

Examining the Effectiveness of Electronic Group Communication Technologies: The Role of the Conversation Interface

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Abstract

Recently, a growing body of empirical research has begun to examine the practice of electronic group communication. Electronic group communication is a key process through which people can maintain communities of practice and leverage the strength of weak ties. Even though prior empirical investigations of electronic group communication have been successful at providing evidence for its effectiveness, these prior studies have not adequately dealt with the differences in the types of technology implementations of electronic group communication. We argue that different social and technical designs of electronic group communication technologies will influence various aspects of electronic group communication, such as level of participation, patterns of interaction and genres of communicative purposes. We propose and define the notion of *conversation interface* to be an important factor in electronic group communications. This paper illustrates the characteristics of the conversation interface and derives preliminary propositions concerning the impacts of conversation interface on electronic group communication based on prior theory. We also conduct an exploratory investigation of actual electronic group communication technologies to highlight the importance of the conversation interface factor. The paper concludes with discussions and directions for future research on electronic group communications.

Keywords

Electronic Group Communication, Conversation Interface, Group Communication Technologies

1. Introduction

Recently, a growing body of empirical research has begun to examine the practice of electronic group communication. Electronic group communication is a key process through which people can maintain communities of practice (Lave & Wenger, 1991) and leverage the strength of weak ties (Constant, Sproull, & Kiesler, 1996; Granovetter, 1973). Electronic group communication has been recognized as one of the major facilitators of organizational learning (Boland & Tenkasi, 1995).

One of the important effects of electronic groups is that communication technology leads people to have contact with different people (Sproull & Kiesler, 1991). The use of electronic communication technologies brings together not only different people but also a greater pool of different people (Sproull & Faraj, 1995). Thus electronic communication networks may support organizational activities such as seeking and providing help and advice between people with little or no prior knowledge of each other. Indeed, previous studies have documented evidence of helping behavior over an organizational computer network despite a lack of interpersonal connection between information seekers and providers (Constant et al., 1996). Other studies have even shown similar helping behavior in a world-wide community of practice outside of an organization's boundaries (Faraj & Wasko, 1998; Wasko &

Faraj, 1999).

Even though, empirical evidence shows that electronic communication technologies can be effective modes of communication for knowledge exchange, what is yet unclear is the role of the technology in supporting these helping behaviors. Prior research investigating electronic group communication has not adequately dealt with the differences in the types of technology implementations. Some studies have examined various forms of email distribution lists (e.g., Constant et al., 1996; Hesse, Sproull, Kiesler, & Walsh, 1993; Orlikowski & Yates, 1994) whereas others have explored Usenet newsgroups (e.g., Roberts, 1998; Whittaker, Terveen, Hill, & Cherny, 1998; Yates, Orlikowski, & Okamura, 1999), two widely used communication technologies that share some similarities but also have fundamental differences. Furthermore, even within a specific technical implementation, these prior investigations have not adequately characterized the various social implementations that may be institutionalized within the communication technology.

The distinction here is important in that patterns of interaction, or genres of communication (Yates & Orlikowski, 1992), are influenced by technology-use-mediators as well as the technical capabilities of the electronic medium (Yates et al., 1999). Thus, different social and technical implementations of electronic communication technologies may afford different outcomes in terms of patterns of interaction. In fact, a previous study that compared email distribution lists, Usenet newsgroups and commercial networks (e.g., CompuServe special interest groups (SIGs)) have shown evidence of different communicative patterns (e.g., levels of interactivity) between networks (Rafaeli & Sudweeks, 1997). Their rationale behind the comparison was that different networks would *appear* differently to the participants. The above study is unique in recognizing the significant role of the *interface* in influencing communication outcomes.

Consistent with Rafaeli and Sudweeks (1997), this study proposes the notion of *conversation interface* as an important, yet under examined variable in electronic group communication. We define the *conversation interface* to be “the user interface through which the participants of an electronic group discussion communicate”. The conversation interface is not simply the interface of the computer application (i.e., email client or newsreader program) with which one reads and posts messages to electronic groups. We are concerned more with how different social and technical designs *represent* the on-going discussions to the participants through the interface. Thus, we are not interested in a particular application, rather in the general characteristics of the communication technology as perceived by the discussion participants.

The objective of this study is to propose a theoretical framework of conversation interface in electronic group communication. This paper illustrates how different social and technical designs of the communication technology may result in different conversation interfaces, which may ultimately have an influence on various aspects of electronic group communication. We also present observational data collected over 5 months from two electronic group discussion forums as an initial exploratory examination of the impact of the conversation interface on electronic group communication.

2. Effects of Conversation Interface

Today, a wide variety of electronic group communication technologies have gained popularity and acceptance. Examples include Usenet newsgroups and email distribution lists. Most of these technologies are based on the simple, yet flexible model of email communication¹. Even though simple messaging (i.e., email) is the basic technology underlying most electronic group communication technologies, there exist subtle differences in the

¹ Email is a simple message transfer protocol identified by the sender, the recipient (individual or group), a subject and a body.

conversation interface. The choices in the social and technical design of an electronic group communication system will change how the discussions are presented and organized (i.e., the appearance of the conversation interface). We argue that the difference in conversation interface will affect how participants interact using the technology.

