Beyond Threaded Discourse

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The educational potential of asynchronous, computer-mediated conferencing is well documented. Opportunities for increased group interaction, more equitable communication patterns, higher degrees of reflection, and time-and-place-independent discussions are some of the benefits cited by researchers. This article focuses on one of the apparent limitations of the medium: the lack of support for convergent processes. Threaded online environments support electronic conversations that expand and branch, but provide few facilities for drawing together discourse in meaningful ways. The implications of this restriction are explored in two studies. The first study analyzes the degree to which students and instructors write convergent notes (e.g., notes that synthesize or summarize ideas) in three graduate-level computer conferencing courses. The second study explores student perceptions relating to their own synthesizing and summarizing practices. The results suggest that online participants rarely engage in convergent processes in spite of widespread agreement that such efforts confer educational benefits. Possible explanations for this phenomenon are discussed.

Recent advances in computer and telecommunications technologies have raised new possibilities for distance education. Increasingly, the Internet is the medium of choice for delivering course materials and supporting interaction between teachers and learners. One of the more common distance education technologies is asynchronous computer-mediated conferencing
(CMC). In a typical CMC course, individuals dial-in to a central database from anywhere in the world and view the writings of their teacher and classmates. Responses to these writings can then be crafted and stored to the course database for others to read. In this fashion, whole-class discussions can take place without having to coordinate a common meeting time or meeting place. Instead, people can participate from home and organize class time around their individual schedules (Kaye, 1989; Harasim, 1987, 1989).

Studies of CMC as an alternative to traditional instruction suggest that online environments affect more than just the “where” and the “when” of course-taking. They also change the nature of classroom discourse. In a regular classroom, discussion is sequential and transient; only one person (generally) speaks at a time and the content of the conversation is not preserved. CMC, on the other hand, allows everyone to “talk” (write) at once because there is no need for turn taking (Mason & Kaye, 1990). This allows shy, and less vocal students to participate without risk of interruption (Davie, 1988), and reduces the possibility of a dynamic individual dominating the conversation (Eastmond, 1994; Tuckey, 1993). Furthermore, since all discourse is preserved electronically, participants can easily revisit old ideas and reflect longer on new ideas before committing them to public scrutiny (Levinson, 1990; Mason & Kaye, 1990). Thus, asynchronous CMC has the potential to be a highly social, egalitarian, and deliberative medium (Harasim, 1989). It would be a mistake to interpret this form of distance education as simply conventional instruction delivered remotely. CMC provides affordances for a fundamentally different form of learning, one that engages students as active, reflective participants in an electronically-linked community.

Despite the promising nature of CMC-based instruction, a number of problems are often associated with online courses. Frequently cited concerns include Information Overload (Paulo, 1999), the challenge of conveying emotion in a text-only environment (Hiltz, 1986), and the lack of support for convergent (e.g., synthesizing and summarizing) processes (Eastmond, 1994). The latter issue is the subject of the following investigation. Researchers and online instructors have known for a long time that it is difficult to bring ideas together in a CMC environment (e.g., Beckwith, 1987; Harasim, 1990; Eastmond, 1994). Yet there have been no studies that have analyzed the problem in depth. This article begins an exploration of this issue by examining the incidence of convergent processes in three course-based computer conferences at the University of Toronto. This analysis is accompanied by a study of student perceptions relating to their own efforts to synthesize and summarize ideas. Subsequent sections discuss the implications of these findings and possible avenues of research for designers of next-generation discourse environments.
METHOD

The data for this study were drawn from three graduate-level online courses at the University of Toronto. Class sizes ranged from 15 students to 24 students (21 students on average). A different instructor taught each course, but the instructional formats were similar: each engaged students in a series of issue-based, exploratory discussions on matters relating to education.

