Computer-Mediated Communication Effects on Disclosure, Impressions, and Interpersonal Evaluations
Getting to Know One Another a Bit at a Time

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This investigation examined how computer-mediated communication (CMC) partners exchange personal information in initial interactions, focusing on the effects of communication channels on self-disclosure, question-asking, and uncertainty reduction. Unacquainted individuals (N = 158) met either face-to-face or via CMC. Computer-mediated interactants exhibited a greater proportion of more direct and intimate uncertainty reduction behaviors than unmediated participants did, and demonstrated significantly greater gains in attributional confidence over the course of the conversations. The use of direct strategies by mediated interactants resulted in judgments of greater conversational effectiveness by partners. Results illuminate some microstructures previously asserted but unverified within social information processing theory (Walther, 1992), and extend uncertainty reduction theory (Berger & Calabrese, 1975) to CMC interaction.

T he advent of computer-mediated communication (CMC) and its penetration into so many people's lives provides communication theorists with an interesting lens on human behavior. Do individuals adapt to the restrictions of the medium, and if so, when and how? Can we learn about human communication in general from these adaptations, the ways that communication with new tools subtly differs from traditional modes, and how they affect our fundamental relations with one

another? As important as the burgeoning of the Internet is the growth of research on its impacts. Yet despite many studies examining the perceived similarities and differences in communication outcomes across media, in many areas, fundamental questions about the processes that lead to such outcomes lag behind.

For instance, while it is now known that the Internet provides venues for the initiation of relationships, from friendly to romantic (e.g., Baker, 1998; Parks & Floyd, 1996; Parks & Roberts, 1998), such studies do not describe at a theoretical or behavioral level how these relationships come to be. Research provides little at the level of particulars regarding changes in the basic process of acquaintance development and interpersonal knowledge acquisition in online settings. These processes not only deserve attention in their own right, but examination of these building blocks informs other theories, traditional and newer, about communication with and without media. They also reflect public interest in questions such as: How can people get a sense of one another without face-to-face communication and the observation of nonverbal cues?

This study sought to determine the means by which impression development takes place in CMC, and the extent to which impression formation is accomplished, relative to face-to-face (FtF) communication. Given the differential availability of cues and interaction contexts between mediated and FtF communication, this research focuses on (a) the potential redistribution of impression-seeking questions and self-disclosure processes within CMC and FtF channels, which affect impressions and attributional confidence, and (b) the evaluative consequences of potentially different patterns. Does one's self come shining through regardless of the interaction conduit? If so, how?

CMC Theories and Evidence

It is well known that text-based CMC such as email, computer conferencing, and chat systems differ from FtF communication in several respects, the most apparent of which is that the written medium precludes the exchange of nonverbal cues that accompany FtF speech. This differential has led some to suggest that impressions and relational development might be thwarted in CMC, rendering it a relatively impersonal medium (e.g., Kiesler, Siegel, & McGuire, 1984; Siegel, Dubrovsky, Kiesler, & McGuire, 1986). Other perspectives suggest that users rely on alternative mechanisms to accomplish these functions (see for review Walther, 1996). Empirical research on the formation of relationships online has produced mixed conclusions, especially with regard to users' impression formation processes. Early research suggested that people using CMC were prevented from gaining impressions due to the lack of nonverbal cues in the medium (e.g., Kiesler, 1986; see also Kiesler et al., 1984; Siegel,

et al., 1986). Other research shows that online impressions and relationships are developmental, operating within different temporal frames than FtF communication (Walther, 1993; Walther & Burgoon, 1992) or that they are subject to the effects of salient group identities (Spears & Lea, 1992; Walther, 1997). The social information processing (SIP) theory of CMC (Walther, 1992) argues that without nonverbal cues, communicators adapt their relational behaviors to the remaining cues available in CMC such as content and linguistic strategies, as well as chronemic (Walther & Tidwell, 1995) and typographic cues (Walther & D'Addario, 2001). Despite these formulations and studies, it remains to be seen precisely whether the respective relational states are achieved through the specified mechanisms. That is, while there must be some means by which CMC partners translate social information into the text-based medium of CMC, few studies have examined by what specific means users adapt to the medium in order to seek and to exhibit uncertainty-reducing, impression-bearing cues.

Research supporting the paradigm of impersonal CMC effects was generally strong on content analysis of conversational behavior, but did not as a rule assess interpersonal evaluations (e.g., Hiltz, Johnson, & Turoff, 1986). In contrast, research supporting alternative paradigms has not, for the most part, explicitly examined the alternative behavioral processes that allegedly occur in the theoretical chain of events they specify. The communication behaviors nominated to correspond to the outcomes specified in these theories either (a) have not been investigated, or (b) have been analyzed but not related to outcomes. Social information processing research, for example, generally involved assessing CMC/FtF differences, in combination with temporal variations, on outcome measures including self-reported impressions of partners and relational communication (Walther, 1992; Walther & Burgoon, 1992). In a study on impression development, Walther (1993) concluded that "CMC users formed increasingly developed impressions over time, presumably from the decoding of text-based cues" (p. 393). In that study, impressions and time were examined, while the text-based cues were presumed to have occurred. Thus these empirical tests have focused on the conditions and outcomes that are consistent with the framework, rather than on the specific microbehaviors that are presumed to facilitate them. Using a more micro-level focus, Utz (2000) found a relationship between the use of textual paralinguistic devices and the development of relationships in a CMC setting, consistent with SIP theory. That study did not isolate the mediating role of impression development, however, and the frequency of paralinguistics was assessed through self-report rather than content, leaving some room for bias, as Utz acknowledged.

A related approach, the hyperpersonal perspective of CMC, argues that the absence of nonverbal cues, as well as editing capabilities, identity cues,

and temporal characteristics may prompt CMC users to engage in selective self-presentation and partner idealization, enacting exchanges more intimate than those of FtF counterparts. Tests of this framework have included manipulation of salient identities, time frames, and the presence of photographs (in combinations of CMC/FtF settings), on dependent measures of self-reported assessments of partners' relational communication and attractiveness (Walther, 1997; Walther, Slovacek, & Tidwell, 2001). Results supported and extended the framework. Recent research specifically examining online impressions has found that CMC partners form deeper, but not broader, impressions during task-focused communication (Hancock & Dunham, 2001). That is, in CMC versus FtF settings, partners rated one another on a smaller number of attributes, but with more extreme scores, suggesting more selective and yet exaggerated social information sharing online, consistent with the hyperpersonal approach. In all these cases, however, the specific cues potentially leading to the self-reported effects were presented anecdotally but not analyzed formally.

Similarly, the social identity and deindividuation (SIDE) theory (Lea & Spears, 1992) argues that the lack of nonverbal cues in online interaction prompts users to form impressions that are based on social categories of communicators, not interpersonal cues. Tests of this theory have involved salient personal, group, or national identities, and the presence of primed norms, or photos, in combination with CMC. The effects of these independent variables on self-reported ratings of partners' social attraction, similarity, and other evaluations were studied (see for review Postmes, Spears, & Lee, 1998), but not the behaviors that prompted them. In a recent exception, one test of SIDE theory examined the content and style of users' online comments, finding convergence in message attributes toward subgroup norms over time (Postmes, Spears, & Lea, 2000). However, these convergences were not shown to relate to affective outcomes or impressions. Similarly, Joinson's research (2001, Study 1) found more self-disclosure in CMC than parallel FtF discussions, but the connection between disclosure and participants' goals and outcomes was not specified.

Each of these approaches has advanced our knowledge about media and communication in the development of impressions and relationships, through the kinds of sensible first steps of research in any area. After all, if there are no gross effects there is little reason to look for particulars. But an important second step is to see whether and how the intervening processes occur as specified.

