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Affect in Computer-Mediated Communication: An Experiment in Synchronous Terminal-to-Terminal Discussion

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ABSTRACT

With the spread of computer networks, communication via computer conferences, electronic mail, and computer bulletin boards will become more common in society, but little is known about the social psychological implications of these technologies. One possibility is a change in physiological arousal, feelings, and expressive behavior—that is, affect. These computer-mediated communication technologies focus attention on the message, transmit social information poorly, and do not have a well-developed social etiquette. Therefore, these technologies might be associated with less attention to others, less social feedback, and depersonalization of the communication setting. In the present study we examined what would happen to feelings and interpersonal behavior in an experiment in which two people met for the first time and discussed a series of questions in order to get to know one another. We

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measured physiological arousal (pulse and palmar sweat), subjective affect (emotional state and evaluations), and expressive behavior (self-disclosure and uninhibited behavior) in both synchronous computer-mediated and face-to-face discussions. (For comparison purposes, we also examined these effects under high- and low-evaluation anxiety). Communicating by computer did not influence physiological arousal, and it did not change emotions or self-evaluations. However, people who communicated by computer evaluated each other less favorably than did people who communicated face-to-face, they felt and acted as though the setting was more impersonal, and their behavior was more uninhibited. These findings suggest that computer-mediated communication, rather than provoking emotionality per se, elicits asocial or unregulated behavior. Of course, our data are based on a laboratory experiment using just one type of computer-mediated communication, but the results are generally consistent with anecdotal evidence and new field research on how people use computers to communicate in organizations.

1. INTRODUCTION

Just as the telephone and the automobile did, modern computing technologies seem likely to have major effects on patterns of social contact. People are using computer networks for communicating through electronic mail, computer bulletin boards, asynchronous computer conferencing, instantane-

ous document facsimile production, and on-line simultaneous conversations. Computers used for communication will be a significant technological development over the coming decades, and it seems sensible to study the underlying psychological and social implications of this development.

Research on the behavioral and social effects of computers falls into four general categories—technology assessment, organizational, technical capabilities, and social psychological studies. Technology assessment studies evaluate the potential impact of computers on society or on a given societal institution such as education (Boguslaw, 1981; Tucker, 1983). Organizational studies examine the impact of computers on jobs and job performance, and organizational functioning (Bikson & Gutek, 1983; Hiltz, 1984; Whisler, 1970; Zuboff, 1982). Technical capabilities studies investigate the relative ease or difficulty with which people learn or carry out particular computer operations as a function of equipment or software variables (Black & Moran, 1982; Ogdin, 1982). Social psychological studies investigate such issues as the social context in which people learn to compute and the effects on groups of computer-mediated communication (Chapanis, 1972; Hiltz, Johnson, Aronovitch, & Turoff, 1980; Kiesler, Siegel, & McGuire, 1984; Sproull, Kiesler, & Zubrow, in press). In comparison to the first three areas of research, social psychological studies of computing are more recent and fewer in number.

The present study, an experiment on the affective consequences of communicating simultaneously by computer, falls into this fourth category. Virtually nothing is known as yet about the social psychological effects of using modern computer networks for communication. This study was designed to address one question raised by the research that does exist: Does computer-mediated communication change individuals' feelings? This issue has been discussed by groups and organizations concerned about the physiological and emotional effects of using computers (Ostberg, 1984). The issue also has application to social psychological theories about affect, since computer-mediated communication creates a communication setting which uniquely combines situational factors that individually have been associated with affect in previous research.

1.1. Aspects of Computer-Mediated Communication that Might Influence Affect

In social situations in which people communicate, three types of affect have been distinguished: (1) physiological arousal; (2) subjective emotions or affective feelings, including evaluations of others; and (3) expressive behavior (Reisenzein, 1983; Schachter & Singer, 1962). Physiological arousal refers to heightened activity of the autonomic nervous system. Subjective affect is an affectively loaded interpretation of self, others, or events (such as feeling "in

love," evaluating someone as lovable, and interpreting an event as exciting). Expressive behavior is overt behavior which is or seems to be affective in tone (for example, angry aggression, hugging, and shouting). In this study we investigated whether computer-mediated communication influences one or more of these three forms of affect.

