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Is a Picture Worth a Thousand Words?

Photographic Images in Long-Term and Short-Term Computer-Mediated Communication

This article asks whether, and when, participants benefit from seeing each other's faces in computer-mediated communication. Although new technologies make it relatively easy to exchange images over the Internet, our formal understanding of their impacts is not clear. Some theories suggest that the more one can see of one's partners, the better one will like them. Others suggest that long-term virtual team members may like each other better than would those who use face-to-face interaction. The dynamic underlying this latter effect may also pertain to the presentation of realistic images compared with idealized virtual perceptions. A field experiment evaluated the timing of physical image presentations for members of short-term and long-term virtual, international groups. Results indicate that in new, unacquainted teams, seeing one's partner promotes affection and social attraction, but in long-term online groups, the same type of photograph dampens affinity.

With the expansion of the Internet and new communication technologies, we are witnessing the diffusion of high-end, high-bandwidth multimedia technology for a wide range of people. It is common for many computer-mediated communication (CMC) users to create multimedia World Wide Web sites with graphics and pictures. In business, consultants and developers now emphasize "richer" technologies such as videoconferencing for connecting dispersed colleagues (e.g., Gates, 1999; Johansen & O'Hara-Devereaux, 1994). In contrast, other developers (e.g., Hollan & Stornetta, 1992) suggest that systems that attempt to endow CMC with face-to-face (FTF) attributes miss the point: The widespread adoption of text-based electronic communication indicates that plain text systems offer advantages beyond what can be achieved through FTF communication or systems that attempt to re-create

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FTF levels of presence. According to Sproull, Subramani, Kiesler, Walker, and Waters (1996), "At least some of the time, trying to make interfaces more like humans apparently results in disconcerting users, if not actually confusing or displeasing them" (p. 100).

Research is still in the early stages of addressing the advantages and disadvantages of different media properties. Although initial technology research tends to focus on main effects, comparing one medium to another or one medium to none, more recent research has begun to explore the interplay of media properties as they interact with other, social variables. These interactions often provide greater theoretical insights as well as pragmatic implications for the application of communication technologies. This research endeavors to examine one set of interactions related to new media: the deployment of photographic information in the context of computer conferencing, with the timing of such deployments in relation to a group's longevity. In other words, when, if ever, does the presentation of communicators' photographs help or hinder their communication in online conferencing, compared to the impressions and relations that are built solely on the basis of text-based communication? Which is better, a picture or a thousand words?

Review

Assessing the impact of photographs in computer conferencing provides an opportunity to examine several theories about mediated communication and interpersonal interaction. Early theories and research regarding the social effects of CMC suggested that the absence of nonverbal cues had negative effects on interpersonal relations. More recent efforts have identified positive social relations in CMC and suggested the dismissal of earlier positions. Walther (1996) argued that there are identifiable contingencies that support either position; under certain circumstances, CMC may be impersonal, interpersonal, or hyperpersonal, the latter referring to the development of interpersonal relations that exceed the affinity of parallel, offline interactions. This contingency approach provides the basis for the present research.

Social Presence

Social presence theory (Short, Williams, & Christie, 1976) was one of the first theoretical frameworks to be applied to CMC (for a review, see Hiltz, Johnson, & Turoff, 1986; Rice, 1984). Originally a theory of teleconferencing, the theory conceives of social presence as a communicator's subjective sense about the salience of an interaction partner. This feeling is a function of the number of cues that a medium offers: The fewer the number of cue systems

(i.e., verbal, aural, visual, and their subcategories), the less the degree of social presence one experiences when using that medium. The effect of reduced social presence is, in turn, a reduction of interpersonal warmth and affection that communicators enact and experience with one another. CMC, bereft of nonverbal cues, is posited to be very low in social presence. Drawing on this theory, several studies found greater task-oriented than socially oriented communication in CMC compared with FTF conversations (for a review, see Rice, 1984, 1993).

It is not clear from social presence theory what critical level of cue systems is required for a threshold degree of social presence. Although high-bandwidth multimedia such as interactive videoconferencing certainly offer more cue systems than text-based CMC, research finds that a high degree of cue exchange may not be more effective than a moderate level (for a review, see Whittaker & O'Connell, 1997). Even though users *rate* video higher than CMC on social presence (e.g., Rice, 1993), they do not depend much on the dynamic aspects of video that lead to social presence ratings (see Noll, 1992; cf. Tang & Isaacs, 1993). For instance, Gale (1991) compared CMC alone, CMC plus audio, and CMC plus audio plus video and found that users focused their attention to the video on only whether partners were still attending to the discussion rather than using the video as a channel to help promote message or attitude understanding. Attention to video also led to slower and less effective task performance. At the same time, video was rated higher in perceived social presence than CMC only or CMC plus audio. Considering that participants ignored the dynamic aspects of video, perhaps the visual appearance of others is adequate to instill social presence and the interpersonal outcomes associated with it.

Although it seems natural to surmise that the content and nature of one's appearance might be expected to affect the nature of social judgments, social presence, like other perspectives, focuses on only the quantity, rather than quality, of cues transmitted by different media. The theory posits a linear increase in presence as cue channels are added. In line with this unidirectional premise, Storck and Sproull (1995) summarize the value of physical appearance with respect to mediated communication as "more information leads to greater positive regard" (p. 202). Such assumptions are similar to those that uncertainty reduction theory portends for initial FTF interactions among strangers (Berger & Calabrese, 1975): Greater amounts of information about partners reduce discomfort, increase predictability, and raise the level of affection toward others. Indeed, in a test of uncertainty reduction theory using photographs of prospective conversational partners, Berger and Douglas (1981) found that seeing photographs did have uncertainty-reducing effects. Applying uncertainty reduction theory to CMC, Lawrence and

Mongeau (1996) found that photographs helped to increase affiliativeness in CMC.

Although a good deal of research has supported social presence theory and similar approaches, other findings conflict to the extent that some researchers have suggested abandoning the theory (e.g., Baym, 1995; Fulk, Schmitz, & Schwarz, 1992; Spears & Lea, 1992; Steinfeld, 1992).