Each of the three classes used a conventional threaded, web-based computer conferencing environment for their online activities. Threading allows an author to designate a newly written note as a response to an earlier note. This makes it easier for readers of the conference to find and follow conversational chains. For example, in Figure 1, a list of indented note titles illustrates the threaded relationship between eight notes in a web-based conference. Notes 1 and 2 begin two separate threads. Notes 3 and 5 were saved as responses to note 1, notes 7 and 8 were saved as responses to note 3, and so forth. The hierarchical structure allows the reader to trace a conversational branch (e.g., note 1, note 3, note 7) without being distracted by unrelated notes from other threads (e.g., note 4). It also allows the class to simultaneously pursue multiple avenues of inquiry without confusion.

Note 1. Where is knowledge? by June Nason
Note 3. Where is knowledge: the situative perspective by Jim Dunlop
Note 7. Problems with the situative perspective by Don Wilson
Note 8. Questions about situated learning by Linda Morrison
Note 5. Knowledge and representation by Don Wilson
Note 6. How does knowledge transfer? by June Nason

Note 2. The learning paradox by Jim Dunlop
Note 4. What knowledge are we born with? by Linda Morrison

Figure 1. A typical threaded organization

Students and instructors in each class had full access to the contents of their class conference. All participants could initiate new threads. Interaction was asynchronous; people could login at times of their own choosing to contribute to the course discussions. To respond to a particular note, participants would display the note on the screen and then click on a “Reply” button. They would then compose their response and save it to the conference. In this fashion, members of a class could engage in extended online discussions with one another. On average, each student contributed between two and three notes a week.
The organization of threaded discourse (Figure 1) might lead a casual observer to conclude that online discussions develop along branching paths that never come together again. However, it is important to distinguish between the hierarchical structure imposed by the system and the linkages that are implicit in the text of the notes. Online discussions may be much more intertwined and interrelated than the threaded representation indicates. For example, a learner may choose to write a note that summarizes a thread, or reconciles two, previously distinct, lines of inquiry. Such notes are convergent because they cut across the hierarchical structure of a conference by pulling together ideas from multiple sources. To identify convergent notes, and to determine their frequency in computer conferences, the following qualitative rating scheme was developed:

1. Standalone: A standalone note introduces new ideas to the conference and does not build on the ideas of other notes. Typically, a standalone note is one that begins a new thread.
2. Add-on: As the name suggests, an add-on note builds on the ideas of one other note in the conference. Typically, these are notes in which one person responds to an idea that someone else has introduced. Such notes are not considered to be attempts at convergence because convergence (by definition) involves bringing together ideas from at least two different sources.
3. Multiple reference without convergence: These notes make reference to two or more previous notes, but not in a way that could be considered an attempt at convergence. For example, the phrase, “I agree with Eli’s response to Zoe’s note,” makes mention of two notes, but does not discuss the content of notes or how they interrelate.
4. Convergent: A convergent note is one that discusses (if only briefly) some of the ideas expressed in two or more other notes in the conference.

**DATA ANALYSIS**

Two raters analyzed a total of 830 notes from the three distance education courses. Notes were extracted from main discussion areas only; special areas reserved for practice or announcements were not included in the study. The inter-rater reliability was .90 and disagreements were settled by discussion among the raters. The results are displayed in Table 1. Ninety-four percent of the students’ notes were assigned to one of the first two categories. These notes either made no reference to other messages in the conference,
or they made a reference to a single previous submission. Four percent of
the submissions contained multiple references and only 2% were rated as
attempts at convergence.