Our observations of the characteristics of terminal-to-terminal computer-mediated communication in computer networks have led us to believe that there might be affective implications. We have noted especially the speed and user control with which computer-mediated commuication operates; its reliance on text alone, which reduces to a minimum nonverbal feedback and social context information; and the paucity of norms for its use. The first two are technical characteristics of computer-mediated communication and the last is a cultural characteristic.

Although there are important differences between, say, simultaneous computer conferences and electronic mail, computer-mediated communication programs have some significant technical characteristics in common. They are all responsive and flexible for even a relatively naive person. Whether one uses modern programs for asynchronous electronic bulletin boards, or computer conferences; or whether one sends computer messages which appear on another's computer screen or engages in synchronous conversation with others, messages can be written and sent in minutes or even seconds. On the other hand, one can edit messages endlessly and write messages of any length. One can reach one person or any number of people on the network or on linked networks. One's messages can be formal, like an official letter, or informal, like a greeting on the street. And programs can be adapted for special functions such as automatic copying to a prescribed distribution list, blind carbon copying, and editing and filing of received messages. This controllability, of course, concerns text messages. Computer-mediated communication lacks the aural and visual social information which is provided in face-to-face communication and which is provided partly in telephone and video conference communication. A person using computer-mediated communication is focusing his or her attention on written text, which makes it like paper communication; but with respect to message content and audience, the text is far more flexible (in relation to time spent) than it is in paper communication.

Culturally, people are still trying to construct and to inculcate a shared social etiquette for computer-mediated communication (Brotz, 1983). Although computer professionals have used computer communication for at least two decades, and they comprise a subculture whose norms influence computer users and computer communication, no strongly shared norms as yet apply to how electronic communication should be used in society. Some user manuals devote space to appropriate uses of computer communication (e.g., users are warned not to forget they are communicating with other people rather than with the computer). But generally speaking, people receive no formal instruc-

tion in an etiquette of electronic communication, and what informal socialization exists tends to be received haphazardly.

These technical and cultural characteristics of computer-mediated communication might influence two important aspects of the situation in which people communicate; that is, the focus of attention and social feedback. Each of these variables is known to have affective implications in communication settings. For example, researchers have observed that having to monitor the immediate environment for incoming cues can be physiologically arousing (Williams, Bittker, Buchsbaum, & Wynne, 1975). The technology of computer-mediated communication—its speed, flexibility, and reliance on text—tends to make that form of communication both absorbing and demanding. People need to be alert in order to control a technology which is so responsive and which so rapidly emits information. This alertness implies increases in various autonomic responses such as pulse and heart rate. Of course, we must distinguish between routinized computing tasks such as text and data entry, and novel or nonroutinized computing involved, for example, in programming a new computer game or communicating with one or more persons. In fact, routine computing is known to reduce autonomic physiological activity such as heart rate (Grandjean & Vigliani, 1980). Hence, if computer communication has physiologically arousing properties, it is not the technology per se, but nonroutine, attention-demanding activities which would be implicated.

If computer-mediated communication is absorbing and demanding of attention, however, the most important effects might be social psychological rather than physiological. That is, if greater attention is focused on the message and on manipulating messages, then less attention might be focused on the people with whom one is communicating. This would reduce introspection and concern about how others will react, hence private and public self-awareness. Reduced self-awareness, in other settings, has been shown to result in a less caring attitude about others and in behavior that is antisocial or unrestrained (Carver & Scheier, 1981, pp. 171–176). Of course, this might not motivate people to feel emotional or to act more emotionally; absorption in a message rather than in others could reduce emotionality (Scheier, 1976; Scheier & Carver, 1977; Scheier, Carver, & Gibbons, 1981). However, if unrestrained behavior meant behaving irresponsibly or aggressively or too intimately toward those with whom one is communicating, then a cycle of escalating emotional behavior could ensue.

That computer-mediated communication might increase uninhibited behavior and might detract from relationships can be inferred not just from greater focus of attention on messages, but also from the fact that the communication takes place without an exchange of nonverbal cues and social context information. It has been previously found that nonverbal involvement is important in coordinating and comprehending messages efficiently (Kraut & Lewis,

in press; Kraut, Lewis, & Swezey, 1982). Consider the consequences if one cannot look quizzically to indicate if the message is confusing or if one cannot make eye contact, or nod one's head or murmur "hmm" to indicate that one understands the other person. These difficulties are not just annoying; they are sometimes blamed on the communicators rather than on the mode of communication. (See Gibbons and Wright, 1981.)

