing the others by name or acknowledging replies), and they do not take part in extended exchanges that elaborate a topic or topics (Fig. 4).

Finally, there is little indication, either by the persistence and elaboration of topics, or by the introduction and uptake of science vocabulary, that the community enabled the learning of science content—certainly not content related to the mentor’s field.

Thus, it appears that two of the teammates are quite removed from the discussion, and there is little evidence that they benefited academically or affectively from the exchanges. The team’s community was weaker than it might have been, and the mentors’ experience correspondingly more difficult, because of the quality of the girls’ participation.

4. Looking at Team B

On the promise of the analysis of Team D, we can examine the quality of other teams in Eyes to the Future, to see if the approach can give us a way of comparing team performances. For a contrastive sample, we will use Team B, from the same city but from a different school.

The team consists of middle school members Sugar and Spice 110, Room 112, and JustinTLover18; high school mentor LavaLamp; and adult mentor Deep Sea. Their conversation stretched from 23 November 1999 to 2 May 2000, thus extending over a period twice as long. In the analysis that follows, we will draw primarily from the first 50 messages in describing the team and comparing it to the team analyzed above. These 50 messages were exchanged over approximately three weeks, and within the same number of messages as constituted the whole of Team D's communication, Team B evinces a dramatically different character, which is maintained throughout the whole relationship.

Formal Characteristics

Participant structure. In this selection of the corpus, Sugar and Spice wrote 13 messages, JustinTLover and Lavalamp, the high school mentor, both wrote 12 messages, Room 112 wrote six messages, and Deep Sea, the adult mentor, wrote seven. Two messages were written from the whole team of middle school girls to the high school mentor.

An interesting complementarity between the adult and the high school mentors is suggested by the patterns of their posting messages, which reflects their shifting presence in the foreground or background of the team conversation. Owing to her research commitments, Deep Sea did not appear until message 25; when she did, she became the most important mentor contributor in terms of number and length of messages posted, a trend that continued throughout the rest of the team's existence. In this segment of the corpus, two-thirds of LavaLamp's contributions (8/12) came before Deep Sea joined. After Deep Sea joined, LavaLamp became a less regular participant, though she remained active all through the program. Some of this difference of intensity of participation is likely to be due to LavaLamp's increasing busyness during the spring (as she often declares). Some of it may also be due to the strong connection that was built with Deep Sea and the enjoyment and interest that the middle school girls received from Deep Sea's mentorship. Finally, another contributory factor may be that LavaLamp's perspective as a high school student was explored actively early on in the program, and the focus of interest was shifted by Deep Sea's joining.

In many Eyes to the Future teams, we have seen that the adult and high school mentors develop conversational threads between them, often more focused on career or other topics than the discussions with the middle school girls. In this connection, it is worth noting that the relationship between Deep Sea and LavaLamp was quite different from that shown in Team D discussed earlier, in which Cerise (high school) and Fifi (adult) had a relatively strong exchange. In Team B, Deep Sea and LavaLamp exchange messages once (at Deep Sea's initiative) over the course of the

five months, and not at all during the 50-message period that we are examining here.

There is no clear pattern to theme introduction. All the members introduced new topics to the conversation. By far the most topics were first opened up by LavaLamp, the high school mentor; this is one of the ways in which she facilitated a rich dialogue, starting from her first post, which was message 1 in the whole sequence: of the six themes she introduced, all were taken up by at least one other team member, often more than one. All other members introduced at least one new topic, and all of those were continued in messages from at least one other team member.

Register. In this community, there are no strongly differentiated registers discernible. Almost all of the messages would be called ‘formal’ by comparison to the variants seen in Team D, despite variations in consistency of spelling and punctuation, and occasional use of ‘literary casual’ spellings such as ‘cause,’ or colloquialisms: ‘I am not really lovin’ my life like I should right now’ (but note the careful punctuation). There are some examples of the ‘informal’ style seen in Team D, but it is quite rare, and not used consistently by anyone; it seems to be used jocularly or in great haste, and even when used shows relatively few of the abbreviations seen in Team D:

[31]

Sender: LavaLamp

Date: 06-Dec-99 9:36PM

Subject: Re: LavaLamp

Hi yea i have a sister shes a freshman! my favorite charcter is WOODY TOO!! and i like buzz! thE SECOND ONE WAS REALLY GOOD JUST LIKE THE FIRST!! OK GOT TO GO TALK TO U LATER BYE! YEA I HAVE AOL

Thus, in this team register does not appear to provide evidence about role definition or engagement among the members.

