Exploring coherence relationships in online group discussions around Web documents

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Coherence in computer-mediated discussions

A central aspect of coherence in asynchronous computer-mediated communication is how a message connects to previous messages in a dialogue. This is also a frequent source of problems for users: because of the time delay and the fact that several conversations may be going on simultaneously, the participants in an online discussion may need support for placing a message in a discourse context. This goes both for the reader of a message, who must grasp where the message belongs in a complex dialogue, and for the author/sender, who needs to indicate how a message connects to the previous discourse when posting it. In addition, coherence of a discussion may be important to establish in a retrospective, offline sense, when a user is trying to obtain an overview of what has been said.

In spoken, face-to-face conversation, there are abundant means for participants to connect to a previous contribution, and thus create coherence. A speaker may signal this relationship either implicitly, or explicitly through various linguistic and paralinguistic means. The structural regularities of the conversation are essential elements in this process, so that participants tend to recognize that a contribution is oriented to a previous initiative as a response. To signal which contribution is being responded to in a group discussion, non-verbal gestures and gaze are important elements. Utterances contain elliptic and anaphoric expressions to refer back to objects introduced earlier in the discourse. More formal mechanisms for linking are descriptive referential expressions, pointing directly to a previous utterance or paraphrasing it: "what Max said", "in response to your argument about X" etc.

In standard email and newsreading software, the coherence of a discussion is supported by a threading mechanism, which emphasizes the reply-to relationship and shared subject between messages. The structure of a discussion is sometimes visualized through indentation of messages that belong to the same dialogue thread. As a discussion proceeds, this hierarchical message structure grows, and participants may have difficulty getting an overview of the entire discussion due to its complexity and the limited screen space.

The relevant context for a reply can also be specified by the author of a message through quoting parts or the whole of previous messages, a strategy that is used and supported differently in different CMC contexts. Quoting gives an immediate context for a reply to a message, but has the disadvantage of increasing the length of a message. In a survey of Usenet users about email habits, it emerged that quoting increases the sense of dialogue in a CMC discussion for a majority of users (Severinson Eklundh & Macdonald, 1994). A follow-up study was made to compare quoting patterns in two sets of data, one email corpus and one excerpt from a Usenet newsgroup (Severinson Eklundh, 1998). It was shown that quoting was used in both contexts, but in newsgroup discussions, quoting was used both more frequently and more selectively, including mainly text parts actually responded to.

In addition to the kind of coherence which concerns the initiative-response structure of dialogues, there are other kinds of coherence that may be of importance for participants to

make sense of a discussion, such as establishing a link between several messages by the same person, or messages written in a common temporal or spatial context. In general, the need for system functions for establishing coherence is likely to be dependent on many factors such as the overall purpose of the communication, the relationship between participants, the number of parallel conversations, and the frequency of new messages.

Web-based tools for interactive discussion around documents

The emergence of the World Wide Web, with its flexible hypermedia platform for computer-mediated discourse, has meant that the discourse context of a computer message has become potentially much more complex. A message may not only refer to previous text messages in a local dialogue sequence; it can also be anchored in a hypermedia document or a set of interlinked documents which provide an underlying context for ensuing dialogues, and which gives participants a shared interpretative environment.

Since 1996, we have been engaged in the development of a set of Web-based groupware systems, designed to support collaboration around documents in small or medium-sized groups. The systems are based on the idea of shared annotation of a set of documents or document sections, where the annotations are gathered in a common dialogue space for each document or section. The three systems, DHS, Collaboracio and Collecio, have basic interface features in common, based on a layout of four frames (see Figure 1, available online).

Here, we will be concerned with the DHS system, which has been developed through a set of longitudinal case studies within an educational context (Rodriguez, 2001). The system is typically used for discussion of a set of documents, each submitted by a member of the group. With respect to dialogue features, the design of the system has been made deliberately simple, although the commenting interface has been gradually improved to address user demands. Importantly, there is no threading facility, mainly because the purpose of the system has been to support communication during the development of shared documents. Thus, each comment is expected to be oriented towards a particular document, and longer threads are not expected to occur. In the system, comments are therefore displayed by the system as they occur in a chronological sequence, and users create their own strategies to link to the surrounding discourse.

DHS has similarities to the system WebAnn (Bernheim Brush et al, 2002), which supports shared annotation of Web documents. However, WebAnn supports threading of comments. Another difference is that Web Ann allows comments to be associated with a particular part of a document, such as a word or paragraph, whereas the DHS links a comment with the entire document. This difference has consequences for the evolving communication. In a comparative study where WebAnn was used along with a traditional discussion board system, it emerged that the discussions in WebAnn were more concerned with specific points in the papers discussed (Bernheim Brush, ibid.).

The referential space of a DHS domain

A site in the DHS is called a *domain*, and consists of a collection of documents and a set of comments for each document (see Figure 1). As a discourse environment, this means that we are considering a set of parallel, but related dialogues, each emanating from and discussing a separate document. A salient feature of the dialogues evolving in a domain is their potential referential complexity. Possible references include:

1. Usually, a comment refers to *the document* defining the particular dialogue space (henceforth the top document). We have found that in all contexts where the system has

been used, a majority of all comments in some way (implicitly or explicitly) address either the content or the form of the top document.

