INTERACTIVITY ON THE NETS

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Abstract: What makes computer-mediated groups tick and / or stick? To what degree are computer-mediated discussants really sustained "groups"? Does the grouping quality reflect anything beyond technical structure? Are technical structure and grouping related? How do threads define groups, or vice-versa? Does any of this change between academic and commercial networks?

We propose that one useful perspective for studying group CMC is interactivity. Interactivity is a theoretical construct that grapples with the origins of captivation, fascination, and allure that can be inherent in computer-mediated groups. In the sample of messages collected by ProjectH, we have a first-of-its kind representative snapshot of communication among the very large groups populating the networks.

The central unit of interest in studying computer mediated groups is, in this case, the thread of messages. A message thread is a chain of interrelated messages. Rather than individuals' self-report, linguistic and socio-linguistic analyses of content, or observational data of larger units, we examine interactivity, the dependency among messages in threads.

Results indicate that the content on the net is less confrontational than is popularly believed: conversations are more helpful and social than competitive. Over half of the messages in the sample make reference to a previous message, one-fifth of messages refer to more than one previous message, and one-tenth of messages refer to how previous messages related to even earlier ones. Interactive messages seem to be more humorous, contain more self-disclosure, display a higher preference for agreement and contain many more first-person plural pronouns. This indicates that interactivity does indeed play a role in the social dynamics of group CMC, and sheds a light on comparing interactive messages with conversation. Differences in interactivity are reported for different networks and different types of authors as well. The focus, we propose, should be on the glue—that which keeps message threads and their authors together—and what makes the groups and their interaction tick.

INTRODUCTION

A network is a net. In sports, a "net" is a barrier. "Net" is also that which remains after all deductions and adjustments are made. A third etymological derivation for "net" is a means of entrapment, surrounding and captivation. Among all interpretations of the "net" in "network" this third meaning is, in our view, the most appropriate. This paper is about the captivation (or engagement) of participatory communication on the NETworks. How are we trapped by group computer mediated communication (CMC)?

We begin with the observation that group computer mediated communication over the nets is a series of experiments in social integration and democratic participation. By some measures at least, the experiment works. Group CMC is succeeding in attracting sustained exponential growth. People want to join, and when they do, many stay. But the success is, in some ways, paradoxical. We propose to examine how captivation occurs through interactivity. Interactivity is a variable quality of communication settings. It expresses the degree to which communication transcends reaction (Rafaeli, 1988). Following classical scholars such as Goffman (1959), and Parsons (1962), and more contemporary work such as Bretz (1982), Steinfield (1987), Rogers and Rafaeli (1985), Rafaeli (1984, 1985, 1988, 1989) and others, we believe that interactivity is a pivotal measure (and, perhaps, cause) of the social dynamics of group communication. Such interactivity is made possible, but not always exercised, by computer mediated communication. It is especially interesting, but hardly studied as-of-yet, in the context of large groups.

In accordance with theoretical and experimental predictions, this paper reports on the nature and levels of interactivity in the ProjectH data—a content analysis of a representative, random sample of computer mediated discussions. The paper relates interactivity to several dimensions of interest: activity itself, type of list (voluntary / academic vs. commercial), list climate, the emergence of leadership (the "guru" phenomenon), and others. We propose that interactivity is associated with those message qualities which invite people and make them gravitate to the groups on the net. Thus, interactivity may be a mechanism through which netting occurs on the net.

GROUP CMC

Many people congregate on the nets. They spend much energy in the collaborative effort. Networks are centralized distribution mechanisms that are both democratic and anarchic. Computer mediated groups can be viewed as an enigma in traditional, rational and economic terms. After all, the medium is owned by no one. The process is unmanaged in any traditional sense of motivation, profit, control or censorship. Joining and departing participants do so without so much as a required introduction or an agreed upon etiquette. The groups are of an undetermined size or constitution. The situation is neither the classical written nor traditionally spoken communication. Group CMC is neither mass media as we have grown to know it, nor interpersonal face-to-face (FTF). If we weigh numbers of participants and symmetry in participation, we find that this is the largest form of conversation, or the smallest form of mass communication. Or something else altogether?

Computer mediated groups beg the questions: why do people make this investment and why does this social phenomenon happen? Is the allure of group CMC in its emulation of FTF interaction? We argue that interactivity is the mediating phenomenon. Interactivity may occur in FTF contexts, but is not mandatory. It may be present in CMC contexts as well. Here, too, not always. In any case, it is not the direct similarity to FTF that matters.