Table 1
Counts of Note Types Across Three Classes

<table>
<thead>
<tr>
<th></th>
<th>Class 1</th>
<th></th>
<th>Class 2</th>
<th></th>
<th>Class 3</th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Students</td>
<td>Instructor</td>
<td>Students</td>
<td>Instructor</td>
<td>Students</td>
<td>Instructor</td>
</tr>
<tr>
<td>Standalone</td>
<td>27</td>
<td>4</td>
<td>89</td>
<td>6</td>
<td>123</td>
<td>0</td>
<td>239</td>
</tr>
<tr>
<td>Single</td>
<td>241</td>
<td>9</td>
<td>136</td>
<td>2</td>
<td>164</td>
<td>0</td>
<td>541</td>
</tr>
<tr>
<td>Multiple</td>
<td>19</td>
<td>2</td>
<td>8</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>33</td>
</tr>
<tr>
<td>Convergence</td>
<td>6 (2%)</td>
<td>4</td>
<td>6 (3%)</td>
<td>0</td>
<td>5 (2%)</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>293</td>
<td>19</td>
<td>239</td>
<td>8</td>
<td>298</td>
<td>0</td>
<td>830</td>
</tr>
</tbody>
</table>

The performance of the course instructors varied. One instructor chose
not to participate in the mainline conferences at all. Another instructor par-
ticipated regularly, but even this individual only produced a handful of
notes that could be categorized as convergent.

The results suggest that none of the three computer conferences con-
tained many convergent notes, even though the course instructors had dif-
ferent instructional styles. While there was a considerable amount of inter-
action between participants, virtually all it could be characterized as add-on
style responses. Few people tried to produce a more sophisticated kind of
note that tied together ideas from different sources.

In an attempt to further understand these results, a follow-up question-
naire was administered to 32 students. Each person was asked a variety of
questions pertaining to his or her online habits. The key findings were as
follows:

- All students said that they would personally benefit from higher levels
  of synthesis and summarization in their class computer conference;
- 81% of the students said that they personally never make an effort to
  synthesize or summarize ideas from different notes during their comput-
er conferencing sessions;
- 75% of the students said that the notion of synthesizing or summarizing
  ideas from different notes rarely or never occurs to them; and
- 50% of the students said that they rarely or never check to see how their
  note fits into the larger discussion when writing a response to a particu-
lar note.
These results suggest an interesting discrepancy between student desires and student actions. All of the students reported that more synthesizing and summarizing would be beneficial. At the same time, most of the learners acknowledged that they rarely wrote synthesizing notes themselves. In fact, three-quarters of the students indicated that the notion of writing a synthesizing or summarizing note rarely or never occurred to them.

**DISCUSSION**

There may be a number of reasons why students rarely work at consolidating ideas in a computer conference. One possibility is that students see synthesizing and summarizing as the teacher’s responsibility. Another possibility is that convergent operations are more intellectual taxing than simply extending an existing thread. Consequently, people may avoid the complex business of drawing together ideas, since they can make other kinds of contributions with less effort. However, the “conservation of effort” hypothesis does not fully explain why so many students rarely (or never) consider writing a summary. This article hypothesizes that there may be other factors at work. In particular, it is proposed that the lack of convergence is partially tied to the “reply” protocol in most computer conferencing programs. The reply feature of CMC environments—indeed, the very word “reply”—suggests a practice of writing responses to individual notes. Consequently, people are less likely to take the multiple note perspective required for convergent operations. The problem is not simply that CMC systems make it inconvenient to write notes that bring together ideas from different sources. Rather the problem is that such operations are less likely to come to mind when “reply to this note” is the only support for interaction offered by the software. Consequently, as the questionnaire data indicates, online participants may start to develop a rather limited idea of what online interaction entails. They think primarily in terms of targeted responses to particular notes, and rarely consider summarizing and synthesizing (which require a multiple note focus) as alternatives.

Interestingly, even when attempts are made to summarize findings, such efforts may be hampered by their low visibility. For example, the indented, hierarchical organization of Figure 1 precludes the possibility of a new note simultaneously extending the, “Where is knowledge?” thread and, “The learning paradox” thread since each new note can only be electronically linked to one of its predecessors. Consequently, if a summary note is linked to the “Where is knowledge?” thread, people reading other threads
are less likely to be aware of the summary’s existence, or its relevance to those discussions. This may limit the summary’s impact and effectiveness.