2. A comment may also refer to *previous comments on the same document*, replying to what has been said by someone else in the group.
3. The comment may refer, implicitly or explicitly, to *other documents* in the domain. For example, a group member may compare the document to another document, e.g. the one written by himself.
4. The comment may refer to *comments on the other documents* in the domain.
5. The comment often refers to the DHS system itself. In fact, there is a separate dialogue space in each domain, where the system developer (the second author of this paper) responds to questions and takes part in discussion about the system.
6. Comments may be given on a meta-level, referring to the ongoing discussion.

The extent to which the above kinds of references actually occur depends on the particular context of use: the purpose and nature of the collaboration; what aspects of the document are being negotiated etc. In the two educational contexts where the system has been used so far, only one developed into a *discussion context*, where the participants interactively discussed each others' experiences as expressed in a submitted document. The other was predominantly an *annotation context*: each comment addressed the document, but there was virtually no interaction between participants in the form of an interactive dialogue (see Rodriguez, 2001). This difference can be explained by the character of the tasks involved. The interaction between users and developer about the system itself has been analyzed as a case of participatory design in a recent study (Rodriguez and Severinson Eklundh, 2001).

Linking strategies in a discussion context

As there are few system features in DHS to support coherence, it is of interest to explore how participants use the referential space to connect to each other's contributions, and how they cope with the potential ambiguity caused by the dual referential context of documents and comments. Later, we will consider how the system might be extended to provide means for representing and visualizing various kinds of coherence in these data.

In the group discussion we will look at here, there were 13 university students as participants, each of whom had submitted a story about a personal experience of group collaboration with technology, as an introductory assignment in a CSCW course. The assignment included reading and responding to other students' stories in the DHS system during a period of approximately two weeks. In addition to the students themselves, an instructor read the assignments and also provided system support in a separate dialogue space.

In general, the commenting dialogues in this corpus have an informal, conversational character. The comments are short (mean length 85 words), context-bound and contain frequent elements of direct reference to the content of the corresponding document, or the previous comments on the document, through anaphoric elements. Very often a comment or part of it addresses the author of the commented text with her/his first name or just "you", and direct questions to the author are common as part of a response.

Of the 90 comments in total submitted to the 13 documents in the domain, 57 referred directly to the corresponding document, 24 referred to one or more previous comments, and 9 contained both kinds of reference.

The following is an example of two initiating comments on the same document. Note that both messages are linked to this discourse context through the phrase "this tool".

Comment # 1:1 Date: 01/02/05 Time: 19:28:15 Bill K.

It would have been interesting to see how this tool would be used in a workplace where all users are personal and are online all the time. Then I think it would work much better.

Was it possible to add that everyone would get a notification when something had been changed?

Comment # 1:2 Date: 01/02/05 Time: 22:03:58 Julia G.

This seems to be a great administrative tool for projects!

That the flags showing when an object had been modified did not work would have been solved if you had had nine users instead of three. But I understand that you did not want to pay to get access to more users.

As this excerpt shows, the participants take advantage of the spatial proximity between documents and comments, and rely on conversational coherence mechanisms such as deictic reference. This may not be a problem, but occasionally a message is ambiguous, so that it is not possible to say if the response is oriented to the top document or a previous comment, or both. In other cases, such as the following, an author is clearly aware of the potential ambiguity, and provides an explicit link to a previous comment by pointing out the addressee:

Comment # 1:5 Date: 01/02/11 Time: 13:09:32 Anna S:

In response to Leif:

There is something called "activity reports". These are sent by e-mail, once a day. When I used the Web site it was only the project leader that got these reports, i.e. I got them and thought they were good. Now they have changed it so that all registered users can get them…(etc.)

Sometimes both a document and a comment are simultaneously referenced in the same message. The resulting dialogue may be confusing if no effort is spent on the clarification of discourse context. The same goes for cases where two or more comments are responded to simultaneously. In the following comment, two different comments are referenced explicitly by quoting and a pointer naming the addressee. Also, a third comment is referenced implicitly. The top document is a story about experiences of computer games.

Comment # 5:7 Date: 01/02/12 Time: 23:29:40 Greg L.

Mary> Have you tried games like Baldur's Gate?

Don't know if it is similar to Diablo2, but it sounds similar, if you play over a LAN you can always pause and talk to each other. If you however play with people that possibility goes away.

I agree that in Quake it can be a bit hard to communicate because it's so fast, but in Counter-Strike for example it is possible. The simplest is to use the programmed radio messages, and hope that the ones you play with will understand.

Bill> Isn't it common that clans in e.g. Quake have pre-set patterns for how they should move?

That's true, every person has a task that they have practiced and are very good at.

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Playing games doesn't have to take a lot of time, but it easily gets too
much.

I more or less succeeded to ruin my first year at the university with too
much MUD….