Voice. The four voices distinguished for Team D are present in the current corpus as well. A notable difference is the very low proportion of messages that represent the program voice. A message such as the following, which suggests that the request for information may not have intrinsic value for the questioner, is very rare:

Sender: sugar and spice 110

Date: 03-Dec-99 9:04AM

Subject: Deep Sea

Text: Deep Sea—Can you please please write back to us because we need to know as much stuff as possible about you as we can. Ms. Heanue(the lab teacher) is begging me to get off, so I to.

Sugar and Spice needs the information so that her team can construct a web page about their mentor. In teams where this kind of message is relatively common, the relationship (as represented by the exchange of information) feels impersonal or even exploitative. In the context of a substantive series of messages, in which the middle school girl's personal curiosity seems to be in evidence, this appearance of the program voice does not convey the same message of distance.

Cohesion and engagement. The team's messages show strong evidence of cohesion and engagement, in several different ways.

Cohesion. The team's messages very often show many formal cohesive ties between them, so that the thematic continuity and elaboration is accompanied by attentiveness to specific wording. In Fig. 5, an exchange between one middle school girl and the adult mentor, the adult's reply shows many obvious ties to the girl's message. Sixty-five percent of the 40 lines show at least one cohesive tie, and the average number of ties per line is 1.3. Further, the ties are primarily of the comparative (type 3), lexical (type 7), and substitution (type 4) types which indicate thematic engagement.

Engagement: thematic cohesion. As described above, the themes that are raised are followed, often through more than one message, and often through more than two partners in the exchange. Furthermore, many themes are elaborated. The theme of high school courses was opened by LavaLamp in the first message when she describes her computer drafting class. The topic is taken up by the group of middle school girls in the next message, and then pursued through another series of exchanges between Sugar and Spice and LavaLamp. The topic first leads to a description of the course content, then to LavaLamp's current class project, the ability to draw, favorite subjects in school, and the search for interesting things to do.

Reading each other's messages. The members of Team D, the first team analyzed, essentially did not read each other's messages; this pattern seems to be quite a common one in the program. Team B, by contrast, shows several examples of overlap, starting with the second message:

Sender: sugar and spice 110

Date: 01-Dec-99 1:39PM

Subject: LavaLamp

Text: My team and I(Sugar and Spice 110, Room 112, and JustinTLuver18) have a few questions for you. First, we are in eighth grade. Sugar and Spice 110 is Elena, Room 112 is Natie and JustinTLuver18 is Raquel. What is Computer Drafting? How do you do it and what is it all about? What is your favorite subject and why do you like it? Do you like Justin Timberlake from N'SYNC? Do you know Alex Melendez from 11th grade? If you have any questions about anything, ask us.

P.S. Hope to meet you someday!