Uncertainty Reduction: Strategies and Limitations

Although CMC research has been relatively silent at the level of particulars, an approach exists which focuses on behavioral strategies leading to interpersonal impressions and evaluations, and which is associ-

ated with accompanying methodologies for examining the behavioral strategies it specifies. Although it has not been applied to CMC, uncertainty reduction theory (URT; Berger & Calabrese, 1975) is among the most heuristic approaches to impression formation and initial relational development in FtF settings. The ways that its dynamics manifest themselves in CMC settings, however, may not be the same. An unstated boundary condition in URT is the presence of FtF interaction; URT presumes that partners encounter each other physically when they interact. This aspect is not the central focus of this theory (or others on impressions and attraction) and might be dismissed as theoretically irrelevant (Lea & Spears, 1995); even though URT explicitly includes nonverbal affiliative behaviors in its calculus, these are substitutable with verbal behaviors. However, tests of URT have been conducted using FtF conversation, necessarily involving the conventionally obvious aspect of seeing one's partner before speaking and potentially gleaning data from physical appearances and other nonverbal indicators (see Douglas, 1990). In the age of the Internet, the FtF boundary is an anachronism and the FtF research setting, a potential confound. Since the role of physical presence in URT has not been examined, its applicability to situations in which there is no physical presence remains unknown. The constraints on uncertainty reduction strategy selection, usage, and interpretations demanded by virtual interaction deserve exploration both to inform URT as well as to unpack communication processes suggested in the CMC theories described above.

According to URT, uncertainty reduction is the exchange and collection of information that allows one to predict another's attitudes and behaviors (Berger & Calabrese, 1975). In reducing uncertainty people create impressions—mental models that help them to make sense of people and situations (Srull & Wyer, 1989). The more information one gets about one's partner, the less uncertainty he or she has. The mechanisms by which they exchange information, however, may be limited in CMC settings. URT predicts that individuals use passive, active, and interactive strategies as a means of reducing uncertainty. Berger (1979; Berger, Gardner, Parks, Schulman, & Miller, 1976) identified three passive strategies, two active strategies, and three interactive strategies, that people utilize in order to acquire information about others. Which of these strategies are employed, and when, depends in part on politeness and situational appropriateness requirements.

Passive strategies are those in which the information seeker collects information about the target without affecting the target's or other actors' behavior. The first passive strategy identified by Berger (1979) is the reactivity search, the unobtrusive observation of a target person in a situation in which the target interacts with, and reacts to others. The second is social comparison, observing a target as he or she interacts with others who

are known to the observer, and drawing comparisons based on similarity of the target to the others. The third passive strategy is disinhibition searches or deviation testing (Berger et al., 1976). This strategy seeks to identify the target's candid behaviors by looking at them in situations where targets' inhibitions are likely to be less impacted by social norms and rules.

The two active, yet indirect strategies, differ from the passive strategies in that they involve proactive efforts to gain knowledge about another person (Berger, 1979). However, they are indirect as they do not confront the target. The first of these two consists of asking others about the target individual. The second, environmental restructuring, entails the creation of a set of circumstances followed by unobtrusive observation of the target in that environment, in order to view the effect of the manipulation.

Interactive strategies for uncertainty reduction require direct and obtrusive exchanges with targets. The first, deception detection, involves identification of falsifications, distortions, or omissions of information. Second, verbal interrogation refers to question asking. Finally, self-disclosure is that which a person knowingly communicates to another about him- or herself, which is not publicly known (Worthy, Gary, & Kahn, 1969). Disclosure is bound by the norm of reciprocity: self-disclosure begets disclosure from a target person, thus its utility as an information-seeking behavior.

Although any of these strategies might be chosen in FtF settings, their availability may be much more limited in CMC settings. For instance, passive strategies require public settings, rather than private ones. In CMC these may be confined to unusual contexts such as Usenet groups, Multi-User Dungeons/Object Oriented (MUDs or MOOs), and mailing lists. However, the most common form of CMC is electronic mail (Kraut, Mukhopadhyay, Szczypula, Kiesler, & Scherlis, 1999). Given the predominance of email for communicating online, unless one is operating within one of these other special settings, passive strategies are largely unavailable (cf. Ramirez, Walther, Burgoon, & Sunnafrank, 2002).

Active strategies, too, can be more difficult to deploy in CMC than FtF, as they require certain resources that may be less available online. Specifically, in the case of asking third parties for information, CMC relationships offer a more limited network of common acquaintances than in FtF associations (Parks & Floyd, 1996). Similarly, environmental restructuring requires advance planning and the involvement of third parties. These two strategies might be adaptable to ongoing CMC environments such as MUDs or lists, where it may be possible to observe the target unobtrusively, but in general, the opportunities to implement passive and active uncertainty reduction strategies are very limited in CMC, particularly in initial interaction settings.

All of the interactive strategies suggested by Berger and colleagues may be utilized in both FtF and CMC. Deception detection, however, tends to be considered unreliable in CMC (see Donath, 1999; Van Gelder, 1985). Whether reliable or not, people attempt to detect deception FtF through observation of individuals for nonverbal "signs" of deception (Zuckerman, DePaulo, & Rosenthal, 1981). Unless target individuals contradict either themselves or known facts, deception detection is less likely employed in a CMC environment. This leaves verbal interrogation (i.e., question asking) and self-disclosure as the uncertainty reduction strategies most available in CMC. Questions and disclosures are both readily deployed in CMC. Personal questions can easily be posed in text. Self-disclosures may also be effective in CMC settings and operate in patterns similar to FtF: They not only provide impression-bearing information, but the process of disclosing creates a demand, so that the recipient feels obligated to respond in kind, typically generating return disclosures from the target individual (Jourard, 1971).

While these formulations about strategies available in CMC seem rather straightforward, the literature has not considered the implications. In one exception, Joinson (2001, Studies 2 and 3) found greater self-disclosure in CMC chat than FtF meetings, although these findings were largely in response to experimental variations in public and private self-awareness or videoconferencing; question-asking, as a means of interpersonal knowledge acquisition, was not regarded. In a sense, the relative unavailability of strategies in common CMC settings provides a scope condition to URT: The interactive strategies of questioning and self-disclosure should be those most relied upon for acquiring knowledge in CMC, whereas a variety of strategies may be used FtF. The question remains whether CMC users will use more interactive strategies as an accommodation to the lack of other means, as suggested by SIP theory, or whether they will simply mirror the same proportion of interactive uncertainty reduction in their conversations as do FtF communicators (although other theories question whether interpersonal impressions are even sought through CMC, much less how).

> H1: In initial interactions, computer-mediated interactants deploy a greater proportion of interactive uncertainty reduction strategies (questions and self-disclosures) than do FtF counterparts.

Reconciling Efficiency With Politeness

Other interesting questions about the different natures of FtF and CMC are raised by considering the implications of such a shift in strategy use. As interactive strategies are considered riskier in FtF than are other strategies, how might such a difference in usage affect users' reactions to one

another in CMC? It is a rule in FtF communication that in order to appear polite, interactants must balance the efficiency of uncertainty reduction strategies with social appropriateness (Berger & Kellermann, 1983; Kellermann & Berger, 1984). Although they are also more time- and resource-consuming to use, passive and indirect strategies for uncertainty reduction are less face-threatening than interactive strategies, and therefore more polite (Brown & Levinson, 1987). The desire to demonstrate both effective and appropriate behavior may hinder more direct and efficient uncertainty reduction activities in a FtF context. However, appropriateness and effectiveness concerns may take shape differently in CMC contexts. Given the lack of alternative strategies for uncertainty reduction available in CMC, the otherwise face-threatening interactive strategies may be forgiven in this context due to their greater relative normalcy. While question-asking and disclosure might be less polite FtF, evaluation of these strategies may be more favorable in CMC.

> H2: Media type interacts with interactive uncertainty reduction strategies such that when CMC interactants use more interactive strategies, they are judged to be more appropriate by their partners; whereas, when FtF interactants use more interactive strategies they are judged to be less appropriate by their partners.

