JEFFREY T. HANCOCK[1]
PHILIP J. DUNHAM

Impression Formation in Computer-Mediated Communication Revisited

An Analysis of the Breadth and Intensity of Impressions

Following either a text-based, synchronous computer-mediated conversation (CMC) or a face-to-face dyadic interaction, 80 participants rated their partners' personality profile. Impressions were assessed in terms of both their breadth (the comprehensiveness of the impression) and intensity (the magnitude of the attributions). Results indicated that impressions formed in the CMC environment were less detailed but more intense than those formed face-to-face. These data provide support for theories that, in addition to acknowledging the unique constraints and characteristics of CMC, consider the cognitive strategies and heuristics involved in the impression formation process. The differential impact of a text-based medium on trait-specific impressions (e.g., extraversion, neuroticism) is also discussed in the context of a cross-modal approach to impression formation.

Whether our interactions are long or short, task-oriented or casual, awkward or comfortable, as humans we seem to exit most of our social encounters with some general impression of the other person's characteristics and dispositions. When forming impressions about others, two general factors are involved. First and most obvious are the various forms of direct and indirect information available. Such information involves autonomous cues such as physical appearance (Jones, 1990), descriptions of a target's behavior or personality traits (Anderson, 1981), and other more subtle cues that emerge during social interactions. The latter can include social markers in speech (Scherer, 1979), reciprocation and verbal elaboration (Wyer, Swan, & Gruenfeld, 1995), and other aspects of language use (Semin, 1989). In addition, once we have gathered data about our social partners, we employ a

COMMUNICATION RESEARCH, Vol. 28 No. 3, June 2001 325-347

variety of inferential heuristics or strategies that also influence the impression formation process (Fiske & Taylor, 1991). Although an extensive review of these heuristics is beyond the scope of the present article, examples of such cognitive strategies include schema development (Cantor & Mischel, 1977), attitudes and stereotyping (Fiske & Taylor, 1991; Hogg & Abrams, 1988), person memory (Wyer & Srull, 1989), and other systematic biasing mechanisms that influence our attributions (Bem, 1972; Funder, 1987).

Questions about the factors influencing impression formation are currently being revisited with renewed vigor in the context of recent technological developments generally described as text-based, computer-mediated communication (CMC) (see Jacobson, 1999; Lea & Spears, 1992, 1995; Sproull & Kiesler, 1986; Walther, 1996, 1997). Early analyses of these text-based social exchanges emphasized the extent to which the CMC environment modifies or eliminates many of the cues and sources of information that have been identified as important in traditional impression formation research (for reviews, see Johansen, Vallee, & Spangler, 1979; Kiesler, Siegel, & McGuire, 1984; Walther, Anderson, & Park, 1994). Initial data tended to suggest, in general, that the impoverished CMC environment supports at best impersonal and task-oriented forms of communication (Hiltz, Johnson, & Turoff, 1986; Siegel, Dubrovsky, Kiesler, & McGuire, 1986; Sproull & Kiesler, 1986).

Theories that evolved from or were applied to these early findings tended to focus on CMC's diminished capacity for conveying emotional and personal information. These accounts include, among others, social presence theory (Short, Williams, & Christie, 1976) and reduced social context cues (Siegel et al., 1986; Sproull & Kiesler, 1986). Collectively, these theoretical approaches have been described by Culnan and Markus (1987) as defining a cues filtered-out (CFO) perspective. The unifying theme central to these approaches is that the reduction of nonverbal social and relational cues in CMC produces a depersonalized form of communication and decreased awareness of others, inhibiting interpersonal relations (for reviews and discussion of this perspective, see Garton & Wellman, 1995; Parks & Floyd, 1996; Spears & Lea, 1992; Walther, 1996).

The fundamental implication of the CFO perspective for impression formation in CMC is clear. The restriction and elimination of impression-relevant signals should lead to the development of relatively amorphous impressions when compared to a face-to-face (FtF) environment (Walther, 1993). Consider, for example, Dubrovsky, Kiesler, and Sethna's (1991) suggestion that the reduced cues in CMC "may lead people to forget that messages are communications, not just soliloquies to a computer. People can forget the nature and size of their audience or even that their communications will be read" (p. 124).

Whereas the CFO approach focuses on the reduction in sources of information available for impression formation, more recent theories have questioned the technological determinism implicit in this approach and have begun to focus on some of the social heuristics and inferential processes that contribute to impression formation. Two early and important challenges to the CFO perspective are the Social Identification/Deindividuation (SIDE) model (Lea & Spears, 1991, 1995; Spears & Lea, 1992, 1994) and the social information-processing theory (Walther, 1993; Walther & Burgoon, 1992). The SIDE model acknowledges the lack of cues afforded by CMC but shifts the focus to the social identity variables that frame CMC interactions and to the cognitive processes by which humans make significant inferences and overattributions about others on the basis of minimal information (Lea & Spears, 1992, 1995; Spears & Lea, 1992, 1994). Essentially, Spears and Lea (1994) argue that the lack of individuating cues in CMC compared with FtF interactions (e.g., physical appearance, vocal cues, etc.) renders zero-history participants relatively anonymous. The major consequence of this deindividuation, defined by visual anonymity and physical isolation, is an increased reliance on the few remaining social cues (e.g., cues to role, status, etc.) on which to form impressions of a CMC partner (Lea & Spears, 1995; Spears & Lea, 1994).