This section will explain the effects of different conversation interfaces. We will highlight how different social and technological implementations of online group discussion technologies differ in terms of the conversation interface and derive initial propositions concerning the impact of conversation interface on the use of electronic group communication technologies. But first, a brief overview of the design choices is presented.

2.1. Design Choices in Electronic Group Communication Technologies

The first basic difference in the model of message transfer concerns the technology underlying the conferencing technologies. Usenet newsgroups follow the Network News Transport Protocol (NNTP) where messages are sent to and stored at a news server. The news servers synchronize routinely so that the same content is available to everyone regardless of the server accessed. Distribution lists, on the other hand, follow the Simple Mail Transport Protocol (SMTP), where messages are sent via email to a distribution list server, which keeps a list of subscribers' email addresses to which the server sends incoming postings. Postings are thus delivered individually to each participant as email messages.

Usenet newsgroups (or “**threaded**” discussions) usually organize messages by topic (or conversational thread). A conversation begins with an initiating post about an issue, a question or a request for information. Subsequent messages sent in response to an initiating posting are linked to that message. There may exist multiple levels of threading, thus allowing responses to responses. A conversational thread is thus a collection of messages organized with a hierarchy of initial and follow up posts. Most newsreading software applications organize messages according to threads, so participants can view conversations in terms of the initiating post (Figure 1). Distribution lists, on the other hand, organize messages by time of receipt since messages are essentially email messages received by the participants (Figure 2). Thus, the two different technologies differ in terms of message organization.

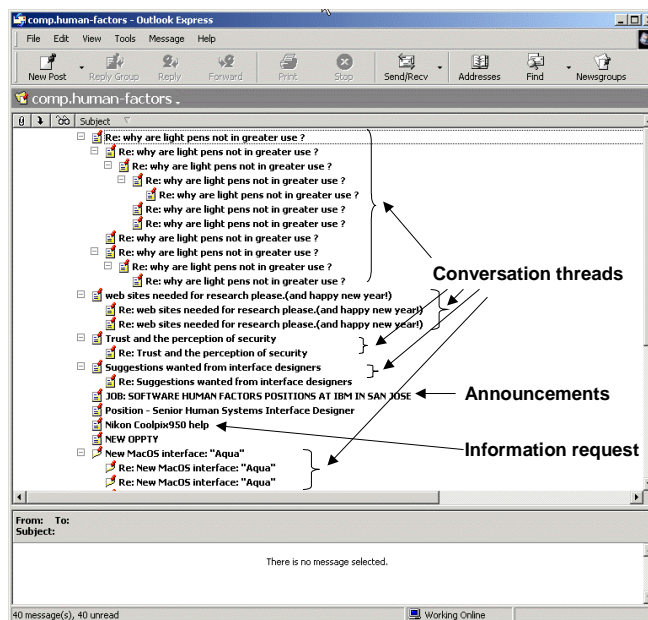


Figure 1 – The Conversation Interface of Threaded Discussions

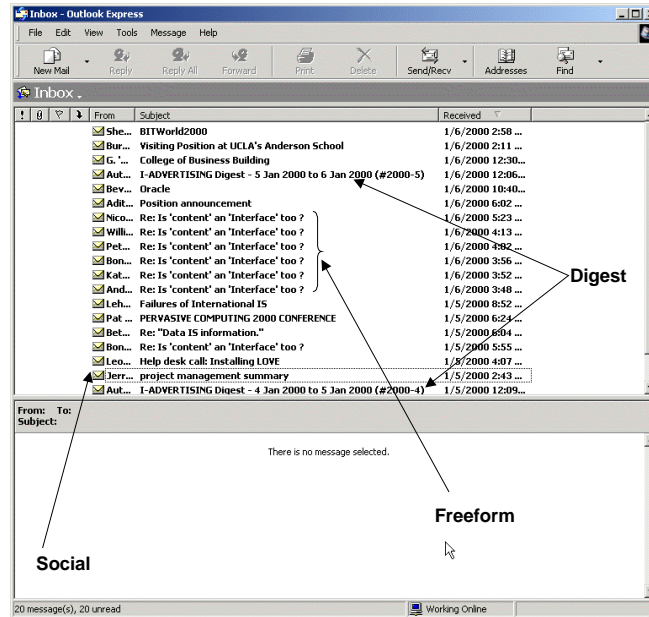


Figure 2 – The Conversation Interface of Email Distribution Lists

The second design choice concerns mainly distribution lists. One of the major problems with distribution lists (and also email in general) today is information overload (Hiltz & Turoff, 1985). Typical list subscribers are easily overwhelmed with the volume and pace of information because messages in distribution lists are not necessarily sequential and multiple concurrent threads are highly common (Kerr & Hiltz, 1982). Distribution lists allow for multiple configurations for the effective operation of the list. These configurations may be technically structured (i.e., organizing or restricting the nature of message transfer via automated software that resides on the list server) or socially defined (i.e., organizing or restricting the nature of message transfer through socially defined norms of the group).