Line	Text	Cohesion type	Tied to line
1	Sender: Room 112		
2	Subject: Deep Sea		
3	Hi Deep Sea, How are you? I am so glad that you are my mentor, not only me	7	prev
4	but Elena and Raquel. Oh by the way my real name is Natic and I am 15 years	7	prev
5	old. I like to work with computers and I am having so much fun writing		
6	letters to you and my other mentor from the High School!		
7	I think your job is so cool and I am so interested in finding out how you do	1,3,7	prev
8	your job. Oh yeah, what advise would you give me if I wanted to be a model		
9	when I get older? People tell me I am too chubby and my body image is too		
10	big and models have to be really skinny. I don't really care what other people		
11	think because I will try my best to make my dream come true! I should		
12	describe myself for you and tell you a little about myself. I have brown hair,		
13	eyes, and my hair is down to my shoulders, a little down further. I am		
14	Portuguese and I was born in Sao Miguel from the Azores. I like to eat		
15	tunafish sandwiches, pizza and salads.		
16			
17	Sender: Deep Sea		
18	Subject: to Natic (Room 112)		
19	Hi, Natic! I really enjoyed your message - you're making it easy for me to	2,4	3
20	write to you, since there is so much neat stuff in your email.	7,3	5
21	You mentioned that one of your dreams is to be a model some day.	7,3	8,11
22	You go, girl! While most of the models out there are very skinny,	7,1,4	9,10,12
23	I've noticed that, more and more, other kinds of women are	7,3	9,11
24	coming on to the scene. I hope that this is a sign of the times,	3,7	10,11
25	because it's not healthy for everyone to be that skinny. When I was		
26	your age, I worried *alot* about my body and how it looked.	3,7	10,11
27	Do you know when I became beautiful? When I decided my body	7,3,1	10
28	was fine just as it is! (I'm serious! So, keep your dream and hold	7,3	10,11
29	tight to your self-respect.	7,3	12
30	You also mentioned that you were born in the Azores and are	7	14
31	Portugus. So cool! I'm part Portuguese (just a little bit, though). The	7,3	14
32	Azores are amazing. They have hot springs there (did you ever visit them, or	7,3	14
33	were you too little?) because the islands are located near the Mid-Atlantic	1	14
34	Ridge, which is where there are a bunch of undersea volcanoes. These	1,4	14
35	undersea volcanoes are covered with life. The clams and shrimp that live		
36	there (different from the ones		
37	you'd like to eat) feed on the energy-rich chemicals spewing out of the	7,3	14
38	volcanos. So what do you remember (if anything, if you left when you were		
39	very little) about the Azores? And who's your favorite model, and why?	7,3	14, 8-10
40			

FIG. 5. Sketch of formal cohesive ties between middle school message and mentor's response, Team B. Cohesion types: 1. Pronominals; 2. Demonstratives; 3. Comparatives; 4. Substitutions; 5. Ellipsis; 6. Conjunction; 7. Lexical.

This is not an isolated incident that might be explained by the desire for a group introduction. Although subsequent messages are almost always exchanged between one sender and one receiver, there are several instances of messages to and from multiple members. Furthermore, there are two or three cases where a theme introduced in an exchange between a mentor and a middle school girl is taken up by another middle school girl who was not part of the exchange before. In Fig. 6, for example, Sugar and Spice expresses a worry about the possibility of danger in high school, which is then taken up both by the high school mentor, and by another teammate.

[4]

Sender: sugar and spice 110
 Date: 02-Dec-99 7:59AM
 Subject: Re: LavaLamp
 Text: Hi

It's me Elena. Well, computer drafting sounds really cool, but I can draw. That program your doing sounds neat because I need to get into some new stuff. I am a big Backstreet Boys fan and Raquel is the biggest N'SYNC fan, she is 13 and she loves Justin Timberlake. Natie loves Marc Anthony and 112 and The Hot Boys. Natie is 15 turning 16 in May, Elena is 13. Raquel likes History, Natie likes when we go down to the computer lab and I like History. We all are scared of getting beaten by older girls. I probably will get lost. Do you know Alex Melendez, he is a Junior! please answer that question because Natie really needs to know!!! What is your last name? Write back soon.

[7]

Sender: LavaLamp

Date: 02-Dec-99 7:45PM

Subject: Re: LavaLamp

... Don't be worried about getting beat up by anyone, I will protect you guys! =) and it's not like on TV where people start fights every ten seconds so don't worry about that. And about getting lost everyone gets lost at least once, but that's how you make friends, you all get lost together, because most likley the people in your math class for example will be in your history and science classes, not always but most of the time! ok well I will talk to you guys later!!
bye!!

- JENN!!

Sender: JustinTLuver18

Date: 02-Dec-99 8:38PM

Subject: Re: LavaLamp

Text: Lava lamp i play basketball and i am on a cheerleading. Thanx you are so kind for watching our back. I wonder if you are on right now.

FIG. 6. Team B messages.

Science vocabulary. By contrast with Team D, Team B made use of several terms introduced by the team's mentor. Terms introduced and later used appropriately at least once by the middle school girls include: bacteria, sea-floor vents, marine ecologist distinguished from marine biologist, biochemical pathway, sulfide, tube worms, methane hydrate, ecosystem, purple bacteria. It is noteworthy that some of these terms entered the discourse because the girls read websites that the mentor suggested, and then asked questions about what they had read. Thus, there is evidence that the discussion of the mentor's work led to the girls' growing understanding of the work of a marine ecologist, and some of the science concepts related to that work.