Under these conditions, participants are assumed to construct more stereotyped and exaggerated representations of their partners, based on the minimal cues emerging primarily from the relevant contextual signals provided in text-based discourse (e.g., cues to gender, status, categorical membership, etc.; Lea & Spears, 1991). Impression-relevant information may also emerge from the partner's communication style (e.g., word choice, paralinguistic cues, typographic information, etc.; Lea & Spears, 1992). As Lea and Spears (1992) note,

> In CMC, the presence of typing errors in a message may indicate that the sender was in a hurry when writing, but if errors are consistently observed over a series of messages they may be interpreted to mean that the person is careless or incompetent. (p. 324)

Within the original SIDE model formulation, any impressions formed are presumed to reflect the operation of underlying social categorization processes (Lea & Spears, 1992). For example, when deindividuated CMC participants perceive themselves as part of a group, this group identity is intensified and becomes more salient than their individual self-identities. The primary consequences of this social perception are strong positive feelings toward the partner and intensified attributions of similarity. The opposite outcome is

outcome is assumed in equally deindividuated conditions where the individual identities of participants are made more salient. In this latter case, unique aspects of a partner's communication style can accentuate negative feelings toward the partner (Lea & Spears, 1992; Spears & Lea, 1992). Note that, in sharp contrast to the CFO perspective, the scarcity of social and interpersonal information in CMC is assumed, paradoxically, to produce more intense and exaggerated positive or negative impressions of communicative partners, depending on the social context.

Social information-processing theory challenged the CFO perspective on several issues primarily concerned with the development of social impressions in CMC over time (Walther, 1993; Walther & Burgoon, 1992). The major thrust of social information-processing theory is that CMC retards the rate at which impression-relevant cues are exchanged during social interaction, rather than simply reducing or eliminating the amount of such information. Communicators are assumed to take an active role in forming impressions through text-based information. Initial impressions are presumed to be incomplete relative to FtF, but they become more developed and comprehensive over time as participants seek out relevant information about their partners (Walther, 1993, 1996). In one test of this hypothesis, Walther (1993) compared the depth of impressions over the course of three interactive sessions in CMC and FtF conditions. As predicted, after the first session, the impressions of partners formed by CMC participants were incomplete relative to those formed FtF, but by the third session, impression development in CMC approximated the development observed in the FtF condition.

A more recent theory proposed by Walther (1996, 1997), the hyperpersonal model, extends the developmental constraints outlined by social information-processing theory within a larger framework that recognizes both the cognitive processes highlighted by the SIDE model and some of the unique communicative features of the CMC environment. The hyperpersonal model, for example, incorporates the SIDE model's fundamental assumption that deindividuated participants in this social context will tend to form more stereotyped (i.e., hyperpersonal) impressions based on the limited social and interpersonal cues available. As described earlier, these stereotypic representations lead participants to overattribute in the absence of individuating or contraindicating information (Walther, 1997).

Although the SIDE model emphasizes the influence of social categorization processes on the intensity of positive and negative attributions emerging during CMC, Walther (1996) describes a wider array of interpersonal and social-communicative mechanisms that may operate over time. Participants are also presumed, for example, to take advantage of the communicative limitations of CMC to engage in what Walther (1996) has termed *selective*

self-presentation. Because CMC provides only textual information, participants can intentionally select positive and desirable cues (e.g., witty rapport) to present to their partners while masking or minimizing physical and behavioral cues not normally under the participants' control (e.g., physical appearance). In addition, whereas the lack of physical cues in CMC is typically portrayed by the CFO perspective as a hindrance to communication, the hyperpersonal model notes that this lack of cues may allow the user to reallocate cognitive resources normally applied to active involvement in FtF interaction, such as providing timely back-channel responses (Clark, 1996), to language selection, message construction, and impression management (Walther, 1996, 1997).

When these processes are considered together, the hyperpersonal model presents several experiential, cognitive, and behavioral factors that may produce interpersonal impressions in CMC that are more intense, rather than less so. Receivers of CMC messages tend to make overattributions regarding their partners' personality; senders of CMC messages, freed from some of the demands and constraints of FtF interaction, may engage in selective self-presentation and construct more thoughtful and carefully created messages.

Given this general overview, it is perhaps informative to contrast, in a particular social context, the predictions generated by the hyperpersonal model with predictions generated by the traditional CFO perspective. Suppose, for the moment, that two people meet for the first time in a text-based, CMC environment (e.g., a chat room, a technical support forum, a distributed learning environment, etc.) and converse about a particular topic. After the conversation, assume the participants are asked to rate each other on various personal characteristics measured on a Likert scale.

The CFO perspective suggests that impressions should be poorly developed in CMC relative to those formed during a similar interaction situated in an FtF context. The basic implications of the CFO model at the level of measurement operations are that (a) the impoverished CMC social environment will reduce the number of personal characteristics on which participants are confident in rating each other (i.e., participants will make fewer attributions in this impoverished environment) and (b) those characteristics that are rated will tend to cluster in the neutral range of a Likert scale. Note that these predictions address the impact of the impoverished environment in terms of both the *breadth* (i.e., number of characteristics rated) and the *intensity* (i.e., the magnitude of the attributions) of the impressions formed during the exchange.

In contrast, the hyperpersonal model acknowledges the impoverished nature of this communicative environment but implies that zero-history, deindividuated participants should initially be willing to form exaggerated

and stereotypic impressions enhanced by the unique communicative features provided by the CMC environment (e.g., selective self-presentation). The social information-processing perspective adopted by the hyperpersonal model suggests that the relatively slow rate of social information exchange presumed to occur in CMC interactions will tend to reduce the number of individual characteristics that participants are willing to rate after a one-time interaction (Walther, 1993). With regard to the intensity issue, however, the hyperpersonal model suggests an increase in the intensity of the more stereotypic and exaggerated aspects of the impressions that are formed. Thus, those characteristics that are rated by participants should tend to cluster toward the extreme (either positive or negative) ranges of the Likert scale. Again, we note that the impact of the CMC environment on impression formation is considered in terms of both the breadth and intensity dimensions of the process.