In addition to nonverbal feedback about the message itself, social information about the persons communicating is contained in paralinguistic communication and in social artifacts. People exchange information about their social status in the world through what they wear and how they stand and how loudly they speak, for instance, and this information affects how much influence they have with one another (Edinger & Patterson, 1982; Humphreys & Berger, 1981; Patterson, 1983). Also through paralinguistic communication and social artifacts they communicate their moods, their loyalties, their preferred style of interacting, and especially their individuality (Ekman, Frieson, O'Sullivan, & Scherer, 1980; Mehrabian, 1972). All of this information helps make communication seem personal, and it increases the social regularity of communication. If electronic signals convey only faint cues about people in their social context and as individuals, then communicating by computer might increase people's sense of anonymity and reduce their sense of others as individuals, and this would reduce their consideration of others' feelings and increase their assertiveness.

Except that it involves submergence in a technology rather than in a group, computer-mediated communication seems to comprise some of the same conditions as are important for one kind of depersonalization experience called *deindividuation* (Diener, 1979; Festinger, Pepitone, & Newcomb, 1952; Forsyth, 1983; Prentice-Dunn & Rogers, 1980). Deindividuation is a state of unself-consciousness and impulsivity that describes people caught up in the action of gangs, crowds, or mobs. Should computer-mediated communication create a form of deindividuation, we would predict less empathy for others and less guilt, as well as less social comparison, less embarrassment, and reduced fear of retribution or rejection, hence more negative evaluations of others and more uninhibited behavior.

Although the ideas presented here have not been tested directly as yet, four previous experiments from our own laboratory showed that communicating via computers can elicit expressive behavior. In comparing the effects on decision-making of computer-mediated communication with face-to-face communication, the same three-person groups took longer to resolve conflicts and reach consensus, were more disorganized, acted more excitedly, and were more uninhibited using the computer (Kiesler, Siegel, & McGuire, 1984). In computer communications there was more swearing, name-calling, and insulting. Also, when groups were given classic choice-shift problems (Dion, Baron, & Miller, 1978; Stoner, 1961), they made group choices which were further away from their initial individual choices when they used the computer

to communicate than when they talked face-to-face. These data might be indicative of subjective affect in computer users because feelings are frequently associated with expressive behavior.

Observers of actual computer networks have noticed expressive behavior in people using this technology (Hiltz & Turoff, 1978). In the computer subculture, the word *flaming* refers to the emotional expression of opinion and feeling which occurs more frequently on the computer than in other communication settings. Indeed the Defense Communications Agency, which manages the nation's oldest computer network, ARPANET, has had to police use of the network bulletin boards:

> 27 Jul 82
> ARPANET-BBOARDS at MIT-ML
>
> Due to past problems with messages deemed in bad taste by "the authorities," messages sent to this address are manually screened (generally, every couple of days) before being remailed to the BBoards
> (File:PS:<SFH.PUBLIC>APRINT.TXT.1).

Communication which deviates from norms has been noted in business and home networks. When IBM installed the personal computer in offices and created an internal message system, VNET, to link them, people used this subsystem to complain about management. The system came to be called GRIPENET, and new IBM policies were formulated to deter "inappropriate" behavior on internal computer networks (Emmett, 1981). Compuserve, which is a private network of microcomputer owners, is reported to foster various forms of flaming and uninhibited behavior in activities ranging from computer sex to consciousness raising (Van Gelder, 1983). Finally, in an unpublished field study of electronic mail in a major corporation (Sproull & Kiesler, 1984), respondents reported seeing far more flaming in electronic mail from their colleagues than they heard face-to-face; and the contents of their electronic mail suggested significant disinhibition.

1.2. An Experiment on Affect in Synchronous Terminal-to-Terminal Discussions

Experimental research, anecdotes, and field research suggests that computer-mediated communication elicits expressive behavior. One question that immediately arises, with regard to the previous research, concerns the degree of affective feeling associated with the observed uninhibited behavior. That is, does physiological arousal and subjective affect, as well as behavioral expression of affect, increase as a consequence of communicating via computer? The main purpose of the present study was to examine these three kinds of affective experience in computer-mediated communication.