Although questions are efficient, purposeful, and easily understood in both CMC and FtF settings, these attributes may be particularly valued in CMC. Efficiency is important since CMC simply takes more time and effort than FtF communication (Olaniran, 1996; Sproull & Kiesler, 1991). Questions are also perceived to be honest in nature. In the absence of most nonverbal cue systems, expressions of sincerity are particularly important online (see Donath, 1999). Proactive self-disclosing is also valued for the same reasons. Disclosures commonly occur when the other is perceived to be trustworthy or when the "discloser expects he will benefit in some way if he permits the other person to know him as he is" (Jourard, 1971, p. 65). Due to the norm of reciprocity, mediated interactants may realize that proactive sharing of information assists in the mutual acquisition of information and reduction of uncertainty. Since CMC interactants are assumed to share the same desire to reduce uncertainty as FtF participants (Walther, 1992), this may be one of the few practical means of achieving that goal. If mediated interactants understand that certain (passive) strategies in FtF settings may not be possible in CMC, then those who adapt to CMC and use direct, interactive uncertainty reduction strategies will most likely be judged to be more effective.

> H3: Media type interacts with interactive uncertainty reduction strategies such that when mediated interactants use more interactive strategies, interactants

are judged to be more effective by their partners; whereas, when FtF interactants use more interactive strategies, they are judged to be less effective by their partners.

CMC may alter not only the proportion and the evaluation of self-disclosure and interrogation, but also expand the depth. Altman and Taylor (1973) explain in social penetration theory that as a relationship develops, the individuals become willing to disclose more aspects of their self, providing depth of information on a breadth of topics. Initial social acquaintanceship conversations in a FtF setting do not provide the proper forum for allowing truly deep revelations: Prior research suggests that at least the first minute of FtF conversation is consumed primarily with relatively low-intimacy demographic information. The CMC channel, as we have argued above, provides fewer efficient methods to reduce uncertainty, and questions of greater depth may provide another efficient twist on otherwise less personal exchanges. At the same time, CMC provides some sheltering effects not offered in FtF conversation, and mediated interactants may feel more comfortable disclosing more intimate information, with less self-consciousness, than in FtF settings.

> H4: CMC interactants engage in deeper self-disclosures than do FtF counterparts.

In addition to leaving open the role of impression-facilitating behaviors in CMC, previous research has not attempted to assess directly the degree of mediated interactants' attributional confidence regarding their partners. As mentioned above, Hancock and Dunham (2001) found that in a short time interval CMC partners rated each other on a smaller number of attributes than FtF counterparts. Walther (1993) found that, over extended interactions and similar amounts of message exchange, CMC and FtF partners reached similar levels on the number of traits they could attribute to their partners. However, the degree of uncertainty reduction has not been directly assessed. Although both FtF and CMC interactants are predicted to reduce uncertainty, they may not do so to equal extents. FtF interactants have access to a wider range of cues than are available in CMC and deliver nonverbal cues simultaneously with verbal cues. Numerous studies comparing FtF and CMC, as well as the exchange of physical and aural cues via audio- and video-conferencing systems, predominantly report greater feelings of "social presence" when more cues are available, suggesting that uncertainty reduction is itself highly dependent on the exchange of multiple cues (e.g., Gale, 1991; Whittaker & O'Conaill, 1997; cf. Burgoon et al., 2000; Walther et al., 2001). SIP (Walther, 1992) argues that impressions and relational communication improve over time in CMC to parallel that of FtF communication, precisely due to the

development of personal knowledge structures of one's partners. In contrast, the hyperpersonal perspective (Walther, 1996) describes how CMC partners develop impressions and relational states that are as positive or better than those of FtF partners, a perspective premised on the exaggeration and overprocessing of partial and fragmented information. It is thus unclear whether impression development is due to actual uncertainty reduction, or to biased processing and relationally-positive yet relatively uncertain states. Given these conflicting positions, a research question is posed.

RQ1: Do FtF interactants have greater attributional confidence than their CMC counterparts?

The Nature of Cues in Impression Formation Online

As alluded to above, SIP predicts that personal knowledge structures accrue during CMC interaction. If so, certain cues should serve as the basis for attributions, which interactants may recall. Alternatively, the SIDE model predicts that it is not the individual-level information that stimulates impressions of others in CMC, but rather the social identity shared by members of an online conversation (Lea & Spears, 1992; Spears & Lea, 1992, 1994). SIDE theory equates nonverbal cues with individuating impression stimuli. Since such cues are absent in CMC, one's social, or group, identity may be more salient than personal identity. Context cues related to social categories become more important, providing a primary basis for attributions, within which users' "paralinguistic content of messages in CMC can provide social cues that assist with impression formation" (Lea & Spears, 1992, p. 328). These dynamics promote attraction within a group as they lead members to attribute similarities among themselves and others. If SIDE is correct, a few prominent social identity cues impact impressions through global heuristics, providing social category indicators that allow for social comparisons.

At this time, it is unclear which elements in CMC lead to uncertainty reduction: a variety of verbal and paralinguistic cues as predicted by SIP, over-reliance on salient social identity cues as predicted by SIDE, or reliance on some other facet of the interaction. Are mediated interactants truly forming personal schemata of their conversational partners, or are they simply deriving images from categorical heuristics, imbued with misplaced confidence? Research in this area is both contradictory and sketchy (see Jacobson, 1999). For that reason the following research question was formulated in order to direct inquiry into the means by which impression formation occurs in a mediated environment.

RQ2: On what cues do CMC and FtF interactants rely in order to reduce uncertainty?

METHOD

Participants (N = 158), half male and half female, were recruited from communication courses at a moderately-sized, private American university where they received extra course credit for their participation. Ages ranged from 17 to 24 with a modal age of 19. Participants were instructed to sign up for a time slot with someone of the opposite sex with whom they were not already acquainted (i.e., a stranger), and told that they would engage in one or more conversations taking place across one or more communication channels. All participants had email accounts through the university, and were required to know how to use email in order to participate. They rated their experience level using email very high on a 7-interval scale (M = 2.09, SD = 1.54, where 1 = *very experienced* and 7 = *not at all experienced*), and they used email frequently on both a daily (M = 6.06, SD = 1.48) and weekly bases (M = 5.03, SD = 2.05), as shown on 7-point scales (1 = *not at all* and 7 = *all the time*).

Partners were instructed to report to different laboratory rooms in order that they would remain unacquainted prior to their experimental interaction. A research administrator presented a research consent form and specific instructions in writing and aloud detailing the channels of communication to be used. Half of the dyads then met in a small meeting room for a FtF discussion. Each member from the other half of the dyads went to an individual room to communicate with his or her partner over a semi-synchronous CMC system. Using email accounts established specifically for this research, they used the email system to send messages to one another and to read responses as soon as the messages were completed. The system was similar in form to instant messaging systems, but the email protocol facilitated generating copies of the messages for retrieval and analysis of individuals' responses.

Participants were instructed either to get to know one another, as is common in URT research, or to work on a solution to a decision-making problem, as is common in CMC research. Whereas this topic variable had some main effects on disclosure behaviors (to be reported elsewhere), it did not present disordinal interactions with the independent variables in this report, and the analyses to follow collapsed across these conditions.[1]

Different time periods were allocated for FtF and CMC conditions. Altman and Taylor (1973, p. 189) assert that "the social penetration process is a time-bound one," and SIP research also argues strongly that constrained or equal time periods in CMC and CMC/FtF research have dramatic impacts on communicator behaviors and their comparisons (see Walther, Anderson, & Park, 1994). Therefore, it was important to make interaction opportunities equivalent across the two communication conditions. FtF subjects were told that they could converse for up to fifteen minutes or until they signaled the administrator that they were finished,

but since 15 minutes in a FtF setting is not equivalent to 15 minutes in CMC (typing alone accounts for differences in the amount of remarks generated per minute by FtF and CMC participants; Siegel et al., 1986), CMC interactants were allocated up to 60 minutes, four times the amount of time provided for FtF interactants. A subsequent analysis of the conversations determined that the FtF meetings lasted from 57 seconds to 25.82 minutes ($M = 15.1$ mins, $SD = 8.83$ mins), while the CMC interactions lasted from 8.1 minutes to 61.78 minutes ($M = 43.1$, $SD = 17.01$). The FtF interactions ranged from 8 to 230 utterances ($M = 87.32$, $SD = 64.04$); CMC interactions ranged from 4 to 150 utterances ($M = 42.97$, $SD = 29.02$). Despite attempts to equalize talk time, approximately twice as many utterances were contained in the FtF meetings as in the mediated interactions. Since this discrepancy in the baseline number of messages appeared between conditions, several hypothesis tests were calculated using proportions of conversation elements rather than frequencies.