Networked group CMC is unprecedented, not even by FTF, in several ways. The technology allows for "conversations" held simultaneously or asynchronously by numbers heretofore considered unmanageable. Group CMC is about dozens or hundreds or thousands of people

interacting. It is as much a social and group phenomenon as it is psychological and interpersonal. Turn-taking and interrupting are another case in point. Interrupting is easier to do in CMC than in FTF. At the same time, interruptions are less disruptive for the speaker. After all, group "members" are not really members in any officially sanctioned way. Are they ever really there? There is no "there" to be at. There is no "when" to be on. Group CMC longevity, not to mention functionality, is not fully understood (Rafaeli & LaRose, 1993). And yet, the growth of group CMC is astounding. At the time we collected the data reported here, network users numbered over 10 million worldwide and growth rates were estimated at 5% monthly. Both size and growth rates have since increased appreciably. Governments have been moved to declare national "information highway" emergencies and policies to deal with the onslaught of traffic. Where is everyone going, and why? If group CMC is not simply magnified FTF, how should we study computer mediated groups, and how can we account for the social, conmmunication phenomenon they represent?

INTERACTIVITY

Interactivity is a process-related, variable characteristic of communication settings. Like FTF communication, computer-mediated communication has the capacity of enabling high interactivity. One postulated outcome of interactivity is engagement. Interactivity can lead to sociability. We therefore propose that the concept of interactivity is a likely candidate to help in explaining how groups, especially CMC groups, stick together. And it is interesting to examine interactivity on the nets.

Interactivity is not a characteristic of the medium. It is a process-related construct about communication. It is the extent to which messages in a sequence relate to each other, and especially the extent to which later messages recount the relatedness of earlier messages. Following Goffman (1967, 1981), Bretz (1983), McLaughlin (1984), Rogers (1986), Tannen (1989), Schegloff (1987, 1992) and others, we note that communication is mostly about and for the purpose of interaction. Interactivity places shared interpretive contexts in the primary role. Interactivity describes and prescribes the manner in which conversational interaction as an iterative process leads to jointly produced meaning. Interactivity merges 'speaking' with 'listening'. And it is a general enough concept to encompass both intimate, person-to-person, FTF communication and other forums and forms.

Logically, interactivity is indicated as a useful concept for mapping group CMC because it is (like group CMC itself) a hybrid construct. The concept of interactivity directs our focus to the intersection of the psychological and the sociological, the bridge between mass and interpersonal communication, the meeting of mediated and direct communication, and the paradox of written vs. spoken. Interactivity varies along a continuum (Rafaeli, 1988). At one end is declarative (one-way) communication (e.g. most radio and television). Reactive (two-way) communication is further down the road. In reactive communication, one side responds to the other side. Fully intractive communication requires that later messages in any sequence take into account not just messages that preceded them, but also the manner in which previous messages were reactive. In this manner interactivity forms a social reality (see Figure 1).

Interactivity is the condition of communication in which simultaneous and continuous exchanges occur, and these exchanges carry a social, binding force. Brown and Yule (1983) and Zack (1993) summarize additional qualities of interactive communication: allowing for multiple types of cues, potential spontaneity, emergent progression of the content, the ability to interrupt or preempt, mutuality, and patterns of turn-taking. But our definition of interactivity goes beyond Schegloff's simultaneous exchange and Goffman's continuous feedback. We support Schudson's (1978) contention that FTF conversation cannot be used as the standard of comparison for group CMC. We argue that interactivity is a continuum, a variable, not just a condition.

And we insist that most communication, FTF or not, falls short of full interactivity. The case of group CMC differs from conversation, if only for sheer size, and because interruptability and turn-taking take on different meanings.

