Relational Communication in Computer-Mediated Interaction

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This study involved an experiment of the effects of time and communication channel—asynchronous computer conferencing versus face-to-face meetings—on relational communication in groups. Prior research on the relational aspects of computer-mediated communication has suggested strong depersonalizing effects of the medium due to the absence of nonverbal cues. Past research is criticized for failing to incorporate temporal and developmental perspectives on information processing and relational development. In this study, data were collected from 96 subjects assigned to computer conferencing or face-to-face zero-history groups of 3, who completed three tasks over several weeks' time. Results showed that computer-mediated groups increased in several relational dimensions to more positive levels and that these subsequent levels approximated those of face-to-face groups. Boundaries on the predominant theories of computer-mediated communication are recommended, and principles from uncertainty reduction and social penetration are discussed.

When we move from face-to-face conversations to dialogs over computer terminals, the communication is purely verbal. The work done non-verbally now has to be realized verbally. How are realizations of (communicative) functions altered over the change of channels?

—Hobbs (1980, p. 65)

High tech/high touch is a formula . . . to describe the way we have responded to technology. What happens is that whenever a new technology is introduced into society, there must be a counterbalancing human response—that is, *high touch*—or the technology is rejected. The more high tech, the more high touch.

—Naisbitt (1982, p. 39)

Computer-mediated communication (CMC) systems have become popular tools among large organizations and among private computer users. In university and military research, CMC networks con-

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nect workers across the globe (see Rice, 1980). In automated office systems, CMC follows word processors and electronic spreadsheets as the most popular application (Rockart & DeLong, 1988). In electronic bulletin boards in every major city, invisible organizations of computer aficionados post and retrieve messages (Allen, 1988). In high-tech organizations and research facilities, people collaborate in "computer supported cooperative work" (Greenberg, 1991) or deliberate via "electronic meeting systems" (Dennis, George, Jessup, Nunamaker, & Vogel, 1988). Teachers and students separated by geography use CMC in "distance education," while many on the same campus supplement their classes through "online education" (e.g., Harasim, 1990). Although the existence of these systems reaches back a scant 2 decades, their utility is evidenced by their popularity. For many of us, CMC is no longer a novelty but a communication channel through which much of our business and social interaction takes place, and this transformation is expected to continue; "in the Nineties . . . Steve Jobs of Next Computer suggests rechristening (personal computers) '*inter*-personal computers' " (Kirkpatrick, 1992, p. 96).

As the opening epigraph suggests, the dissemination of CMC has also generated some concerns about how the new medium might alter communication, compared to more traditional interaction. Of general interest to the study of human communication are larger questions about how people adapt to the restrictions of the media. What happens in the transformation to fewer communication channels? Will communicators find ways to make the media suit their various goals, choose different media for different goals, or will reliance on the medium force communication to be less "interpersonal"?

Accordingly, in the past decade and a half, the study of CMC has become a growing field. One dominant view held in this new area is that CMC produces much different affective and relational patterns than do other types of communication, due to the reduction and types of cues available to participants. Consistent with this position, several empirical studies report that CMC is less personal or socioemotional than is face-to-face (FTF) communication (Hiltz, Johnson, & Turoff, 1986; see Rice, 1984). These reports have mixed implications for CMC:

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Discussions with a heightened task focus may make electronic deliberations more efficient. At the same time, a reduced tendency to express support or agreement makes group consensus less likely, and may be less satisfying to participants (see Connolly, Jessup, & Valacich, 1990; Hiltz et al., 1986).

But in the rush to describe and catalogue effects, theories may have developed and become reified prematurely. There is reason to question the validity of many claims about how CMC group members relate to one another in light of (a) other knowledge about group processes and relational communication (i.e., the messages that people use to define their interpersonal relationships), (b) contradictory findings from field studies, and (c) design, timing, and measurement features in previous experiments. Other time frames and other measures might well reveal alternative patterns.

Recent work has enumerated these criticisms, suggesting weak effects of the medium and the adaptation of relational communication over time in CMC (Walther, 1992b). The current investigation reports an initial test of these alternative predictions. First, previous theories and research of CMC are reviewed and critiqued. The thrust of this discussion is that the fixed, impersonal qualities imputed to CMC may not be inherent to the medium but strictly bounded to certain specifiable conditions and kinds of partners. Second, an experiment is reported that applies a multidimensional and longitudinal analysis of relational communication in one form of CMC—asynchronous computer conferencing—and in FTF group interactions, intended to explore whether the differences between CMC and FTF during initial and subsequent encounters are differences in rate but not in kind.

INTERACTIVE MEDIA THEORIES AND CMC RESEARCH

Social presence theory (Short, Williams, & Christie, 1976) has been used to account for task-oriented and impersonal tone in CMC (Culnan & Markus, 1987; Hiltz et al., 1986; Rice, 1984; Steinfield, 1986). Social presence is defined as the degree of salience of another person in an interaction and the consequent salience of an interpersonal relationship. Social presence is said to be a differential property of communication media: The fewer the channels or codes available within a medium, the less the attention paid by the user to the

presence of other social participants. Short et al. (1976) stated that electronic communication systems differ in their "capacity to transmit information about facial expression, direction of looking, posture, dress and nonverbal, vocal cues" (p. 65). Computer-mediated communication, with its paucity of nonverbal elements and feedback cues, is said to be extremely low in social presence in comparison to face-to-face communication. When social presence is lower, messages presumably are more impersonal. The CMC literature also suggests that because the nonverbal codes are generally those that carry relational information, it is the loss of this particular information in written-only CMC that causes unemotional or undersocial communication.

In related research, Sproull and Kiesler (1986) defined the critical difference between FTF communication and CMC as having to do with the absence of "social context cues" in CMC. Social context cues include aspects of physical environment that define the nature of the social situation and the actors' relative status. In FTF settings, these cues might be conveyed by spatial features, artifacts, physical adornments and personal appearance, and actors' dynamic nonverbal behaviors (Dubrovsky, Kiesler, & Sethna, 1991; Siegel, Dubrovsky, Kiesler, & McGuire, 1986; Sproull & Kiesler, 1986). The absence of such cues in CMC leads to increased excited and uninhibited communication such as "flaming" (insults, swearing, and hostile, intense language), greater self-absorption versus other-orientation, and messages reflecting status equalization (Kiesler, Siegel, & McGuire, 1984; Siegel et al., 1986; Sproull & Kiesler, 1986). The lack of social context cues is also conducive to equalized participation. When these cues are absent, actors who would otherwise defer speaking turns to higher-status participants become disinhibited (see also Hiltz, Johnson, & Agle, 1978).

Social presence theory and the lack of social context cues hypothesis both point to similar causes and effects regarding the relational nature of CMC. Indeed, these theories have been collectively dubbed the "cues filtered out" approach by Culnan and Markus (1987), who articulated their common assumptions: "(1) communication mediated by technology filters out communicative cues found in face-to-face interaction, (2) different media filter out or transmit different cues, and (3) substituting technology-mediated for face-to-face communication will result in predictable changes in intrapersonal and interpersonal variables" (p. 423). Because this perspective implies "that the structure or bandwidth of the medium alters the nature and

interpretation of messages," one critic observed, "it implies that such effects are inherent, constant, and context-invariant. By implication, there are no identifiable boundary conditions associated with this perspective" (Walther, 1992b, p. 58).

PROBLEMS IN CMC RESEARCH

The inherency, constancy, and unboundaried aspect of the cues-filtered-out perspectives may be challenged on several grounds. While a detailed critique of the literature is available elsewhere (see Culnan & Markus, 1987; Lea, 1991; Rafaeli, 1988; Walther, 1992b; Williams, Rice, & Rogers, 1988), a synthesis of some of this criticism is instructive. Recent criticism has focused on time effects, inconsistent and unexplainable findings, and methodological shortcomings.

Time may be a confound in CMC research. Testing periods in CMC laboratory experiments have often been brief, and CMC users' typing requirements reduce the number of messages they transmit in the same period as FTF communicators (Hiltz et al., 1986; Siegel et al., 1986; see also Rice, 1980). Yet in studies where CMC groups had unlimited time, the number of messages they exchanged was no different than in FTF groups (Dubrovsky et al., 1991; Weisband, 1989). These findings suggest that rate of communication differs between CMC and FTF. Time-limited experiments may therefore constrain users' opportunities to develop interpersonal relations, and differences in the tone of CMC versus FTF may be the indirect result of abbreviated opportunities for relational development in CMC, rather than direct effects of the medium (Walther, 1992b). Field studies, in which user interaction time is not constrained, have found greater levels of socioemotional content in CMC than has laboratory research (e.g., Rice & Love, 1987; Steinfield, 1986), findings not accounted for by the cues-filtered-out approach.