Participant Style

Self-identification. Another feature employing the device of lexical cohesion that lends the whole series of exchanges a sense of continuity is this team's frequent use of names, both real and screen names, in salutations and valedictions. In strong contrast to Team D, Team B messages include the use of sender or receiver names (screen or personal, or both) in 96% of the first 50 messages. All team members exchanged real (first) names, and used them interchangeably with the screen names. This is one

more element that provides a sense of a community of people in relationship.

In addition, the middle school girls offer details about their personal appearance, and ask such information from their mentors; describe their interests and activities across a wide range, and bring references to family or friends into the messages as well. One girl, who has previously described herself in some detail, writes (at the end of a long message):

Oh yeah—do you think scientists could be inventors and what kind of hair do you think they have?

The mentor accepts this as a legitimate question and a source of play, and her answer elaborates on the picture that she has been drawing about what scientists are like as people:

You asked what kind of hair scientists have. Well, I have messy hair, one of the guys in my lab shaves his hair, Zoe has pretty, red hair, and Fred's hair always looks great—so, I guess the hairdo depends on the scientist!

Scientists can be inventors, too. In the course of their research, people sometimes come up with devices that would be useful in the 'real world,' too.

Themes discussed and pursued. As suggested previously, this team's conversations were thematically very rich, and notable for their persistence and elaboration. Several notable topics that were developed include high school ambience and academics; careers, futures, and courses; the work and science of the adult mentor, and fields of science.

High school ambience and academics. As quoted earlier, the middle school girls were very concerned about danger in high school—the metaphorical danger of getting lost in the huge building, and the actual danger of fights or being beaten by other girls. The importance of getting help from good teachers is emphasized. At one point, a girl asks LavaLamp if she is part of the cool crowd, and LavaLamp replies with some perspective on friendships and 'crowds' in high school:

I don't really know if I am in the 'cool' group at shs, I have alot of friends, and there are alot of different groups so it's hard to tell if your in the 'cool' group or not.

In addition, LavaLamp introduced, in her opening message, the topic of coursework. This was followed up and elaborated by all the middle school girls, both in exploring more details of LavaLamp's courses, and discussing their own classes and courses. In the following message, Sugar and Spice

provides basic background on the whole middle school team, in a message that is typical in its thematic richness:

Sender: sugar and spice 110

Date: 02-Dec-99 7:59AM

Subject: Re: LavaLamp

Text: Hi

It's me Elena. Well, computer drafting sounds really cool, but I can draw. That program your doing sounds neat because I need to get into some new stuff. I am a big Backstreet Boys fan and Raquel is the biggest N'SYNC fan, she is 13 and she loves Justin Timberlake. Natie loves Marc Anthony and 112 and The Hot Boys. Natie is 15 turning 16 in May, Elena is 13. Raquel likes History, Natie likes when we go down to the computer lab and I like History. We all are scared of getting beaten by older girls. I probably will get lost. Do you know Alex Melendez, he is a Junior! please answer that question because Natie really needs to know!!! What is your last name? Write back soon.

Bye!!!!!!!!!!!!!!!!!!!!

JustinTLover picks up on this theme, describes herself as a student, and elaborates on some of her motivation for working hard:

Sender: JustinTLover18

Date: 02-Dec-99 8:50PM

Subject: Re: LavaLamp

Text: hey thanx for saying i seemed liek i was kewl ... I want to talk something with computers in high school and something that might help me in my career. I wanna be a Lawyer. Do you know of any coarses i should take and which are the best? Do you have a boyfriend? By any chance if any of us at terc need some help with anything would you give us advice liek on boys and stuff? Just out of curiosity. i got honors this quarter. I am considered a good student I guess. Last year was the only year i didn't make honors. I did for only 1 quarter. I had trouble in English. me and you have a lot iin common. my fav radio stations are BCN and KISS 108. I really am goinna try my hardest in school. I think I am going to Shigh school. But my sister said there is a lot of trouble there. But I am not oging to make my parents waste money for me to go to a private high ...

Careers, futures, and courses. LavaLamp introduces the question of high school courses, but then the middle school girls make the connection between their aspirations and their high school coursework. One girl writes:

I have a couple questions for you. Do you know what you want to be when you grow up? and if you do, what courses do you need to take to be that? I still don't know what I want to be when I grow up. That's another situation I'll have to think about.