Following the interaction, participants were separated and asked to complete a number of measures relating to their impressions of their partners and their own behaviors. Measures featuring 7-interval Likert-type scales, with demonstrated reliability and validity, assessed participants' perceptions of conversational effectiveness, appropriateness, uncertainty, and self-disclosure. Additionally, a small number of open-ended questions were utilized to identify conversation cues that aided or hindered interactants' uncertainty reduction efforts.

Conversational effectiveness was assessed using a five-item subset of the conversational effectiveness scale (Canary & Spitzberg, 1987). Perceptions of partners' conversational appropriateness were determined using a three-item subset of Canary and Spitzberg's (1987) conversational appropriateness scale. Both yielded acceptable Cronbach reliabilities ($\alpha = .73$ for each).

Postconversation uncertainty about the partner was assessed using a five-item subset of Clatterbuck's CL7 measure of global uncertainty (Clatterbuck, 1979; Douglas, 1990). High scores represented greater uncertainty, whereas low scores indicated greater levels of attributional confidence (i.e., a high degree of confidence regarding knowledge of another and ability to predict and understand another's behavior), $\alpha = .90$. Participants also completed this measure with reference to their preinteraction uncertainty in order to provide a retrospective pretest baseline. Participants were asked, "Remind yourself how you felt before the conversation began. How well did you 'know' your partner; that is, how well did you know his or her beliefs, values, attitudes, goals, or experiences? Select a number on the scale from 0 to 100 that best indicates how well you knew your partner before your conversation began." This same scale was used to measure terminal attributional confidence. The use of this mea-

sure retrospectively is somewhat unorthodox, yet methodological constraints, and other research precedents, suggested this approach. While an actual pretest measure of attributional confidence would in some ways be preferable, introducing one would have been likely to heighten artificially participants' responsiveness to the information-seeking focus of the research (as noted by Douglas, 1990), especially in the decision-making context in which half of the dyads operated. However, posttest retrospective ratings have been employed successfully in interpersonal evaluation research (e.g., Hale, Lundy, & Mongeau, 1989) as well as in communication technology research (e.g., Rice & Contractor, 1990) in which both pre- and posttest ratings were gathered after the stimulus period. In order to check whether the use of these scales revealed theoretically expected patterns of uncertainty reduction over time (see Douglas, 1990), CMC/FtF conditions were collapsed and tested together. Retrospective ratings of initial attributional confidence were compared to terminal levels, which differed significantly, $t(156) = -4.16$, $p < .001$: Interactants were more confident at the end of the conversation ($M = 47.3$, $SD = 25.69$, $n = 158$) than they believed they had been at the beginning ($M = 6.15$, $SD = 14.98$, $n = 158$), as would be expected. It thus appeared that the retrospective rating operated as it was intended, although readers should interpret the results of these measures cautiously in the context of their dual administration.

The cues that individuals utilized to reduce uncertainty, the focus of RQ2, were collected by asking the open-ended questions, "What sorts of things affected your ability to get to know your partner? That is, what sorts of things made it easier to get to know him/her?" Three judges each evaluated all the open-ended responses (using a procedure later replicated with the conversation transcripts; complete unitizing and coding rules are available upon request). First, by placing vertical lines around each utterance, the judges designated utterances using Holsti's (1969, p. 116) definition of an utterance as "a single assertion about some subject." Each judge initially identified utterances independently, after which responses were compared across judges. When two or more judges agreed upon a judgment, it was accepted. When necessary, differences among judges were resolved through discussion. This procedure yielded 301 utterances. Intercoder reliability was calculated between judges A/B, B/C, and A/C. The proportion of consensual answers (agreements divided by the total number of utterances) generated interjudge agreements in the range of .92 to .94. Next, a composite judgment reliability was calculated using Guetzkow's (1950) procedure, which yielded a proportion of .97.

Judges then identified and labeled uncertainty-reducing conversation cues, by assigning each utterance to one of nine uncertainty-reducing cue categories that best represented the participant's meaning when taken in context. The nine categories were taken from Tidwell, Douglas, and Banski

(1995), and are detailed in the results section. Interjudge reliabilities were calculated based on content agreement. The proportion of correct responses was calculated for each coding set by dividing the number of consensual judgments by the total number of utterances. The proportion of agreements ranged from .66 to .72, with a Guetzkow's composite reliability of .88.

Participants were also asked to identify those conversation elements that increased or enhanced uncertainty, with the question, "What sorts of things affected your ability to get to know your partner? That is, what sorts of things made it less easy to get to know him/her?" Judges evaluated the content of the utterances once again using Tidwell et al.'s (1995) cue categories, with interjudge agreement between .59 to .68, with a Guetzkow's composite reliability of .85.

Participants' assessments about the amount and depth of their self-disclosures were assessed using Wheeless's (1978) instrument, adapted to past tense to refer to the conversation the subject had just completed. High scores reflected greater levels of self-disclosure (5 items, α = .77) and control over depth of self-disclosure (5 items, α = .82).

Disclosures and questions. All audiotapes of the FtF meetings were transcribed and electronic mail messages were printed. Verbal records were coded by two judges in order to assess the quantity and quality of verbal disclosure and interpersonal questions. The judges first identified all thematic utterances. Using the same coding procedure mentioned previously, coding responses were compared and disagreements were resolved through discussion. The conversations contained a total of 10,515 utterances. Interjudge utterance reliability was calculated as a proportion of agreements divided by the total number of utterances, with a proportion of .95.

Next, judges assigned utterances to one of three content categories: question, self-disclosure, or other. Questions were operationally defined as "an expression of inquiry that invites or calls for a reply; an interrogative sentence, phrase, or gesture" (Morris, 1976, p. 1070). Self-disclosures were operationalized as messages that reveal personal information about the sender, as derived from Dindia (1983) and Chelune (1975, p. 133, as cited in Tardy, 1988) as "a verbal response (thought unit) which describes the subject in some way, tells something about the subject, or refers to some affect the subject experiences." Utterances that were neither a question nor a self-disclosure (e.g., exclamations and imperatives) were coded as "other." Coding disagreements were resolved, and the interjudge reliability proportion was .94 for the content of the utterances.

Breadth and depth of questions and self-disclosures. Next, two additional judgments were performed on each self-disclosure and question utterance. Judges identified the topic and degree of intimacy of each question and disclosure. While several classification schemes were examined, only one had actually been used to code utterances with reliability: Taylor and

Altman's (1966). In the present effort, some topic categories from the Taylor and Altman self-disclosure scheme were merged, while other distinctly different topic constructs were added.[2] Using the modified classification scheme, the two judges evaluated each question, self-disclosure, and other expression in order to assign a topic rating. A reliability proportion was calculated by taking the initial number of agreements and dividing that by the total number of utterances. Interjudge reliability was .88 for topical content. Disagreements were resolved through discussion.

The depth of each utterance was assessed using Altman and Taylor's (1973) three-layer categorization scheme consisting of the peripheral, intermediate, and core layers. The peripheral layer is concerned with biographic data. The intermediate layer deals with attitudes, values, and opinions. The core layer is comprised of personal beliefs, needs, fears, and values. Judges' intercoder reliability for utterance depth was .95, and disagreements were resolved through discussion. Once the utterance content, topic, and intimacy judgments were performed, frequencies were calculated. This was done by assessing the number of questions, disclosures, topic categories (breadth), and intimacy ratings (depth) utilized by each individual.