Reply-based interaction may be problematic in other ways as well. Research by Herring (1999) suggested that online discussions are often subject to rapid changes in topic. It is proposed that this phenomenon is caused (or at least exasperated) by tendencies to write responses to specific notes without taking earlier contributions into account. Over 50% of the students in the survey reported that their responses are directed at a particular note, and they rarely review the thread as a whole. This practice can lead to a phenomenon that I call the **tunnel vision effect**. The tunnel vision effect refers to situations in which a singular focus on individual notes causes a discussion to lose its overall coherence. For example, in Figure 2, the second note was written as a response to the first note. Similarly, the third note was written as a response to the second note. The third note, however, is not particularly relevant to the first note. Although each note was written as a meaningful extension of its predecessor, the thrust of the conversation changed dramatically.

*Figure 2.* Topic change due to the tunnel vision effect

From the Figure 2 example it is apparent that the continuity of consecutive thread components does not guarantee the continuity of the whole. Again, it is proposed that the source of the problem is the “reply” convention. “Reply” prompts students to respond to a single note, a practice that ensures continuity at the local (i.e., successive note) level, but not at the global (i.e., thread) level. As a result, threaded discourse can meander unpredictably from one idea to the next. The educational implications of the tunnel vision effect are unclear. Sometimes, an abrupt change in topic can bring about beneficial new insights. On the other hand, it is difficult to pursue a systematic line of inquiry if most of the contributors are not cognizant of the discussion’s original purpose, how it evolved to its current state, or the directions it might most profitably take in the future.

In sum, the emphasis on reply-based interaction in conventional CMC systems gives rise to several educational concerns. First, reply functionality
prompts participants to respond to individual notes, and the lack of alternatives may produce an excess of add-on style notes relative to notes that synthesize elements of the ongoing conversation. Second, online discussions may be susceptible to internal coherence problems because of the tunnel vision effect. This can cause electronic discourse to evolve in an unpredictable fashion, making it difficult to pursue a given line of inquiry.

**CONVENTIONAL SOLUTIONS TO THE CONVERGENCE PROBLEM**

Researchers and online instructors have developed a number of online practices that can reduce the severity of the convergence problem. These include:

1. *Use a moderator to guide online discourse.* One way to increase the level of convergence is to appoint a leader, or moderator. Typical moderator activities include weaving together ideas from different group members (Feenberg, 1989), reviewing collective progress, and gently guiding conference participants toward promising avenues of investigation (Davie, 1989). Thus, the moderator can serve as a positive force for consolidating threads. The problem, from a pedagogical perspective, is that the appointment of a moderator can bifurcate online activity. Creating connections between ideas may come to be understood as the moderator’s responsibilities, leaving learners even more strongly focused on reply-style discourse. The result can be an electronic tug-of-war in which the students pursue a branching mode of interaction, while the moderator struggles to draw ideas together and keep people on track.

   Educationally it is important for the students, and not just the moderator, to engage in cognitively challenging operations like synthesizing and summarizing (Scardamalia & Bereiter, 1991). To this end, some instructors regularly provide their students with opportunities to take on moderating duties (Tagg, 1994). This practice helps students develop an even deeper understanding of the subject-matter and a greater appreciation of the ways in which ideas interrelate.

2. *Assign tasks that require group synthesis.* Another common way to foster higher levels of convergence involves assigning tasks that make synthesizing and summarizing a necessity. For example, an instructor might challenge students to develop a group consensus on certain issues. Such tasks push students to consolidate ideas.
3. **Reject threaded systems in favor of linear systems.** Some computer conferencing packages, like PARTICIPATE use a linear discussion format rather than a threaded one. Linear systems do not allow branching; all notes are simply stored in a single, chronologically ordered list. One of the positive aspects of this design is that users are not prompted with a “reply” button as they are in threaded environments. Since linear systems lack this feature, they may be more conducive (or at least less antagonistic) to attempts to bring convergence to group discussions.