If one examines the existing literature for data relevant to these issues, there are, to the best of our knowledge, no experiments comparing impression formation in CMC and FtF environments in which both the breadth and the intensity of impressions are measured independently in the same experimental context. Procedures that assess the breadth of the impression formed are particularly rare. In most studies, participants are required to provide intensity ratings on a fixed number of traits identified as relevant by the experimenter and are not given the option of omitting an item if they are not confident in making the attribution. Indeed, as described above, in the first and only study in which participants were given the option of not rating participants, Walther (1993) reported that CMC participants were willing to rate their conversational partners on a smaller array of attributes than FtF participants following an initial interaction. As indicated earlier, this observation that impressions are less broadly formed after an initial interaction is consistent with predictions flowing from both the CFO perspective and the hyperpersonal model.

Research measuring the intensity dimension of impression formation has yielded inconsistent data. Several studies directly comparing CMC (deindividuating) and FtF (individuating) conditions have failed to yield significant intensity differences in the impressions formed in these two different communicative environments. For example, in an early study primarily assessing self-awareness in CMC, Matheson and Zanna (1988) found no difference across CMC and FtF conditions for participants' average evaluations of their partners on a 13-item, bipolar adjective scale following a short interaction. Similarly, in a study that was primarily concerned with group

decision-making processes, Lea and Spears (1991) failed to observe a significant difference across CMC and FtF conditions when participants were also asked to complete an ancillary measure assessing interpersonal evaluation of their partners (see also Lea & Spears, 1992, Study 2).

These failures to observe differences in the intensity of impressions formed across FtF and CMC settings contrast somewhat with more recent results reported by Walther (1997). Although this study did not directly compare across FtF and CMC conditions, significant differences in partner ratings of attractiveness (e.g., social and physical), productivity, and affection were observed within CMC conditions. Identity factors (individual versus group-salient identity) were factorially crossed with short-term versus long-term group membership. Impressions formed by partners in both group-identity conditions (short term and long term) were significantly more intense than those formed by partners in the two individual identity conditions (short term and long term). Of particular interest in the present context is that these differences in the intensity of impressions emerged from individuation manipulations within a CMC environment. Previous failures to observe differences across deindividuated CMC and, by default, individuated FtF conditions are therefore somewhat surprising. Note also that the more intense ratings that emerged on these interpersonal traits are consistent with the hyperpersonal model's assumption that personal attributions can be exaggerated in CMC.

The specific goal of the present study was to measure both the breadth and intensity dimensions of impression formation independently in the same experimental context. Following a short-term interaction between zero-history dyads in either a CMC or FtF environment, participants were asked to rate the personality characteristics of their conversational partners on a well-established, standardized measure of personality attributes that was modified to assess separately both the breadth and intensity of their impressions.

As discussed above, both the CFO and hyperpersonal perspectives suggest that, given the option, CMC interactants will be willing to rate fewer characteristics of their partners than FtF interactants. However, the predictions of the CFO and hyperpersonal models differ with respect to the intensity of the participants' ratings. The CFO model assumes that CMC participants will make relatively neutral attributions (i.e., attributions in the neutral range of a Likert scale) in this deindividuated environment, whereas the hyperpersonal approach argues that CMC participants will make more intense attributions based on the limited cues available in CMC.

Method

Participants

Participants were 84 English-speaking (12 male and 72 female) members of the university community, who received course credit or token remuneration for participating in the experiment. Participants were randomly paired to form 42 dyads. The members of each dyad were not acquainted with each other prior to the experiment. Participants knew when they volunteered that a partner would be involved. More females volunteered to participate in the study; consequently, random pairings of participants produced 12 male-female and 30 female-female combinations. Two dyads (four participants) were excluded from analysis because one of the participants in the dyad misunderstood the instructions and failed to complete the task.

Assessments

To assess participants' perceptions of their partners, each participant completed an observer form of the NEO-Five Factor Inventory (NEO-FFI; Costa & McCrae, 1991). This instrument is a shortened form of the NEO-Personality Inventory (NEO-PI), which taps the five-factor model of personality (Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness), a well-known and generalized model of personality (Costa & McCrae, 1992; McCrae & John, 1992). Cronbach's alpha reliabilities from the present administration, generated from cases that completed all 12 items of the relevant factor, were estimated to be Neuroticism (n = 20), .71; Extraversion (n = 26), .83; Openness (n = 18), .74; Agreeableness (n = 28), .79; and Conscientiousness (n = 32), .88. These reliability estimates are generally consistent with previous assessments of this scale (Foltz, Morse, Calvo, & Barber, 1997).

In addition to its well-established psychometric properties, this instrument was selected in an effort to assess a much wider array (breadth) of personal characteristics than has typically been measured in previous research. The observer form of the NEO-FFI consists of 60 items, 12 for each of the five traits. Each item or statement (e.g., This person is not a worrier) contained six possible responses: *strongly disagree*, *disagree*, *neutral*, *agree*, *strongly agree* and "cannot make judgment." The instructions described this last option as the appropriate response to the item if the participant felt he or she had insufficient evidence about the partner to make that particular judgment. The neutral option, in contrast, was described as the average response. Participants were instructed to select one response for each item.

Two dependent measures corresponding with our hypotheses were extracted from the observer form of the NEO-FFI. First, the number of the NEO-FFI questions answered provided an index of breadth (i.e., how detailed participants' impression of their partners was). Similar to the operational definition in Walther (1993), the more questions answered, or the fewer "cannot make judgment" responses, the more comprehensively developed the impression. In addition, the NEO-FFI permitted an analysis of impression development across the five personality traits by examining the number of questions answered within each trait domain.