Impressions, Relations, and Time

The social information processing (SIP) theory of relational communication in CMC (Walther, 1992) represents one alternative to the social presence approach. SIP differs in several assumptions: (a) Communicators' affiliation motives induce them to develop impressions and relations despite hindrances that alternative media may impose. (b) Users adapt their efforts to present and acquire social information using whatever cue systems a medium provides. CMC users employ language, content, and timing to achieve social goals. (c) Relational processes take time, and CMC is relatively slower than FTF. Thus, if time is restricted, social development is retarded (Walther, 1992). The dimension of time is a critical one in this view: The negative effects associated with a lack of social presence, it suggests, are confined to zero-history groups with no longevity (for a review, see Walther, 1996). When greater periods of time are available and as CMC participants actively seek and present social and personal information about each other, knowledge accrues, CMC partners construct impressions of each other, and their relationships develop to normal interpersonal levels. Research has alternately lent support to this position (e.g., Chidambaram, 1996; Peterson & Schliesman, 1997; Walther, 1993; Walther, Anderson, & Park, 1994; Walther & Burgoon, 1992) or led to its modification.

One of the modifications to the theory was a reexamination of an assumption that online partners experience affiliation motives similar to those of offline communicators that unidirectionally impel relational development. Research has established variations in such motivations and in subsequent communication due to several contextual factors, such as skepticism about CMC (Utz, 2000) or overt interest in online relationship seeking (Roberts, Smith, & Pollock, 1996). Participants' anticipated future interaction also impacts CMC affiliation in significant ways. Although anticipated future interaction is known to affect social information exchange rates and interpersonal evaluations offline, it affects CMC partners more strongly: It promotes more personal questions and self-disclosures online than in FTF first encounters (Tidwell & Walther, 2000), and it influences intimacy levels even more than media differences do (Walther, 1994).

These dynamics help us understand how and when CMC users adapt to the medium and re-create social presence in a text-only medium. Yet, there are sometimes even more than normal levels of presence possible through CMC. By extending SIP and incorporating principles from other social-psychological and cognitive theories, a variant was proposed to account for hyperpersonal processes in CMC.

The Hyperpersonal Communication Framework

The hyperpersonal perspective offers an approach to understanding the ways CMC users sometimes experience intimacy, affection, and interpersonal assessments of their partners that exceed those occurring in parallel FTF activities or alternative CMC contexts.

RECEIVERS

The hyperpersonal perspective posits that under certain circumstances, CMC users construct hyperbolic and idealized constructions of their virtual partners. These circumstances are partially illuminated by drawing on social identification/deindividuation (SIDE) theory (Spears & Lea, 1992). This theory argues that when communicators interact using visual anonymity (i.e., they cannot see physical cues that identify their partners as individuals), they are deindividuated. Under these conditions—common in text-based CMC—any bit of social information transferred by the context or content is subject to overattribution by receivers. Furthermore, when partners experience a salient group identity rather than an individual orientation, these attributions accentuate assumed similarities and shared norms. In reaction, social evaluations are more positive.

SIDE theory does not specify what naturally occurring factors may prompt a group (vs. individualistic) identity, other than ingroup/outgroup categorizations' being especially salient. The hyperpersonal perspective draws on other aspects to predict the valence of relational dynamics.

SENDERS

As communicators create messages in CMC, they may engage in selective self-presentation. Although impression management also takes place offline, its performance in CMC may be more controllable and fluid. Users may modify their texts using CMC's affordances to inspect, edit, and revise messages before they are sent (a luxury that is rare in FTF interaction). In addition, in CMC there is no accidental transmission of unintended nonverbal behavior

or physical appearance cues. Moreover, some of the cognitive-behavioral resources that are required in FTF interaction are unnecessary in CMC (environmental scanning, attending to partners' nonverbal cues, backchanneling, and monitoring one's own nonverbal behaviors) (see Burgoon & Walther, 1990); communicators may reallocate such resources to create more targeted messages in terms of their nature, content, style, and potential impact (Walther, 1997b).

THE CHANNEL: DISENTRAINMENT

Entrainment is the joint focus and coordinated information processing that group members devote to a project despite competing demands on their attention and time (Kelly, Futoran, & McGrath, 1990). Such coordination is difficult in FTF conversations. Kelly and McGrath (1985) found that when time is limited and entrainment is strained, positive social/relational aspects of communication are ignored, and meetings are more impersonal. In contrast, asynchronous CMC users can attend to the communication process at times of their own discretion and convenience, without needing coparticipants to be active at the same time. They can concentrate on both the task and the social dimensions of communication because the time spent on one function need not reduce time for the other. As a result, CMC should allow more intended and desirable message construction.

FEEDBACK

These sender-receiver-channel processes, of course, are reciprocally related through feedback, which may add a further dynamic. When a message receiver perceives a partner favorably (or unfavorably) and then acts toward that partner on the basis of this impression, a self-fulfilling prophecy is instantiated. Snyder, Tanke, and Berscheid (1977) refer to this as "behavioral confirmation": When we communicate on the basis of our preconceptions of others, the other persons tend to enact those properties implied in the messages of the first person, which are magnified through reciprocal reinforcement.

In sum, the hyperpersonal perspective depicts how senders select, receivers magnify, channels promote, and feedback increases enhanced and selective communication behaviors in CMC. Online communicators may exploit the capabilities of text-based, nonvisual interaction to form levels of affinity that would be unexpected in parallel offline interactions.

In its original form (Walther, 1996) the hyperpersonal perspective was unclear about the precise conditions under which these directions would take

place, and little was said about (hyper)negative outcomes. Yet, by subsuming SIP principles, such predictions come into focus: If CMC users anticipate a long-term commitment with their partners, they initiate affiliative behaviors, and as time accrues, these experiences affect communication patterns through the proposed processes. The overall dynamics appear to affect users' instrumental efforts, as well as assessments of partners' intimacy, social attractiveness, and even projected physical attractiveness (Walther, 1997a). Conversely, if short-term commitment is anticipated, and as brief associations curtail the tendency to attend to both task and social factors, there will be a concurrent negative shift in relational patterns. Combining the tendency toward impersonal orientation when time is inadequate with the use of a medium that requires more mechanical effort than FTF (Reid, Malinek, Stott, & Evans, 1996; see also Kelly & McGrath, 1985; Olaniran, 1996), virtual partners with a short association should be expected to adopt disaffiliation behaviors and impersonal orientations and to denigrate those online partners with whom they must temporarily work.

Such hyperbolic projections should be diminished by grounding interactions in FTF conversation or by the presence of photo-realism. Because hyperpersonal CMC yields impressions that are above average and because the physical appearance of most normal people is, by definition, average, receivers' impressions may be dampened if physical reality intrudes. As Curtis (1992) observes,

The sensorial parsimony of plain text tends to entice users into engaging their imaginations to fill in missing details while, comparatively speaking, the richness of stimuli in fancy [systems] has an opposite tendency, pushing users' imaginations into a more passive role. (p. 66)

Jacobson's (1999) interviews with CMC users show how these mutual constructions create discontinuities between imagined and actual appearances:

It is not uncommon for people who meet in the text-based environments of cyberspace . . . to be mistaken, sometimes wildly so, when they imagine one another's offline appearances. . . . Studies of computer-mediated communication have paid scant attention to . . . the fit between imagination and reality.