Distribution lists are owned by a listkeeper who sets the basic technical configuration for the list². Technical configurations include message filtering through moderators, and the aggregation of messages into periodical digests. Distribution lists are moderated in the sense that a moderator (or a group of moderators) may filter all incoming messages and grant the posting of only messages relevant to the group's general area of conversation. Moderation has been employed as an effective mechanism to reduce irrelevant or socially undesirable messages (e.g., spam or flaming). The owner of the distribution list may also opt to configure the list server with the option of sending periodical digests to the subscribers. We will term this technical implementation of the distribution list the “**digest**” list. With the digest form, the list server accumulates all messages received and sends them as one aggregated email message at a pre-specified frequency (e.g., once daily). The digest list has also been employed as an effective mechanism to reduce overload since each subscriber only receives one message per day instead of multiple messages, which may easily flood his/her mailbox in the case of lists with heavy traffic.

Patterns of communication are often structured according to socially defined rules of conduct. Again, these social norms frequently emerge as a means to reduce information overload or to promote more pleasant and inclusive

² Note that technology design choices exist both at the message processing and distributing server end but also at the message receiving client end. For example, the choice to receive messages in a daily digest instead of in individual messages may be made by the subscriber (even though there may be different default setting on the list server during subscription).

interactions. We will term this social implementation of the distribution list the “**social**” list. For example, some distribution lists encourage participants to send responses directly to the initial poster and not to the whole list (i.e., to all subscribers). The initial poster is usually expected to post a summary of the responses to the list so that everybody may benefit from the discussion without having to flood all the subscribers’ mailboxes. This pattern of interaction is not restricted by the technology. On the contrary, subscribers may (often accidentally) send replies to the list instead of the initiating individual. However, non-conformance to the social norms generally results in social sanction from the other subscribers. Other examples of socially defined norms may include encouraging participants to limit their message lengths, encouraging subscribers not to quote the whole messages of the prior posts or discouraging extended two-party arguments. These are, again, procedures to reduce information overload within online discussion groups.

The other extreme of social interaction is the “**freeform**” discussion list (i.e., absence of technical and social constraints). Freeform lists usually encourage subscribers to respond to the list instead of to the individual initiators so that others may see and participate in the interaction. The various implementations of electronic group technologies are summarized in Table 1.

Table 1 - Different Implementation of Electronic Group Technologies

Differences	Technology Types			
	Threaded	Digest	Social	Freeform
Underlying Technology	NNTP	SMTP	SMTP	SMTP
Social Norms	No	No	Yes	No
Technical Constraint	No	Yes	No	No

The design of an electronic group communication technology involves the design of the social interaction system (Hiltz et al., 1985). The design of such technologies involves various challenges different from the design of applications developed for individuals or organizations because of social influences in their use context (Grudin, 1994). We observe various social and technical choices incorporated in the design of these technologies. Many of these choices have functional objectives such as the reduction of information overload. For example, mailing a digest of all email responses as one message rather than sending a number of individual email messages certainly reduces the number of messages a user sees in his/her mailbox. However, these design decisions in the organization and presentation of the messages may affect how participants interact with one another. This is an important issue in electronic group communication technology design since the value of the technology lies in its ability to promote effective interaction between potential information seekers and the large pool of information providers. We thus argue for a shift in focus from the design of the message delivery mechanism to the design of the conversation interface (i.e., the presentation of the conversation to the participants).

2.2. The Conversation Interface

How a communication technology is designed and implemented affects how the technology is perceived and used. The basic difference between different implementations concerns the difference in the conversation interface. The characteristics of the conversation interface affected by the technology design choices include the level of social and content cues afforded, the recipient role in accessing the discussions, interaction flexibility and level of organization of discussions. We argue that how the technology presents the conversation to the participants of an electronic group communication technology will have an effect on how it will be used for group interaction and collaboration. We now highlight the different dimensions along which conversation interfaces differ.

Social Cues

First, the presentation of the conversation interface will differ in terms of social cues. The social cues of a

conversation interface refer to the representation of information about other participants in the group. This provides the participants an awareness of who is around and how they can be reached (Buxton, 1992; Cockburn & Greenburg, 1993). Different group communication technologies have varying levels of visibility of other contributors / participants. For example, in the *threaded* discussion technology, where the interface shows all messages posted with the author of each message, a participant browsing through a discussion sees the names (or email addresses) of all contributors to the thread. In addition, since the messages are presented individually, the cues to contributors will be highly salient. On the other hand, with email distribution lists, the visibility of other participants and contributors may vary based on the social and technical norms and constraints embedded in the discussion group. With the *freeform* discussion list, the visibility and salience of other contributors will be high, since as with the threaded discussion, the messages are not aggregated and show the authors of each message. However, with the *social* discussion list, with social constraints to reduce information overload by having contributors respond directly to the original information requester who compiles and posts the summary of the responses, all messages pertaining to a conversation will be aggregated into one single message with the original requester as the author who posts to the list. In such a case, participants in the list cannot *see* the contributors, thus the visibility and salience of other contributors will be low. Finally, with the *digest* list, all messages will be aggregated into a daily digest sent by the moderator of the list. Again, in such a case, the participants in the list cannot see cues to who is contributing to the list, thus making the visibility and salience of other contributors low.