RESULTS

Uncertainty Reduction Strategies in CMC

The first three hypotheses dealt with uncertainty, and the impact of the medium on the strategies that were employed in order to reduce uncertainty.[3] The first hypothesis predicted that computer-mediated interactants would engage in more interactive uncertainty reduction strategies in the form of increased questions and self-disclosures. The second hypothesis predicted that the increased use of interactive uncertainty reduction strategies in CMC would lead to judgments of greater appropriateness, and according to the third hypothesis, to greater effectiveness also, compared to judgments of these behaviors FtF.

The first hypothesis was assessed using t-tests, comparing the arc sine transformations of the square roots for proportions of questions, and for those of self-disclosures in the FtF condition, to the transformed proportions of each found in CMC (see Snedecor & Cochran, 1989). As predicted, CMC and FtF interactants differed in both behaviors. CMC interactants ($n = 74$) utilized a significantly higher proportion of questions (M_{CMC} proportion = .18, SD = .11) than their FtF counterparts ($n = 84$; M_{FtF} proportion = .13, SD = .08), $t(156) = -3.20$, $p = .002$. CMC interactants also produced significantly higher proportions of self-disclosures (M_{CMC} = .69, SD = .12) than did those in FtF interactions (M_{FtF} = .59, SD = .13), $t(156) =$

-4.98, $p < .001$. FtF interactants, in contrast, displayed a significantly greater proportion of other expressions ($M_{FtF} = .28$, $SD = .11$) than did CMC participants ($M_{CMC} = .13$, $SD = .08$), $t(156) = 9.28$, $p < .001$. Other expressions included conversation elements such as statements of fact that were nonpersonal in nature, statements about third parties, exclamations, imperatives, preview and summary statements, greetings, backchanneling elements, and other filler items that were clearly not questions or self-disclosures.

Thus, CMC interactants used a greater proportion of direct and interactive uncertainty reduction strategies than did their FtF counterparts. FtF interactants diluted their use of interactive strategies with other conversation elements. These findings support Hypothesis 1: Interactive uncertainty reduction strategies are used with greater proportion in CMC than they are in FtF.[4]

Hypotheses 2 and 3 concerned the differential effect of questions and self-disclosures on conversation attributions. They predicted that increased use of interactive uncertainty reduction strategies by CMC interactants would raise judgments of appropriateness (H2) and effectiveness (H3) by conversational partners, but lower appropriateness and effectiveness ratings when FtF partners exhibited the same behaviors.

Correlations were computed between the frequency of questions, disclosures, and other utterances—and the proportions of these elements to total utterances—with judgments of appropriateness and effectiveness within each respective communication condition (see Table 1). In the FtF condition, conversational effectiveness showed a negative zero-order correlation with proportion of questions, $r = -.28$, $p = .05$ (two-tailed), and a positive correlation with the proportion of "other" comments, $r = .33$, $p < .001$. No other zero-order correlations between appropriateness or effectiveness and utterances were significant.[5] Hypothesis tests, however, involved z-tests of the differences among (Fisher z' transformations of) the correlations within CMC against those within FtF (the results of which are also displayed in Table 1).

No differences in the relationship of appropriateness ratings and the quantity or proportion of self-disclosures was obtained due to communication conditions. Similarly, the relationships among appropriateness and the amount or proportion of questions did not differ between conditions. H2 was not supported.

With regard to conversational effectiveness ratings, the correlations with proportion of questions were significantly different due to communication channel, $z = -2.56$, $p < .01$ (one-tailed). The relationship for CMC interactants was mildly positive ($r = .12$) whereas the FtF interactants' was significantly negative ($r = -.28$). No effects were obtained with regard to the correlations between effectiveness and proportion of self-disclo-

TABLE 1
Correlation Matrix of Interactive Strategies, Appropriateness, and Effectiveness

		Perceived effectiveness	Proportion of self-disclosures	Proportion of questions	Proportion other	Total self-disclosures	Total questions	Total other
Perceived appropriateness	FtF	.14	.12	-.05	-.11	.12	.10	.01
	CMC	.32**	.08	-.04	-.04	.07	-.01	-.10
Perceived effectiveness	FtF		-.12	**-.28***	.33**	-.05	-.12	.09
	CMC		-.13	**.12**	.07	-.04	.05	.01
Proportion of self-disclosures	FtF			-.54**	-.79**	.20	-.31**	-.39**
	CMC			-.77**	-.43**	.33**	-.31*	-.17
Proportion of questions	FtF				-.06	-.00	.56**	.07
	CMC				-.22	-.41**	.33**	-.24*
Proportion other	FtF					-.17	-.00	.46**
	CMC					.13	.15	.58**
Total self-disclosures	FtF						.63**	.69**
	CMC						.61**	.67**
Total questions	FtF							.62**
	CMC							.54**

NOTE: Proportion refers to the arc sine transformation of the square roots of the original proportions. Correlations for FtF, $n = 84$; CMC, $n = 74$. Bold pairs indicate that the coefficients were significantly different from one another, $p < 01$.
*$p \leq .05$, **$p \leq .01$ for two-tailed correlations.

sures (nor with quantities of either questions or disclosures). Interestingly, the difference between the proportion of "other" comments and effectiveness ratings approached significance, $z = 1.71$, $p = .09$ (two-tailed), favoring the FtF communicators, who were considered more effective by their partners the more they used comments other than questions or disclosures. This finding may also reflect the notion that there are different expectations for effective communication in CMC and FtF communication. Questions and disclosures may be superfluous or inefficient in FtF compared to the bounty of nonverbal cues and superficial banter. One is reminded of the customary chat room greeting, "R U MorF?" ("are you male or female?"; Van Gelder, 1985) as an extreme example of an effective online, but likely ineffective FtF, question. Overall, with respect to Hypothesis 3, the results were mixed. Mediated interactants who used proportionately more questions were perceived to be more effective than when FtF partners did so, and FtF partners may be more effective when they veer away from such direct strategies.

Accelerated Intimacy in CMC

The fourth hypothesis predicted that CMC partners would engage in deeper questions and disclosures than would those in ongoing FtF relationships. Using the coders' ratings of question and disclosure depth (peripheral, intermediate, or core), proportions of questions and self-disclosures were calculated for each of these categories, within each individual's total utterances.

Analyses assessed transformed proportions of peripheral and intermediate questions and self-disclosures between channel conditions, which revealed contrasting patterns. FtF interactants communicated higher proportions of peripheral questions ($M_{FtF} = .54$, $SD = .35$) than did CMC partners ($M_{CMC} = .36$, $SD = .32$); $t(156) = 3.32$, $p = .001$. However, the pattern was reversed for intermediate questions: CMC interactants conveyed a higher proportion of intermediate questions ($M_{CMC} = .65$, $SD = .33$) than did FtF partners ($M_{FtF} = .45$, $SD = .35$); $t(156) = -3.70$, $p < .001$. No significant differences were identified for proportions of self-disclosure levels. These results suggest that CMC partners relied on relatively deeper probes than the questions used by the FtF dyads. CMC dyads compensated for the limitations of the channel by making their questions more intimate than those exhibited FtF.

This effect may be threatened by the interdependency of the proportions. In order for participants to demonstrate more peripheral questions, they were likely to exhibit proportionally lower amounts of something else. Due to the interdependency, it was helpful to examine the frequencies of questions and self-disclosures in each layer directly, and then compare them across the channel conditions. FtF interactants voiced a signifi-

cantly higher amount of peripheral questions (M_{FtF} = 8.04, SD = 8.87; M_{CMC} = 3.27, SD = 4.32); t(156) = 4.25, p < .001. FtF partners also expressed more peripheral self-disclosures (M_{FtF} = 21.56, SD = 23.72; M_{CMC} = 11.43, SD = 11.73), t(156) = 3.33, p < .001; and intermediate self-disclosures (M_{FtF} = 28.31, SD = 18.79; M_{CMC} = 18.41, SD = 12.42), t(156) = 3.85, p < .001.