Moreover, when a CMC user has been exercising selective self-presentation only to find that a photograph has been introduced, the latitude of his or her self-presentation opportunities may be mitigated. According to Curtis (1992), "It is substantially easier for players to give themselves vivid, detailed, and interesting descriptions . . . in a text-based system than in a graphics-based

one" (p. 66). Without photo-realism, hyperpersonal effects may inflate global impressions and overattributions of users' characteristics, in comparison to which photo-realism may be disappointing.

Hypotheses

The attention to time and cues in the recent theories and research suggests moderating influences that may help us to untangle the apparent conflicting predictions that the theories, in total, suggest. Following social presence theory in short-term, one-shot interactions only, if CMC partners are presented visual information at the inception of their communication, members may communicate more affection and enjoy social interaction more than do parallel, zero-history partners who do not receive visual information.

Hypothesis 1: For new groups (with no history), the presence of a picture promotes greater (a) affection and (b) social attractiveness than does the absence of a photograph.

However, for group members who work with each other over some period of time, an opposite effect is hypothesized, which would limit social presence theory. The hyperpersonal model predicts that relationships developed through long-term, text-based CMC may come to exceed parallel offline counterparts in affection and sociability. Like SIDE theory (Spears & Lea, 1992), it suggests that the relationships people form virtually may reflect more affinity than those in which a physical impression is present. However, unlike SIDE, and drawing on the temporal dimension of SIP research (Walther, 1994), this prediction is limited to long-term versus short-term interactions. Partners who anticipate long-term associations and who then have them have a greater affiliation motive, seek and exchange more personal information, and evaluate each other more positively than those emerging from short-term interactions or from more concrete, uncontrollable self-presentations (such as FTF, or in this case, that provided by photographically anchored virtual interaction). In the context of long-term virtual groups, the introduction of a photograph in later interactions may be disappointing and unattractive, mitigating otherwise hyperbolic social evaluations and relational communication and detracting from the self-presentation and idealization partners exchange through reciprocal virtual interactions. "Video primacy" effects—visual images are attended to more readily than language (Argyle, Alkema, & Gilmour, 1971)—should influence impressions and override idealization when images are present. Drawing on this perspective we predict the following:

Hypothesis 2: For groups with long-term association, the presence of a photograph decreases (a) affection, (b) social attractiveness, and (c) physical attractiveness, relative to the absence of a photograph.

A more complex prediction can also be derived. It is possible that both pairs of hypotheses are true, due to an underlying theoretical dynamic that resides in the interaction effect of time and media. That is, the presence of a photograph stimulates an opposite reaction depending on whether the group members who see it are in new, interpersonally uncertain groups as opposed to established, hyperpersonal groups whose members may be disappointed. Thus, a disordinal interaction is posited, a finding of support for which would override the previous predictions.

Hypothesis 3: Virtual groups with long-term histories and the absence of photographs experience greater (a) affection, (b) social attractiveness, and (c) physical attractiveness than long-term groups with photographs, but short-term groups with photographs are greater than short-term groups without photographs.

A graphical depiction of the dynamics predicted appears in Figure 1.

The hyperpersonal perspective suggests another contingency: that certain factors may lead CMC interaction to achieve various levels of affinity, conveniently labeled impersonal, interpersonal, and hyperpersonal. The contingency specifies that short-term groups using text-based CMC with no anticipated future interaction are expected to experience relatively unpleasant, impersonal interactions and social evaluations, whereas less restricted communication (FTF communication or less constrained CMC) facilitates normal levels of relational communication and interpersonal perceptions. However, when such participants expect and accrue long-term interaction that is strictly virtual, they may achieve the exaggerated intimacy of the hyperpersonal level. The presence of a photograph may operate in a fashion similar to the physical appearance stimuli in FTF communication by providing impression-bearing cues, or social presence, to zero-history groups. Such cues may raise short-term groups' otherwise impersonal relations to more moderate levels of affinity. At the same time, such photographs may quash hyperpersonal long-term groups' idealization and reduce such groups to more moderate interpersonal, rather than hyperpersonal, levels. This contingency is expressed as follows:

Hypothesis 4: Virtual groups with long-term histories and the absence of photographs experience greater (a) affection, (b) social attractiveness, and (c) physical attractiveness than either long-term groups with

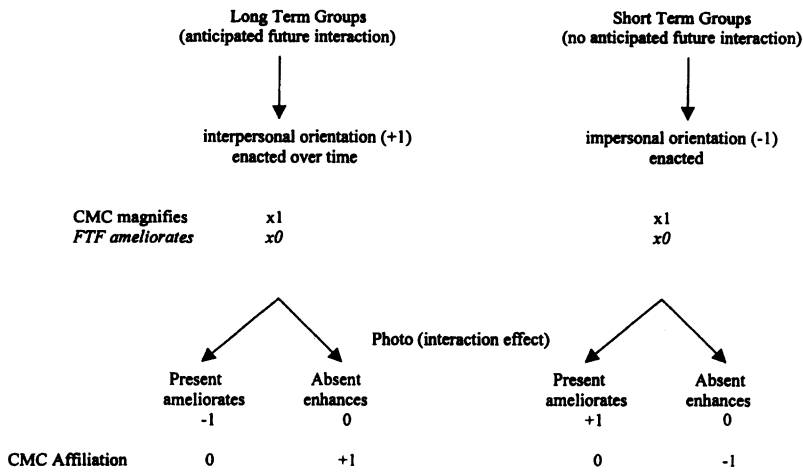


Figure 1. Schematic for Hypothesized Relationships

Note. CMC = computer-mediated future communication. FTF = face-to-face.

photographs or short-term groups with photographs, which in turn are greater than short-term groups without photographs.

While Hypothesis 3 posited disordinal interactions (opposite effects of a photograph between short- and long-term groups), Hypothesis 4 is not obviated by Hypothesis 3. Hypothesis 4 specifies a hierarchy among conditions that may be true regardless of Hypothesis 3.

A further question about self-presentation is also directly related to the hyperpersonal perspective. This approach contends that CMC communicators take advantage of the limitations of the medium and engage in a heightened degree of selective self-presentation. Consequently, we should expect that people with no picture may find CMC more helpful and be more successful at self-presentation, whereas those “stuck” with photographs perceive lesser prospects for impression management, find CMC less helpful, and are less successful.