Content Cues

Another outcome of different technology choice concerns the level and amount of content cues the conversation interface presents to the participants. Content cues are important in electronic group communication technologies since one of the greatest threats to the success of the technology is information overload. Without content cues, it is impossible for the participant to manually (or automatically by means of software filters) filter out the messages that are of potential interest. Therefore, the availability and amount of content cues presented through the conversation interface should affect the participants' information retrieval behaviors and subsequent response behaviors. Content cues in electronic group communication technologies are basically represented and perceived through the message subject in the conversation interface. The content of the subject field may trigger the attention of the recipient of a message who may then decide to contribute with a response. The availability and salience of content cues differ between different types of group communication technologies. With the *digest* list, content cues will not be available since the digest message cannot possibly show the content of all the individual messages of the daily digest within the limited space limitations of the subject field. The other group technologies (i.e., both *freeform* and *social* lists and also *threaded* discussions), on the other hand, support the availability of content cues since they send each individual message. Even though these three types of group technology implementations support the availability of content cues, those technology implementations will not support the same level of salience of content cues. For example, with the *social* list, the number of messages posted to the list for a given topic will be always two (i.e., the request for information and the summary of the responses). On the other hand, on the *freeform* list or the *threaded* discussion, the number of messages posted on the list will be equal to the total number of messages (i.e., request and individual responses). The total number of messages will thus always exceed two if more than one person replies. Therefore, the same content cues will be present more often, thus increasing its salience.

Recipient Role

Another difference in the conversation interface between different technology implementations is the extent to which the access to the technology is active or passive. The fundamental distinction here arises from the underlying technology. The technologies can be categorized as either NNTP-based as in Usenet newsgroups (i.e., threaded discussion) or SMTP-based as in email distribution lists. If the underlying technology is the NNTP, then the participants have to actively initiate a move to look at the discussion list (e.g., open the news reader program),

whereas the SMTP based distribution lists will send messages to your inbox as email messages that participants normally would scan as part of their existing activities. Thus, with SMTP based technologies the participants can passively wait for the messages to come to them.

Interaction Flexibility

The flexibility of conversation supported by the conversation interface may also differ between technologies. By flexibility, we refer to the possibility of changing and refining the direction of the conversation content as the interaction evolves. The change in conversation direction is usually conveyed through the change of the message subject. In the cases of the group technologies that have social or technical norms and constraints, it is difficult to exercise flexibility of the conversation. For example, with the *social* list, since information request and the summary of the responses are the only messages represented in the conversation interface, this limits the opportunity for any of the respondents to change direction of an ongoing conversation. On the other hand with the *digest* list, even though respondents may change content and direction of the conversation, this is not shown at the conversation interface since all messages are aggregated into the daily digest. However, with the *freeform* lists and the *threaded* discussion lists, the participants in the conversation may change the course of the conversation and may make this visible by purposely changing the subject of the response. Even though both the freeform distribution list and the threaded discussion list offers the facility to change the subject of a message, the nature of the technology will have different impacts on the presentation on the conversation interface. With the *freeform* discussion list, if a respondent chooses to redefine the course of a conversation by changing the subject of a message, the resulting change will be shown as a new topic in the interface. However, with the *threaded* discussion, since the conversation interface organize the messages in terms initial and follow up posts, the change in subject will have no great impact on how the conversation is perceived by the participants.

Level of Organization of Discussions

A final difference in conversation interface arising from different technology implementations is the extent to which discussions appear organized. This is an important aspect of electronic group communication technologies because multiple conversations topics are often conducted simultaneously at a given time (Kerr et al., 1982). The technology that offers the highest level of organization is the *threaded* discussion, since follow-up messages are linked to the original message and can be arranged by threads. On the other extreme, *digest* lists and *freeform* lists offer the lowest level of organization. With *digest* lists, it is impossible to arrange the individual messages since those are embedded in the daily digest. On the other hand, users may arrange the messages in the *freeform* list by sorting the messages with the email client software. However, as discussed earlier, since the participants have the liberty to change the subject of the messages as the conversation evolves, automatically grouping the messages by topic may not always be possible. Finally, the *social* list offers a form of organization that is different from those of other technologies. Since, the original information requester posts a summary of the responses when a conversation is complete, all the messages pertaining to a certain conversation will be embedded in that summary message. Therefore, the users do not need to organize the message because they are already organized since the entire conversation is compacted into a single message.

In summary, we may suggest that the technical and social choices in the design of electronic group communication technologies lead to conversation interfaces that differ significantly on dimensions that are important in influencing participant behavior. The differences in the conversation interface are summarized in Table 2. Since the conversation interface is the medium with which people engage in communicative activities, a difference in the conversation interface will have an impact on how the group technology is used for interaction and collaboration. We explore these impacts next.

Table 2 - Differences Conveyed in the Conversation Interface

	Threaded	Digest	Social	Freeform
Visibility of social cues	High	None	Low	High
Salience of social cues	High	Low	Low	High
Visibility of content cues	High	None	High	High
Salience of content cues	High	None	Low	High
Active / passive role of participants	Low	High	High	High
Flexibility of conversation	Medium	N/A	None	High
Organization of conversation	High	Low-	Medium	Low+

2.3. Impact of Conversation Interface on Electronic Group Communication

A variety of electronic group communication technologies are currently available to foster group interaction and collaboration. Even though these different technologies are designed and implemented with similar goals – sharing of information among participants, the difference in the conversation interface resulting from various social and technological implementation choices may have a profound effect on how these communication technologies afford different communication behaviors and attitudes.

We consider six characteristics of electronic group communication influenced by the conversation interface – participant characteristics, level of overall participation, amount of help generated, communication patterns, level of agreement and types of problems solved. We highlight the influence of the conversation interface on each of these characteristics.