Second, the intensity of each response was scored in terms of deviation from the neutral point on the Likert scale. Scores for each question could, therefore, range in either direction from 0 (average) to 2 (extreme). For example, both *strongly agree* and *strongly disagree* responses were scored as a 2 (extreme); both *agree* and *disagree* responses were scored as a 1; neutral responses were scored as 0 (neutral). Mean attribution ratings for each individual were obviously based on only those questions answered by the participant.

Procedure

On arrival at the laboratory, participants were led to separate rooms, avoiding any contact between the members of a dyad prior to the task. At this point, participants were told that they would collaborate to complete a figure-matching task. This task was adapted from Schober and Clark (1989). One participant, randomly designated the director, described a series of 12 tangrams (abstract shapes) to another participant, the matcher, and the latter attempted to identify the tangrams being described from an array of 16 tangrams. The director was instructed to describe each tangram, one at a time, to the matcher. Each tangram was discussed until the matcher claimed to have identified it. The matcher was encouraged to ask questions during this process and was instructed to notify the director when he or she believed the tangram had been correctly matched. Note, however, that to minimize individuating cues, participants were instructed not to reveal their name, age, or gender. Finally, no time limit was imposed on the dyads.

Two additional points about the above-described procedures should, perhaps, be emphasized. First, our decision to employ a task-oriented social interaction (i.e., the tangram-task) was an effort to avoid imposing ceiling effects on the breadth and/or intensity measures employed in the study. Intuition suggests that a task-oriented social environment would support more moderate levels of impression formation than a purely social exchange (e.g.,

discussing an attitude-based topic), especially in the FtF condition. The second point concerns our decision to instruct participants in the CMC condition not to reveal their names, gender, or age. There are obviously a large number of specific ways in which these global CMC and FtF environments differ (e.g., information differs regarding a partner's race, age, gender, dress, hairstyle, hygiene, prosody, affect, etc). These differences in available information contribute to the deindividuation process that is emphasized in current theories of CMC. Although this may threaten ecological validity to some degree, our goal in including explicit instructions about name, age, and gender in the CMC condition was to optimize deindividuation in this initial study. Presumably, if reliable effects are observed under these optimal conditions, subsequent research can proceed to restore specific properties to the CMC environment and/or strip away specific characteristics of the FtF environment in an effort to identify the roles played by the different elements of individuating information that define each of these two more global conditions.

Participants assigned to the CMC condition performed the task at isolated computer terminals. Participants used one of two desktop computer stations while the experimenter monitored and recorded the interaction from a third station. The three computers were networked such that signal transmission was virtually instantaneous between stations. Each terminal was equipped with the Windows95™ operating system and Mirabilis ICQ software (v. Beta1.113). Partners could send and receive messages simultaneously, with messages displayed on a What You See Is What I See (WYSIWIS), character-by-character basis. Once participants were situated at their terminals, the experimenter briefly demonstrated the use of the computer interface.

Participants assigned to the FtF condition performed the task in an interaction room where they sat at a table across from each other. The table had a 36 cm vertical barrier that prevented the participants from viewing each other's tangrams during the task.

Once the task was completed, participants in the FtF condition returned to separate rooms to complete the NEO-FFI about their partner; participants in the CMC condition remained at their computer station to complete the measure. After completing the NEO-FFI observer form, each member of the dyad was introduced to his or her partner and debriefed. Participants did not know in advance that they would be meeting their partner.

Results

Recall that the number of responses on the observer form NEO-FFI is assumed to index the breadth of impression development regarding the participant's partner. A 2 (communicative environment) × 5 (trait) mixed General

Linear Model (GLM) with trait as the repeated measure was conducted on the number of items answered (see Table 1). Consistent with both the CFO and hyperpersonal perspectives, a main effect of condition was obtained, $F(1, 78) = 5.48$, $p < .05$, $\eta^2 = .07$, with participants in the CMC environment responding to significantly fewer questions per trait ($M = 7.19$, $SD = 3.79$) than participants in the FtF environment ($M = 8.95$, $SD = 3.54$).

This difference, however, was not uniform across the five traits, as revealed by a significant interaction, $F(4, 312) = 2.54$, $p < .05$, $\eta^2 = .04$. Planned comparisons on each trait across conditions revealed that the groups differed in response frequency for three of the five traits, Extraversion, $t(78) = 2.43$, $p < .05$; Agreeableness, $t(78) = 2.33$, $p < .05$; and particularly Neuroticism, $t(78) = 2.45$, $p < .01$. In contrast, the differences in response rate for Openness, $t(78) = 1.68$, n.s.; and Conscientiousness $t(78) = 1.36$, n.s.; were not statistically significant and suggest that participants were prepared to make judgments regarding their partner's openness and conscientiousness in as much detail in the CMC condition as in the FtF condition (see Table 1). It should also be noted that the interaction effect obtained because high mean scores on some dimensions (e.g., 8.28 for FtF Neuroticism) were lesser than low mean scores on other dimensions (e.g., 9.23 for CMC Conscientiousness). Within each dimension, directional relationships between FtF and CMC were consistent, if not individually significant; the interaction is, therefore, ordinal and does not challenge the main effects.