Linear systems have their disadvantages. Since they store all notes in a single chronologically ordered list, it is difficult to hold more than few online conversations at once. For example, a conference may contain a note about Subject A, followed by two about Subject B, another about Subject C and finally a response to the initial Subject A contribution. Keeping track of all these discourse strands can be an intellectual challenge. In contrast, threaded conferences reduce cognitive overhead by establishing electronic connections between related items. This means that all Subject A contributions can be examined before the Subject B contributions, and so on. Participants can focus on one conversational chain at a time, freeing up intellectual resources that would otherwise be dedicated to disentangling discussions.

It is not clear whether or not the advantages of linear conferencing packages outweigh those of their threaded counterparts. The “reply” functionality of threaded systems prompt people to formulate responses to individual notes, a practice that leads to ever-diverging discourse and other problematic behaviors. But without note referencing, learners must keep track of multiple conversations in a common, chronological list. Neither alternative is ideal.

4. **Use Synchronous Technologies to Support Convergence.** Another line of thought proposes that asynchronicity makes it difficult for group members to coordinate their activities (Tuckey, 1993). Negotiating any kind of group consensus or agreement is difficult because of the lack of co-presence. For example, it may take days to receive a response to a single question. Consequently, group activity cannot be easily organized and people tend to head off in separate directions.

Several strategies have been developed to add an element of synchronicity to CMC. One approach is to augment conventional computer conferencing
with in-person interaction (Velayo, 1994). Periodic face-to-face group meetings help communities better ground their ideas and set priorities. Such gatherings are impractical in distance education situations, so researchers are also experimenting with the use of videoconferencing, audioconferencing, and synchronous online chat environments as a supplement to asynchronous discourse (Douglas, 1993; Berge, 1995; Watabe, Hamalainen, & Whinston, 1995). Synchronous settings allow for faster turn taking (Tuckey, 1993), and thus should alleviate some of the problems of group coordination.

Adding synchronicity to distance education raises a number of logistical problems. One issue is that of coordinating group meeting times. Part of the appeal of an online course is the time-independent nature of participation, and that advantage is lost when real-time interaction must be worked into personal schedules. A second concern is the lack of information flow between the synchronous and asynchronous worlds. Many commercial distance education packages contain a variety of tools: computer conferencing, e-mail, chat, videoconferencing, and so on. Unless records are kept, ideas generated in one environment (e.g., an online chat room) are easily forgotten or neglected when people move to another environment (e.g., asynchronous conferencing). This gulf between the synchronous and asynchronous reduces the likelihood that advances made in real-time settings will be successfully transferred to the CMC arena.

Although videoconferencing and electronic chat environments offer exciting new educational opportunities, their ability to improve the convergence situation is still uncertain. While such environments may provide useful support for decision-making, operations like summarizing and synthesizing require the kind of time-intensive, reflective processes that highly interactive, real-time environments are unlikely to foster. Thus, even if the logistical problems can be ironed out, it is unlikely that synchronous supports alone will completely solve the convergence problem.

**THE PROMISE OF NEXT-GENERATION DISCOURSE ENVIRONMENTS**

The results from the previous analyses suggest that reply-based protocols unintentionally impose a bias in favor of divergent, branching discourse. However, the source of the problem is not the branching and broadening of
electronic conversations, for this is where new ideas are nurtured and developed. Rather the problem is the absence of counteracting processes that draw branches together, tease out the best ideas, and rally the community around promising new avenues of investigation. Without these consolidating moves, threads grow unchecked and it becomes more difficult to build the intellectual touchstones that draw people together as a learning community.

In the short term, perhaps the most effective way to support convergence is through effective moderating (ideally, with students acting as moderators at least some of the time). However, such a strategy is not ideal because it fails to change the reply-based orientation that gives rise to the problem in the first place. A more pressing challenge is to design a new generation of conferencing systems that support convergent operations. From an educational perspective, there is a need for tools that facilitate practices like summarizing and synthesizing, and bringing side-conversations into the mainstream.