The selection and analysis of data units in previous research has been questioned. Most early CMC studies employed ratings by outside observers who coded CMC and FTF transcripts. The failure to include the relational nonverbal behaviors of FTF control groups presents a very strong possibility that negative socioemotional or task-oriented cues in these settings were ignored in analyses. Criticism has also been levied against the coding measures used in past research. Adaptations of Bales's (1950) interaction process analysis

system provide limited potential for coding task- versus socioemotional communication (Lea, 1991; Walther, 1992b; see McGrath, 1984), much less other relational dimensions.

VERBAL/TEXTUAL ACCOMMODATION OF RELATIONAL CUES

If the relational tone effects of the cues-filtered-out research are limited to initial interactions among strangers, then changes in relational communication should be expected to occur when such communicators continue their interactions over time. Some CMC researchers have posited that CMC users may come to adapt their textual messages to socioemotional content (Hiltz & Turoff, 1978; Rice & Love, 1987), but no compelling explanation or evidence has yet been offered for this phenomenon.[1]

A social information-processing perspective[2] offers an alternative approach to explaining relational communication development in CMC (Walther, 1992b). This perspective recognizes that limited-time encounters in computer conferencing preempt normal social penetration processes in relational development. Extended interactions, however, should provide sufficient information exchange to enable communicators to develop interpersonal knowledge and stable relations. Because CMC groups take longer to communicate than FTF groups, CMC and FTF groups may operate at different rates of social information exchange. The limited bandwidth of CMC offers less total information per exchange than does FTF exchange, and the progression of relational development should therefore be slower in CMC than FTF. CMC partners may require more verbal message exchanges than will FTF partners in order to achieve similar effects. Eventually, however, these levels should converge. Thus the depersonalizing effects of CMC may be limited exclusively to initial interactions, especially among unacquainted partners (Walther, 1992b).

An underlying assumption in this discussion is that verbal and textual behavior can convey relational meanings. Some readers may not dispute this notion; however, it deserves comment nevertheless. After all, the cues-filtered-out research suggests that it is unlikely, and much research on relational communication "has focused on nonverbal codes as best suited to the relational function, relegating verbal codes to a content function" (Donohue, Diez, Stahle, & Burgoon, 1983,

TABLE 1
Verbal/Textual Cues of Relational Communication

Immediacy/affection
- Verbal immediacy (Wiener & Mehrabian, 1968)—grammatical and lexical measures of spatio-temporally indicative demonstratives, denotative specificity, selective emphasis, agent-action-object relationships

Receptivity/trust
- Self-disclosure (Burgoon & Hale, 1984)
- Vulnerability pattern[a] (Millar & Rogers, 1976)
- Freely stated overt judgments (Knapp, 1984)

Composure/relaxation-arousal
- Flaming (Kiesler et al., 1984, 1985)
- Language intensity (Bradac, Bowers, & Courtright, 1979)
- Intentional misspellings, punctuation marks (Carey, 1980)
- Capitalization (Allen, 1988)
- Relational icons (Asteroff, 1987)

Formality-informality
- Form of address communicators use (Argyle & Cook, 1976)
- Lexical surrogates[b] (Carey, 1980)
- Formal expressions (Kiesler et al., 1985)

Dominance/inequality-submissiveness/equality
- Proportion of group participation (Kiesler et al., 1984)
- Manipulation of verbal floor-managing cues (Shimanoff, 1988)
- Relational control grammatical constructions (e.g., imperatives), compliance-seeking (Millar & Rogers, 1976; Rogers & Farace, 1975)
- Redundant signature (Sherblom, 1988)

Similarity/depth
- First-person plural, private symbols, verbal shortcuts (Knapp, 1984)
- Self-disclosure (Burgoon & Hale, 1984; Kiesler et al., 1985)

a. Vulnerability pattern is the combined frequencies of the times when actors have put themselves in a position of vulnerability to another; a vulnerable position is one in which outcomes are controlled by the other and outcomes are potentially less rewarding than the actor's costs.

b. For example, typing out "hmmm" or "yuk."

p. 1). However, language behavior and verbally transmitted message strategies may also convey relational messages (Burgoon et al., 1987). Examples of such language-based indicators derived from communication literature are offered in Table 1. Other behaviors that may affect relational meanings have been discovered in CMC interactions. These, too, appear in Table 1.

As communicators develop relationships over time, the character of their relational communication in CMC is expected to change in

proportion to message accumulation. According to Burgoon and Hale (1984), there is a multidimensional set of relational themes that people use to define their relationships; tests have confirmed that communicators do deploy and recognize communication performances of these dimensions (e.g., Burgoon et al., 1987; Burgoon & Hale, 1987; Burgoon & Newton, 1991; Burgoon, Newton, Walther, & Baesler, 1989). These relational *topoi* include *intimacy*, which is comprised of *affection, immediacy, receptivity, trust,* and *depth.* Empirically, immediacy and affection cluster together, as do receptivity and trust, whereas depth (or familiarity) clusters with another theme, *similarity* (Burgoon & Hale, 1987). Remaining themes are *composure/relaxation, formality, dominance/inequality,* and *task-social orientation.*

Changes in these relational dimensions are expected through message exchange as interaction history develops. Social penetration theory (Altman & Taylor, 1973) predicts that communicators develop more affiliative relationships as their interactions continue. Rather than continuing to become infinitely more intimate and personal, however, Knapp, Ellis, and Williams (1980) suggested a modified view of relational trajectories: When interpersonal relationships develop, several dimensions of relational/communicative behavior increase linearly toward greater affiliativeness until reaching plateaus of relational stabilization. While these general trends may occur in several dimensions, Knapp et al. (1980) noted that the precise progression rate or plateau in any one dimension may differ from those of other dimensions. Based on previous research in interpersonal, group, and computer-mediated communication, the following predictions about the valences of relational communication in initial interactions are posited for FTF and CMC groups. Predictions for their subsequent development through available cues are advanced as well.

Immediacy/Affection

The immediacy/affection construct—incorporating affection, inclusion, and involvement (Burgoon & Hale, 1984)—appears the least likely to gain in CMC according to the characterizations of CMC from the cues-filtered-out perspective. On the other hand, research on immediacy indicates that the verbal channel not only conveys immediacy but may compensate for immediacy reductions in other channels (Argyle & Cook, 1976; Argyle & Dean, 1965; Donohue et al., 1983; Wiener & Mehrabian, 1968).

Although initial interactions among unacquainted others in CMC may be relatively low in immediacy/affection, interactants may increase in this dimension over time. FTF interactants may more easily manifest this increase through nonverbal and verbal cues, producing a rapid initial increase that should then plateau (in accordance with Knapp et al., 1980). This could easily produce a quadratic trend for FTF. CMC interactants, limited to verbal cues, should reach this same level of immediacy/affection but more gradually. The CMC trend may be linear. Accordingly, the following hypotheses were offered:

H1: Initial messages among previously unacquainted interactants in CMC are lower in immediacy/affection than are later messages.

H2: The effect of message frequency on immediacy/affection is mediated by the communication channel such that (a) immediacy/affection is greater in initial FTF than in CMC conversations and (b) immediacy/affection increases and converges in FTF and CMC after many exchanges in both conditions; that is, initial intercepts are higher in FTF than in CMC, both become more immediate/affectionate, and terminal positions converge.

Similarity/Depth

This dimension of relational communication pertains to the degree to which a communicator stresses similarities and interest in a deeper relationship as well as how familiar and nonsuperficial the relationship is. Knapp (1984) claimed that as relationships develop, partners' communication becomes less awkward and strained, and more smooth and similar. In social penetration theory (Altman & Taylor, 1973), depth refers to the degree of knowledge about personal information that relational partners have of each other. This information is transmitted through self-disclosure, so that the degree of disclosure "indexes" the depth of the relationship (Burgoon & Hale, 1984). Although some self-disclosure may occur among strangers, it is generally less expected in the early stages of ongoing relationships than in later stages. One study that examined this particular phenomenon in CMC and FTF dyads found "no main effects of conditions on self-disclosure" (Kiesler, Zubrow, Moses, & Geller, 1985, p. 94). In general, depth is more likely to increase as conversations continue. Considering the ability for communicators to reveal attitudes through verbal/textual cues regardless of additional nonverbal cues (see Byrne & Clore, 1966), the progression of similarity/depth should be similar between the two media conditions. Two further hypotheses were formulated:

H3: Initial messages among previously unacquainted interactants in CMC are lower in similarity/depth than later messages.