The next question of interest was whether attributions in the CMC environment would be more intense than attributions made FtF. To address this question, a second 2 (condition) × 5 (trait) mixed GLM was conducted on the intensity scores derived from responses to the observer form of the NEO-FFI. As predicted by the hyperpersonal model, a significant effect of condition was obtained, $F(1, 67) = 3.92$, $p < .05$, $\eta^2 = .06$. The magnitude of the responses was greater in the CMC condition ($M = .92$, $SD = .23$) than in FtF ($M = .84$, $SD = .26$; see Table 2). The condition by trait interaction for attribution magnitude was not significant, indicating that the increased intensity of judgments in CMC was consistent across the different traits.[2]

Given that some dyads consisted of males and females (dyads = 11) whereas the majority of dyads consisted of only females (dyads = 29), additional analyses were conducted to determine whether the gender of participants had an impact on either the breadth or intensity of impression development. A 2 (condition) × 2 (male-female vs. female-female dyads) × 5 (trait) mixed GLM was conducted first on the frequency scores and then on the intensity scores. Neither analysis revealed any significant patterns across conditions. A second analysis was conducted to examine whether the gender of the perceiver influenced either dimension of impression development. A 2

Table 1
Mean Frequency (Standard Deviation) of Responses to Items by Personality Factor

	Neuroticism		Extraversion		Openness		Agreeableness		Conscientiousness		Total	
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
Computer-mediated conversation	5.78	(4.11)	7.30	(4.03)	6.30	(3.90)	7.32	(4.02)	9.23	(2.91)	7.19	(3.79)
Face-to-face conversation	8.28	(4.03)	9.33	(3.34)	7.78	(3.97)	9.25	(3.33)	10.13	(3.01)	8.95	(3.54)
Mean difference	2.50		2.03		1.48		2.02		.90		1.76	
Total	7.03	(4.24)	8.31	(3.84)	7.04	(3.98)	8.29	(3.80)	9.68	(2.98)		

Note. Frequency scores could range from 0 to 12 for each trait.

Table 2
Mean Intensity (Standard Deviation) Scores by Personality Factor

	Neuroticism		Extraversion		Openness		Agreeableness		Conscientiousness		Total	
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
Computer-mediated conversation	.85	(.19)	.85	(.25)	.95	(.24)	.97	(.24)	.95	(.21)	.92	(.23)
Face-to-face communication	.81	(.21)	.77	(.27)	.78	(.26)	.91	(.28)	.92	(.28)	.84	(.26)
Mean difference	.04		.08		.17		.06		.03		.08	
Total	.83	(.20)	.82	(.26)	.86	(.26)	.94	(.23)	.94	(.24)		

Note. Intensity scores could range from 0 (Neutral) to 2 (Extreme).

(condition) × 2 (male vs. female perceiver) × 5 (trait) mixed GLM again revealed no significant results. These results should be interpreted with some caution, however, given that the low number of males and male-female dyads in the sample reduced the power to detect any differences.

Finally, although the tangram task is not the focus of the present article, it should be noted that no differences in task performance were observed across communicative settings, t (38) = .40, n.s. This result is consistent with other studies that have failed to observe task performance differences across CMC and FtF conditions (Williams, 1977). Dyads in the FtF condition made as many errors (M = 2.85, SD = 2.35) as did dyads in the CMC condition (M = 2.60, SD = 1.47). Furthermore, individual differences in task performance did not correlate with any of the measures of impression formation (i.e., breadth of impression, intensity of attributions).

As would be expected, significant differences were also observed between conditions for task completion times, t(20.73, corrected for unequal variances) = 6.78, $p < .001$. Dyads communicating FtF completed the task more quickly (M = 7.69 minutes, SD = 3.52) than dyads communicating via computer completed the task (M = 36.22 minutes, SD = 18.49). As a consequence, CMC participants were exposed to their conversational partners for a significantly longer period of time than their FtF counterparts.

Discussion

The present research revisited the issue of impression formation in an effort to examine both the breadth and intensity of impressions, across a range of personality traits, that developed during a one-shot interaction in synchronous CMC and FtF conditions. The present data speak to several issues.

Consider, first, the breadth or comprehensiveness of impression formation in the CMC and FtF environments. An examination of response frequency on the observer form of the NEO-FFI revealed that, after a one-time interaction, zero-history participants in a text-based communicative environment made fewer attributions about their partners relative to participants communicating FtF. Indeed, setting aside specific traits, interactants in the CMC environment responded to only 59.9% of the 60 items; interactants in the FtF condition responded to 74.6%. This difference is consistent with Walther's (1993) observation that initial impressions formed in a CMC environment are relatively incomplete relative to those formed during an FtF interaction.

This finding supports predictions flowing from both the CFO and hyperpersonal perspectives. The broad reduction of nonverbal data about a partner in a one-time CMC interaction apparently constrains the range of

information normally relied on to form more robust impressions. It is important to note, however, that although CMC participants made fewer attributions about their partners, CMC participants nonetheless indicated that, in absolute terms, sufficient information was available to rate their partners on more than half of the 60 items (59.9%). We should also note that a ceiling effect was not observed in the FtF condition, with participants responding to substantially less than 100% of the items (74.6%).

Consider next the intensity of the impressions formed in each communicative environment. An analysis of the magnitude of the attributions on the observer form of the NEO-FFI revealed that, rather than developing neutral impressions as suggested by the CFO perspective, participants in the CMC condition made more extreme attributions than did partners communicating FtF. That is, compared with impressions developed after an FtF interaction, impressions of a partner's personality profile after a CMC interaction were more intense.

These data contrast with previous studies that have failed to observe significant differences in the intensity of impressions across FtF and CMC conditions (e.g., Lea & Spears, 1991; Matheson & Zanna, 1988). Our tentative explanation for this discrepancy is that the wider array of personal characteristics assessed in the present study, and the fact that participants were not required to make intensity ratings on every item, may constitute a more sensitive measure of the intensity dimension than those employed in previous research.

The more intense partner ratings observed are, however, consistent with Walther's (1997) findings indicating that, within a CMC environment in which individual identities are not made salient, participants can make exaggerated attributions regarding a partner's personal qualities (e.g., physical and social attractiveness, productivity, etc.). In addition, although Walther did not explicitly manipulate FtF and CMC conditions in this study, the attractiveness ratings of collocated participants, who potentially used alternate methods of communication over the course of the study (e.g., FtF, telephone), were compared with the ratings of distributed partners, who communicated only by CMC. Congruent with the present data, the ratings of collocated (CMC/FtF) participants were more neutral than the ratings of the distributed (CMC only) partners, who produced more intense attributions (e.g., more or less socially attractive).