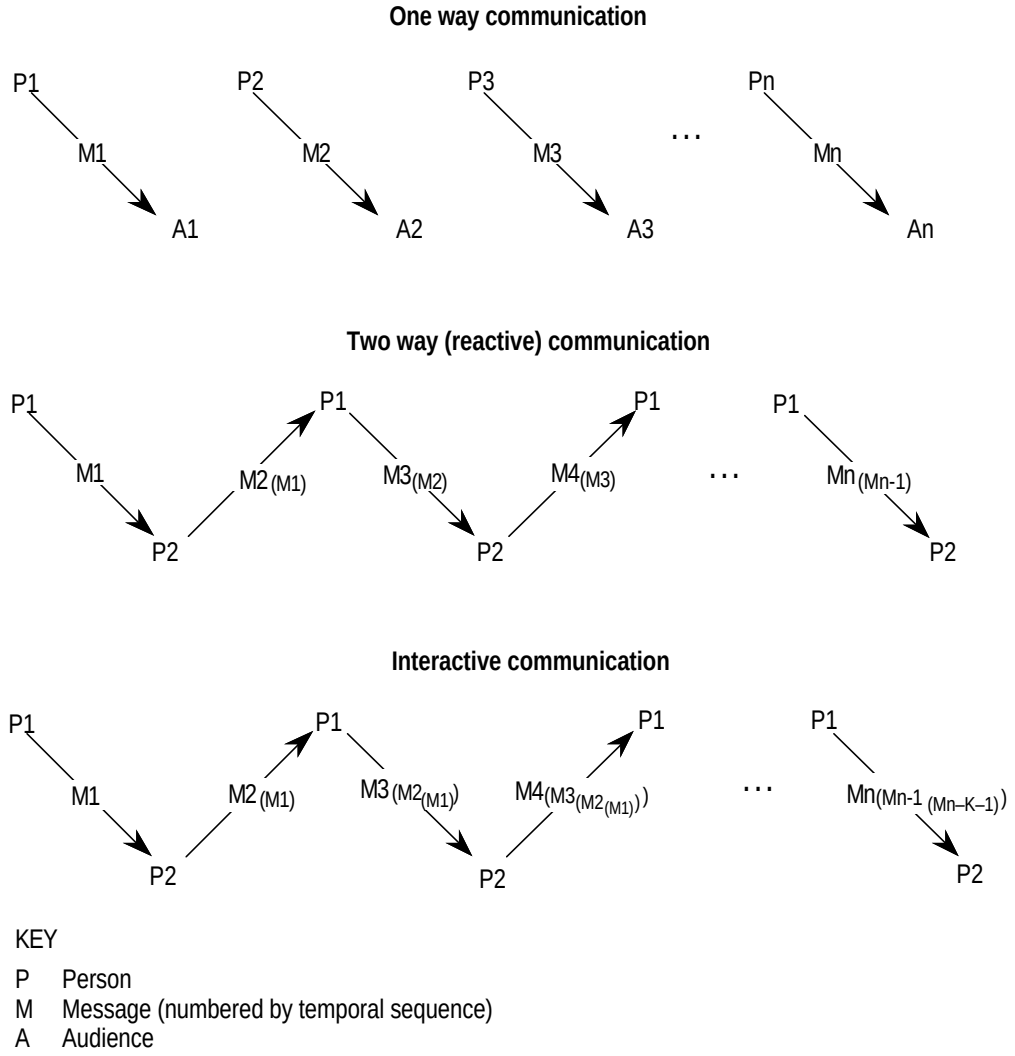

Figure 1. One-way, two-way, and interactive communication.

What does interactivity do? Interactivity in communication settings is associated with the attitudinal dimensions of acceptance and satisfaction. But it is also related to performance quality, motivation, sense of fun, cognition, learning, openness, frankness and sociability (Rafaeli, 1988). Interactivity operates in a supplementation mode. Quasi-interactive (reactive) media can allow people to use the media as a substitute for sociability. The human need for interaction (Beniger, 1987), when satisfied, allows people to use interactive media to bolster their favorable

disposition toward interacting with others. Interactivity can be shown to lead to more cooperation. What are the processes involved?

We turn now to an examination of issues that arise from research on group CMC.

EXPERIMENTAL EVIDENCE

Laboratory based, experimental work has uncovered a series of dysfunctional or problematic attributes of group CMC. Among the topics studied in the laboratory were flaming behaviors (McGuire, Kiesler and Siegel, 1987; Siegel, Dubrovsky, Kiesler and McGuire, 1986, Sproull and Kiesler, 1991), disinhibition and deindividuation (Hiltz and Johnson, 1989; Matheson and Zanna, 1989, 1990). Hiltz, Johnson and Turoff (1986) find CMC to be cold and unsociable when compared to FTF contexts. Somewhat more optimistic experimental work introduced findings on status levelling, consensus formation, group dynamics and brainstorming creativity and productivity (e.g. Dennis and Valacich, 1993; Dubrovsky, Kiesler and Sethna, 1991; Valacich et al., 1993; Osborn, 1953). Important as they may be, these concepts neither disprove nor explain either growth or the "glue" that keeps together CMC groups. The picture of group CMC painted by summing laboratory studies may be somewhat incomplete. The external validity of laboratory studies of group CMC is problematic for three reasons. (1) Most subjects in laboratory studies are an atypically captive audience. Experimental subjects (usually students fulfilling class requirements or paid) are not reflective of the group CMC environment. They are not voluntary participants who choose to participate. In any case, subjects' free coming and going (mostly coming) is not allowed, recorded or reported. (2) Groups studied in experiments tend to be small, usually a dozen participants or less. The "real life" experience of group CMC is of a much larger group. (3) An almost natural inclination of experimental design is to contrast computer mediated communication with a FTF standard of comparison. As discussed earlier, this contrast may be misleading.