Such dynamics have been seen in other communication media. In an analysis of the commercially unsuccessful AT&T picturephone, Noll (1992) observed that whereas some “might like to see the other person while talking on the telephone, very few are willing to be seen” (p. 316). The same may be true for computers, yet the results of several studies examining the use of humanlike faces as computer interfaces produce conflicting implications. In a comparison of communication through a text-only channel to one with still images of a humanoid face, Bengtsson, Burgoon, Cederberg, Bonito, and

Lundeberg (1999) found marginally *lower* ratings on sociability and dynamism when there was some face rather than none. This contrasts Sproull et al.'s (1996) findings, in which participants interacting with a computer script rated facial interfaces greater in sociability and activity and experienced greater arousal and more favorable self-presentations than when the same words came from a text-only display. More telling, Nass, Kim, and Lee (1998) found that users interacting with their own prerecorded facial images engaged in less impression management than when they were confronted by someone else's face. How such phenomena may adhere as users see their own and others' faces in actual interaction through, and not to, the computer, remains to be seen.

Hypothesis 5: Self-presentation through CMC is perceived to be less successful when CMC is accompanied by a photograph and more successful when it is not.

Method

Participants

A field experiment was conducted among international virtual work-teams ($N = 8$ groups) composed of students in the United States and England ($N = 24$ participants) who were taking a course from two locations. Of the participants, 14 were women and 10 were men, and their mean age was 21. Participants had worked on a series of academic projects using text-based CMC (e-mail and text-based computer conferencing) over the course of a semester with various partners. A randomized-blocked procedure was used to assign participants to groups originally, blocking on country, to obtain consistent ratios of domestic and foreign partners. A careful counterbalancing scheme was used to assign some partners to new groups and keep others in the same groups over the course of these projects.² The resulting sample was rather small, yet the organic educational settings, with specific electronic modifications, provided a relatively rare opportunity for a field experiment. As Reid et al. (1996) noted of their CMC experiment using participants at only one location, "A plausible and relevant task requiring high levels of involvement over a realistic period of time was used. The very high costs of these arrangements, however, did mitigate against large sample sizes" (p. 1022). Although statistical power is a concern, a review of previous research in this domain yields some extremely large effects,³ and a theoretical approach subsuming previous conclusions should also yield large effects, ameliorating power concerns somewhat.

Procedures

The research employed a 2 (long-term/short-term) by 2 (photograph/no-photograph) design. For longevity, in this, their last course project, half the students worked in established, long-term groups in which they had completed three collaborative assignments over the previous 12 weeks. The other half were mixed into new groups composed of partners with whom they had not previously worked. In the new groups, those participants from the same country (i.e., in the same class section) knew each other somewhat from FTF classroom meetings. Although virtual (i.e., international) partners may have heard of one another before this project, they had not collaborated, nor had they seen or heard each other.

Within each of these longevity conditions, half of the groups, selected at random, were presented with digitized color photographs of each group member prior to a decision-making exercise using a computer conferencing system, and the other half were not. Photographs were created by isolating single frames from videotapes of the students at both sites, which had been taken several weeks prior, ostensibly for other purposes. Frames were selected on the basis of their featuring a head shot of the participants' faces and their reflecting a pleasant demeanor. Images were altered to achieve consistent color balance and to feature the person's name in the frame.

All interactions took place in university computer laboratories that were reserved for these classes at the respective institutions. Computers in both locales were arranged so that one user could not see another's screen casually.

Each person was first presented with a paper handout with one of two discussion topics on it (which later showed no differences on outcomes). Following the topic, instructions directed participants to use a World Wide Web browser to view a Web page on which all of their names were listed alphabetically. By clicking on one's name, a hyperlink instantiated another page on which further instructions appeared. There were two versions of this second page. On the no-photograph version, all instructions were in text, as recreated in Figure 2, but with actual participant names where indicated.

Participants in the photograph-present condition were shown an alternative type of page when they clicked on their names, featuring photographs of their partners and themselves as depicted in Figure 3.

The computer conferencing system, NecroMOO, was a real-time, text-based virtual reality system running in Norway and available through the Internet at the time this study was conducted. The participants from each site had learned how to communicate in such a system from previous exercises in their courses, although they had not communicated across sites before using this venue. They each had characters represented by their real

Instructions:

You will be working with these people: Name 1, Name 2, and Name 3.

Leave Netscape running in one window. In another, please log in to NecroMOO (sirill.svg.mbs.no:7777) and log in under your name. Then give the command, @go #1249. This will take you to a private room where you and your group partners can work on the decision task.

Note: Real names have been removed for protection of participant confidentiality.

Figure 2. Example Instructions for No-Photograph Condition

Note. Real names have been removed for protection of participant confidentiality.

Instructions:

You will be working with these people:



Leave Netscape running in one window. In another, please log in to NecroMOO (sirill.svg.mbs.no:7777) and log in under your name. Then give the command, @go #1250. This will take you to a private room where you and your group partners can work on the decision task.

Figure 3. Example Instructions for Photograph Condition

Note. Actual photographs appeared in color, with participants' names superimposed on their images. Photographs used with permission.

names on NecroMOO. The specific MOO system was chosen due to the minimal response lag (see Marvin, 1995) it afforded to both sites, compared with similar systems in the United States and United Kingdom that tended to be good for one continent but not the other. The line in the instructions with the address "sirill.svg.mbs.no:7777" was a hyperlink that when clicked, invoked a telnet program that automatically connected to the particular MOO. Once connected, executing the command "@go #1249" transported these group members to a virtual room where they could communicate with each other. Each group had its own "room," which had been programmed in advance. Each room was "locked," but each group member's character was made to have the property of a "key" to the specific room to which each was assigned. That is, a participant could go into his or her group's room without

impediment but could not accidentally go into another group's room. To be in a room is to be able to see the comments of people who are in that room but not to see comments by those who are elsewhere.

At the end of the online discussion, participants completed a self-administered questionnaire containing measures for the dependent variables of this study. Scales for relational communication and interpersonal attractiveness were repeated for one virtual and co-located member of the group, and self-presentation was completed with reference to the single communication episode.