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Apart from the two quoted text parts, a third comment is implicitly referred to by the sentence "Playing games doesn't have to take a lot of time…", which follows up on a topic in a previous comment. One reason that this comment was not quoted may be that it did not contain a question or other direct elicitation. The study of quoting in Severinson Eklundh (1998) showed that in newsgroup discussions, participants often select a direct question or other elicitatative act to be quoted in the reply, deleting the entire rest of the message.

Examples such as 5:7 are interesting, in that they show that some participants are prepared to put down significant work to create coherence in the discussion. However, it is more common in the corpus with comments that refer in an implicit, conversational way to the preceding discourse. In these cases the discussion is reminiscent of an informal round-table group discussion. In such contexts, participants tend to avoid formalities in addressing others, but instead connect to each other's contributions through content, gestures, and ordinary conversational principles. When the same linguistic strategies are used in an asynchronous, text-based environment, with several parallel discussions and in the absence of a threading mechanism, the result is a potential ambiguity.

Visualizing conversations in a DHS domain

We have begun to use visual representations to chart the discussions analyzed in DHS, in order to clarify the conversational activity exhibited there. The purposes are mainly explorative: to assess the interactivity of a particular domain, and how the complex web of references creates a hypertextual structure, part of which is difficult to discover in other ways. However, we believe that visualizations like the ones we are experimenting with can also provide input into the further design of the system, and eventually be made available to users as optional coherence tools. This would increase the accessibility of the discussion space, and thereby its "social translucence" (Erickson et al, 1999), i.e. the degree to which other people's activities are immediately available and visible to a user.

The most basic way of visualizing the discussion analyzed above is to start with a sequence of 13 parallel threads, where each one is linearly progressing down from its top document. Figure 2 (available online, see address below) shows this structure, where squares are used to signify documents and circles represent comments. The links created initially show only how one message follows the other in a temporal sense. However, based on this structure, one can also make connections between comments and documents across the chart, showing how they relate to one another referentially as discourse contributions.

The numbers on the document and comment icons signify participants. With this information is easy to see how each person has spread out her activities among the different discussions. This overview might be supported by an interactive feature in the software, so that all contributions from a certain person could be highlighted or read in their original sequence. As a social navigation feature (see Munro, Höök & Benyon, 1999) this may both support coherence and promote the group's discussion when the number of participants increases.

In addition to this way of representing the data, showing the activity of the whole domain, we have also developed a visualization technique focusing on one single document and its commenting dialogue (see Figure 3). This diagram is more detailed, and gives a picture of both the interactivity and the pace of an individual conversation. The baseline represents the

top document, and on the left axis, the participants are plotted in the order of their activity in the system with the author first. The dotted lines are references from a comment to the top document. The straight lines are reference links between individual comments, which give a picture of how they are organized into threads. Finally, there are also lines stretching out in the periphery to another document, represented as a box. In all, this is a kind of fish-eye perspective, which gives a detailed view of one selected dialogue at a time.

As an additional feature, the visiting patterns of users could be derived from these graphs. In the domain-centered version this requires a link from each comment to its time of creation. For example, an analysis of the data in terms of time stamps shows that user 1 visited the domain 3 times, and each time she posted 3-5 comments spread out on different documents.

At the workshop, we will discuss if and how a graphical representation can be used as part of an active coherence mechanism for users, which could be automatically created when a reply comment is posted. This would give the possibility to both preserve the document-focus of the environment, and to provide for increased interactivity. In addition, we wish to open a discussion about what traditional threading could have meant in this discourse context, and what other options are available for making the coherence of the ongoing discussion available to participants.

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Figures

See http://www.nada.kth.se/~kse/CHI-workshop/FigureX.gif

Biographical information

Kerstin Severinson Eklundh is a professor of Human-Computer Interaction at the Department of Numerical Analysis and Computer Science, Royal Institute of Technology, Stockholm. With a background in linguistics, she acquired her Ph.D. in Communication Studies from the University of Linköping in 1986. Her dissertation focused on dialogue processes in electronic mail communication, and included a conversational analysis of a corpus of messages from the Swedish COM system.

At present, Kerstin leads the research at the Interaction and Presentation Laboratory (IPLab), which is an interdisciplinary research group working with topics in human-computer interaction. She is also vice director of the Graduate School of Human-Machine Interaction, which is a collaboration with Linköping University. Kerstin's current research areas are computer-mediated communication and cooperative work, computer-support for the writing process, and recently also human-robot interaction. She is currently supervising 10 graduate students in these areas.

Henrry Rodriguez received a B.Sc. diploma in Informatics in 1987. In 1994 he earned a B.Sc. degree in Computer Aided Systems of Information, Processing and Control in The Electrotechnical State University of St Petersburg, and in 1996 he got a M.Sc. at the same university. From 1996, he worked at the Center for User Oriented IT Design (CID) of the Royal Institute of Technology of Sweden (KTH). In 1998 he became a member of the Interaction and Presentation Laboratory (IPLab) and was accepted in the Human-Machine Interaction graduate school of Sweden where he is currently doing his doctoral research on computer supported collaborative writing. His research interest areas are CSCW and HCI, and he has worked actively with the development of tools oriented to support text-based communication and collaboration in distributed synchronous and asynchronous modes. He has also studied Social communication at "La Universidad del Zulia" in Venezuela.