SURVEY EVIDENCE ABOUT GROUP CMC

Many field studies of group CMC focus on the narrow bandwidth and cue deficiencies that typify CMC. Short, Williams and Christie (1976), Rice (1984), and Culnan and Markus (1987) use the term "social presence". Sproull and Kiesler (1991) refer to the "lack of social context cues". Trevino, Daft and Lengel (1990) mention "media richness". Taken together, these related terms suggest that CMC is best thought of as a task-related and/or problem-solving environment. In other words, much of the survey work on CMC hints at it not being a suitable context for social interaction. Others (e.g. Rice and Love, 1987) have uncovered actual emotional use of CMC, albeit often negative emotions. Self reports of CMC users are often in contradiction to the notion of media poverty; experienced CMC users rate CMC as richer than even FTF (Steinfield, 1986). Other field-based studies, mostly in organizational contexts, search for reasons people adopt or "use" CMC, frequently arriving at social influence or cultural construction explanations (e.g. Fulk, 1993; Steinfield, 1989; Schmitz and Fulk, 1991; Kraut, Rice, Cool and Fish, 1994). Common to these studies is a focus on constructs such as social influence and critical mass. These are all external qualities, not internal to the communication setting. A focus on content has led some to study creative ways in which members of CMC groups seek to break the bandwidth barrier. The topic of nonverbal behavior on the net, for example, has been the subject of much study (e.g. Carey, 1980; Hellerstein, 1989; Blackman and Clevenger, 1990).

Case studies of individual computer-mediated groups seem to be more upbeat and optimistic in their description of group CMC (c.f. Danowski and Edison-Swift, 1985; McCarty, 1990). Finholt and Sproull (1990) observed CMC groups within an organization behaving like real so-

cial groups, despite the fact that their members shared no physical space, were 'invisible', and their interaction was asynchronous. Hahm and Bikson (1989) report on a field study among retired and employed individuals, in which group CMC resulted in increased interaction among members of the group. From the perspective of searching for the "social glue", a description of the way in which computer-mediated groups come and hold together, it seems unlikely that either social presence or the use of emoticons is the answer. However, because they are case studies of single groups and often intraorganizational, these studies, too, do not offer a convincing driving force that would explain the cohesiveness, binding, "netting" force of group CMC. Group CMC is a sweeping enough social, volition-based phenomenon which deserves a social-level explanation.

RESEARCH FRAMEWORK

Our hypotheses relate to (1)the nature of messages, (2) the nature of interactive messages when compared to other messages, (3) the nature of interactivity on different networks, and (4) the nature of interactivity when comparing messages by the most active authors to the norm.

Generally, we expect to find that group CMC, as a whole, will display the same "preference for agreement" typical of FTF conversation. The interactive messages subset of group CMC will surpass all messages on these measures of agreement. In addition, interactive messages will be more opinionated, self-disclosing, humorous, and community oriented (using first-person plural). Networks will have different levels of interactivity, stemming from their differing structural arrangements. Authors who are more active (contribute more) will produce more interactive messages. Stated formally and specifically:

H1: The content of group CMC will demonstrate a preference for agreement

Group CMC is modelled on an extension of interpersonal conversations. As such, group CMC should contain a higher proportion of "agreeing" content than disagreeing content. McLaughlin (1984) summarizes how the conversational system has a built-in preference for accord among the conversants.

H2: If agreement is conversational, interactive messages are even more 'conversational', but also 'involving' more than average

We expect interactive messages, within group CMC, to be even more agreeable than the norm for FTF, or other messages. And while interactive messages may be even more agreeable than average, they will also be more opinionated, humorous, self-disclosing, and community oriented. We interpret more opinionated and self-disclosing content as indications that groups have gotten beyond preliminary introductions or when group members are only meeting for the first time (Duck, 1976). Sherblom (1990) has shown how the use of personal pronouns reflects the degree of involvement in organizations. Thus, we expect interactive messages to contain more first-person plural pronouns.

H3: Structural characteristics of networks affect their interactivity

Consider group CMC on the different networks. These differ in at least two ways: the manner in which messages are stored and disseminated, and whether group members pay to use the network. There should be differences in interactivity between voluntary nets and commercial nets. These differences are expected because there is a different implied social contract when one pays to participate. Compuserve special interest groups (SIGs) are man-

aged by sysops who may exercise varying degrees of editorial intervention. And there will be a difference between groups that appear to the reader as a newsgroup (Usenet) and those that appear (to the reader / subscriber / member) as individual messages (Bitnet Listserv groups).

H4: Interactivity is related to individual activity and communication salience of participants

Consider the difference between those who write often and those who make only infrequent contributions. Messages by frequent (active) authors differ in the amount and nature of interactivity of their messages than infrequent authors. We expect frequent authors to produce more interactive messages.