Items were presented as 5-interval Likert-type scales. Intimacy/affection was assessed using scales from Burgoon and Hale's (1987) Relational Communication Questionnaire, modified for groups in CMC (see Walther & Burgoon, 1992). The measure (after adjustments to improve reliability, with 9 items retained) obtained Cronbach's alpha = .90. Attractiveness was measured using a subset of the scales developed by McCroskey and McCain (1974) for task attractiveness (5 items, $\alpha = .90$), social attractiveness (5 items, $\alpha = .86$), and physical attractiveness (3 items, $\alpha = .95$). Self-presentation success was assessed using two original items ("The computer-mediated communication allowed me to present myself in a favorable way" and "I think I made a good impression on the others through the computer system"), $\alpha = .80$.⁴

Results

Manipulation Check

To make sure that new groups' members differed in their acquaintance level from old groups', a manipulation check on familiarity was conducted. A single item asked, "To what extent did you know [Person A] before this project?" with possible responses ranging from 1 (*not at all*) to 5 (*very well*). Among CMC-only partners, the results showed that members of old groups ($M = 3.27$, $SD = .93$) expressed greater familiarity with partners than did members of new groups ($M = 2.32$, $SD = 1.17$), $F(1, 22) = 4.95$, $p = .037$, confirming that these conditions were different. No manipulation check was conducted for photographs. Although it is possible that some participants may not have noticed the photographs when they appeared, the Web page layout and the necessity to click through it suggests that this was extremely unlikely.

Analysis Strategy

Prior to hypothesis testing, data were analyzed using a nested, hierarchical analysis of variance of the Photograph \times Longevity interaction, with a repeated measure within subjects (because each subject assessed two

partners) to generate statistical terms appropriate for the analysis of participants operating in groups. By specifying one group with photographs and one group without photographs in each level of a groups variable (see Anderson & Ager, 1978), a MANOVA procedure generated the *MS* associated with groups within the Picture \times Longevity interaction effect for each dependent variable, respectively. The hypothesis tests used focused contrast analyses, using these derived groups-within-interaction terms as the *MS* error, or the denominator, for the respective contrast tests.

The main analysis strategy followed this procedure. First, focused contrast analyses were used such that specific contrast weights were assigned to the means from participants' assessments of their CMC-only (foreign) partners,⁵ and weights of zero were assigned to the FTF partners' means. For example, to address the Hypothesis 3 interaction hypotheses on affection and attractiveness, the following contrast weights were used: old CMC groups with no photographs, +1; old CMC groups with photographs, -1; new CMC groups with photographs, +1; new CMC groups with no photographs, -1; each of the four FTF conditions, 0 (see Table 1). On dependent variables for which the interaction hypotheses were significant, no further analyses were conducted for Hypothesis 1 or Hypothesis 2, as the disordinal interaction would override main effects. In the cases in which the interaction did not obtain, main effect hypotheses would be tested using additional contrast analyses. Hypothesis 4 was tested using a further set of contrast weights: +1, 0, 0, -1, 0, 0, 0, 0. Although these multiple tests were not orthogonal and risk some alpha slippage, methodological opinion suggests that because they were derived from a priori theoretical predictions, they were nevertheless called for without alpha protection (Keppel, 1982; Rosenthal & Rosnow, 1984; Winer, 1971). Hypothesis 5, the test for photograph on self-presentation, was assessed using contrasts for photograph-present (-1) and photograph-absent (+1), using means collapsed across longevity and media. For ease of presentation and comprehension, in the following, each dependent variable is reviewed in turn for the interaction hypothesis, Hypothesis 3; then main effect hypotheses where applicable; then the test of Hypothesis 4. The results for Hypothesis 5 appear afterward.

Intimacy, Social Attraction, and Physical Attraction

The first hypothesis test examined the interaction of Photograph \times Longevity on intimacy/affection. Hypothesis 3 predicted that for virtual partners in new groups, a picture would enhance relational outcomes relative to unfamiliar partners with no picture, whereas a photograph would reduce the affect among virtual partners in experienced groups. The contrast analysis con-

Table 1
Comparison Weights, Means, Standard Deviations, and Cell Sizes for Longevity by Photo Effects on Intimacy/Affection, Social Attraction, and Physical Attraction, and Photo Effects on Self-Presentation

	Computer-Mediated Communication				Face-to-Face Communication			
	Long-Term		Short-Term		Long-Term		Short-Term	
	Photo	No Photo	Photo	No Photo	Photo	No Photo	Photo	No Photo
Contrast								
Hypothesis 3	-1	+1	+1	-1	0	0	0	0
Hypothesis 4	0	+1	0	-1	0	0	0	0
Score								
Intimacy/affection ^a	3.53 (.76)	4.12 (.78)	3.77 (.71)	3.03 (.47)	3.28 (.79)	2.69 (.28)	2.81 (.42)	3.94 (.71)
Social attraction ^a	3.44 (.59)	4.17 (.65)	3.90 (.68)	3.43 (.67)	3.14 (.97)	2.89 (.24)	2.70 (.13)	3.94 (.71)
Physical attraction	3.57 (.76)	3.52 (.42)	2.86 (1.36)	3.37 (.38)	2.50 (1.00)	3.61 (.53)	3.11 (2.01)	2.50 (1.18)
<i>n</i>	6	7	6	5	6	7	6	5
Contrast								
Hypothesis 5	-1	+1						
Score								
Self-presentation ^a	3.50 (.89)	4.14 (.69)						
<i>n</i>	12	12						

Note. Standard deviations are in parentheses. *N*s under computer-mediated communication and face-to-face communication represent the same participants, rating different targets. For Hypothesis 5, long-term/short-term was collapsed.
 a. Significant differences as predicted.

firmed the Hypothesis 3(a) interaction, $t(6) = 2.12, p < .05, \eta^2 = .44$. Long-term groups with no photographs were higher in intimacy/affection than were long-term groups that had photographs, but short-term groups with photographs were more intimate/affectionate than were short-term groups with no photographs.⁶ Descriptive statistics are presented in Table 1. No further tests of Hypothesis 1 or Hypothesis 2 on intimacy/affection were conducted.

Hypothesis 4 was supported with respect to intimacy/affection. Hypothesis 4(a) predicted the impersonal/interpersonal/hyperpersonal hierarchy among communication conditions, such that short-term groups with no photographs were expected to be lowest in intimacy/affection, followed by long-term groups with photographs and short-term groups with photographs. Long-term CMC groups with no photographs would be highest in intimacy/affection. The contrast analysis was significant, $t(6) = 2.46, p < .05, \eta^2 = .50$.