In addition, the present experiment was also intended to explore, in a relatively neutral communication setting, whether changes of affect in computer-mediated communication (if they occur) are positive or negative. We asked: What are people's feelings about themselves and others when they communicate via computer? We attempted to answer this question by comparing subjective evaluations of self and others following computer-mediated communication with evaluations following face-to-face communication. Based on our thinking about focus of attention and nonverbal involvement in computer-mediated communication, we expected subjective evaluations of others to be relatively negative as compared to the outcome of face-to-face communication.

Finally, the present study was also intended to examine some other variables that might be correlates of affective responses. This took the form, primarily, of comparing the content of messages sent by computer with the content of messages transmitted face-to-face. In these messages we examined evidence of communication efficiency, focus of attention, and depersonalization.

The basic design of this study was a comparison of physiological arousal, subjective self-reports of feelings, attributions, and evaluations; and interpersonal behavior in two communication settings, one in which two people met and talked with each other for the first time face-to-face, and the other in which two people met and talked with each other for the first time via on-line computer conversation. However, measures of physiological arousal are notoriously unreliable; a difficulty of this design is establishing a baseline of arousal against which to evaluate the relative impact of computer-mediated communication. One way to resolve this issue is to independently vary a known source of arousal or, emotional experience (see Reisenzein, 1983), and then examine the effects of this known source of arousal after computer-mediated communication. If computer-mediated communication independently elicits affect, it should add to or modify the affect caused by the known source. We adopted a modification of the approach used by Zillman (1971, 1979) to study excitation transfer, the idea that different sources of arousal combine to produce total affective experience.

Although the present study was not designed as a test of the excitation transfer model, we used the idea of excitation transfer to examine the potentially additive consequences of computer-mediated communication. That is, we crossed a manipulation of evaluation anxiety (see Cottrell, Wack, Sekerak, & Rittle, 1968; Wine, 1980) with the manipulation of communication mode. From previous related research, for instance, on social facilitation (Paulus & Murdoch, 1971), we expected evaluation anxiety to heighten arousal as well as concern over self-presentation, behavioral inhibitions, and perhaps, self-focus of attention as a mediating variable. We intended to evaluate the additive or interactive effect of computer-mediated communication on these effects of anxiety. If computer-mediated communication is a relatively neutral source of arousal, as is physical exercise (White, Fishbein, & Rutstein, 1981), then it

should simply add strength to total arousal, anxiety, inhibitions, and interpersonal evaluations. Alternatively, we thought computer-mediated communication might reduce the impact of evaluation anxiety on subjective affect and behavior. That is, even if computer-mediated communication is arousing, if it also lowers self- and other-focus of attention (while increasing attention to messages), then it could distract communicators from their anxiety and reduce inhibitions.

Our general strategy was to evaluate these alternative ideas using a between-groups research design in which communication mode (simultaneous computer-mediated communication versus face-to-face communication) was crossed with a manipulation of evaluation anxiety (high versus low). Using three categories of measures of affect — arousal, feelings, and behavior — we examined the following hypotheses:

(1) Computer-mediated communication will increase physiological arousal relative to arousal in face-to-face communication.

(2) Computer-mediated communication will be experienced as more exciting than face-to-face communication.

(3) Following computer-mediated communication, evaluations of the other person will be more negative than will be evaluations of the other person following face-to-face communication.

(4) Uninhibited behavior will occur more frequently in computer-mediated communication than in face-to-face communication.

(5) Some variables correlated with hypotheses (3) and (4) will be (a) communication inefficiency, (b) change in focus of attention (away from self and other), and/or (c) feelings of depersonalization.

(6) According to excitation transfer theory, computer-mediated communication, if it is arousing, will heighten or make more extreme, the arousal, anxiety, inhibition, and/or evaluations of others caused by evaluation anxiety.

(7) In opposition to hypothesis (6), computer-mediated communication may distract attention away from sources of arousal, hence reduce anxiety and inhibitions.

2. EXPERIMENTAL METHOD

2.1. Subjects

Eighty male and female undergraduate students from Carnegie-Mellon University were paid to participate in a study of communication. Subjects who did not know each other were randomly paired before the experiment. There were 11 female-female pairs, 12 male-male pairs, and 17 mixed-sex pairs, roughly evenly divided among conditions. Although each subject participated with a partner, arrangements were made for each of them to appear at a slightly different time and place so that they would meet only during the experimental

session itself. Participation in the experiment was restricted to students who had had experience using computers and computer terminals. (Eighty percent of students at this university have such experience).