Participant Characteristics

First, the types of people that participate in the discussions may be affected by the conversation interface. If a group technology requires a high level of involvement and active participation, then it is likely that there will be less peripheral lurkers that merely track the list without any active contribution. For example, with email distribution lists, the messages posted are delivered to the subscribers' mailboxes. The participants can *passively* wait for messages to come. Many lurkers on distribution lists merely save incoming messages to local folders without reading or responding to the information requests and the subsequent interactions. On the other hand, with threaded discussions, the participants are required to *actively* go to the discussion list even if they're only interested in keeping in touch with current issues (Pickering & King, 1992). This additional effort required may discourage participants to participate as mere peripheral lurkers. This leads to our first proposition;

Proposition 1:

More active participation and involvement required by the conversation interface will lead to a participant population with a smaller proportion of peripheral lurkers.

Even though peripheral lurkers do not contribute often to the discussions, these participants are a valuable source of unanticipated synergy in group discussions (Hiltz et al., 1985). The existence of and availability of peripheral lurkers implies a greater and more diverse network for potential contribution which would lead to greater access to resources. Thus, a corollary to the first proposition;

Proposition 1a:

More active participation and involvement required by the conversation interface will lead to a lower level of resource access.

Level of Participation

Second, the difference in conversation interface may also have an effect on the overall level of discussion

participation. Conversation interfaces that implement social norms and technical constraints may reduce the perceived liveliness of a discussion forum because the interface only shows a smaller number of individual message posts even though these may comprise multiple messages. In the social list, the information requester compiles and posts the summary of the responses she has received. This one summary message may be and often are composed of numerous replies. However, the participants only see a single post. Similarly with the digest list shows only one message per day with multiple messages aggregated within that digest. Again, the participants only see a single post³. Positive attitudes toward participation and contribution may develop as a result of the lively social atmosphere conveyed in the conversation interface. People generally want to take part in the action when the atmosphere affords action and participation (Cialdini, Reno, & Kallgren, 1990). Since the visibility and salience of other contributions and contributors will increase the perceived liveliness of the discussion forum leading to more positive attitudes and participatory behaviors. This leads us to our second proposition;

Proposition 2:

The presence of social norms and technical constraints on message delivery will reduce the level of overall participation, whereas the visibility and salience of other contributors will increase the level of overall participation.

The level of overall participation may also be affected by the amount of effort required to participate in the discussion (i.e., the cost of participation). Studies have shown that people do not choose to go to the channel of the highest quality for information, but rather to go to the channel of highest accessibility (Gerstberger & Allen, 1968). As argued earlier, the technology underlying the discussion interface may affect the amount of additional effort required to participate. Thus, a corollary to the second proposition;

Proposition 2a:

The higher cost of participation afforded by the conversation interface will reduce the level of overall participation.

The impact on the level of participation may also result in the opposite direction. For example, the higher cost of participation may lead to a more active group population with greater motivation to participate (e.g., proposition 1). This would lead to the opposite effect where higher cost of participation will increase the overall level of participation in terms of fewer non-contributing peripheral lurkers.

Proposition 2b:

The higher cost of participation afforded by the conversation interface will increase the level of overall participation.

Communication Patterns

The conversation interface may also have an effect on the dynamics of the electronic interaction. Earlier we have argued that the implementation of the group discussion technology may affect the level of visibility and salience of other contributors in the conversation interface. The visibility and salience of other contributors may also affect the behavioral dynamics of the group interaction. First, the visibility of other contributors may reduce a participant's attitudes toward responding to an information request. If a participant sees a request for information for which she

³ Here, we are not arguing that implementing social norms and technical constraints is bad. These practices, as mentioned earlier, may have a positive impact in reducing information overload. We are simply arguing that these practices may affect how the computer-mediated discussion network interacts.

has an answer, she may be motivated to provide help by responding (Constant, Kiesler, & Sproull, 1994). However, if she sees other contributors who have similar content to contribute, she may be disinclined to contribute to avoid redundancy and inconsequentiality. In addition, the ability to stand out and participate where others may see you requires a higher level of motivation. On the other hand, the *invisibility* of other contributors will reduce the level of motivation requirement, and thus participation may be less costly. Furthermore, if a participant cannot see what others are contributing, even though she may know that others might contribute similar content, she will believe that her contribution is unique and thus helpful. Prior field studies have documented this phenomenon where many information providers contributed in spite of their apparent inconsequentiality (Constant et al., 1996). Therefore, our third proposition;

Proposition 3:

The visibility and salience of other contributors in the conversation interface will reduce the amount of direct initial responses to a request for information.

When the conversation interface makes the contribution of other participants visible and salient, the salience of content cues will also affect the group interaction dynamics (Rafaeli et al., 1997). The salience of content cues will help participants distinguish between lively and quiet conversation topics (i.e., a lively conversation topic will have a lot of messages with the same or similar subject lines). Those conversation threads that appear livelier will more easily attract participants to take a look at the discussion, which will in turn increase the likelihood of responses.

Proposition 3a:

The visibility and salience of content cues will increase the level of interactivity (i.e., number responses to responses) in the group discussion.