Social attractiveness also was significantly affected by Longevity \times Photograph, as the focused contrasts supported Hypothesis 3(b) on this dimension, $t(6) = 2.36, p < .05, \eta^2 = .48$, with photographs helping new group members' but hurting existing group members' assessments of how well they liked interacting with their partners. Again, the disordinal interaction rendered Hypothesis 1 and Hypothesis 2 analyses moot.

Hypothesis 4(b) was also supported, $t(5) = 2.06, p < .05, \eta^2 = .41$. On social attractiveness, long-term/no-photograph CMC was superior to other forms, and short-term/no-photograph CMC partners liked interacting with each other least.

There were no effects for Hypothesis 3(c) on physical attractiveness, and the array of means suggested that no further analysis would reveal predicted patterns of Hypotheses 1, 2, or 4.

Hypothesis 5 predicted a main effect of the presence of a photograph on perceived self-presentation success, such that participants with no photographs would find the CMC system more helpful in achieving a good impression than would those whose pictures were present. Means for this hypothesis were collapsed across longevity and media, to test for a main effect of photograph. The contrast analysis supported the hypothesis, $t(6) = 1.99, p < .05, \eta^2 = .40$.

Discussion

The findings can be summarized as follows: Hypothesis 3 was supported on two dimensions. The presence of a photograph prior to and during computer conferencing had positive effects on intimacy/affection and social attractiveness for short-term, unacquainted CMC partners. In contrast, CMC partners who had gotten to know each other online over time experienced less affection

and social attraction when a picture was introduced, compared with long-term CMC partners who never saw each others' photos. Hypothesis 4 was supported on the same sets of dependent variables, demonstrating a hierarchy among conditions in terms of intimacy/affection and social attraction, where the long-term, no-photograph condition was higher than any condition with a photo, and the short-term/no-photograph condition was the least beneficial.

Thus, on measures of interpersonal liking, long-term virtual groups maintained levels of affinity that exceeded those that occurred when a dose of physical reality, by means of photographs, was introduced into the interactions of their counterpart groups. These results reveal that CMC partners with time on their side can achieve greater interpersonal outcomes through strictly text-based exchanges than can others using more bandwidth or short-term groups are likely to do. The impersonal/interpersonal/hyperpersonal contingency (Walther, 1996) seems to account for affective results as well. Rather than reject social presence, the results confirm that its domain is limited to short-term conditions only. When conditions are expanded beyond the short term, regardless of bandwidth, CMC achieves higher levels of affinity. However, the greatest affinity occurs in long-term text-based CMC with no other cues. The same photographs that help defeat impersonal conditions also dampen hyperpersonal ones.

Hypothesis 3 was not supported on physical attractiveness. The most simple interpretation would be that the factors that affected liking did not overattribute onto this dimension, as it did under similar circumstances elsewhere: In Walther's (1997a) research on Identity \times Time interactions in hyperpersonal CMC, effects obtained on projected physical attractiveness among CMC partners, but in that study, no actual visual exposure or photographs were involved in any CMC conditions. It is tempting to conclude that when photographs are present, rather than being biased, physical attractiveness perceptions are taken at face value. However, further analyses revealed that another potential bias was operative. In exploring effects for participants' or partners' gender or gender combination, the only outcome variable showing gender effects was physical attractiveness. In this case, a Participant Sex \times Partner Sex interaction emerged among CMC partners, $F(1, 20) = 6.50, p = .02$ (using a between-subjects, not nested groups, analysis). Decomposition of this effect revealed that male participants differed in physical attractiveness ratings of their partners regardless of the presence or absence of photographs (which presented no main or interaction effects): Men rated women higher in physical attractiveness ($M = 3.70, SD = .65$) than they rated other men ($M = 2.06, SD = 1.11$), $F(1, 8) = 9.13, p = .02$. Female participants did not exhibit differences in physical attractiveness ratings of their

partners, men or women. Thus, in this case, the organismic bias of stereotypical sex roles may have influenced assessments of physical attractiveness, overriding the experimentally expected bias.

Hypothesis 1, predicting strict social presence effects in short-term groups, and Hypothesis 2 for strict hyperpersonal effects (i.e., without the Time \times Photo interaction), were not analyzed, as they were obviated by higher order effects.

Hypothesis 5 was supported by a main effect for photo on self-presentation: Users felt that CMC facilitated more success at creating a positive impression when they used text alone, rather than when interaction was accompanied by photographs. This result helps illuminate the hyperpersonal perspective's contention about selective self-presentation. At the same time, the result does not demonstrate that self-presentation per se, either alone or in combination with idealization, was operative; the perspective suggests that both take place.

A follow-up analysis suggests that both processes did occur, but not uniformly. Although no direct measures of idealization were employed, the assessment of how well participants knew their CMC partners—the manipulation check measure—may represent a surrogate scale of impression development. Using this measure, among the CMC partners, knowledge of one's partner should correspond with affection and attraction. Self-presentation success should also show some relationship to affection and attraction. Correlation analyses using all CMC partners' ratings (both with and without photographs) detected no such relationships. However, correlations within the respective photograph-absent and photograph-present conditions showed some contrasting effects.

When there was no photograph, greater familiarity was significantly associated with increased intimacy/affection and social attraction (see Table 2). Self-presentation had no effect on affection or social attraction, but self-presentation success was associated with physical attractiveness. These patterns suggest that both idealization and selective self-presentation are occurring when no photograph is present but that the processes may affect different kinds of partner perceptions. When there is no photograph, physical attractiveness perceptions depend on the success of one's self-presentation.

When pictures were shown, however, self-presentation was *negatively* correlated with physical attractiveness, and familiarity had a *positive* impact on physical attractiveness. Familiarity level was negatively related to social attraction. It appears that when partners' photographs are shown, the less physically attractive they are, the more they engage in successful self-presentation, perhaps in a compensatory manner. Or, the more physically attractive partners are, the less successful they believe their impression management efforts

Table 2

Correlations of Self-Presentation and Familiarity With Relational Communication and Attraction for Computer-Mediated Communication Partners With and Without Photographs and Differences Between Photograph/No-Photograph Correlations¹

	Intimacy/ Affection	Social Attraction	Physical Attraction	Self- Presentation
Self-presentation				
No photograph <i>r</i>	.34	.48	.59**	—
Photograph <i>r</i>	.03	.04	-.62**	—
<i>z</i> _{photo vs. no photo}	.69	1.02	2.98****	—
Familiarity				
No photograph <i>r</i>	.76***	.70***	.22	.28
Photograph <i>r</i>	-.34	-.54*	.50	-.30
<i>z</i> _{photo vs. no photo}	2.86****	3.12****	.69	1.27

Note. *n* = 12.

p* < .05. *p* < .025. ****p* < .01. *****p* < .005.

are. (Or, they are wrong about their perceived success at self-presentation, and the more successfully they believe they self-presented, the less physically attractive they were rated.) Although the precise meaning of these patterns is obviously not yet clear, the revelation that these influences—picture, self-presentation, and familiarity over time—operate in different directions deserves further, deliberate exploration. For the time being, they raise two additional issues: First, physical attractiveness effects in CMC—real or imagined—may be more complicated than the main or interaction effect hypotheses predicted. Second, idealization and self-presentation processes may be differentially sensitive to CMC context and/or exert effects on different perceptions in the hyperpersonal process than have been conceived so far. What is clear is that CMC users do work on their self-presentations, and their ability to mold others' impressions of them is limited by the presence of photographic information during computer conferencing. What is a given in FTF communication is a variable online, which deserves further exploration.