2.2. Design, Manipulations, and Procedure

The design was a 2 × 2 between-subjects factorial, with 10 pairs of subjects randomly assigned to each condition. Two experimenters (one male and one female) conducted each session, each randomly assigned to one of the two subjects. When each of the students arrived, he or she was greeted by an experimenter and was escorted to a regular university office, with ordinary office furnishings such as a desk, table, chairs, and computer terminal. The computer terminal was connected to the university computers and computer network.

The experimenter explained to the subject that the study concerned methods of communication and how different kinds of communication affect physiological responses. The procedure was outlined for the subject and the manipulation of communication mode was introduced: the subject was told either that he or she would meet another student using the computer in an on-line conversation or that they would meet for a face-to-face conversation. The subject completed a consent form, and then practiced using the two recording devices to be used, a digital pulse monitor which clips to the earlobe, and a graphite solution for measuring palmar sweat through fingerprints. (The subject was told that these devices measured pulse and perspiration but was not permitted to see the monitor or prints.) The subject was then given some Charles Schulz books to read and was asked to relax for 5 minutes.

After this initial orientation period, the experimenter took the first measures of physiological response. The next step was to explain how the subjects would meet each other and to manipulate evaluation anxiety. The subject was shown a discussion guide which contained "topics that you are to talk about with your partner." The subject was asked to discuss as many questions as possible with the partner, to follow the order given on the guide, and to wait until both partners had answered each question before going on to the next one. Questions or topics not contained in the guide were permitted but the subject was encouraged to cover the guide questions first. The guide, a copy of which was handed to the subject after the anxiety manipulation was introduced, contained 21 items, ranging from factual questions about the other person's background ("Do you have any brothers or sisters?") and life ("Are you an active member of any organization?"), to questions about opinions, feelings, and evaluations ("Name three important aspects of your ideal boyfriend/girlfriend." "What do you usually do at a party?" "Are you often willing to take risks?").

When the pair of subjects had been assigned to the *low-evaluation anxiety* condition, the experimenter told the subjects not to be concerned about what was said during the discussion because the researchers were only interested in the

"patterns of discussion." However, when the pair had been assigned to the *high-evaluation anxiety* condition, the subject was told:

> Use your best social skills to become well acquainted with your partner. After getting to know your partner you will meet [in person / again, in person] and compete with other pairs of subjects to see which pair is most socially adept in situations which involve interactions with new people. While you are busy conversing [on the terminal], we will record and then analyze what you say to see how well you as an individual adjust to new social situations. A prominent social psychologist will evaluate your personal ability [in using the computer as a communication medium for social interaction / in social interaction] and how well you can interact with a stranger.

After reviewing these instructions with the subject, the experimenter administered the second set of physiological measures.

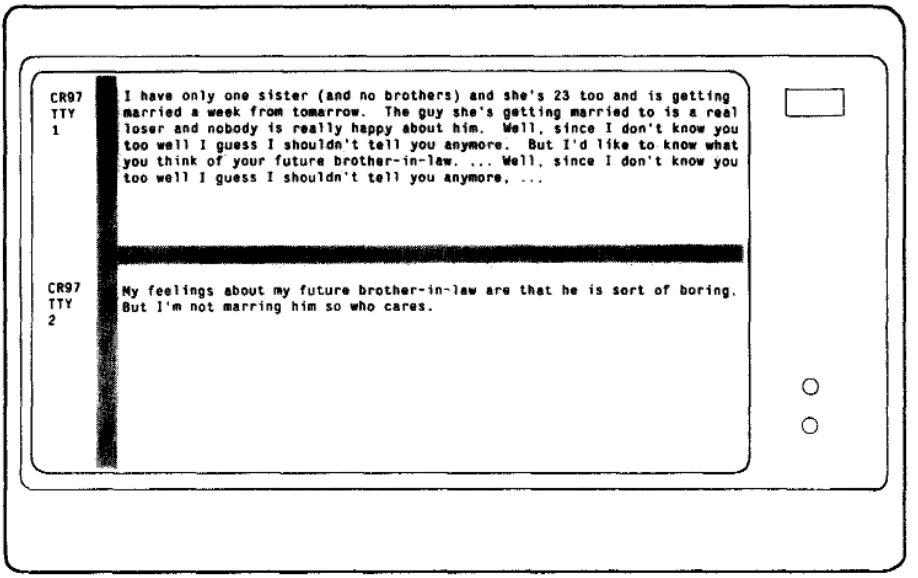
The subject, according to assigned condition, was then either taken to the office where the partner was waiting and was seated at a table with the partner, or was seated at the computer terminal and logged into the computer system. In the *face-to-face communication* condition, the two subjects asked and answered questions from the discussion guide for 20 minutes. In the *computer-mediated communication* condition, the subjects asked and answered questions from the discussion guide using an interactive software program for on-line, synchronous communication, also for 20 minutes. The program, called *Converse,* is a regular feature of the computer network at the university (and also of some other networks). It splits the computer screen into windows for each person (two 10-line windows, in this experiment) so that each person can write and read his message in one window as well as see the other person's message in the other window. Once this program has begun, each window scrolls independently and communicators need not wait to see each others' response before typing their own. Communications are automatically transmitted character-by-character the instant they are typed. An example of a conversation as seen on the screen is shown in Figure 1.