METHOD

The data reported here are the result of a content analysis effort. A large international and interdisciplinary group of researchers carried out a content analysis of a representative, random sample of publicly available communication content in computer mediated discussion groups. The project had its inception and entire existence online. A complete description of the methodology is available in Rafaeli, Sudweeks, Konstan and Mabry (1994). Additionaly, full copies of the data and message corpora, coding instruments, sampling and ethics policy statements are available online. See also Sudweeks and Rafaeli (1994) for a broader treatment of the group process and ethics issues. In this section we will provide a short account of sampling, coding and reliability practices.

Sampling

The sampling strategy aimed at obtaining a representative sample of message exchange over group CMC. Our goal was to address as broad a scope as possible. We needed to consider varying units of analysis: the single message, a thread, the group, and the network within which the group resided.

The sampling method chosen was of fixed-length message threads, at a given starting date, within randomly selected groups stratified to equal numbers by network type. Messages were selected over a restricted domain, in a single temporal sequence of 100 messages per each group. Equal numbers of groups were randomly selected from Bitnet, Usenet and CompuServe groups. Sampling was completely random, but common sense and the research purpose required exclusion of foreign language groups groups on local networks, announcement groups, help / support groups limited to specific products, test and control groups, groups whose contents are only excerpts of other groups selected by moderators, extremely low volume groups (lists with fewer than 25 messages and 3 authors during a selected test month). Some groups were excluded from the sample prior to random sampling where clearly inappropriate. Otherwise, lists meeting exclusion criteria were rejected after selection.

Corpora of messages were downloaded from three networks of group CMC: Internet's Usenet, Bitnet Listservs, and Compuserve SIGs. Populations of groups were compiled. Comprehensive lists of all groups were obtained from the appropriate servers on the respective networks, and the sample groups were screened and random-number sampled, resulting in group numbers as outlined in Table 1.

The sampling period began on Monday 15 March 1993. Volunteer members shared the task of downloading, using several news servers in locations around the world. Articles were collected according to the date and time of arrival at each news server. Including the post-sampling

screening, 77 Bitnet lists, 39 Usenet newsgroups and 23 CompuServe SIGs were selected to get samples of 20 groups for each network. Due to coder attrition, the final database contains complete data for 40 lists (including 10 duplications), and partial data for 4 additional lists, totalling 4322 messages.

Table 1. Groups and messages sampled and coded.

	Bitnet	*Usenet*	*CompuServe*
Pre-filtered groups	3485	1868	337
Post-filtered groups	1907	986	94
Groups in completed sample	10	12	10
Duplicated groups	2	5	5
Messages in completed sample	1128	1694	1500

Coding

A codebook containing 46 closed items was prepared and pretested by all coders. At first, the codebook was constructed in a brainstorming process, carried out publicly and online, with dozens of project members taking part. The codebook formation process involved several iterations and drafts. The rewriting of the codebook and pretests were repeated until we acheived average agreement percentages exceeding 90% on all items. The items included in the codebook are listed in Appendix 1.

Each batch of 100 messages downloaded from selected groups was prepared for coders. Computer programs were written to: (1) split files of 100 messages into individual files; (2) renumber, if necessary, in numeric alphabetical order; (3) precode the first six variables: CODERID, LISTID, MSGNUM, AUTHORID, MSGTIME and MSGDATE; (4) compile a cumulative database of authors across all lists; and (5) reassemble processed messages in one file.

After coding, data was exported as ascii files and emailed to an account dedicated to data processing. Automatic verification and manipulation followed, including five stages: (1) check if incoming mail is data; (2) check for errors; (3) check for completeness; (4) manipulate the database into usable representation; and (5) status report to coder and coordinator.

Coders of each list completed a questionnaire to gather descriptive information about the coders, the technology used, impressions of the list, and problems experienced. Data from this questionnaire are not reported in this paper.

Reliability

Approximately one-third of the lists were double coded to establish reproducibility and reliability of coding. Of the 37 lists (batches of 100 messages) distributed to the research group members, 20 were single coded, 12 were double coded, and 5 were not coded. Of the 32 coded, 4 were unfinished, giving a final tally of 20 single coded and 10 double coded complete lists. The database(s), therefore, has a total of 4322 messages from 30 fully-completed lists, and 4 partially completed lists. Of these, 3322 are unique messages. In addition, there are 1000 doubled-up codes.

It was important to maintain independence of coding, particularly those lists that were double coded. To eliminate a possible source of invalid (inflated) reliability, coders were discouraged from discussing coding problems amongst themselves or within the group. Coder queries were directed, instead, to an advisory committee of twelve members. Each advisor, or “oracle”, fielded questions on a section of the codebook, responding in a non-directive manner.

The typical practice was for an enquiry to be posted to the advisory committee, the specialist oracle—or the leader (the "Commissioner of Oracles") if the appropriate oracle was not available—would post a recommended response, all oracles would comment on the response, and the Commissioner would summarise oracle recommendations and post the final recommendation to the enquirer and / or the group.