H4: Depth increases monotonically in both CMC and FTF as the number of exchanges increases (i.e., initial intercepts are not expected to differ and both conditions reflect a similar positive linear trend).

Composure/Relaxation

The composure/relaxation dimension reflects the degree to which communicators express relaxation and calm or tension, discomfort, and nervous arousal (Burgoon, Buller, & Woodall, 1989; Burgoon & Hale, 1987). Initial interactions in CMC should be less relaxed and composed and more tense and aroused than later interactions. Many relationships become more relaxed as they develop (Knapp, 1984), and arousal reactions to immediacy violations dissipate as communicators grow accustomed to each other (Le Poire, 1989). Communicators who may at first be anxious about meeting new partners should relax as their uncertainty is reduced by interpersonal knowledge acquisition. Kiesler et al. (1985) found that CMC and FTF communicators' physiological arousal (pulse and palm sweat) declined significantly across three measurement points in both conditions. At the same time, slower uncertainty reduction due to the absence of nonverbally-transmitted information may yield less composure in CMC than in FTF in initial conversations only.

H5: Initial messages among previously unacquainted interactants in CMC are lower in composure/relaxation than are later messages.

H6: Composure/relaxation is mediated by the communication channel such that (a) composure/relaxation is greater in initial FTF than in CMC conversations and (b) composure/relaxation increases and converges in FTF and CMC after many exchanges in both conditions; that is, initial intercepts are higher in FTF than in CMC, both become more composed/relaxed, and terminal positions converge.

Formality

There are mixed expectations for the communication of formality in CMC. Initial FTF interactions are typically somewhat formal (Berger & Calabrese, 1975), and relationships generally become more informal as they develop (Knapp, 1984). In the case of groups who interact only in the context of task resolution, however, informality

should not be expected to become extreme. A plateau level of moderately high informality should be achieved in time.

There is some reason to believe that the medium might override the traditional process in this case. According to Siegel et al. (1986), the lack of turn-taking in computerized group meetings may lead to greater informality. In this respect, group conferencing systems are drastically different from FTF meetings. In asynchronous computer "meetings," participants each read and write independently of each other's active presence. This factor may lead to between-group differences in CMC/FTF comparisons of formality.

Yet another aspect of CMC may, alternatively, lead to increased formality: In CMC, messages are all written, and written messages may be perceived as more formal than oral messages (Gibson & Hodgetts, 1986). In one study examining formality, more frequent formal expressions were seen in CMC than in FTF conversations (Kiesler et al., 1985). Although this aspect of the medium may have some initial effect on perceived formality of messages, users are likely to develop and imbue their messages with informality cues as they become accustomed to each other and the medium. For the following hypotheses, a nondirectional hypothesis was advanced for initial differences, whereas a second hypothesis posed that both conditions should become similarly more informal after time:

H7: Initial messages among previously unacquainted interactants in CMC are higher in formality than are later messages.

H8: Formality is mediated by the communication channel such that (a) formality is different in initial CMC than in FTF conversations and (b) formality decreases and converges in FTF and CMC after many exchanges in both conditions; that is, initial intercepts are significantly different in CMC than in FTF; both become less formal, and terminal positions converge.

Dominance/Inequality

Dominance is associated with efforts to control, command, and persuade others. Equality connotes cooperation and mutual respect. While equality-inequality has been treated as a separate dimension in many relational communication studies, there is some conceptual and empirical overlap with the dominance theme (see Burgoon & Hale, 1987; Burgoon et al., 1987). In CMC literature, too, the concepts of

dominance and inequality are viewed through a single operational outcome: proportion of group participation (see Kiesler et al., 1984).

Initial and terminal messages among previously unacquainted interactants should be lower in dominance compared to intermediate messages. In initial interactions generally, messages are nonthreatening, short, and balanced (Berger & Calabrese, 1975). As groups develop, however, members assert dominance as they size up each others' task expertise and resources. These dominance attempts may be reciprocated: Caplow's (1959) research on triads shows that when one actor attempts domination, the remaining partners combine their resources so as not to be overcome by the first. According to Putnam (1986), both "the powerful and the less powerful members use communication strategies to form coalitions and advance their preferred alternatives" (p. 187). From initial to intermediate interactions, dominance messages should increase. As groups head toward closure, however, this trend should revert toward submissiveness.

CMC may mediate this trend, fostering more dominating messages in early interactions than FTF groups exhibit, due to lack of social context cues. Although the CMC experiments show greater equality in CMC as opposed to FTF conditions, it has been a participation equality. The CMC messages themselves more frequently contained attempts to persuade others, suggesting a dominance-seeking pattern. Over time, however, CMC participants should exhibit patterns similar to FTF communicators; that is, some increase, then decrease dominance.

H9: Initial messages among previously unacquainted interactants in CMC are higher in dominance/inequality than are later messages.

H10: Dominance/inequality is mediated by the communication channel such that (a) dominance/inequality is higher in initial CMC than in FTF conversations and (b) dominance/inequality increases and decreases in FTF in a quadratic, inverted "U-shaped" relationship with message frequency, whereas CMC declines converging with FTF toward lower levels; initial intercepts are higher in CMC than FTF, and terminal positions are equal.

Receptivity/Trust

Receptivity/trust pertains to the expression of rapport, openness, and the desire to be trusted (Newton & Burgoon, 1989). Indeed, trust—as evidenced by cooperative versus competitive strategies in

Prisoner's Dilemma simulations—was lower in electronic and written media than FTF in a study by Short et al. (1976). Trust should be low in initial CMC interactions. It should be noted, however, that behavior in social traps like Prisoner's Dilemma reflects more mutual trust when players are allowed to communicate freely with each other (see Marwell & Ames, 1979).

As relationships progress, trust may increase. Although little is known about the verbal expression of receptivity, one communication behavior denoting openness and trust may be the tendency for established relational partners to freely state overt judgments; people do not divulge such in less developed relationships (Knapp, 1984). This relational dimension, like others, may plateau as relationships mature. Accordingly, the following hypotheses were formulated:

H11: Initial messages among previously unacquainted interactants in CMC are lower in receptivity/trust than are later messages.

H12: Receptivity/trust is mediated by the communication channel such that (a) receptivity/trust is greater in initial FTF than in CMC conversations and (b) receptivity/trust increases and converges in FTF and CMC after many exchanges in both conditions; that is, initial intercepts are higher in FTF than in CMC, both become more receptive/trusting, and terminal positions converge.

Task-Social Orientation

This continuous dimension measures the extent to which messages range from work-related to personal. Theoretical and empirical claims about task versus social orientation were mentioned above and do not bear repetition here. Although greater task orientation may appear in initial CMC interactions, interpersonal solidarity is an outcome of task accomplishment (Beebe & Masterson, 1986), and participants in both CMC and FTF discussions should become more socially oriented over time. As in the case of informality, where groups continue to work on decision-making tasks, they should not become exceptionally social but reach a balanced state of task and social orientation. Although CMC may show greater task orientation at first, the patterns of task to social orientation should become similar across conditions as interaction continues, as the following hypotheses suggest:

H13: Initial messages among previously unacquainted interactants in CMC are higher in task orientation than are later messages.

H14: Task orientation is mediated by the communication channel such that (a) task orientation is greater in initial CMC than in FTF conversations and (b) task orientation decreases and converges in FTF and CMC after many exchanges in both conditions; that is, initial intercepts are higher in FTF than in CMC, both become more socially oriented, and terminal positions converge.

METHOD

Participants and Induction

Subjects (N = 132) were undergraduate students at a large university who participated in this project for course credit. Subjects represented several majors and class levels. As will be discussed below, several groups of subjects were eliminated from the final analysis. The final sample consisted of 96 subjects, divided equally into CMC and FTF conditions in groups of 3.[3]

Some general guidelines for research using zero-history partners were followed. First, group members were told that they would meet in their groups together over several sessions. Second, following McGrath (1984), "concocted" or "temporary" alliances must be presented with some real incentive tied to the outcomes of their task accomplishment. In these ways, aggregates of randomly selected individuals become real partnerships and their behaviors should be generalizable and realistic. Accordingly, subjects were informed that their course grades would be determined in part by their performance on several decision tasks that they would perform in the conferences/groups. These conditions were introduced to subjects on the first day of their classes when they were read and given copies of announcements describing the project.