Another girl is clearer about the future:

I want to take something with computers in high school and something that might help me in my career. I wanna be a Lawyer. Do you know of any courses i should take and which are the best?

The high school mentor replies:

Well I am not sure what courses are available for being a lawyer. But I am sure your guidance counselor can help you more with that.

The adult mentor answers later, and puts the question into a wider perspective yet:

So, you dream of being a lawyer. What a great dream—what made you decide on it? What about lawyers is it that you like? They are incredibly powerful in our society. What aspect of law are you interested in? Interpersonal stuff, like divorce law, the big issues, like social justice or environmental law??

The work and science of the adult mentor. The middle school girls ask many questions about the adult mentor's field. She provides long and careful descriptions of the questions she is trying to answer in her research, and some of her research methods, gauging her language to the sophistication of the middle school girls. Her descriptions of her work on the life found near sea-floor vents, the use of the submersible Alvin, and her lab work fire the girls' interest, as does her description of the animals themselves:

When I say I'm a marine ecologist, that means that I study how animals and bacteria interact with each other and with their environment. Questions ecologists ask are pretty simple—for example, who eats who? What makes a place a good place to live? How hot is too hot? ... Believe it or not, my favorite animal is a worm—the giant tube worms found on undersea volcanoes. They're not brown and slimy like earthworms are. Instead, they have a bright red gill that's shaped like a foot-long feather on top of a bright white tube. These guys get to be about 3–4 feet long, so when you visit a site where they live, they look like huge lipsticks.

Fields of science. One important element in this mentorship exchange is the enhancement of the students' understanding of the complexity of science as

a field. What are the different kinds of science, and how do they relate? This kind of information not only opens windows on possible futures, but enables the girls to learn a little more about the way the search for knowledge is organized.

Sugar and Spice writes:

Do you know what the difference is between a marine ecologist and a marine biologist?

Deep Sea replies:

You asked what's the difference between a marine biologist and a marine ecologist? Marine biologists study all aspects of marine life—their physiology, how they're related to each other, etc etc etc. Marine ecologists study how marine life interacts with its environment, and with other organisms. So, actually, marine ecologists are a type of marine biologist. The term 'marine ecologist' is just more specific than 'marine biologist'.

The middle school girl replies:

So you explained what the difference is between a marine biologist and a marine ecologist. But, did you have to be a marine biologist to become a marine ecologist? Oh yeah, and that lipstick worm sounds gross. It actually has gills and can grow that long. How can a worm be your favorite animal down there when there is so many other choices? When I ask that question, I mean what is it about the worm that makes it so appealing to you?

This exchange continues for another round; later, Sugar and Spice writes:

Ya know it is funny that I got you for my adult mentor. Ever since I was little girl, I always wanted to be a marine biologist. So in a way, you can be helping me with my future career.

Characterizing this team. This team has important features not present in Team D, or present only weakly. First, the content of the messages is quite rich. There is considerable exchange about music, movies, boys, family, personal descriptions and aspirations, and current events in the girls' lives. In addition, there are substantive exchanges about several aspects of science, about high school, about work habits in school, and about career paths. In one way or another, all the team members participate in these topics. One important question for Eyes to the Future is what kinds of science are imparted, beyond any hands-on activities that might be part of