However, the frequency was not significantly different for intermediate questions, (M_{FtF} = 4.07, SD = 3.86; M_{CMC} = 3.59, SD = 2.60), t(156) = .90, p = .37, or core questions (M_{FtF} = .02, SD = .15; M_{CMC} = .008, SD = .40), t(156) = .94, p = .35. While a lack of differences does not establish that CMC partners used the same amount of intermediate or core questions as FtF partners, it is nevertheless surprising given the greater number of FtF comments overall. It demonstrates that on average the bulk of FtF interactants' exchanges were focused on more superficial questions and disclosures. Finally, CMC interactants did not pose any core disclosures and FtF levels were almost nonexistent as well (M_{FtF} = .01, SD = .11).

The results with respect to Hypothesis 4 are generally supportive. As opposed to FtF, CMC led to higher proportions of more intimate questions and lower proportions of peripheral questions, as well as fewer instances of peripheral disclosures.

Uncertainty Reduction Levels in CMC

RQ1 addressed whether FtF interactants have greater attributional confidence than CMC counterparts. In previous research (Walther, 1993), the willingness of participants to make attributions about their partners was affected by both time and media. In order to be sensitive to such effects on attributional confidence, subjects' postconversation (terminal) assessments of attributional confidence were gathered, along with a retrospective assessment of initial, preconversation attributional confidence. Research Question 1 asked whether FtF interactants achieve higher levels of attributional confidence than their mediated counterparts, due to greater access to conversation cues.

Initial and terminal attributional confidence scores were combined within each respective communication condition. Comparison of the two conditions, on the pooled attributional confidence scores, approached significance favoring FtF, t (156) = 1.77, .05 > p > .10, two-tailed (M_{FtF} = 8.11, SD = 18.36, n = 84; M_{CMC} = 3.92, SD = 9.48, n = 74). The terminal scores alone, however, suggested a possible reversal of this direction favoring CMC (M_{FtF} = 44.67, SD = 26.71; M_{CMC} = 50.30, SD = 24.31), although the comparison of terminal scores alone did not approach significance, t(156) = -1.39, p > .10. With respect to RQ1, these findings suggest that while FtF interactants had some initial advantage in attributional confidence, perhaps due to their ability to see their partners and make attributions based on physical appearance, this advantage disappeared as the conversation

evolved. CMC participants ended conversations feeling just as confident as FtF interactants, perhaps by making relatively greater gains in attributional confidence.

A more direct method for assessing this possibility was conducted by computing scores reflecting the change in attributional confidence over the course of the conversation, by subtracting initial confidence scores from terminal confidence scores. Results of the comparison between change scores showed that the change in attributional confidence tended to be significantly greater in the CMC condition (M = 46.38, SD = 24.52, n = 74) than in the FtF condition (M = 36.56, SD = 24.37, n = 84), $t(156)$ = -2.52, $p < .025$, two-tailed. Not only did CMC interactants manage to gain knowledge at the same level as FtF interactants, they made up for initial deficiencies. The next research question explores the microprocesses underlying such development in greater detail.

Attribution Stimuli

The second research question sought to identify the cues or strategies upon which CMC and FtF interactants relied in order to reduce uncertainty. In order to address this question, coders categorized individuals' responses to an open-ended question into ten major categories of conversation elements identified by Tidwell et al. (1995): (1) an attribute of the partner, (2) an attribute of self, (3) the partner's conversational performance, (4) one's own conversational performance, (5) the partner's nonverbal or paralinguistic expressions, (6) one's own nonverbal or paralinguistic expressions, (7) common ground, (8) context, or (9) nothing. The tenth category contained "other" cues that did not fit into one of the previously mentioned categories.

The conversational performance categories (3 and 4) were further subdivided into eight subcategories: (a) asked questions, (b) did not ask questions, (c) engaged in self-disclosure, (d) did not engage in self-disclosure, (e) answered questions, (f) did not answer questions, (g) listened, or (h) performed some other behavior. Common ground (7) was also subdivided into (a) recognition of the presence of common ground and (b) realization of the absence of common ground. Context (8) was further segmented into aspects related to (a) the physical setting, (b) the time, and (c) the topic/task/goal. A complete listing of these elements and the number of respondents who identified various cue categories as a means of reducing uncertainty is shown in Table 2.

Multiple regression analyses were conducted to determine if specific conversation elements were associated with reduced uncertainty. Each cue category served as a separate predictor variable, while terminal measures of attributional confidence served as the outcome measures.

TABLE 2
Frequencies of Uncertainty Reducing and Enhancing Conversation Cues

	Uncertainty type	
Conversation cue	*Reducing*	*Enhancing*
Attribute of the partner	25	10
Attribute of self	25	9
Partner's conversational behavior	51	13
Asked questions	8	0
Did not ask questions	0	1
Engaged in self-disclosure	21	1
Did not self-disclose	3	1
Asked questions and disclosed	8	0
Did not ask questions or disclose	0	2
Listened	1	0
Performed some other behavior	10	8
Own conversational behavior	31	12
Asked questions	14	1
Did not ask questions	1	0
Engaged in self-disclosure	5	1
Did not self-disclose	1	1
Asked questions and disclosed	4	0
Did not ask questions or disclose	0	1
Listened	1	0
Performed some other behavior	5	8
Partner's nonverbal expressions	12	1
Own nonverbal expressions	1	1
Common ground	48	9
Recognition of presence	48	3
Recognition of absence	0	6
Context	52	143
Physical setting	19	80
Time	1	27
Topic/task/goal	32	36
Other	42	56
Nothing	1	4
Missing	1	0

When all major conversation elements were entered in a stepwise analysis on both FtF and CMC participants' scores, only partner's lack of self-disclosure had a significant impact on terminal attributional confidence, $F(1, 156) = 3.96$, $p < .05$, $\beta = -.16$. A similar procedure was performed on participants' overall attributional confidence, on which physical setting

showed a significant impact, $F(1, 156) = 4.89$, $p < .05$, $\beta = -.16$. Both cues had negative effects.

Not surprisingly, analyses of cues by channel condition indicated some significant differences. FtF interactants reported nonverbal cues ($M = .14$, $SD = .35$) whereas CMC interactants did not identify any paralinguistic cues. CMC interactants were more likely to note the impact of the situation ($M_{CMC} = .18$, $SD = .38$) than were FtF participants ($M_{FtF} = .07$, $SD = .26$), $t(156) = -2.02$, $p < .05$. Finally, FtF and CMC interactants differed in their assessments of the impact of an attribute of the partner, $t(156) = 2.07$, $p < .05$, or an attribute of oneself, $t(156) = 2.07$, $p < .05$, on their decreases in uncertainty: FtF interactants noted more of an impact of their partner's attributes ($M_{FtF} = .21$, $SD = .41$; $M_{CMC} = .09$, $SD = .29$) and their own attributes ($M_{FtF} = .21$, $SD = .41$; $M_{CMC} = .09$, $SD = .29$).

Evaluation of cues that were reported to reduce confidence revealed a significant difference for the role of the physical setting. CMC participants felt the setting impaired their ability to get to know their partner ($M_{CMC} = .64$, $SD = .48$) more so than did FtF interactants ($M_{FtF} = .39$, $SD = .49$), $t(156) = -3.11$, $p < .01$.

With regard to RQ2, participants tended to identify similar cues, with some slight variations by channel. The finding that CMC interactants felt the situation impeded their attributional confidence is unsurprising on one hand, yet notable on the other: One would have expected interactants to find CMC somewhat arduous given the mechanical requirements of the medium, yet CMC interactants were able to make greater gains in attributional confidence. These patterns suggest loose support for the hyperpersonal effect: Individuals attempted to compensate for perceived limitations of the channel by engaging in more personalized conversations.