Subjects were assigned numbers and then were randomly assigned to communication condition (CMC or FTF). Then, within each treatment condition, subjects were assigned to groups of three.

CMC Procedures

CMC subjects signed up for and attended one of six training sessions. Participants received standard training on the computer conferencing system from several experimenter's assistants, using handouts and hands-on experience. The CMC system used was the

computer COnferencing SYstem (COSY) (see Rapaport, 1991; Smith, 1988), a text-based electronic communication medium. COSY is an *asynchronous* system in that users need not be on-line simultaneously. The system stores group entries, and users may access the system individually to read and write messages at their own discretion and convenience. Each message in this system is automatically imprinted with the user's last name, message number, date, time, and length of message. In COSY, participants are directed to new messages (previously unread) within one of several "topic" groups when they log on. They may read messages, "attach" comments to prior comments of their own or their partners', or initiate new, "unattached" comments. Participants were able to access COSY from numerous campus terminal locations 24 hours a day or with a personal computer and modem.

Participants faced three decision-making tasks over the 5-week course of the conference. This arrangement allowed ample opportunity for message exchange, so task "deadlines" did not impede the amount of communication possible. The order of the tasks was counterbalanced across groups. Instructions for these tasks requested group discussion and the presentation of a group recommendation for the decision solution. Deadlines were announced, and participants were reminded that they would be evaluated on the quantity of their participation and the quality of their decision.[4]

Subjects were instructed to complete dependent measure questionnaires immediately after completing each task, and survey packets were delivered to and picked up from subjects in their classes to facilitate this procedure. Subjects who failed to participate whatsoever within a single task were excluded from further participation, and remaining group members were notified of this. These groups were dropped from further analysis for the present study. Sixteen groups remained for analysis.

Face-to-Face Procedures

These subjects were instructed to attend a classroom for three meetings over a 5-week period, in which they addressed one task per meeting. Meetings were scheduled for 2 hours each to provide ample time to complete each task, and no group took longer than 70 minutes. Meetings were rescheduled as often as possible when attendance conflicts arose. Subjects who failed to attend a meeting were canceled

from further participation, and those groups were dropped out of analysis for the present study. Sixteen groups completed all three meetings.

The classroom used for the FTF meetings featured a large desk and three padded chairs. On the desk was a tabletop microphone, three pens, and three copies of the decision task. Also on the desk was a name tag for each participant. Subjects had to sort out the tags rather than use them to infer seating position, so seating selection was performed by the group, and subjects could associate their partners' names appropriately with the names on the dependent surveys. A videotape camera across the room was fully exposed, paralleling the CMC groups' knowledge of the experimenter's consistent perusal of their messages. One of several lab assistants conducted meeting sessions. The tasks were identical to those used in the CMC condition, with the instructions modified slightly to accommodate the FTF administration. The assistant then deliberately diverted his or her attention from the groups during the discussions. When subjects indicated that they were finished, they were separated within the room and dependent measures were administered.

Dependent Measures

At the end of each task, subjects completed 64 Likert-type items of the relational communication questionnaire (Burgoon & Hale, 1987), modified to reflect the triadic nature of the group experience. This instrument asks respondents to report numerous judgments about the relational communication of others rather than to tally highly specific content-level performances. This approach has the disadvantage that it does not directly assess the discrete mechanisms of relational communication, several of which were suggested above.[5] However, the primary purpose of this investigation was to explore whether relational communication dimensions did in fact vary as hypothesized. Further explorations of specific relational performances in CMC are a logical next step, if and only if more global, dimensional changes are demonstrated.

Subjects also completed two other measures, the results of which are reported elsewhere (Walther, 1992a, 1992d).

The data from the first administration of the relational communication items were subjected to a factor analysis to determine whether the relational dimensions specified in the hypotheses and used in

previous research were maintained in the present administration of the instrument. Principal components analysis with varimax rotation yielded a seven-factor solution that was very similar to previous configurations of the relational communication measures, with two exceptions. First, several items related to dominance did not load on that factor. Three formed an *equality* dimension, in contrast to the unidimensional dominance/inequality construct in the hypotheses above. These were therefore treated as a separate dimension in subsequent analyses. Another factor emerged from items previously associated with the dominance factor. Their wording ("tried to persuade," "didn't attempt to influence," "tried to gain approval," "try to win favor") suggests a dimension pertaining to *attempted influence*, a factor that also emerged in previous research (Burgoon & Hale, 1987). Remaining dominance items pertain to a member's attempt to control the interaction, assert, have higher status, dominate the conversation, and so forth. Second, items for immediacy/affection and similarity/depth clustered within a single factor. In past research, both these measures have been conceptually and empirically related to intimacy, and their emergence as a single factor may be a result of forced orthogonality in the present analysis (see Burgoon & Hale, 1987; Burgoon & Newton, 1991).

The viability of treating all these dimensions as separate was examined via reliability analysis. Reliability was analyzed based on data from each subject regarding one other subject after the first task. One item was dropped, which severely reduced reliability of equality. Resulting Cronbach's alpha coefficients were generally high, ranging from .78 to .93.[6]

RESULTS

Group Effect

When persons are operating within a relationship, one's behavior is likely to be affected not only by individual and contextual factors but partly by one's partners and the relationship itself (Sabatelli, Buck, & Kenny, 1986). To assess the effect of the group on relational communication, intraclass correlations were computed for groups within conditions on each relational communication outcome variable at Times 1 and 3. Several variables showed intraclass correlations with

large magnitudes, average intraclass $r = .37$. It was apparent that group members' behavior was affected by other members of their respective groups.

Based on this analysis, it was decided that further tests of the hypotheses would take the group effect into account by including a between-subjects groups factor nested within CMC/FTF condition. Results from the $2 \times 3 \times 16$ analyses of variance yielded significant univariate effects for Group-Within-Condition on many of the dependent measures.[7] Although these were not hypothesized effects, the large effect sizes of the factor cannot be overlooked on the analysis of group behavior. Methodologically, these findings add merit to the approach of using groups-within-conditions in several analyses that follow.

Message Accumulation

Analyses were conducted to verify the number of messages exchanged across conditions and tasks, so that the administration of dependent measures at the end of each task would represent equal or near-equal intervals of message accumulation. Eight coders were trained to unitize propositional "idea units" (see, e.g., Weisband, 1989) from videotapes and from CMC transcripts. Any single coder rated both media. Spot checks for intercoder reliability were conducted after every tenth of the sessions were coded by having all coders unitize the same session. Two coders' work was dropped when it deflated reliability even after retraining. Remaining coders' Cronbach's alpha reliabilities equaled or exceeded .95. No differences were detected as a result of videotape versus transcript coding, $t(5) = -0.72$, $p > .20$, as assessed by unitizing a single group meeting from videotape and a transcription of the same conversation.

A $2 \times 3 \times 16$ repeated measures analysis of variance, with time as a repeated factor, revealed no significant differences across conditions, $F(1, 30) = .85$, $p > .05$, or time, $F(2, 128) = 2.98$, $p > .05$, or due to the Condition × Time interaction, $F(2, 60) = 1.58$, $p > .05$. Although there were significant differences between groups, $F(30, 64) = 7.64$, $p < .01$, and a Group × Time interaction, $F(60, 128) = 7.73$, $p < .01$, these differences did not favor one condition over another; these merely document that some groups spoke more than other groups and more in some intervals than in others. Thus the assumption that message frequencies across communication media and time intervals would be equivalent