RESULTS

The database of messages and content-analysis values contains data about 4322 messages. These messages represent three networks (Usenet, Bitnet, and Compuserve), 32 groups (lists), and the efforts of about 40 separate coders spread around the world.

The first reportable result was that the project was completed and a usable database was made available. Some evidence for the success of this group is in the measures of the reliability of coding between coders by variables. In this paper we do not report on reliabilty of the data, other than saying that, on average, intercoder agreement exceeded 75% for the variables used in the following analyses, in the lists for which double codes were available. Reliability measures in a project such as this are complicated, and should include coder-, list-, variable-, and network-focused orientations. We leave this analysis for another time.

Interactivity varied among groups from a high level of 40% in some groups, to absolutely no interactive messages in some groups. On average, just under 10% of the messages were coded as directly referring to how previous messages related to others. We consider these 388 messages to be interactive messages. More than half the sample of messages (52.5%) were coded as referring to a single message that preceded them. These 2269 messages are considered "reactive". Table 2 compares characteristics of reactive, interactive and all messages in the sample.

Almost one third of the messages in the corpora quoted other messages verbatim (QUOTE1). Interactive messages were slightly longer than reactive messages. Reactive messages, in turn, were slightly longer than all other messages. The differences in length were not large.

Fully 57% of all messages (first column) contain statements of facts. More than a quarter of the messages contain a question or request. Examined in a different way, when coders classified the overall nature of each message, they found 40% of the messages to be primarily providing information, probably in response to the 14.6% of the messages that were predominantly requests for information. The other half of the message body was classified as "mixed" (22%), opinionated (18.7%), and persuasive (3.6%).

It appears that messages exchanged by participants in group CMC are predominantly factual, conversational, agreeable, and supportive. More than one in every five messages contained at least an attempt at humour. And more than a third of the messages contain personalizing content, in the form of a verbal self-disclosure, an admission or introduction. 9.3% of the entire corpora of messages use first-person plural pronouns. Messages were more likely to contain agreement than disagreement. This finding is repeated, using both measures of the expression of opinion about statments and persons within the list ((16% over 12% agreement to disagreement) and opinions external to the list (9.5% to 5.2%).

Among interactive messages (reading across Table 2), there is more statement of opinion in general, and specifically more expression of agreement. For example, interactive messages contain statements of agreement with persons or statements on the list twice as often as the general sample. Likewise, and even more interestingly, interactive messages are twice as likely as the general sample to contain statements of agreement. Using both the internal-to-the-list and the external measures, we find interactive messages to be even more agreeable than messages overall. These differences are statistically significant. Interactive messages contain more opinions, more self disclosure, and more than twice as much use of first-person plural pronouns.

Table 2. Messages content and nature: All messages vs. interactive messages (percentages)

	All messages (N=4322)	Interactive (N=388)	Reactive (N=2269)
Contains agreement within list/group (COALIT1)	16.0	30.7(+)	19.6(-)
Contains disagreement within list/group (COALIT1)	12.0	21.1(+)	15.9(-)
Contains agreement with persons/statements external to the list (EXTCOAL)	9.5	17.5(+)	9.6(-)
Contains disagreement with persons/statements external to the list (EXTCOAL)	5.2	10.4(+)	5.7(-)
Primarily provide information (NATURE=1)	40.1	26.8(+)	41.9(-)
Contain a fact (FACT)	57.1	61.9	60.6
Primarily request information (NATURE=2)	14.6	8.5(+)	8.4(=)
Contain a question (QUESTION)	26.5	32.0(+)	21.5(-)
Primarily opinionated (NATURE=3)	18.7	24.0(+)	24.0(=)
Contain an opinion (OPINION)	50.0	67.7(+)	57.3(*)
Contain self-disclosure (FIRSTPER)	35.3	41.0(+)	36.8(-)
Attempting humour	20.8	27.1(+)	17.8(-)
Use of first-person plural (COALIT2)	9.3	24.5(+)	9.1(-)

Reactive messages are those coded as responding to one message Interactive messages are those coded as containing references to the manner in which previous messages related to those preceding them.

Significance (Mann Whitney U Test):
(+) Interactive messages differ significantly ($p<0.001$) from noninteractive.
(=) Reactive messages differ significantly from noninteractive but not from interactive.
(*) Reactive messages differ significantly from interactive AND noninteractive.
(-) Reactive messages differ significantly from interactive but not from noninteractive.

Reactive messages resemble the general sample (and differ from interactive messages) in all these respects, with two exceptions: Reactive messages are as opinionated as interactive messages, and they tend, like interactive messages, to contain fewer requests for information. Interactive messages do not differ from others in how factual they are.