Diversity of Content

As a consequence of the increased interactivity in the discussion, the amount of diversity in the discussion will also be affected by the intensity of the conversation. When there are more messages within a conversation thread, the chances that the messages are of greater diversity are higher than when there are only a few voices pertaining to a topic. The greater number of messages in a conversation thread does not necessarily imply more different people are involved. Two people arguing the same position back and forth will also lead to more messages albeit with less diversity. Hence, a greater number of messages is only a necessary condition to content diversity, it is not a sufficient condition. Thus, our fourth proposition;

Proposition 4:

A higher level of conversation intensity may lead to more diverse information content when more people participate in the discussion.

Interaction flexibility may also affect the diversity of content within conversation topics. The subject field is usually used as a means to convey one's perspective in the discussion. Thus the modification of the subject field would occur when the author of a message perceives that the current running title for the discussion is inappropriate in reflecting his / her perspectives or arguments. Therefore, when the conversation interface supports flexibility of interaction (e.g., changing of message subject fields), the interface would afford greater variety of arguments through differences in content cues.

Proposition 4a:

The flexibility of conversation will lead to more diverse information content.

The level of organization of the discussion supported by the conversation interface will also affect content diversity in the group's interaction. When messages are grouped together, each message within the group is perceived as a subset of the whole perspective and not as an independent voice in the discussion. Prior empirical studies have shown evidence of increased agreement with threaded discussions (Rafaeli et al., 1997).

Proposition 4b:

The organization of conversation will lead to less diverse content of information provided.

Interactivity

In a group discussion setting, the diversity of viewpoints and arguments would lead to greater interactivity in the communication process. Close interaction is required in such situations in order to compare, contrast and synthesize the numerous of arguments. In an electronic group communication environment, interaction would be required even more due to the characteristics of the medium (i.e., asynchronous nature of the message transfer and the inability to convey multiple cues) (Daft & Lengel, 1984; Daft & Lengel, 1986). We therefore, hypothesize that a similar communicative process of high interactivity would occur in the electronic communication environment when there exists great diversity of content in the discussions.

Proposition 5:

A greater level of content diversity will lead to greater interactivity in the discussions.

Communication Purposes

Interactivity is an important characteristic of group dynamics (Rafaeli, 1988), especially when the communication requires a shared interpretive context (Zack, 1993). For example, the resolution of ambiguous and equivocal content requires higher levels of interactivity than when communicating unambiguous content. Prior research has shown evidence of media choice and use where interactivity of the communication medium plays a key role in the choice behaviors of the users. Users tended to choose and actually use media with greater potential for interactivity when the conversation required a shared interpretive context, whereas they were comfortable using less interactive media when the communication required simple information transfer without the need for a shared interpretive context (Zack, 1993). Even though prior studies have most often compared face-to-face vs. computer-mediated communication media, it is highly plausible that this relationship persists when comparing between different types of computer-mediated communication media. As we have argued above, the difference in the technology and in the social norms and technical constraints implemented within the technology will lead to differing levels of interactivity between different computer-mediated communication technologies. Thus, our final proposition;

Proposition 6:

Group technologies with varying levels of interactivity will be used for different types of communicative purposes.

The effects of conversation interface on electronic group communication are summarized in Table 3. In order to gain insights into these effects, we conducted an exploratory investigation of two real world group technologies with different conversation interfaces. Details of the study are presented next.

Table 3 - Effects of Conversation Interface on Electronic Group Communication

	Threaded	Digest	Social	Freeform
Number of postings	Medium	Low	Low	High
# of direct responses	Medium	High	High	Medium
# of response to response	Medium	Low	N/A	High
Divergence of conversation	Low	Medium	Low	High
Interactivity	Low	Low	Low	High
# of peripheral lurkers	Small	Large	Large	Large

3. Exploratory Investigation of Electronic Group Communication

This section presents a preliminary investigation of electronic group communication technology use⁴. Two archetypes of commonly used electronic group communication technologies were identified. Both were email distribution lists, but differed substantially in terms of the conversation interface. We content analyzed the messages and interactions over a period of 5 months⁵.

The first (List I), was an email distribution list intended for members of the information systems research community. Open discussion was firmly discouraged by the social norms of the group. When the need for interaction or information sharing occurred, the *netiquette* of the group was to reply to the original information requester who would collect, summarize and post the collective responses to the whole list in a single message. Thus List I showed the typical characteristics of the *social* list discussed previously.

The second (List C), was intended for open discussion on human factors issues of the World Wide Web. There were no explicit social norms as to the desired interaction on the list. Information requesters would frequently post a message to the list soliciting answers or comments. The respondents would post the responses directly to the list so that all subscribers would receive each message. Thus List C showed the typical characteristics of the *freeform* list as described previously.

3.1. Results

3.1.1. Demographics

At the time of the observation and data collection, there were 2383 people subscribed to List I, whereas 1138 were subscribed to List C. During the 153 days of observation, a total of 732 messages were posted to List I from 374 different individuals, whereas List C has a total of 688 messages postings from 254 different individuals. For List I, we also identified an additional 318 messages from 111 different contributors from the summaries of responses, since most of the summary messages indicated the individual contributors. Given the difference in size of the distribution lists, it is extremely difficult to compare raw numbers between groups. Therefore, we normalized all the data by size of the network. All following data and results presented are normalized per 1000 subscribers. Table 4 summarizes the results of the observation.