TABLE 2
Hypotheses, Contrast Weights, and Results

Hypothesis	*Contrasts*	*Results*
Immediacy/affection		
H1: Greater immediacy/affection at Time 3 than at Time 1 in CMC	CMC1: −1 CMC3: +1	n.s.
H2: A Condition × Time interaction		$p = .025$ (n.s.)
H2a: Time 1 immediacy/affection greater in FTF than in CMC	CMC1: −1 FTF1: +1	n.s.
H2b: Plateau-type increase in FTF, linear increase to similar level in CMC	FTF: −1, +2, +2 CMC: −4, −1, +2	Supported
Similarity/depth		
H3: Greater similarity/depth at Time 3 than at Time 1 in CMC	CMC1: −1 CMC3: +1	n.s.
H4: Linear increase in both conditions to similar level	FTF: −1, 0, +1 CMC: −1, 0, +1	Supported
Composure/relaxation		
H9: Greater composure/relaxation at Time 3 than at Time 1 in CMC	CMC1: −1 CMC3: +1	n.s.
H10: A Condition × Time interaction		n.s.; time main effect
H10a: Time 1 composure/relaxation greater in FTF than in CMC	CMC1: −1 FTF1: +1	n.s.
H10b: Plateau-type increase in FTF, linear increase to similar level in CMC	FTF: −1, +2, +2 CMC: −4, −1, +2	Supported
Formality		
H11: Lower formality at Time 3 than Time 1 in CMC	CMC1: +1 CMC3: −1	n.s.
H12: A Condition × Time interaction		n.s.; time main effect
H12a: Time 1 formality different in CMC than in FTF	CMC1: +1 FTF1: −1	n.s. (two-tailed)
H12b: Plateau-type decrease in FTF, linear decrease to similar level in CMC predicted; because no Time 1 difference, probed for linear decrease in both conditions	FTF: +1, 0, −1 CMC: +1, 0, −1	Linear decrease supported
Dominance		
H13: Lower dominance at Time 3 than at Time 1 in CMC	CMC1: +1 CMC3: −1	Supported
H14: A Condition × Time interaction		n.s.; time main effect
H14a: Time 1 dominance higher in CMC than in FTF	CMC1: +1 FTF1: −1	n.s.
H14b: FTF has inverted-U trend; CMC declines and converges with FTF at Time 3	FTF: −1, +2, −1 CMC: +1, 0, −1	Supported

TABLE 2 Continued

Hypothesis	*Contrasts*	*Results*
Attempted influence		
Not hypothesized		Time main effect
Probed for linear increase in both conditions	FTF: −1, 0, +1 CMC: −1, 0, +1	Supported (two-tailed)
Probed for Time 1 difference between CMC and FTF	CMC1: −1 FTF1: +1	n.s. (two-tailed)
Equality		
Indirectly hypothesized as converse of dominance		Time main effect, $p < .05$ (n.s.)
Receptivity/trust		
H15: Greater receptivity/trust at Time 3 than at Time 1 in CMC	CMC1: −1 CMC3: +1	Supported
H16: A Condition × Time interaction		Supported; time main effect
H16a: Time 1 receptivity/trust greater in FTF than in CMC	CMC1: −1 FTF1: +1	n.s.
H16b: Plateau-type increase in FTF, linear increase to similar level in CMC	FTF: −1, +2, +2 CMC: −4, −1, +2	Supported
Task-social orientation		
H17: Lower task orientation at Time 3 than at Time 1 in CMC	CMC1: +1 CMC3: −1	Supported
H18: A Condition × Time interaction		n.s.; time main effect, condition main effect
H18a: Time 1 task orientation greater in CMC than in FTF	CMC1: +1 FTF1: −1	No; overall, CMC less task oriented
H18b: Plateau-type increase in FTF, linear increase to similar level in CMC	FTF: +1, −2, −2 CMC: +4, +1, −2	Trend supported but no convergence

NOTES: "n.s." indicates statistic was not significant; "no" indicates means were not in hypothesized direction and no statistic was applied.

was accepted and time intervals were used as the oper- ationalization for message accumulation in the following analyses.

Hypotheses Tests

Hypotheses were tested in two stages. First, data were analyzed preliminarily for interaction and main effects with a 2 (Condition) × 16 (Group-Within-Condition) × 3 (Time) ANOVA, with time as a repeated factor. Second, direct tests of the hypotheses were conducted with 1 degree of freedom contrast analyses (see Rosenthal & Rosnow,

1985). These contrast tests are reported as one-tailed t tests (except where noted). Between-condition Time 1 tests adopted contrast weights of +1 and −1, using the omnibus Group-Within-Condition MS as MS_{error} (see Winer, 1971). Time 1/Time 3 tests within CMC also used −1 and +1 weights, with the MS for Time × Group-Within-Condition as the error term. Contrast analyses were also used to test the mutual CMC and FTF trends specified by the hypotheses. In each case, total scores from both CMC and FTF cells were weighted according to hypothesized patterns for each condition to calculate a single $MS_{contrast}$ (with the MS for Time × Group-Within-Condition as MS_{error}). For example, to test initially different CMC/FTF intercepts, with a positive linear trend for CMC, converging with a plateau FTF trend, polynomials of −4, −1, +2 for CMC and −1, +2, and +2 for FTF were adopted. Contrast weights for each hypothesis test are reported in Table 2.[8]

Immediacy/Affection and Similarity/Depth

Because factor analysis loaded items from these dimensions on a single factor, the tests for each of these dependent variables employed a Bonferroni corrected alpha, $p = .025$, to reduce the chance of family-wise error among tests of the variables.[9]

Immediacy/Affection

Hypothesis 1 predicted that initial messages among previously unacquainted interactants in CMC are lower in immediacy/affection than are later messages. The direct comparisons of CMC groups after Times 1 and 3 did not support this hypothesis, $t(60) = 1.08$, $p > .05$.

Hypothesis 2 received mixed support. Immediacy/affection was not significantly greater in initial FTF than in CMC conversations (Hypothesis 2a). The trends predicted for the mutual development of CMC and FTF over time were supported (Hypothesis 2b). The means, standard deviations, and trends for immediacy/affection as well as the other dimensions are presented graphically in Figure 1.

The Condition × Time interaction approached significance (at the adjusted alpha), $F(2, 60) = 3.91$, $p = .025$, $\eta^2 = .12$. Although FTF ratings of immediacy/affection appeared somewhat higher at Time 1 than the CMC ratings, they were not significantly different, $t(30) = 1.14$, $p > .05$; because the pattern of means at Time 1 was in the predicted

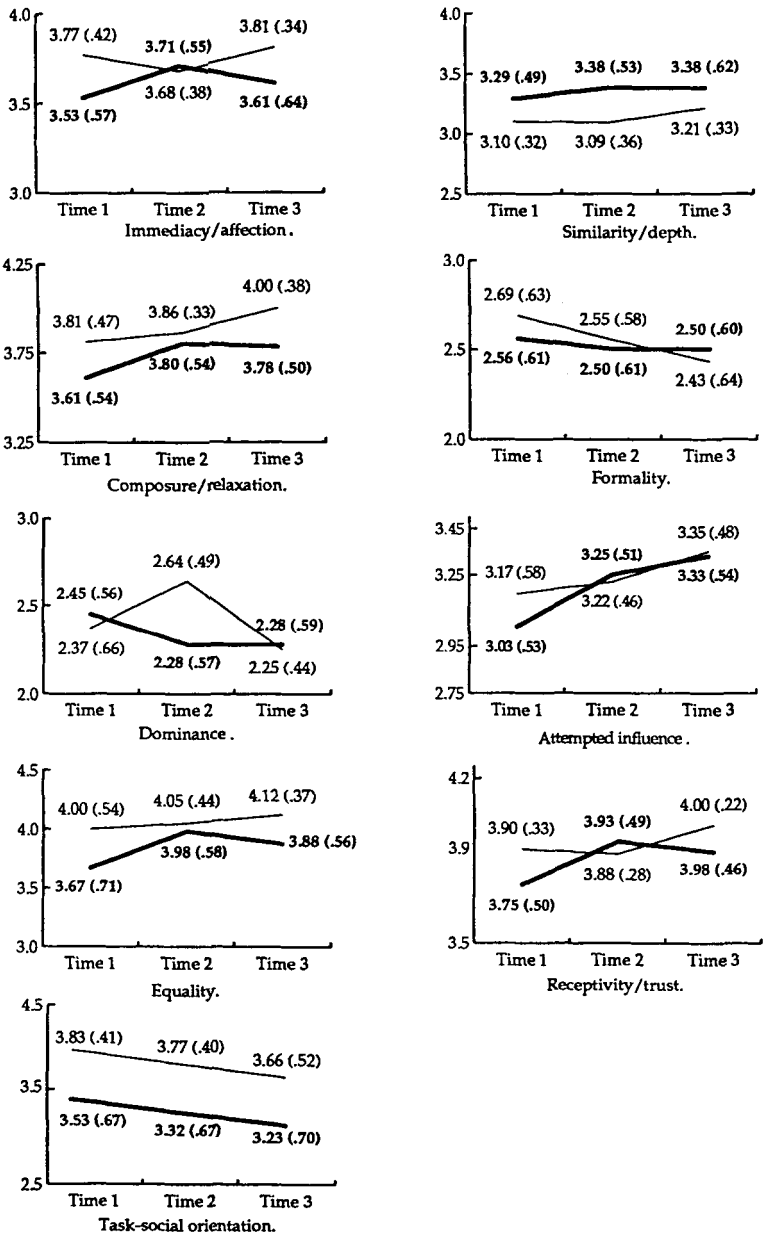

Figure 1: Means and Standard Deviations for Relational Dimensions, by Condition and Time

NOTE: CMC means are in bold. Standard deviations are shown in parentheses ($n = 48$).

direction, the trend analysis was conducted as planned. This contrast test was significant, $t(60) = 2.14$, $p < .025$, $\eta^2 = .03$. Inspection of the means showed that the FTF groups did not demonstrate the predicted trend perfectly—Time 2 was less than Time 1—and CMC did not gain in immediacy/affection at Time 3. A post hoc probe of the CMC means showed that a significant increase occurred between Times 1 and 2 $t(60) = 2.31$, $p < .025$, $\eta^2 = .04$, which may have produced much of the change detected in the trend analysis.