Table 3 displays the distribution of reactive and interactive messages by the three networks. Listserv mediated messages were significantly less interactive than either Usenet or Compuserve SIG messages. Compuserve SIG messages were least likely to contain no reference to previous messages.

Table 3. Networks and interactivity level

A. Interactivity:

11% of Usenet messages were coded as interactive.

3.8% of Bitnet messages were coded as interactive.

10.3% of Compuserve messages were coded as interactive.

B. Reactivity:

	Network type			Row
DEPEND1	Usenet	Bitnet	Compuserve	Total
Not at all	782	429	174	1385
	46.3	38.1	11.6	32.1
Yes, 1 message	664	554	1051	2269
	39.3	49.2	70.3	52.7
Yes, >1	147	59	82	288
	8.7	5.2	5.5	6.7
Yes, a sequence	96	83	187	366
	5.7	7.4	12.5	8.5
Column	1689	1125	1494	4308
Total	39.2	26.1	34.7	100.0

Overall, 1450 different authors contributed messages to the corpora content analyzed here. The most frequent contributor is responsible for 39 messages, however most frequent contributors had about a dozen messages. More than two thirds of the sample of messages were written by authors who appear in the sample only once or twice. Table 4 displays interactivity and reactivity of messages by frequent contributors. Messages by the most frequent contributors (10 or more messages per author), as well as those by frequent contributors (4 to 9 messages per author), are significantly more reactive than the norm. However, messages by frequent authors are not more likely to be interactive.

Table 4. Interactivity and reactivity in messages by frequent contributors (percentages)

	Messages by most frequent contributors (10 or more msgs) (N = 1021)	Messages by frequent contributors (4 to 9 msgs) (N = 691)	Entire sample (N = 4322)
Interactive messages	9.0	10.1	9.0
Reactive messages (responding to only one preceding message)	70.2(*)	60.5(*)	52.5
Reactive messages (responding to one or more preceding messages)	87.0(*)	81.3(*)	67.7

Significance: (*) connotes significantly different from rest of sample, using Mann Whitney U test.

DISCUSSION

Communication theory is based on a split in levels of analysis. Individual level motivations and the building blocks for social, interpersonal relationships reside in the minds of the relational partners. But the actual social actions and relations are transacted through observable behaviors, the exchanges of messages (Watzlawick, Beavin and Jackson, 1967; Cappella, 1987, Palmer, 1994). When we come to the new reality of group CMC there is yet another split. That which is communicated, the messages, is the fruit of an unknown proportion of the participating audience—only those who actively contribute. There is a silent portion of participants about whom we can only speculate. In a time when much is spoken of virtual reality, there may be a big irony here.

The most "real" part of the social phenomenon of communication is the text exchanged. More real even than the groups, people, and emotions involved. This paper follows this irony, by focusing an empirical lens on the "real" artifacts of a new kind of communication. In a departure from previous perceptions, we believe the groups formed on the net are neither pseudo (Beniger, 1987), nor imagined (if that is what 'virtual' means, e.g. Palmer, 1994). We believe the documented presence of interactivity in the behavior of these groups is both evidence for their reality, and a mechanism for their formation.

We are still far from a theory of interactivity. But these data may bring us slightly closer. The findings reported here do not prove the proposed definition of interactivity, or its role in group CMC, namely that interactivity leads to engagement. A typical lament of communication studies is of the paucity of data. This paper is no exception to that practice. The data reported here are based on content analysis alone. There are no behavioral correlate measures available here. We are aware of the fact that "lurkers", those who read bu do not contribute, are just as much part of group CMC as the active authors. There is only little dynamic, time based information in these data, content-analyses alone are unidimensional and therefore too poor to capture the full model of interactivity. And the sample was, after all, collected within a limited time period. To study interactivity in all its gore or glory, we need (but may never really have) access to simultaneous, ongoing and longtitudinal reliable measures of attitudes and behaviors, in addition to communication content.

However, the central claim of this paper, that interactivity plays a role in creating the attraction of networks and in generating their growth patterns has provided some support. The contribution here is an unprecedented, cross-sectional, representative account of group CMC. These data indicate a certain relationship between interactivity and captivating / engaging communication parameters as well as discrimination between varying levels of interactivity.

The results reported here support some of the hypotheses. While there is a 'propensity to agree' displayed in all messages, this propensity is enhanced in interactive messages, along with (and maybe despite) the fact that interactive messages are more opinionated. Interactive messages are significantly more humorous, and more likely to contain self disclosure. Interactive messages are more than twice as likely to contain first-person plural pronouns in reference to members of the list, indicating that interactivity is associated with a sense of involvement and belonging. In addition, there are significant structural correlates of interactivity. The networks differ in the interactivity and reactivity of their messages.