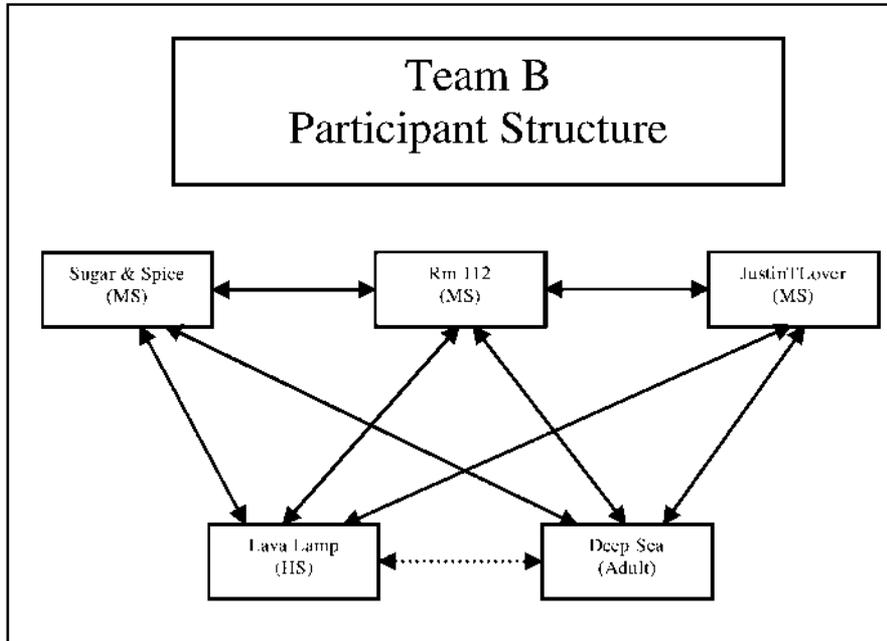


FIG. 7. Team B participant structure. Thickness of lines represents relative intensity of communication.

the clubs' program. When the middle school girls ask genuine questions (*sensu* Searle, 1969), and then pursue the mentor's answers further, we have some evidence that the girls in that case are picking up on the science content and the discourse of the scientist.

The patterns of participation in Team B (Fig. 7), and the attentiveness revealed by the linguistic and thematic cohesion between messages, suggest that within the first few weeks of the program, this team has in fact developed into a community that, as the project envisioned, provided both affective and academic support to the middle school girls who were involved. The high school girl did not interact with the adult mentor significantly, so that there is no evidence that she benefited from the mentor's presence, but she definitely served her middle school teammates well, reading and writing conscientiously and genuinely on topics that interested them and her. The several layers of analysis here provide strong evidence that, though only 25% of the total communication had taken place by this time, the team members saw this group as a supportive, learning community, in which each participant spoke in her own voice, and which provided much material of interest for the participants.

5. Conclusions

Our analysis has provided evidence that several aspects of discourse

analysis can be applied fruitfully to the study and understanding of web-mediated communities. In particular, it can help us address systematically important questions about the quality and nature of the interactions between team members, and about their understanding of the purpose of their involvement. Such answers in turn can contribute to an insightful analysis of the strengths and weaknesses of our program, and the electronic communities that implement it.

The analysis suggests that:

1. linguistic register can be discernible from vocabulary, orthography, and sentence structure in messages, as well as from diacritics (such as 'emoticons'), and when it is discernible it can provide clues to the participants' role definitions within the community. Participants sometimes shift registers depending on the intended recipient, thus signaling similarities and differences, or degrees of affinity, among the members of the electronic community;
2. the voices of the participants are identifiable from several factors, including characteristic themes and concerns addressed, as well as participant style. The voices provide evidence about how the participants perceive the purpose of their membership in the electronic community;
3. the linguistic and thematic cohesiveness between messages provides evidence of the attentiveness with which the participants are reading and replying, which in turn provides evidence of solidarity, trust, mutual enjoyment of the relationship, and its value to the participants;
4. participant style, register, cohesiveness, and voice provide ways to talk about the quality of the community constituted by the web-mediated texts. Affinity and community are signaled as well by thematic development over time. For example, in the exchange within some teams, information about personal history, preferences, and concerns ceases after an initial period of intensity, and is replaced by less personal exchanges about the science topics of the project, or about events and popular culture. In other cases, personal narratives extend over several messages, or are revived from time to time. Students in some cases adopt a richer set of vocabulary about their mentors' scientific pursuits, and in some cases also the students and mentors shift into using the same 'casual' register. Such thematic and stylistic shifts reflect developments in the relationships.

Some elements of discourse analysis can be applied to the analysis of the structure of web communities, and it is hoped that the article will stimulate further work, in other contexts, synchronous as well as asynchronous. In the case of Eyes to the Future, this analysis can provide insight into the nature of mentorship relations in this multi-age electronic community, which may have direct application in the monitoring and facilitating of such a community. The mentorship relations mediated by the Web may in

turn provide insight into patterns of communication between novice and expert in other informal learning situations, and into formal settings in which an inquiry-based approach to science learning enforces an apprenticeship model of learning.

Correspondence: Brian Drayton, TERC, Inc., 2067, Massachusetts Avenue, Cambridge, MA 02140, USA; e-mail: brian_drayton@terc.edu

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