DISCUSSION

CMC has joined FtF communication as a common means by which individuals communicate with others. The use of email and other forms of electronic communication raise interesting theoretical questions about interpersonal processes, not the least of which is how these channels may cause people to alter or adapt their communication behaviors, methods of forming acquaintances, processes of forming attributions, and ways of relating to one another. This investigation sought to illustrate the manner in which the communication channel impacts micro- and macrolevel processes of acquaintanceship development in CMC.

Our findings indicate that the restrictions of CMC prompt users' adaptation to the medium through modification of uncertainty reduction behaviors. Bereft of most nonverbal cues, CMC partners forgo the pe-

ripheral questions and answers that mark the normal, superficial exchanges among new acquaintances in FtF encounters. Instead, CMC interactants appeared to employ a greater proportion of more direct, interactive uncertainty reduction strategies—intermediate questioning and disclosing with their partners—than did their FtF counterparts. The probes and replies they exchanged were more intimate and led to levels of attributional confidence similar to their offline counterparts'. According to their partners, CMC interactants are more effective when engaging these more intimate exchanges, compared to FtF communicators who act similarly. It seems likely that the increased intimacy of these microlevel behaviors may lead to perceptions of extraordinarily affectionate relations, or hyperpersonal states, as seen in recent studies among long-term CMC partnerships; while such a theoretical connection would mirror the dynamics of FtF relations (Sunnafrank, 1985), that specific connection awaits direct demonstration.

Theoretical Implications

Several theories are addressed as a result of this investigation. Berger and Calabrese's (1975) URT was found to account not only for behavior in FtF settings, as it originally pertained, but in electronic settings as well. Both FtF and CMC interactants exhibited efforts to become acquainted with their conversational partners, and interactants exhibited classic uncertainty-reducing strategies as they asked questions and performed self-disclosures with their partners. Demonstrating the effect of the communication channel on these processes, and the application of the channel's characteristics to the politeness/effectiveness trade-offs associated with strategy selection, results differed between CMC and FtF settings. It is worthwhile to retest theories as new communication modes present new theoretical boundary conditions, and as the characteristics of CMC place certain limits on uncertainty reduction strategies, these results present a modification of the derivations of URT, attesting to its heuristic value. CMC partners employed a greater proportion of questions, disclosures, and more intimate questions than their FtF counterparts, attesting to SIP theory's contention (Walther, 1992) that email users adapt their relational needs and goals into the linguistic codes of CMC.

Early research in CMC indicated that it was a limited channel of communication, ill suited for tasks such as getting to know one another (see Rice, 1993, for review). Such a position is once again challenged by these findings. More recent theories have suggested that either CMC interactants come to know each other individually over time (Walther, 1992) or on the heuristic basis of assumed ingroup similarities (Lea & Spears, 1995). The extent to which these impressions are based on personal cues, even highly selective ones, or based on social cognitive heuristics has become a mat-

ter of theoretical contention, and the present research adds new ballast to both sides of the question. SIDE theory suggests that in the cue-limited CMC environment, only social category cues remain, and the assumed similarities among users' social category memberships are subject to vividness and overattribution effects (Spears & Lea, 1992). In this study, the relatively dramatic gains in attributional confidence by CMC partners might be taken as greater overattribution based on lesser personal information, especially since, in one sense, CMC interactants generated and received much less conversation (i.e., no physical cues and fewer utterances). Given the lesser amount of cues present in CMC, but the same level of terminal attributional confidence as FtF interactions, the attributional confidence data appear to support this interpretation.

However, the main contribution of this study—its focus on the content of CMC and FtF uncertainty reduction strategies—suggests a different interpretation. SIDE theory emphasizes social cues rather than interpersonal cues based on the assumption that discreet, individuating information is absent in CMC (Lea & Spears, 1995). Yet the relatively greater proportions of questions and disclosures in CMC, and particularly the greater depth of CMC questions indicate that while CMC interactants are making more attributions from fewer absolute cues, they are efficiently accommodating to the medium by deploying more intimately personal cues. It seems contrary to SIDE that personal questions and self-disclosures, offering potentially individuating information, reinforce the presence of social, and the lack of individual, identity. Such efforts suggest instead support for a SIP/hyperpersonal view of acquaintance development and personal knowledge development through information exchange in CMC. At the same time, the reciprocation of disclosure may function as a group (dyadic) norm within these associations, and the adherence to norms is considered a potent process within SIDE. Overall, these results reinforce the difficulty in untangling hyperpersonal from SIDE effects (see Walther, 1997).

Although the results reinforce SIP's contentions about the adaptation of CMC users to the linguistic and content mechanism of the channel (Walther, 1992), the findings also challenge a dimension of the theory. It appears that sometimes quality is more important than quantity: One caveat in SIP is that adequate time must be provided in order to equalize communication transmissions and that equalized message exchange is necessary for relational development to be parallel in CMC and FtF contexts. Equal message exchanges did not occur across the two channels in this investigation, with FtF conversations containing many more utterances than the CMC conversations, at least the way they were coded. Nevertheless, the mediated interactants did not seem to be disadvantaged. In fact, they were shown to attain significantly greater increases in attributional confidence during a single conversation than those in the

FtF condition, where multiple cues were present. Such variations were also noted by Roberts, Smith, and Pollock (1996) in online settings where socializing and developing relationships were the primary goals. When people want to get to know one another, they overcome the limitations of the medium and do so.

Limitations

One problem with the present research pertains to the unequal volume of utterances between CMC and FtF settings, and the use of proportions rather than frequency data with which to test hypotheses. Although attempts were made to provide time enough for equal accumulations across the two channel conditions, FtF interactants generated about twice as many utterances as their CMC counterparts. This prompted some troubling issues. First, it suggests that CMC may require even more than four to five times the amount of time spent in a FtF interaction in order to convey the same amount of utterances. This level of disparity has not been seen in previous studies: In time-unlimited tests, Dubrovsky, Kiesler, and Sethna (1991) and Weisband (1992) found that CMC groups took four to five times as long, respectively, as FtF groups. In other experiments that provided unequal time limits in order to equalize communication opportunities, Siegel et al. (1986) gave FtF groups 10 minutes and CMC, 20; Lebie, Rhoades, and McGrath (1995/1996) gave FtF groups 15 minutes and CMC, 20. This underlying ratio may be at the heart of many studies showing differences between CMC and FtF in experiments that imposed equal amounts of time on both conditions, and that may now be considered anomalous (see Walther et al., 1994). Alternatively, the present ratio could indicate that these participants were particularly slow in their use of email (which seems unlikely, given their experience levels), or that the units that coders identified as single comments contained more verbiage when they had been created by typing, and therefore appeared to be fewer. Regardless of the cause, the inability to equalize communication efforts made it difficult to assess differences in questions and self-disclosures. Use of proportions of conversation elements controlled for volume differences, but this practice established interdependencies that made detection of differences in use of strategies difficult. In order for a change in one area to be detected, it required a corresponding decrease in one or more other areas. Use of frequencies would have been more desirable, so that changes in one conversation element would be independent of other changes. Hopefully, future research can equalize the two channels more successfully in order to delineate the similarities and differences at the utterance level.

Another concern emanating from this disparity is the possibility that CMC participants felt rushed or time-pressured, which is one of the very problems for which the inequality in time periods was implemented. With-

out ample time, one could surmise that CMC partners felt rushed and therefore employed more intimate and effective uncertainty reduction strategies in order to compensate for the relative lack of time within the medium, obfuscating our ability to determine whether the observed intimacy was actually the result of time rather than medium, or an interaction effect of the two. While such a potential confound is an interesting possibility, it would contradict a growing amount of empirical research showing that time limits and time pressure in CMC lead to less affinity, more confrontation, and less social orientation than when time is unlimited (e.g., Reid, Ball, Morley, & Evans, 1997; Reid, Malinek, Stott, & Evans, 1996; Walther et al., 1994), and the current results, as predicted in several hypotheses, indicate that such affinity was not hampered (at least terminally); in other words, the results appear robust with respect to the problem of message inequality. While we cannot rule out that the possibility that the extra time fatigued the CMC participants, it is unclear how fatigue would have led to the intimacy effects they produced; neither can we rule out or confirm the possibility that they were enjoying themselves.