⁴ In the spirit of an initial exploratory investigation, extensive rigor in methodological procedures (e.g., target sampling, data collection and analysis) was not emphasized. The main focus of this investigation was to gain initial insights into how different electronic group collaboration technologies were actually used in the real world.

⁵ The period of data collection was from June 1 to October 31, 1999 (153 days).

Table 4 - Descriptive Statistics for the Two Distribution Lists

Category	Data Collected		List I (Social)	List C (Freeform)
Overall Usage	Total number of messages (over 153 days)	(a)	440.6	604.6
	Total number of contributors	(b)	203.5	223.2
	Mean number of messages per contributor	(c)	2.2	2.7
	Mean number of messages per day	(d)	2.9	3.9
Discussion	Total number of discussion messages	(e)	150.2	468.4
	Other messages	(f)	290.4	136.2
	Percentage (%) of discussion messages	(g)	34.1 %	77.5 %
	Percentage (%) of other messages	(h)	65.9 %	22.5 %
Participants	Number of non-discussants	(i)	116.2	43.1
	Number of discussants	(j)	87.3*	180.1
	Percentage (%) of non-discussants	(k)	57.1 %	19.3 %
	Percentage (%) of discussants	(l)	42.9 %	80.7 %
Interaction Patterns	Total number of information request messages	(m)	16.8	58.0
	Total number of response to requests	(n)	133.4*	410.4
	Average number of responses per request	(o)	7.9	7.1
	Direct responses	(p)	7.9	3.2
	Responses to responses	(q)	0.0 ⁶	3.9

* includes the count of responses summarized by the poster.

3.1.2. Level of Participation

We may see from Table 4 that the level of participation was higher for List C over List I. Overall, we see that there were more messages posted (Table 4 - row a), and more people posting to the list (row b). There was on average, one more message posted on List C than List I (row d). In addition, not only do we observe a greater liveliness in terms of number of messages and proportion of active participants, but also a more active participation in terms of the greater number of messages per contributor (row c). This is an interesting result considering the fact that the actual size of List I (2383) is more than twice the size of List C (1138). This is consistent with the theory of weak ties, in that the usefulness of weak ties lies in the capacity to bridge the individuals rather than in the sheer number of individuals (Granovetter, 1982). We may infer from the data that the greater (or lesser) participation may have been due to the capability of the conversation interface to bridge individuals. In other words, the visibility and salience of other participants conveyed in the conversation interface of List C may have lead participants to contact one another and thus the greater level of participation, whereas the lack of social cues in the conversation interface of List I may have reduced the propensity of the subscribers to interact (proposition 2).

3.1.3. Communication Purpose

The data in Table 4 shows that the distribution lists were used with highly different intentions (rows g and h). List I was mainly used for non-discussion related announcements (e.g., call for papers, journal table of contents, conference announcements, job openings etc.) (65.9 %), whereas List C was mainly used for discussions (77.5 %) (proposition 6).

There may be several explanations behind the observed data. For example, the difference in size of the network may make List I more attractive for announcement so as to reach a broader audience. However, this explanation is unlikely due to several reasons. First, List I requires authorization to become a subscriber reducing the probability of spam and the list also shows evidence of strict social sanction when participants do not follow posting guidelines. Thus the size of the group may not be the determining factor underlying the observed use. In such a situation, the greater size of the network would, contrary to the observed data, make List I more attractive for conducting

⁶ On List I, all responses can only be direct responses to the original request due to the pattern of interaction defined and constrained by the social norms of the group.

discussions. Another difference between the two lists lies in the topic of interest that binds the group together. List I is concerned about information systems, whereas List C is concerned with human factors issues of the World Wide Web. Both lists were thus concerned with research issues. The difference in topic cannot be seen as a major factor affecting the observed pattern of use. Given that the only major differences between the two discussion networks are the size of the network, the topic of interest, and the conversation interface, we hypothesize that the observed difference in the use of the discussion list may have been due to the difference in the conversation interface. Even though a lively discussion may take place within List I, the conversation interface is such that other participants do not *see* the action happening. They may only see two messages (i.e., the original request and the summary of responses). On the other hand, with List C, when a similar discussion takes place, the conversation interface shows all the messages individually thereby conveying the liveliness of the discussion. Therefore, subscribers of List I will perceive fewer discussions which would lead to a generalized perception that the discussion list is not meant for discussions. In other words, the lack of social cues may lead to less impulse to initiate conversations. This is consistent with previous research suggesting that different patterns of use lead to the structuring of different genres of communication (Orlikowski et al., 1994; Yates et al., 1999).

3.1.4. Participant Characteristics

The third part of Table 4 shows the distribution of roles of the participants (rows i to l). The results show that there was a slightly greater proportion of non-discussants⁷ in List I, whereas the ratio of discussants to non-discussants was much greater in List C. These results are similar to the findings in the previous section where a large proportion of messages in List I were related to announcements and not discussions (proposition 2).