Indeed, the pattern that emerges from the breadth and intensity data in the present study provides general support at the initial stage of impression formation for Walther's (1996, 1997) hyperpersonal model. The less broadly developed impressions in the CMC condition are consistent with the temporal constraints associated with the differential rates of social information

processing specified within the hyperpersonal framework, whereas the increased intensity observed in the CMC partner ratings is in line with an underlying assumption of the hyperpersonal model that "CMC partners produce overattributions of each other based on the minimal social cues conveyed by the medium, in the absence of contraindicating information" (Walther, 1997, p. 350).

The hyperpersonal model also suggests that as the interaction proceeds, participants begin to actively generate adaptive strategies for reducing uncertainty about a partner's personal qualities in text-based communication (Walther, 1996). Presumably, given this relatively short period of interaction, CMC participants were unable to seek out and gather sufficient impression-relevant information about their partners to match the breadth of the impressions formed by FtF communicators, although the short duration of their interactions did not prevent participants from producing exaggerated attributions.

An important question remains, therefore, as to how these differences in breadth and intensity will change over time. Our reading of the hyperpersonal model suggests that with more interactions over a longer period of time, CMC/FtF differences in the breadth of impressions should disappear as CMC participants learn more about each other. Predictions are less clear for the intensity measure. On one hand, as more individuating information is learned about a partner, impressions of that partner should be based more on interpersonal information and less so on exaggerated, social identity-derived stereotypes. With the increased individuating information, impressions should become less intense (Spears & Lea, 1992; Walther, 1997). On the other hand, the unique affordances of the CMC environment outlined by the hyperpersonal model indicate that impressions can become more intensified over time as participants engage in selective self-presentation and cognitive reallocation and as intensification processes such as behavioral confirmation begin to operate (Walther, 1997). Future longitudinal research, in which both breadth and intensity of measures are assessed over time, is obviously an important next step in addressing these questions adequately.

Several other factors may also have played a role in the impression formation process in the present context. These include (a) the synchronous format of the CMC condition, (b) the mechanical nature of the tangram task, and (c) the instruction set. The synchronous format employed here is a departure from the asynchronous formats (e.g., e-mail, newsgroup) employed in previous research on the hyperpersonal model and its predecessor, the social information-processing theory (e.g., Walther, 1993, 1997). Although the use of this format extends the conditions for which the hyperpersonal model has received support, it also presents the possibility that the array of active

strategies and cognitive mechanisms described by the hyperpersonal model to facilitate overattributions was more difficult to implement. Cognitive reallocation, for example, may have been less feasible given the online, simultaneous nature of the synchronous format. Similarly, both the instructions to not reveal one's name, age, or gender and the task-oriented nature of the tangram problem-solving conversations may have dissuaded or discouraged participants from explicitly seeking information about their partners. Indeed, an examination of the transcripts indicates that active interpersonal inquiry, defined as questions focused on learning about a partner's personal qualities, were not observed in the CMC condition.

These factors did not, however, eliminate interpersonal information and signals from being presented in the CMC condition. A partner's choice of descriptive devices (e.g., geometric vs. analogic descriptions), communicative style, and paralanguage (e.g., use of emoticons, punctuation, capitalization, etc.) all provided potentially impression-relevant information. Consider the following example:

> Director: OK, the next one looks like an altar boy. He is holding something out.
> Matcher: What exactly does an altar boy look like?
> Director: Sorry, I am not too religious myself.

In this example, the director infers from the matcher's question that the matcher is not religious, and this piece of information may factor into the director's judgments of his partner. In the director's response, subtle selective self-presentation is also evident, with the director describing himself as similarly not religious.

In the next example, the style of the communication, rather than its content, can be seen as potentially influential in the formation of an impression.

> Matcher: Thanks.
> Director: No problemo :)
> Matcher: Um . . . the body — kind of like a
> Director: A parallelogram.
> Matcher: —thanks, that's the word I was looking for. :-)
> Director: :)

The use of ellipses, emoticons, hyphens, and the collaborative nature of the interaction in this example all demonstrate some of the additional nonverbal forms of information about a partner's personality available in text-based discourse.

As described by the SIDE model, and incorporated into the hyperpersonal framework, the salience of these social and interpersonal cues is enhanced within the CMC condition's deindividuating context (Lea & Spears, 1992; Spears & Lea, 1992; Walther, 1996). The exaggerated, stereotypical impressions formed in this condition were presumably based on, and biased by, these minimal cues, in the absence of other individuating information.

It is also of some interest to note that these data have some implications for cross-modal approaches to the examination of impression formation. Previous research has compared trait-related information presented in the visual and audio modalities (Borkenau & Liebler, 1992; Maxwell, Cook, & Burr, 1985). Borkenau and Liebler (1992), for example, demonstrated that some traits, such as extraversion, are consistently expressed in both the visual (e.g., clothing style, extent of smiling, etc.) and audio (e.g., loud, powerful voice, etc.) modalities. The use of the NEO-FFI in the present experimental context raises similar questions about what type of trait-specific information is expressed in text-based verbal exchanges.

The significant interaction between communicative environment and trait domain observed for response frequencies revealed that the influence of a textual communication format on the breadth of impression formation following a single interaction was not equivalent across the five trait domains. Significant differences existed between conditions for Neuroticism, Extraversion, and Agreeableness, with participants in the CMC setting making fewer attributions for these three trait domains than participants that interacted FtF. In contrast, participants rated Conscientiousness and Openness in equivalent detail across the CMC and FtF environments.