Although Hypothesis 2b received mixed support, some of the test results add credence to the underlying rationale nevertheless. The near-significant interaction and the pattern of means indicate that the two conditions converged on immediacy/affection in their first two sessions. Although the development patterns of immediacy/affection within CMC and FTF conditions were not entirely as predicted, the CMC groups did appear to change over time and the convergence between conditions—at a point higher than CMC's initial level—did occur.

Similarity/Depth

Hypothesis 4 was supported, whereas Hypothesis 3 results did not achieve significance. Similarity/depth in both conditions showed an overall linear increase over time (Hypothesis 4; no between-conditions difference was predicted for Time 1). Although the patterns of means suggest some variation in the development of the two conditions may occur, the contrast test of the predicted linear trends was significant, $t(60) = 2.09$, $p < .025$, $\eta^2 = .03$, supporting Hypothesis 4 and suggesting support for Hypothesis 3. However, an additional nonorthogonal test comparing the means for CMC at Times 1 and 3 failed to confirm Hypothesis 3, $t(60) = 1.65$, $p > .05$.

Composure/Relaxation

Hypothesis 5 was supported; initial messages in CMC were lower in composure/relaxation than were later messages. Hypothesis 6 predicted a Condition × Time interaction, such that (a) composure/relaxation is greater in initial FTF than in CMC conversations, whereas (b) composure/relaxation levels both increase after Time 1 to similar levels. Hypothesis 6 received mixed support.

FTF was not significantly higher in perceived composure/relaxation than was CMC at Time 1, $t(30) = .99$, $p > .05$; hence Hypothesis 6a was

not supported. However, given that the Time 1 patterns of the means were in the direction predicted by Hypothesis 6a and the trends hypothesis (Hypothesis 6b), the test of the mutual, convergent trends was executed as planned; this direct test was supported, $t(60) = 4.82$, $p < .001$, $\eta^2 = .14$. The umbrella Condition × Time interaction was not significant, $F(2, 60) = 1.68$, $p = .19$, but a main effect for time emerged, $F(2, 60) = 8.21$, $p < .001$, $\eta^2 = .10$. Finally, because inspection of the means showed that CMC was not higher at Time 3 than at Time 2, a planned comparison of the initial versus terminal CMC means was conducted to test Hypothesis 5. This test showed a significant increase as predicted, $t(60) = 2.58$, $p < .01$, $\eta^2 = .04$.

Overall, the composure/relaxation predictions received mixed support. Although CMC groups were not significantly less composed than FTF at first, both conditions experienced greater composure/relaxation as they continued.

Formality

Hypothesis 7 predicted that CMC groups become less formal from Time 1 to Time 3. Although the CMC means at Times 1 and 3 were in the predicted direction, the difference was not significant, $t(60) = .80$. Hypothesis 8a was not supported; CMC was not significantly different in formality than FTF at Time 1, $t(30) = .51$, $p > .05$ (two-tailed).

Hypothesis 8b predicted that both CMC and FTF become less formal, approaching a similar level over time. This prediction was generally supported, although the planned test was modified somewhat based on the Hypothesis 8a results. Because there was no Time 1 difference, the trend analysis for Hypothesis 8b was conducted as a probe for a linear decrease in both conditions in formality. This test was significant, $t(60) = 2.73$, $p < .005$, $\eta^2 = .05$. In a like manner, the predicted interaction term was not significant, $F(2, 60) = 1.74$, $p = .184$, but a main effect for time emerged, $F(2, 60) = 4.74$, $p = .025$, $\eta^2 = .06$, as groups became less formal over time. In general, the conditions did not appear to differ, and later means overlapped at more informal levels, offering some support for the underlying rationale.

Dominance, Attempted Influence, and Equality

Although hypotheses originally regarded a combined dominance/inequality dimension, the results of the previously discussed factor

analysis dictated that dominance and equality, as well as attempted influence, were not a single dimension. Because the factor analysis forced orthogonality, these dimensions may yet be strongly related. For this reason, Bonferroni corrected alphas (.016) were used in examining these dimensions to protect for familywise error.

Dominance

Hypothesis 9 was supported, with terminal CMC exchanges rated less dominant than the initial exchanges, $t(60) = 2.49$, $p < .01$, $\eta^2 = .05$. Hypothesis 10a was not supported, whereas Hypothesis 10b was. CMC groups appeared higher in dominance at Time 1 than FTF groups (Hypothesis 10a), but the difference was not significant, $t(30) = .44$, $p > .05$.

Hypothesis 10b predicted that FTF groups exhibit a curvilinear, inverted U-shaped trend over time for dominance and that CMC converges with FTF over time at a lower level than CMC's initial point. These trends were supported, $t(60) = 6.07$, $p < .001$, $\eta^2 = .19$. Although the omnibus interaction term did not reach significance, $F(2, 60), = .28, p = .756$, a main effect for time did obtain, $F(2, 60) = 5.57$, $p < .005$, $\eta^2 = .06$.

Overall, groups in both conditions were similarly dominant in their first interactions, whereas the trends for each condition differed thereafter. FTF groups displayed a quadratic development in dominance, and CMC declined, with the conditions converging at Time 3 as expected. Except for the failure of Hypothesis 10a (no differences at Time 1), the dominance predictions were largely supported.

Attempted Influence

Although no hypotheses had been advanced for this factor, exploratory tests were conducted. An inspection of the means suggested that the patterns associated with the dominance hypothesis were inapplicable for attempted influence: FTF did not demonstrate an inverted U, nor did CMC decline over time. Rather, the pattern of means suggested an overall linear increase in attempted influence, which was assessed in a post hoc probe using a polynomial contrast. This test was significant, $t(60) = 4.71$, $p < .001$ (two-tailed), $\eta^2 = .10$. Additionally, an omnibus ANOVA revealed a significant time main effect, $F(2, 60) = 11.27$, $p < .001$, $\eta^2 = .10$. Although the mean for FTF groups

appeared higher than the CMC groups at Time 1, this difference was not significant, $t(30) = .88$, $p > .05$ (two-tailed).

Considering that no a priori predictions had been offered for this dimension, no further probes appeared warranted. It appears that participants tried to influence each other more as they continued over time; communication condition did not mediate this effect.

Equality

This dimension did not show correspondence with related predictions. Equality was approached using predictions from the original dominance/inequality hypotheses; that is, that FTF is higher than CMC in equality at Time 1 and that terminal CMC conversations were higher in equality than initial CMC conversations. It was clear that the FTF trend did not conform to the quadratic, inverted-U pattern predicted for *inequality* over time, as had been hypothesized, so this trend was not tested statistically.

The CMC means between Times 1 and 3 did not differ significantly, $t(60) = 1.47, p > .05$. Results indicated that FTF groups did not perceive greater equality at Time 1 than did CMC groups, $t(30) = 1.05$, $p > .05$. Equality was affected by a near-significant main effect for time, $F(2, 60) = 3.08$, $p < .05$; no other main or interaction effects obtained.

Receptivity/Trust

CMC groups increased in receptivity/trust over time, supporting Hypothesis 11. Hypothesis 12 received mixed support. The predicted interaction was significant, $F(2, 60) = 3.39$, $p = .040$, $\eta^2 = .10$, and the planned contrasts demonstrated several of the predicted effects. Hypothesis 12a, though, was not supported. FTF was not significantly higher in receptivity/trust than were CMC groups at Time 1, $t(30) = .83$.

Hypothesis 12b received support. The test of the trends toward greater receptivity/trust was significant, $t(60) = 3.12$, $p < .005$, $\eta^2 = .05$. Because CMC was not higher at Time 3 than at Time 2, the previous trend test did not test Hypothesis 11 directly. An additional nonorthogonal test of CMC means at Times 1 and 3 was conducted, which demonstrated that CMC was indeed higher at the end than at the beginning, $t(60) = 2.34$, $p < .025$, $\eta^2 = .03$.[10] A significant main effect for time also emerged, $F(2, 60) = 4.40$, $p < .025$, $\eta^2 = .05$, although the significant interaction effect overrode the main effect.