Although these results provide some support for the hyperpersonal CMC perspective, they offer an interesting counterpoint to SIDE theory (Spears & Lea, 1992). SIDE theory argues that when CMC partners are visually anonymous, they experience deindividuation and are more prone to the influence of a salient group identity or an individual identity. Group identity, when salient, leads to greater social attraction. From a SIDE perspective, we would expect a photograph to eliminate visual anonymity/deindividuation, thereby ameliorating the potential value of a group identity and reducing social attraction (see, e.g., Spears, Lea, & Lee, 1990). Indeed, the results within the long-term group conditions in this study conform to this prediction if we

presume that the mere existence of the groups rendered group identities salient among their members. However, the short-term groups complicate matters, for their results were contrary, and there is no clear reason why the presumption of a salient group identity should be any less applicable for the short-term groups. To presume so requires reference to temporal and developmental effects, which SIDE theorists have acknowledged (Lea & Spears, 1995) but are only beginning to incorporate into the model (see Postmes, Spears, & Lea, in press). The hyperpersonal model's focus on interactive exchange over time to build idealized structures—its reciprocal being that underdeveloped, strictly virtual associations may be frustrating even when they are visually anonymous—is more explicit in the matter but is based on different assumptions about the nature of impression and relationship construction.

At a more abstract level, this study reinforces the notion that the study of CMC effects is not best served by blanket statements about technology main effects on social, psychological, and interpersonal processes, nor by proclamations that online relationships are less rewarding than FTF ones (cf. Kraut et al., 1998). Rather, qualities of CMC are, in this case as in others, more often the product of interesting and predictable interactions of several mutual influences than main effects of media.

This study raises several questions for future research. In addition to those raised above with respect to the roles of idealization and self-presentation, others arise with respect to the form, content, and effects of visual information that may affect the affinity that CMC groups experience. Because a photograph makes a difference on at least some dimensions of CMC, future research might explore different forms and contents of photographs to see if different kinds of pictures enhance desirable or mitigate undesirable effects (see, e.g., Berger & Douglas, 1981). Another effect to explore pertains to the categorical and personal impressions that one's photograph may instantiate in one's partners. Text-based messaging via the Internet is sometimes lauded for its ability to break down social barriers due to otherwise visible demographic/intergroup differences such as age, sex, race, and status that may be suggested by visual cues accompanying FTF communication. Adding in graphical displays that may invoke such stereotypical impressions presents a double-edged sword. Although the detection of individual differences may subvert hyperpersonal creations and render CMC similar to "normal" interpersonal communication obtained in FTF groups (Walther, 1997a), it has the potential to lead to negative evaluations about others in some circumstances (Spears et al., 1990). Moreover, our male participants' biased perceptions of physical attractiveness based on partner gender, even when no picture was present, suggests that social categorical judgments may arise regardless of

physical appearance among many types of social category cues in CMC (see also Postmes, Spears, & Lea, 1998).

In addition to perceived differences due to social/categorical factors, natural variations in appearance-related stereotypes and physical attractiveness may affect the social evaluations, responsiveness, and socioemotional climate of conversations (for a review, see Eagly, Ashmore, Makhijani, & Longo, 1991). This would be true if such perceptions and evaluations merely were accurate, but they may be inaccurate as well. Photographs are known to bias assessments of others. For instance, Rind and Gaudet (1993) found that people were able to use photographs to judge some personality dispositions such as social adjustment accurately, but they inaccurately judged other traits such as aggressiveness (equating greater height, weight, and build with greater aggressiveness).

We assume that pictures had a content-free effect in this research, their effects depending instead on the longevity condition in which they were introduced. The random assignment of participants to conditions should obviate the potential effect of variations in actual physical attractiveness in this study through random distribution of attractiveness' potential effects. However, the relatively small sample of participants in this study suggests concern about the dispersion of these variations equally through all conditions. Replications of this research might evaluate the attractiveness of the participants or, alternatively—because partners had not seen each other—use a standard set of photographs for all photograph-present groups. Although such a strategy offers a more precise test of the mere presence of photographs, it also risks contamination should participants mention to one another some physical feature in a photograph that did not belong to a partner (which occurred in 5.8% of dyads in Snyder et al., 1977, p. 661). In this experiment, the use of actual partner photographs leaves the attractiveness issue hanging, yet it offers greater ecological validity with respect to the everyday use of newer media.

In advanced telecommunications, of course, the physical presentation of partners need not be a static image (although such systems have been tested commercially) (Noll, 1992), and the effect of images may be an important aspect of videoconferencing as well. However, dynamic visual communication's effects may have little impact on social presence and more to do with other communication functions. In cataloguing the functions of nonverbal behavior in videoconferencing, Whittaker (1995) made no mention of relational warmth or interpersonal impressions. He suggested that videoconferencing systems offer (a) nonverbal movements indicating attitude, offering content-related feedback, or coordinating conversation; (b) indications of the virtual attention or availability of partners; and (c) creation of

shared artifacts and shared workspace. Yet, even some of these functions may be superfluous or counterproductive compared with lower bandwidth combinations: Several studies found that users are relatively unaffected by video in terms of communication or instrumental outcomes of remote conferencing (for a review, see Whittaker & O'Connell, 1997). Similarly, Noll (1992) reports that the picturephone was valued for

its ability to reach others quickly . . . and to show forms. The ability to see the other person was rated much less important. These results were confirmed during a personal visit to [a site] when I saw users standing in front of the picturephone so that only a belt buckle was visible to the other person. (p. 311)

Indeed, adding visual information to CMC as a strategy to enhance person perception may be misguided. Although we casually process verbal and non-verbal behavior FTF, visual images during CMC may create unique cognitive demands, as Hinds (1999) suggests in explaining her findings that personality trait impressions were more biased in participants using multimedia (audio and visual) than in participants using a single medium (audio). Gilbert and Krull (1988) concluded that

information loss can have positive consequences. Indeed, many errors of social judgement that are commonly thought of as products of under-processing (e.g., correspondence bias . . .) are just as easily construed as products of over-processing: the processing and application of superfluous and non-diagnostic information. (p. 201)

An advantage of CMC, then, is its underwhelming demands on multisensory processing and its specific carry-through of malleable information. Users form impressions "based in part [on their partners' behavior] and in part on its absence of reality checks" (Jacobson, 1999). According to Churchill and Bly (1999), "People feel connected or co-present with each other despite the representationally simple nature of [text-based CMC] . . . when communication and conversation are the main requirements" (p. 8).