Why is it that participants interacting in CMC would be less willing to rate their partners on the traits of Neuroticism, Extraversion, and Agreeableness than participants interacting FtF? Although any attempt to answer this question is, at this point, admittedly speculative, there are relevant analyses in the traditional FtF literature to suggest that the specific nature of the cues present in CMC may selectively undermine impressions of certain traits and provide adequate information about others. Traits have been suggested to vary, for example, in their general observability (Kenrick & Stringfield, 1980) or visibility to an observer (Funder & Dobroth, 1987; John & Robins, 1993; Kenrick, McCreath, Govern, King, & Bordin, 1990). From this perspective, the impressions of highly visual traits, such as Extraversion, should be undermined in a text-based CMC interaction whereas impressions of less visually observable traits, such as Neuroticism and Openness, should be less affected (see Table 3 for example items and their level of visibility). Although such an analysis accounts for some of the patterns observed in the present data, this approach seems to be an

Table 3
Example NEO-Five Factor Inventory (NEO-FFI) Items Demonstrating the Visibility of Traits

Trait	Visibility	
	High	Low
Neuroticism		Sometimes this person feels completely worthless
Extraversion	This person laughs easily	
Openness		Poetry has little or no effect on this person
Agreeableness	This person tries to be courteous to everyone	
Conscientiousness	This person is not a very methodical person	

as would be expected, impressions of highly visible traits (e.g., Extraversion) were undermined in the CMC condition relative to the FtF condition whereas impressions of less visible traits (e.g., Openness) were equally detailed across conditions. However, impressions of the least observable trait, Neuroticism, were impoverished in CMC relative to FtF. Participants were more hesitant to rate this trait in CMC, suggesting that factors other than visibility must be involved in ratings of Neuroticism, factors that are available in a single FtF interaction but not in a single CMC interaction.

We did not anticipate these trait-specific effects, and a more definitive understanding of the mechanisms underlying them will depend on additional research. Studies that systematically enrich the text-based CMC environment by adding various forms of visual and auditory information should help us to assess the impact of these different modalities on trait-specific impressions formed across various task settings.

Finally, although the CMC environment is a unique and potentially important addition to the cross-modal approach to impression formation, the present research highlights and confirms the limitations inherent in a technologically deterministic, cues filtered-out approach to interpersonal processes in mediated communication (Garton & Wellman, 1995; Spears & Lea, 1992, 1994; Walther, 1996). Although the reduction of interpersonal and social cues in a CMC environment is an important factor in impression formation, the impact of the cognitive processes involved must also be taken into account to predict accurately both the breadth and intensity of impressions. Indeed, the explanatory advantage of the hyperpersonal, social information-

processing, and SIDE models is derived directly from their consideration of the cognitive strategies (e.g., information seeking, selective self-presentation) and heuristics (e.g., social identity and stereotyping) involved in the formation of impressions. The current research also underlines the importance of considering both the breadth and intensity dimensions of impression formation. Procedures that require participants to respond to all items on a scale may conceal important differences in the breadth of impression development or the rater's confidence associated with each attribution.

Notes

1. This research was supported by grants from the Natural Sciences and Engineering Research Council of Canada and the Social Sciences and Humanities Research Council, awarded to Philip J. Dunham. A Social Sciences and Humanities Research Council fellowship and a Killam doctoral scholarship supported Jeffrey T. Hancock. The authors thank Diana Chard for assistance in the collection and analysis of these data, Frances Dunham for technical support, and an anonymous reviewer for comments on earlier drafts of this manuscript.

2. A directional analysis of the intensity scores revealed that there was no systematic low- or high-score bias in the trait attributions across conditions. That is, the more intense scores observed in the CMC condition were bidirectional and represented both higher and lower attributions than those observed in the FtF condition. Note that this observation is consistent with a hyperpersonal interpretation of the results, in which partners are assumed to come to know each other more intensely but not necessarily unidirectionally (i.e., only positive or only negative impression).

References

Anderson, N. H. (1981). *Foundations of information integration theory.* New York: Academic Press.

Bem, D. J. (1972). Self-perception theory. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 6, pp. 1-62). New York: Academic Press.

Borkenau, P., & Liebler, A. (1992). The cross-modal consistency of personality: Inferring strangers' traits from visual or acoustic information. *Journal of Research in Personality, 26,* 183-204.

Cantor, N., & Mischel, W. (1977). Traits as prototypes: Effects on recognition memory. *Journal of Personality and Social Psychology, 35,* 38-48.

Clark, H. H. (1996). *Using language.* Cambridge, UK: Cambridge University Press.

Costa, P. T., & McCrae, R. R. (1991). *NEO-FFI Form S.* Odessa, FL: Psychological Assessment Resources.

Costa, P. T., & McCrae, R. R. (1992). *NEO-PI/FFI manual supplement.* Odessa, FL: Psychological Assessment Resources.

Culnan, M. J., & Markus, M. L. (1987). Information technologies. In F. Jablin, L. L. Putnam, K. Roberts, & L. Porter (Eds.), *Handbook of organizational communication* (pp. 420-443). Newbury Park, CA: Sage.

Dubrovsky, V. J., Kiesler, S., & Sethna, B. N. (1991). The equalization phenomenon: Status effects in computer-mediated and face-to-face decision- making groups. *Human Computer Interaction, 6*, 119-146.

Fiske, S. T., & Taylor, S. E. (1991). *Social cognition* (2nd ed.). New York: McGraw-Hill.

Foltz, C., Morse, J. Q., Calvo, N., & Barber, J. P. (1997). Self- and observer ratings on the NEO-FFI in couples: Initial evidence of the psychometric properties of an observer form. *Assessment, 4*, 287-295.