3.1.5. Interactivity

Our final observation concerns the pattern of interaction in the discussions. As we have seen above, the total number of discussion related messages is greater on List C than on List I (row e). However, even though List C showed a greater participation in discussions, the patterns of discussion are alarmingly similar between the two lists (row o). Both lists showed approximately 12 % of discussion related messages being requests for information (i.e., approximately 17 messages of a total of 150 for List I, and 58 from a total of 468 for List C) (rows m and n), and the remaining 88 % being the responses to these requests. However, if we look at the interactivity of the discussions, we see a difference. Even though the total number of responses to a request was very similar (7.9 messages for List I vs. 7.1 messages for List C), List C derived less direct responses (only 3.2 messages) than interactive responses to responses (3.9 messages) (rows p and q). Overall, we may say that both groups are equally helpful, however, the nature of the help may be very different between the two groups. List I may be regarded as providing more breadth in the help (proposition 3), whereas List C may be regarded as providing more depth of resource access (proposition 4). One interesting consequence of these results is that the level of resource access may not be related to the size of a discussion network. Intuitively, a greater pool of potential helpers may increase the likelihood of greater access to resources. However, in our observations the greater size of List I did not result in a substantially wider access to resources in terms of number of responses. Ultimately, we may say the List C gained more value from the network due to the design of the interaction system.

4. Discussion and Conclusion

The results of the exploratory investigation suggest that the nature of the conversation interface does in fact influence various aspects of electronic group communication, such as level of participation, patterns of interaction and genres of communicative purposes. However, these results need to be interpreted with caution due to the

⁷ Non-discussants are those who participate by posting messages to the list, however, their postings are not related to any discussions. An example, would be someone who only posts announcements.

exploratory nature of our empirical investigation. First, our study only examined two conversation interfaces within the email distribution list implementation of electronic communication technologies. Without a systematic calibration of the conversation interface factor, it was not possible to investigate all the propositions set forth in our theoretical framework. Furthermore, the limited sample size of one distribution list per conversation interface may also reduce the generalizability of the findings. However, since the purpose of the study was to call to attention the importance of the conversation interface factor, we believe that the evidenced effects through examination of the same underlying technology (i.e., email distribution lists) with different conversation interfaces was sufficiently effective. We plan to pursue an extension of this study to investigate more systematically different ranges of groups and other types of electronic group conversation interfaces in order to reliably examine its effects on group communication.

Second, this study relied solely on inferences on the patterns of interaction conveyed in the actual messages distributed to the lists. We, therefore, couldn't gain access to the messages sent individually between participants without using the distribution network. However, we have made all possible attempts to keep the data complete by also including the messages that were not posted to the distribution lists but quoted in the messages posted. Another problem with this method of data collection is that we may not gain insights into the perceptions of the participants about the different conversation interfaces. Hence, our method does not allow us to test directly the causal relationships from conversation interface to behavioral outcomes. Rather, we relied mainly on inference based on the patterns of interaction in the group discussions to suggest the importance of the conversation interface factor in electronic group communication. We believe that our examination was sufficient for this purpose. However, an extension of this study is also under way to incorporate multiple data collection methods (e.g., online survey administration in addition to content analysis of messages) so as to formally test causal relationships in our theoretical framework.

Thirdly, the categorization of the conversation interface is not, as of yet, fully exhaustive. We have strived to identify the common types of electronic group communication technologies. However, the categories may have richer dimensions than proposed in this paper. For example, our study focused on the social norms of *summary posting after individual off-line replies*. Although this is a frequently observed social norm in electronic group communication, especially with large groups of members, other social norms also exist. For example, some electronic groups discourage the quoting of previous messages in order to reduce redundancy; others limit the length of the postings; some even discourage flaming behavior or extended two-party interactions. Again, these may have drastic effects on patterns of interaction within electronic groups. Future research should examine the effects of different social norms.

Despite the limitations, this study offers several important insights into the theory and practice of electronic group communication. In terms of theory, this study was, to the best of our knowledge, the first to identify the *conversation interface* as an important factor in electronic group communication. We have also shown some evidence from observational data that the interface factor may influence group communication dynamics. In terms of practice, this study also offers various insights for both users (i.e., the organizations that deploy electronic communication technologies) and designers (i.e., the designers and implementers of software or services such as groupware, listservs, newsgroups and electronic bulletin boards) of electronic group communication systems. Currently, organizations can only understand post-hoc the effects of electronic group communication technologies. However, organizations would like to predict in advance the types of communicative patterns that are likely to emerge when different types of communication technologies are implemented. A focus on and analysis of the conversation interface will help managers in the selection of an appropriate and effective technology that suites their organization's communication needs. The designers of electronic group communication technologies will also

benefit from the insights of this study. As we have seen, current implementations of electronic group communication are essentially built upon existing solutions such as listservs or newsgroups. A focus on the conversation interface will guide designers in deciding which features to add to these existing solutions (e.g., different ways to convey social or content cues; different forms of message organization etc.). In addition, with the increasing popularity of the Internet, designers now have a greater flexibility in the design space of communication technologies. Web-based electronic bulletin boards, which are highly popular with virtual communities, are examples of group communication technologies that can be designed to convey additional information and cues, which was impossible to do with email based technologies. These new media have the ability to track the number of times a message was accessed, the ability to incorporate quality assurance cues (e.g., dynamic peer rating of helpfulness of message content), and also greater flexibility in message organization and categorization. Today, even Usenet newsgroups may be accessed through a web-based interface (e.g., <http://www.remarq.com/>). These technologies provide a different conversation interface of the same conversation content. These new features of the conversation interface will certainly affect the patterns of interaction of electronic groups. Future research on electronic group communication should also be directed at analyzing the impact of these new communication media.

5. References

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