Although variations in the contents of photographs present interesting theoretical issues, they also raise practical questions. As Nass et al. (1998) noted, "The addition of video to computer systems opens up a world of opportunities and problems. As designers construct these worlds, they must decide how and whether the user should appear" (p. 153). These same decisions pertain no less to static visual appearances. For instance, might one's photograph on a home page promote or hinder social development? As Miller (1995) notes, a home page "is putting yourself up for interaction," and users

might consider whether the kinds of interactions surrounding others' views of that page might be short-term or long-term ones, whether one wishes to reduce uncertainty through static means or dynamic and controllable measures (see, e.g., Jacobson, 1999). Should photographs be employed when groups start out using CMC? Despite the advocacy of media developers and consultants for using video or FTF before CMC (see Wilson & Morrison, 1999-2000), our findings indicate that groups that can afford the time are better off interpersonally building affection and social attraction without visual cues. Although visual information benefited the short-term CMC partners, they did not surpass the levels of affiliation achieved by long-term groups, especially those with no pictures. The hierarchy analysis in this study, as elsewhere, suggests that long-term, invisible CMC is more "user friendly" in that it prompts users to be more friendly. Forgoing photographic information as CMC groups get started may require greater effort and longer periods of uncertainty, yet there appears to be an eventual payoff in hyperpersonal CMC interaction in which, other things being equal, a thousand words are worth more than a picture.

Notes

1. The authors express their gratitude to Dr. Roloff and the anonymous referees whose insights contributed greatly to this article.

2. Two teams normally had four members due to requirements of the courses' enrollments. Absenteeism on the day of the experiment necessitated that two of these teams work with only three members. Although the participants were systematically assigned to groups to achieve comparable ratios on nationality (United States vs. United Kingdom), they were randomly assigned in other respects. The resulting demographic combinations were nearly homogeneous across groups and conditions. In one instance, an all-male group occurred, but it was counterbalanced in the same condition with a group that contained both men and women. As this condition did not define the extreme points of an effect, it is not expected to have skewed the results.

3. For instance, some of the largest are Siegel, Dubrovsky, Kiesler, and McGuire (1986, Experiment 3), task-oriented remarks due to face-to-face (FTF) versus computer conference versus e-mail, $r = .69$; Weisband (1992), uninhibited comments due to computer-mediated communication (CMC) versus FTF, $r = .60$; Rice and Love (1987), n messages sent and the percentage that are socioemotional in CMC, $r = .75$ (r computed from original findings using formulas in Rosenthal & Rosnow, 1984). Variations are large, even within single reports (e.g., Rice, 1993), and effect size estimations are complicated by noncommon units of analysis (e.g., participants vs. messages) (see Walther, Anderson, & Park, 1994).

4. Hypotheses were originally formulated and data collected with regard to task orientation and task attraction as well. Tentative results seemed to support these hypotheses on one but not the other of these variables, yet the more appropriate nested analysis rendered the tests underpowered. Given the uncertain analyses and the inconsistent results on these variables in other recent research (e.g., Walther, 1997a),

no further discussion of them is offered in this report. Interested readers may contact the first author for more information about our rationale and assessment.

5. Applying directional contrast weights to participants' evaluations of their CMC-only partners and zeros to scores on FTF partners effectively renders the FTF conditions neutralized with respect to the evaluations of hypothetical interest (see Rosenthal & Rosnow, 1985). Inclusion of FTF scores facilitated the derivation of appropriate error terms and affected the computation of *MS* contrast through the calculation and application of harmonic *n* and unweighted means (see Rosenthal & Rosnow, 1984, pp. 349-350).

Exploratory analyses (without contrast tests) were also conducted to detect a medium effect (i.e., to see if evaluations of FTF partners differed from CMC partners). Hierarchical ANOVA, with groups nested within the interaction of longevity by photo as the error term, revealed no significant interactions of CMC/FTF \times Photo \times Longevity, nor a CMC/FTF main effect, on any of the dependent variables assessed. Using a more liberal analysis, including only participants' evaluations of local/FTF partners and a between-subjects error term, ANOVAs revealed significant Photo \times Longevity interactions on social attractiveness, $F(1, 11) = 5.31, p = .04$. Means (see Table 1) do not suggest patterns that were hypothesized for CMC conditions. A possible medium effect may be indirectly inferred, at least on intimacy and social attractiveness, such that the hypothesized dynamics affected CMC and not FTF.

6. Although the presence of a disordinal interaction need not require all underlying cells to differ from all others (Rosenthal & Rosnow, 1984), main effect patterns were nevertheless explored through post hoc *t* tests using nonnested analyses. Among groups with no pictures, long-term versus short-term association affected intimacy/affection, $t(10) = 2.78, p < .01$, and social attraction, $t(10) = 1.92, p < .05$. The effect of group longevity was not significant for groups with photographs present, but this is consistent with the theoretical predictions: Photographs level the playing field such that when there is a photograph present, communication is neither negative (impersonal) nor excessive (hyperpersonal).

7. Although the zero-order correlations suggest the influence of both self-presentation and familiarity on task attraction, multiple regression analyses did not indicate that both predictors were simultaneously active. Within the respective photograph and no-photograph subsamples, no more than one predictor significantly affected a given outcome, and no interactions obtained. Further post hoc analyses found a significant participant gender effect on self-presentation, decomposition of which showed main effects for female participants only, who exhibited greater selective self-presentation success in older ($M = 4.13, SD = .69$) rather than newer groups ($M = 3.5, SD = .89$), $t(12) = 2.09, p < .05$ (one-tailed), and when there was no picture ($M = 4.19, SD = .65$) more than when a photograph was present ($M = 3.42, SD = .86$), $t(12) = 2.43, p < .025$.

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