The single unsupported hypothesis is the predicted association between frequency of contributions by the author and interactivity. Frequent authors write significantly more reactive messages, but are just as likely as all others to write interactive messages.

And these data contain indirect validation of the construct of interactivity itself: (1) Not all networked content is interactive. Interactivity is a variable. In other words: messages, threads and groups can be more or less interactive. Group CMC is not necessarily interactive. In fact, it is more often humorous, playful or reactive. But it can be interactive. (2) The continuum leading from no interactivity through reactive messages, to fully interactive sequences received some substantiation. These data discriminate well (by nature of the messages, differences between

networks, and the qualities of messages written by frequent contributors) between interactive, reactive and other messages. In other words: interactivity is a richer construct than a plain dichotomy. And, (3) several postulated behavioral correlates of interactivity were shown to covary with the interactivity of messages. In other words: it matters whether messages, threads or groups are interactive.

In summary, the interactivity construct is, at once, deceptively simple and profoundly (perhaps dangerously) predictive. The underlying hypotheses about interactivity suggest that less interactive uses of the net are not likely to see stable memberships. Individuals may come, but they will not tarry. While less interactive groups may be or become large, active or famous, they may be doomed to a rotating-door, shifting existence. In such groups there could be many who stop to visit, but few would be "netted" to stay because the content offerings are reactive at best. On the other hand, interactive groups are more likely to sustain their memberships, and yield other desired outcomes, such as symmetry in contributions, creativity and productivity, agreement, humour, and sense of belonging. In addition, our data show that structure of CMC lists is related to how interactivity. This finding suggests design practices, or at least further study to isolate causality. If interactivity proves to serve in this predictive role, it can turn from just a theoretical construct to practical use as well. Longevity of groups in this (stability) sense has obvious implications for the planning of nets, their management, and issues of ownership, pricing, and control.

Future work on interactivity can try to address the theoretical as well as the practical aspects. Will the speculations just outlined prove true? Is it possible to increase interactivity through structural interventions? Baseline measures of the content of public, large scale group CMC are now available. Longitudinal follow-ups, in which the comprehensive trend is measured, are obviously indicated.

Our data give rise to, but do not answer, a few curious questions. Does interactivity relate to group size? Is there a negative correlation between group size and interactivity? Is there an optimal size of group in the CMC context, analogous to the case in small groups? Does interactivity act the same in synchronous contexts?

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Appendix 1.. Codebook items and short descriptions

No	*Variable*	*Brief description and comments*
1	CODERID	Automatically supplied
2	LISTID	Automatically supplied
3	MSGNUM	Automatically supplied
4	AUTHORID	Automatically supplied
5	MSGTIME	Automatically supplied
6	MSGDATE	Automatically supplied
7	MSGLINES	Number of lines?
8	SUBJECT	Is it appropriate?
9	NOISE	Misdirected message?
10	FIRSTPER	Self disclosure?
11	OPINION	Does message contain an opinion?
12	FACT	Does message contain a fact?
13	APOLOGY	Does message contain an apology?
14	QUESTION	Does message contain a question / request?
15	ACTION	Does message contain a call for action?
16	CHALLENGE	Does message contain a Challenge / dare?
17	HUMOUR	Does message contain attempts at humour?
18	METACOMM	Does message contain metacommunication?
19	FORMAT	Is the message formatted appropriately?
20	STYLE1	Appropriate / excessive use capitalization?
21	STYLE2	Is there colloquial spelling?
22	NATURE	Overall rhetorical style
23	EMOTICON	Icon for emotion?
24	EMODEVICE	Device for emotion?
25	ARTICON	Art, other than emotion
26	GENDER1	Male / female?
27	GENDER2	How identify?
28	GENDER3	Gender cues?
29	GENDER4	Gender issues?
30	QUOTE1	From this list?
31	QUOTE2	From other CMC?
32	QUOTE3	From non-CMC?
33	DEPEND1	Reference to previous message or messages?
34	DEPEND2	Message number referenced?
35	DEPEND3	Is there reference to how previous messages related to even earlier messages?
36	DEPEND4	Introduce new topic?
37	COALIT1	Does message contain agreement / disagreement with persons or ideas ON the list?
38	COALIT2	Does message contain use of first-person plural pronouns (“us”, “we”) about the group?
39	COALIT3	Directly address any persons on the list?
40	EXTCOAL	Does message contain agreement / disagreement with persons or ideas OFF the list?
41	FLAME1	What is the rhetorical tone?
42	FLAME2	Does message contain coarse language?
43	FLAME3	Does message attempt to avoid tension / calm?
44	STATUS	Is there mention of status of author?
45	SIGNAT1	Does mention contain any / stylized signature?
46	SIGNAT2	Does signature contain quotation?