Funder, D. C. (1987). Errors and mistakes: Evaluating the accuracy of social judgment. *Psychological Bulletin, 101*, 75-90.

Funder, D. C., & Dobroth, K. M. (1987). Differences between traits: Properties associated with inter-judge agreement. *Journal of Personality and Social Psychology, 52*, 409-418.

Garton, L., & Wellman, B. (1995). Social impacts of electronic mail in organizations: A review of the research literature. In B. R. Burleson (Ed.), *Communication yearbook* (Vol. 18, pp. 434-453). Thousand Oaks, CA: Sage.

Hiltz, R.S., Johnson, K., & Turoff, M. (1986). Experiments in group decision-making: Communication process and outcome in face-to-face versus computerized conferences. *Human Communication Research, 13*, 225-252.

Hogg, M. A., & Abrams, D. (1988). *Social identification*. London: Routledge.

Jacobson, D. (1999). Impression formation in cyberspace: Online expectations and offline experiences in text-based virtual communities. *Journal of Computer-Mediated Communication, 5* [Online]. Available: www.ascusc.org/jcmc/vol5/issue1/jacobson.html

Johansen, R., Vallee, J., & Spangler, K. (1979). *Electronic meetings: Technical alternatives and social choices*. London: Addison-Wesley.

John, O. P., & Robins, R. W. (1993). Determinants of interjudge agreement on personality traits: The big five domains, observability, evaluativeness, and the unique perspective of the self. *Journal of Personality, 61*, 521-551.

Jones, E. E. (1990). *Interpersonal perception*. New York: W. H. Freeman.

Kenrick, D. T., McCreath, H. E., Govern, J., King, R., & Bordin, J. (1990). Person-environment intersections: Everyday settings and common trait dimensions. *Journal of Personality and Social Psychology, 58*, 685-698.

Kenrick, D. T., & Stringfield, D. O. (1980). Personality traits and the eye of the beholder: Crossing some traditional philosophical boundaries in the search for consistency in all of the people. *Psychological Review, 87*, 88-104.

Kiesler, S., Siegel, J., & McGuire, T. W. (1984). Social psychological aspects of computer-mediated communication. *American Psychologist, 39*, 1123-1134.

Lea, M., & Spears, R. (1991). Computer-mediated communication, de-individuation, and group decision-making. *International Journal of Man-Machine Studies, 34*, 283-301.

Lea, M., & Spears, R. (1992). Paralanguage and social perception in computer-mediated communication. *Journal of Organizational Computing, 2*, 321-342.

Lea, M., & Spears, R. (1995). Love at first byte? Building personal relationships over computer networks. In J. T. Wood & S. Duck (Eds.), *Understudied relationships: Off the beaten track* (pp. 197-233). Thousand Oaks, CA: Sage.

Matheson, K., & Zanna, M. P. (1988). The impact of computer-mediated communication on self-awareness. *Computers in Behavior, 4*, 221-233.

Maxwell, G. M., Cook, M. W., & Burr, R. (1985). The encoding and decoding of liking from behavioral cues in both auditory and visual channels. *Journal of Nonverbal Behavior, 9*, 239-263.

McCrae, R. R., & John, O. P. (1992). An introduction to the five-factor model and its applications. *Journal of Personality, 60*, 175-215.

Parks, M. R., & Floyd, K. (1996). Making friends in cyberspace. *Journal of Communication, 46*, 80-96.

Scherer, K. (1979). Personality markers in speech. In K. Scherer & H. Giles (Eds.), *Social markers in speech*. Cambridge, UK: Cambridge University Press.

Schober, M. F., & Clark, H. H. (1989). Understanding by addressees and overhearers. *Cognitive Psychology, 21*, 211-232.

Semin, (1989). Impressions of personality revisited: The contribution of linguistic factors to attribute inferences. *European Journal of Social Psychology, 19*, 85-101.

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications*. London: John Wiley.

Siegel, J., Dubrovsky, V., Kiesler, S., & McGuire, T. (1986). Group processes in computer-mediated communication. *Organizational Behavior and Human Decision Processes, 37*, 157-187.

Spears, R., & Lea, M. (1992). Social influence and the influence of the 'social' in computer-mediated communication. In M. Lea (Ed.), *Contexts of computer-mediated communication* (pp. 30-65). London: Harvester-Wheatsheaf.

Spears, R., & Lea, M. (1994). Panacea or panopticon? The hidden power in computer-mediated communication. *Communication Research, 21*, 427-459.

Sproull, L., & Kiesler, S. (1986). Reducing social context cues: Electronic mail in organizational communication. *Management Science, 32*, 1492-1512.

Walther, J. B. (1993). Impression development in computer-mediated interaction. *Western Journal of Communication, 57*, 381-398.

Walther, J. B. (1996). Computer-mediated communication: Impersonal, interpersonal, and hyperpersonal interaction. *Communication Research, 23*, 3-43.

Walther, J. B. (1997). Group and interpersonal effects in international computer-mediated collaboration. *Human Communication Research, 23*, 342-369.

Walther, J. B., Anderson, J. F., & Park, D. (1994). Interpersonal effects in computer-mediated interaction: A meta-analysis of social and anti-social communication. *Communication Research, 21*, 460-487.

Walther, J. B., & Burgoon, J. K. (1992). Relational communication in computer-mediated interaction. *Human Communication Research, 19*, 50-88.

Williams, E. (1977). Experimental comparisons of face-to-face and mediated communication: A review. *Psychological Bulletin, 84*, 963-976.

Wyer, R. S., & Srull, T. K. (1989). *Memory and cognition in its social context*. Hillsdale, NJ: Lawrence Erlbaum.

Wyer, R. S., Swan, S., & Gruenfeld, D. H. (1995). Impression formation in informal conversations. *Social Cognition, 13*, 243-272.