It also appears that CMC and FTF converged (if not crossed) in their levels of receptivity/trust at Time 2 (although divergence at Time 3 is possible). Overall, Hypotheses 11 and 12b were supported, whereas Hypothesis 12a was not.

Task-Social Orientation

Hypothesis 13 was supported. CMC groups were less task oriented at Time 3 than at Time 1 as predicted, although this effect was small, $t(60) = 1.70$, $p < .05$, $\eta^2 = .02$. Some aspects of Hypothesis 14 received support, whereas other aspects did not. The mutual trends for lower FTF and CMC task orientation over time were statistically supported (Hypothesis 14b), but the initial differences between conditions were quite antithetical to the pattern anticipated in Hypothesis 14a.

The trend analysis toward more social orientation obtained significance, $t(60) = 2.69$, $p < .005$, $\eta^2 = .05$, and there was also an omnibus main effect for time, $F(2, 60) = 4.11$, $p < .025$, $\eta^2 = .05$. However, the two conditions appear not to have converged. Indeed, a significant main effect for condition obtained, $F(1, 30) = 10.32$, $p = .003$, $\eta^2 = .26$. Inspection of the means showed the opposite pattern than anticipated for Time 1: Altogether, CMC was less rather than more task oriented than FTF throughout.

Thus the means of the two conditions may have exhibited two essentially parallel lines, both becoming less task oriented over time but not converging. In opposition to many previous findings about task-social orientation in CMC, it was groups in the computer-mediated condition that were less task oriented than the FTF groups. Also, CMC groups, as well as FTF groups, became less task oriented as they progressed.

DISCUSSION

Although the results generally offered mixed support, there is sufficient support to challenge dominant views on the static effects of the medium. It was found that CMC groups do develop and evolve in relationally positive directions. Participants' ratings of one another's composure/relaxation, informality, receptivity/trust, and social (versus task) orientation became higher during their progressions; dominance became lower. The current study suggests that cues-

filtered-out theories and the associated effects of greater task orientation, self-absorption, arousal, and impersonality do not occur in extended-time, asynchronous interactions in CMC. A social information-processing perspective appears to explain the results more effectively: When CMC and FTF groups are allowed to continue over time and accumulate numerous messages, this continuity has significant effects on groups' relational communication, and social penetration effects occur.

The effects of time were stronger than the effects of medium in general. Time—our surrogate for message accumulation—provided a significant main effect on participants' ratings of *almost every* outcome. Exceptions included immediacy/affection (where the disordinal Time × Condition interaction approached significance), similarity/depth (where the joint trend analysis suggests some temporal effects nevertheless), and equality (where the Time effect would be significant at an unadjusted .05 alpha). Although the effect sizes for time were not particularly large, these effects stand in contrast to those that the cues-filtered-out perspective would suggest: the between-conditions effects. Communication condition was significant only on task-social orientation, but here CMC was more social than FTF. Thus time, overlooked in many CMC studies and recently named in a call for research (Williams et al., 1988), proved an indispensable factor in describing CMC group behavior where it was allowed.[11]

It was hypothesized that time interacts with communication condition in the prediction of relational effects, yet such statistical interactions obtained significance in few cases. This may have resulted from the similarity of CMC/FTF means at Time 1 where they had been predicted to differ but did not. There was not enough of a change in the patterns of means to create a statistically significant interaction term. It appears that the Condition × Time interaction failed because either the initial effect of CMC is negligible in comparison to other factors, or, knowing they will use it over time, CMC users act very much like FTF group members from the onset of their partnerships. In either case, the medium may provide so little a difference, given enough time, that minor differences in some relational dimensions after initial interactions become inconsequential across episodes.

Another aspect of the hypotheses was that groups in each condition reach similar levels on each relational communication dimension over time. Many of the trend analyses were supported in which the contrast weights reflected Time 3 convergence; yet even these did not

conclusively demonstrate equality in Time 3. Although a statistical test cannot conclusively demonstrate the absence of difference, there is some descriptive support for convergence effects in the patterns of the means for several dimensions. In the cases of several dimensions, the patterns were such that CMC and FTF overlapped from their initial positions at Time 2 or 3, including immediacy/affection, formality, receptivity, attempted influence (twice), and dominance (see Figure 1). The means within some other dimensions came very close to one another but did not merge; one cannot confidently conclude that they overlapped in these cases. But where the patterns overlapped, it appears that some convergence in the levels of those respective dimensions took place.

In another case, the between-condition effect maintained across times. For task orientation—the old standard of the cues-filtered-out research—CMC was more socially oriented. The higher ratings for CMC on social orientation invite speculation. Why might CMC participants act more sociable than their FTF counterparts? There are several possible reasons. The first has to do with the nature of the asynchronous environment. Participants in asynchronous conferencing used the system at their convenience. They had time to send and probe for interpersonal effects aside from devotion to task completion. They could afford to ask "What do you think of the Wildcats last night? Think we'll make the playoffs this year?" as well as questions about preferred social activities and other personal information, as some CMC participants exchanged during this project. On the other hand, FTF communicators who digressed from the task may have been less appreciated; they kept other members from finishing their meeting obligation and leaving sooner. Whereas FTF participants in this study were prevented from engaging in social chit-chat while they waited for the third member to arrive (for the sake of experimental control), CMC subjects were similarly prevented from engaging in outside interaction by their confinement to the electronic medium. Yet no groups were prohibited from engaging in off-task interaction *during* their respective "meetings," and this appeared to occur much more frequently in the CMC conferences.

Another influence on the unexpected directions of some effects may have to do with the uncertainty reduction efforts employed by CMC participants (see Berger, 1987; Berger, Gardner, Parks, Schulman, & Miller, 1976). CMC subjects had little to go on as they undertook their conferencing, and their efforts at uncertainty reduction may have

prompted rather bold interactive strategies that were seen as relationally positive by their partners. Some imbued their messages with positive relational cues and sought such cues from their partners. For instance, one CMC member signed her messages "Love, Cara." Another group developed nicknames for each other, and members embellished their "redundant signatures" with large, typed-out graphics. It appears that CMC members attempted to reduce uncertainty by overcompensating in the direction of playfulness, affection, and depth.

The combination of uncertainty and the asynchronous communication mode may actually facilitate more positive relational communication. It is plausible that uncertainty reduction needs combined with a convenient time and channel for expression allow selective self-presentation and relational behavior. In this mode, one may plan, contemplate, and edit one's comments more mindfully and deliberatively than in the more spontaneous, simultaneous mode (Hiemstra, 1982). Thus CMC partners may adopt communication behaviors that are more stereotypically desirable. In several dimensions, the CMC groups believed that their partners acted the way we'd like "good groups" to do—they increased attempted influence but with less domination, became less formal, and more receptive and trusting with each other. Ironically, FTF groups did not act as "good" on as many dimensions as did those in CMC.

In this investigation, FTF communication was synchronous and CMC was asynchronous. CMC systems do vary considerably along this dimension (see Rafaeli, 1988), whereas it is hard to imagine asynchronous FTF communication (other than written or broadcast media). Whereas some might consider the present treatments of synchronicity a failure to control a confound, others might consider this maximizing experimental variation given the focus on social aspects *between* FTF and a form of CMC. More comparisons are needed for examining differences *within* CMC as well as FTF synchronicity, despite Kiesler et al.'s (1985) characterization of e-mail, conferencing, and electronic bulletin boards as the same environment with a common character (see Nass & Mason, 1990).

More work is also needed to identify what specific behaviors led to the developmental changes reported here. The present results suggest that social penetration processes do occur in CMC. A more skeptical view would be that only subject maturation effects obtained. To the extent that relational development is, in a sense, a maturational process, the gravity of this concern is somewhat mitigated, especially

as previous theories predict a more static view. Because time had greater effects than medium, the present results are still revelatory. To the extent that questionnaire items tapped subjective attributions more so than the precise relational behaviors, it cannot be shown in this study that interactants actually performed the textual and linguistic behaviors that should correspond to increases and decreases in the relational dimensions. Aside from the anecdotal examples in this discussion, the issue needs resolution through follow-up research in several ways, some of which have been undertaken since this study was executed. First, reanalysis using observers to rate the participants' interactions would not suffer from maturation effects if fresh coders are used or randomly assigned to time intervals (see Walther, 1992c). Second, content analytic procedures may be employed to detect types of relational behaviors such as those enumerated in Table 1 (see Baldwin & Holmes, 1992). With such analyses, correspondence between performance-level data and participants' judgment-level data could be explored. Third, experimental manipulation of verbal relational cues might yield valuable results as well (see Adkins, 1992). These latter approaches would be extremely revelatory in the continued study of how communicators do adapt themselves to the restrictions of the medium while pursuing interpersonal goals.