How can computer conferencing environments be designed to support more advanced forms of electronic discourse? The following recommendations are offered as a starting point for further research:

**Develop supports for responding to multiple notes rather than just one.** Most conventional conferencing systems only allow the learner to respond to one note at a time. A next-generation conferencing system should provide facilities that allow learners to respond to many different sources simultaneously. In such an environment, threads need not develop along separate paths, but could ideally interconnect and support one another.

**Provide new representations of discourse structures.** The need to accommodate convergent processes raises issues of representation, since conventional text-based mappings (e.g., Figure 1) are incapable of illustrating multiple-reference relationships. Therefore, a next generation conferencing environment requires a flexible mapping utility capable of depicting situations in which discourse strands can both branch and come together.

**Make it easier for learners to review global progress.** A face-to-face group meeting typically lasts about an hour or so, during which most or all participants remain co-present. In contrast, online discussions may be drawn out for months, and participants may only dial-in once or twice a week. The sporadic nature of electronic engagement, combined with the complexity of online discourse webs, introduces problems of familiarity and retention. A few days absence can make it difficult for people to remember the issue that
inspired a particular thread, the important ideas that were developed subsequently, or the key questions that were raised. In such situations, online discourse is susceptible to the tunnel vision effect. Ideally, a next-generation computer conferencing environment would provide tools that would allow individuals to quickly re-acquaint themselves with the contents of a thread, and the key issues under investigation.

Allow learners to view more than one note at a time. Although it is argued that the “reply” protocol focuses learners unduly on individual notes, there are other design factors that also inhibit convergence. Operations like summarizing and synthesizing require the learner to analyze many notes at once, and then write a new note that integrates them in some fashion. However, some conferencing systems—particularly web-based ones—make it difficult or impossible to display the contents of two or more notes simultaneously on the same screen. Consequently, a person wishing to write a summary would need to move back and forth between pages. This increases the user’s cognitive load unnecessarily.

New designs need to smooth the way for convergent operations by tearing down the logistical barriers that add unnecessarily to cognitive load. As few intellectual resources as possible should be applied to mundane tasks like organizing windows, switching screens, or waiting for notes to be displayed. Instead, new, innovative screen designs are required that optimize user workflow.

Recommendations: Summary

New designs need to be developed that reduce participants’ dependence on reply-based interaction while simultaneously providing new affordances for convergence. Thus there is a need for a new generation of computer conferencing systems that employ a networked framework rather than hierarchical one, allow for the simultaneous analysis of many notes, and allow users to respond to many notes at the same time. The goal is to move online communities away from the add-on practices that give rise to divergence and the tunnel vision effect in favor of new practices that support more advanced group processes. A few leading-edge programs like CSILE (Scardamalia & Bereiter, 1996) are already beginning to offer these kinds of facilities.
CONCLUSIONS

Reply-based interaction is ubiquitous in computer conferencing environments. In fact, this pattern of electronic engagement is so common and so deeply ingrained in the culture of online communication that it is rarely questioned. However, a closer examination of the “reply” model may be warranted. For while the simplicity of reply-based interaction is appealing, it can also be educationally limiting. This article argues that reply protocols may lead to two potentially problematic phenomena. First, an exclusive focus on reply-based interaction can foster a narrow way of thinking about online discourse. Learners who view interaction as a targeted response to an individual note are less likely to take the broader, multi-notes perspectives that are required for convergent operations. Second, reply protocols can lead to the tunnel vision effect, which makes discussions susceptible to internal coherence problems.

Effective convergence within a distance education community involves bringing ideas together in ways that intellectually lift the entire group. To accomplish this, learners must be able to monitor both the directions that others are taking and identify the ways in which ideas overlap. Next-generation computer conferencing environments need to find ways to support these processes.

References


**Note**

1. Technically, PARTICIPATE does allow the user to designate special notes as branches to other conferences. However, this form of branching is different from the reply-based branching discussed in this article.