CONCLUSIONS

One of the goals of this research was to investigate the impact of a number of communication phenomena in computer-mediated settings. The results demonstrated that interactants use standard means of uncertainty reduction with slight modifications to accommodate channel differences. Therefore, many common tenets of uncertainty reduction theory may be extended to CMC, with the understanding that at least one stimulus for uncertainty reduction is similar in CMC and FtF communication. However, the means of reduction differ somewhat.

This investigation also provided further support for the notion that mediated interactants can and will develop personalized relationships characterized by intimacy, as suggested by SIP (Walther, 1992) and that individuals' reactions to the limitations of the media prompt them to overcompensate (cf. Utz, 2000). Individuals attempted to compensate for the limitations of CMC by hyperpersonalizing their interactions, presumably leading to accelerated gains in attributional confidence over the course of their brief conversations. Although numerous reports depict users' projective impressions of CMC as an inadequate or inefficient means of getting to know someone, CMC does not appear to hinder uncertainty reduction, merely perceptions of ability to do so. As a result of its use, more effective communicators exchange more intimate questions and disclosures than they would in similar FtF contexts, and acquaintanceship develops in CMC as it does FtF. CMC does not suffer in this comparison. CMC interactants work to overcome limitations of the channel as they get to know one another.

NOTES

1. In the original design of this research, hypotheses were considered regarding possible effects of anticipated future interaction on uncertainty reduction strategies and outcomes (following Walther, 1994). Accordingly, some dyads were induced to believe that the conversation would be the first of several with a particular partner (even though only one meeting actually took place), whereas others were encouraged to believe that this would be their only interaction together. A single-item manipulation check was used to assess participants' perceptions of the probability of future interaction with their partner: "What is the likelihood that you will talk with your conversational partner again? Indicate the number as a percentage from 0% to 100%." The mean rating regarding a future meeting was 38.5 for the one-shot interaction condition and 35.6 for the anticipated future interaction condition. Anticipation did not differ within the FtF dyads, t (82) = .09, p = .93 or the CMC dyads, t (72) = .68, p = .50. Similar to previous research concerning anticipated future interaction (Douglas, 1987; Kellermann, 1986; Walther, 1994), this investigation was unable to manipulate anticipated future interaction successfully, and as a result, this variable was dropped from further analysis.

2. A number of disclosure rating schemes were considered, conflicts among which led to modifications in the coding procedure. For instance, topic categorization schemes for self-disclosure, such as those used by Jourard (1971) or Rubin and Shenker (1978) have only been used in the development of questionnaire items rather than as content analytic approaches. A comparison of Taylor and Altman's (1966) system with Jourard's (1971) and Rubin and Shenker's (1978) revealed a number of blurred classification boundaries, which were modified here so that functional and mutually exclusive categories could be created. The first problem is that attitudes, values, and opinions together form a single topic category on each list. However, these items do not constitute topic categories, but cut across all topics rather than forming a single topic, i.e. attitudes are held on topics, such as family, appearance, money, or current events, but are not a topic in and of themselves. Altman and Taylor (1973) recognize this when they later use attitudes and opinions as a layer depicting intermediate intimacy rather than a topic category. Thus categories relating to attitudes, values, or opinions were removed from the Taylor and Altman scheme. A similar concern arises from the categorization of feelings and emotions, which again does not meet the topic construct, since emotions and feelings are possessed relative to specific topics such as self, others, events, etc. This category was subsumed into all other categories as well.

Next, love and sex are grouped together by Taylor and Altman (1966) and Jourard (1971), but Rubin and Shenker (1978) separate sex from emotion. Love is defined as an emotion or way of relating to another person. So there is some conceptual overlap with categories that deal with relationships with others and categories that deal with feelings and emotions. This resulted in sex being placed in its own category. While Jourard (1971) places sexual performance under the body category, he places facts about one's present sex life in the personality category, which is conceptually confusing. In our approach, sex and love were separated, with love in a single category concerned with feelings toward others and utterances about one's sexual performance or sexual history contained in a single other category.

Distinctions among biography, current, and historical events must also be clarified. Religion is treated as a demographic/biographic factor, despite Taylor and Altman (1966) considering religion as one category and biography as another. Views on religion, as they relate to one's own religion, are best dealt with via demographic/biographic information. In contrast, views on religious persecution would best be categorized under current events. Current events quickly become historical when a "new" issue preempts them. So it makes sense to expand current events to include both current and historical events that one is not personally relating to self or to one's own experience (that would be biography).

Further, regarding biography, Taylor and Altman (1966) separated one's own family and one's parental family from biography. However, since (a) one's biography does include the topics of one's own family and parental family, and (b) family relationships also dictate a

way of relating to others, information about the composition of one's family was considered biographic, whereas information about the quality of the family ties would be included under relationships with others.

Finally, while self-concept is typically considered to be a part of one's biography, Rubin and Shenker (1978) attempted to combine self-concept with interpersonal relationships. While one's self-concept can be shaped by, or drive behaviors and expectations within a relationship, there is mixed opinion on its independence from relationships. Conversationally it is topically separate from relationships, however, and was treated within the biographic topic category.

3. A check for nonindependence of dyad scores was conducted on the results. Kenny (1995) has demonstrated that in data from both members of a dyad, the scores are likely to be correlated and correlations of greater than .3 result in biased p values in significance testing. Dyadic scores in the present inquiry revealed that dyadic correlations between uncertainty and proportion of questions and disclosures were correlated at levels less than .3, and analyses continued using between-subjects designs. Technical problems interfered with the recording and subsequent analysis of some CMC dyads, which accounts for the unequal n in the following analyses.

4. *T*-tests employing frequency data did not reveal these patterns. Indeed, significant differences were obtained in the opposite direction when examining the number of questions, $M_{FtF} = 12.10$, $SD = 10.69$, $M_{CMC} = 6.88$, $SD = 5.45$; and the number of self-disclosures, $M_{FtF} = 51.15$, $SD = 38.53$, $M_{CMC} = 30.19$, $SD = 21.29$; while the difference in other comments still favored FtF to a great degree, $M_{FtF} = 24.94$, $SD = 20.84$, $M_{CMC} = 5.86$, $SD = 5.40$. All of these patterns mirrored the baseline difference in the mean number of comments between the communication conditions (87:43), and demonstrate the value of the proportional analysis.

5. Berger and Kellermann (1983) found that question-asking was associated with appropriateness, but that the relationship of question-asking to efficiency was moderated by the extent to which participants were perceived to be high or low in information-seeking. In order to detect curvilinear relationships for disclosure and questions with evaluations of appropriateness or effectiveness, quadratic terms for these utterance types, and their proportions, were computed and entered into regression analyses. No significant relationships were obtained for any analyses of the CMC data. Within the FtF condition, the quadratic transformation for the proportion of questions showed a significant negative zero-order relationship with conversational effectiveness, $r = -.31$, $p = .004$; there was also a significant zero-order relationship between the curvilinear representation of effectiveness and the proportion of other comments, $r = .31$, $p = .005$. However, multiple regression analyses of the change in R^2 for effectiveness when the quadratic terms were added to the linear terms indicated that the deviation from linearity was not significant: $F_{change} (1, 80) = 2.31$, $p = .13$ for questions, and $F_{change} (1, 80) = .289$, $p = .59$ for other comments. Hypothesis tests continued by comparing linear correlation coefficients between FtF and CMC conditions.

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