CONCLUSION

The contribution of the current research is that it makes a step toward challenging the boundaries of the dominant theoretical position regarding CMC effects—the cues-filtered-out perspective. Additionally, a social information-processing perspective on relational development via limited channel versus multiple channel messages received some support. The theoretical underpinnings used in predicting the trends and relationships among groups were derived from several treatises in interpersonal communication, and these perspectives offered a useful approach to testing accepted maxims about the effects of the new medium. Propositions from uncertainty reduction and social penetration theories, and precepts from the study of relational communication, when examined through a social information-processing perspective, offered challenges to the undersocial view of interpersonal interaction suggested by previous CMC research. This approach did account for significant variation in group behavior be-

yond the effects of the communication channel—computer-mediated interaction versus face-to-face conversation. At most, communicators overcame the ostensible stripping away of socioemotional content in CMC through adaptive relational communication performances. At least, CMC did not impede the feeling of modest relational development over time. All things considered, although initial differences in relational communication between CMC and FTF may exist, they tend to be eliminated over time. As suggested by Walther (1992), "the ways in which humans pursue these interpersonal functions are more robust than can be impeded for long by computer-mediation" (p. 80).

Finally, the effects of varying relational patterns in mediated and nonmediated settings deserve continued attention. As CMC continues to grow as a viable channel for many communication purposes, its effects on satisfaction, effectiveness, and patterns of connections are being cataloged. Yet such research generally considers the abilities of a medium, not the users, as the determinants of these outcomes. The effects of users' intentions, needs, styles, and various relational patterns may offer a more comprehensive view of the media's potential to affect a variety of outcomes, and ways to enhance desired patterns deserve exploration.

NOTES

1. Rice and Love (1987) tested the hypotheses that the percentage of socioemotional content in CMC would increase over time and that socioemotional content would constitute about one third of the total message content in CMC. A modified IPA coding scheme (Bales, 1950) was used to determine the content of messages in a public electronic bulletin board: 28% of coded messages were positive socioemotional, 4% were negative socioemotional, and 71% were task oriented, supporting the latter—descriptive—hypothesis. The hypothesis regarding change over time was not supported.

2. This terminology was discussed by Walther (1992) as follows:

> the term, "social information processing," has been applied to CMC phenomena before, but with a very different meaning. Fulk, Steinfield, Schmitz, and Power (1987), following Salancick and Pfeffer (1977, 1978), originally used this term to describe a socially-constructed subjective model of media choice (as opposed to a rational choice model such as media richness theory). The implication of their use of the term was that one's perception of an object is in large part determined by the communication one has with others about such objects . . . (which they have since re-named a "social influence model"; Fulk, Schmitz, & Steinfield, 1990). Presently, however, the term "social information processing" is used to describe the (individual) cognitive processing of socially-revelatory information (and subsequent communication based on that information), rather than the

social (conjoint) processing of information (about a medium). The present use of the term is consistent with its use in psychological literature regarding impression-formation and related social-cognitive processes (e.g. Lord, 1985; Taylor & Crocker, 1981; Wyer, 1980; Wyer & Srull, 1980; see also Berger & Bradac, 1982). (p. 68)

3. Of these subjects, 43% were seniors, 27% were juniors, 22% were sophomores, and 8% were freshmen. Students in the communication course constituted 51% of the sample and 49% were in the MIS courses. There were slightly more males, 55%, than females, 45%. Of the 48 CMC subjects, 2 had used the computer conferencing system previously in other contexts and 7 had participated in electronic bulletin boards. Eight subjects had their own computers with no modem; an additional 13 had computers and modems. Among CMC subjects, no significant effects emerged for past experience with COSY, past use of electronic bulletin boards, computer ownership, or computer-plus-modem ownership. Some demographic items showed modest effects on dependent variables (see Walther, 1990).

4. Copies of the actual tasks are available from the first author on request.

5. One possible criticism of this research pertains to the ability of the measures to discern the extent to which dimensional scores changed as a result of specific communication performances as opposed to the maturation of the subjects. Although this issue cannot be completely resolved within the scope of the present study, previous research has demonstrated clear correspondences between variations in nonverbal and verbal behaviors to scores on the relational communication measure (e.g., Burgoon, Coker, & Coker, 1986; Burgoon & Hale, 1987; Burgoon, Manusov, Mineo, & Hale, 1985; Burgoon & Newton, 1991; Burgoon et al., 1989; Burgoon et al., 1987; Burgoon & Walther, 1990).

6. Relational communication variables with their respective alpha coefficients (and number of items) are immediacy/affection, .88 (14); similarity/depth, .80 (11); composure, .87 (8); formality, .89 (5); dominance, .86 (7); attempted influence, .78 (4); equality, .82 (2); receptivity/trust, .84 (8); and task-social orientation, .80 (4).

7. Significant effects for the Group-Within-Condition factor in the 2 (Conditions) × 3 (Time) × 16 (Group-Within-Condition) ANOVAs were found on immediacy/affection, $F(30, 64) = 3.45$, $p < .001$, $\eta^2 = .62$; receptivity/trust, $F(30, 64) = 3.83$, $p < .001$, $\eta^2 = .64$; composure, $F(30, 64) = 3.77$, $p < .001$, $\eta^2 = .64$; formality, $F(30, 64) = 2.63$, $p = .001$, $\eta^2 = .55$; similarity/depth, $F(30, 64) = 4.16$, $p < .001$, $\eta^2 = .66$; and task-social orientation, $F(30, 64) = 2.87$, $p < .001$, $\eta^2 = .57$. Additionally, a significant Group × Time interaction obtained on immediacy/affection, $F(60, 128) = 1.73$, $p = .005$, $\eta^2 = .45$; composure, $F(60, 128) = 1.49$, $p = .030$, $\eta^2 = .41$; formality, $F(60, 128) = 1.47$, $p = .036$, $\eta^2 = .41$; similarity/depth, $F(60, 128) = 1.65$, $p = .010$, $\eta^2 = .44$; and task-social orientation, $F(60, 128) = 1.43$, $p = .048$, $\eta^2 = .40$.

8. Every attempt was made to devise sets of orthogonal contrasts; where contrast weights could not be devised that were orthogonal, however, no alpha correction was made. Whereas some statisticians argue that nonorthogonal contrasts risk inflated error, others argue that orthogonality is a minimal concern in the case of *planned* contrasts (Rosenthal & Rosnow, 1984; Winer, 1971) and that the meaningfulness and total number of contrasts, rather than orthogonality, should dictate whether alpha protection is invoked (Keppel, 1982).

9. An alternative strategy would have been to enter both variables into a single multivariate analysis of variance, determine significant multivariate effects, and then

probe corresponding univariate effects as the multivariate results allowed. This strategy was not adopted for several reasons: First, an unprobed nonsignificant multivariate effect might allow significant univariate effects within the set to go undetected; the failure of multivariate analysis achieving significance does not rule out a legitimate univariate effect within a cluster of variables. Second, the MANOVA procedure does not provide adequate protection against familywise error in the absence of some other form of correction, such as the Bonferroni adjustment (Huberty & Morris, 1989). Based on these reasons, and considering the exploratory nature of this research, multiple univariate analyses with adjusted alphas appeared warranted, with planned contrasts offering more direct tests of the hypotheses. This rationale is also applicable to the analyses for dominance, attempted influence, and equality.

10. These two significant, nonorthogonal contrast tests involving the same means and similar patterns are subject to an inflated chance of Type I error. However, because these contrasts reflect planned comparisons, no alpha correction was adopted. It should be noted that the Time 1/Time 3 *t* test would not achieve significance were a correction applied. Interpretations of this result should be approached with caution.

11. Although the case for the importance of time effects should not be discarded, in most cases the effects of time and conditions were small compared to the variation between groups *within* conditions (which comprised the error term for analysis of condition effects—an "individual differences" term for groups). Significant Group-Within-Condition effect sizes ranged from .46 to .66; Group × Time interactions ranged from .40 to .46 in size. Although some critics have called for CMC study to take time factors into account, it is apparently another effect—that of reciprocal interaction in groups—that may provide an even greater predictor of group behavior in CMC or elsewhere.

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