Following their discussion, the subjects were taken to their original places for a third and last recording of physiological response. They completed a paper-and-pencil questionnaire for evaluating themselves, their reactions to features of the experimental setting, and their partner. Then they were debriefed and paid for participating in the experiment.

2.3. Dependent Measures

Physiological Arousal. Because we posited that computer-mediated communication is likely to increase sensory and information vigilance rather than concentrated introspection, we employed two physiological measures that

Figure 1. Display from a synchronous terminal-to-terminal discussion.



have been previously associated with the former type of attentional demands (Carver & Scheier, 1981, pp. 304-5). We used a measure of pulse because cardiovascular response has been correlated with tasks which require sensory input (Williams, Bittker, Buchsbaum, & Wynne, 1975). As described earlier, pulse was measured by attaching a digital monitor to the subject's earlobe (Sears model 564.29151); the earlobe clip was removed after each measure was taken to minimize discomfort. Our second measure of arousal was palmar sweat because increased palmar sweat levels are reportedly associated with readiness to engage the environment as well as subjective feelings of arousal (Johnson & Dabbs, 1967; Johnson, Dabbs, & Levanthal, 1970). We recorded palmar sweat using the Johnson and Dabbs (1967) procedure. The subjects dip a fingertip in a solution which contains polyvinyl formal, butyl phthalate, a semicolloidal dispersion of graphite in trichloethylene, and ethylene dichloride. The resulting fingerprint is impressed on a glass slide. Under magnification, open pores may be viewed as white circles and counted, with a greater number in each quadrant of the slide indicating more palmar sweat, hence

[1] Before we began this experiment, we were advised that the suspension solution could be harmful if ingested and should not be used by pregnant women. Researchers may write to the authors for more information and for a copy of the consent form and precautions taken in this study.

arousal.[1] Each measure was taken three times—first, after subjects were told they would communicate with another person (and, in half the cases, that they would use a computer); secondly, after the manipulation of evaluation anxiety but before the discussion; thirdly, immediately after the discussion had taken place.

Subjective Affect. Subjective affect was measured using bipolar, 6-point Likert scales. The subjects' evaluations of their emotional state was assessed by asking them how relaxed or apprehensive they were before the discussion began, and how calm or anxious, bored or amused, pleased or annoyed they felt during the discussion, and how tired or refreshed they felt at present. The subjects' feelings or emotions attributed to the setting, to the experimenter, and to the partner were also measured. They were asked whether the [computer / discussion room], the experimenter, and their partner made them feel nervous, frustrated, angry, happy, or pressured, respectively. Subjects' evaluations of their partner were assessed further by asking them how much they liked their partner, how well-adjusted he or she seemed, how interesting he or she was, and how well they thought they knew the partner after the discussion. The last two items asked the subjects how honestly they had answered the factual and opinion questions in the discussion guide.

Expressive Behavior and Communication Processes. Expressive behavior and communication processes were evaluated using analyses of the content of the discussions between the subjects. The computer-mediated discussions between each pair of subjects were recorded directly in computer files, and the face-to-face discussion tape recordings were transcribed into computer files. The transcripts were then formatted identically to disguise the mode of communication without altering the content of the conversation. Two coders independently rated each discussion. Afterward they discussed and resolved any inconsistencies in the ratings. The level of this content analysis was remarks rather than words; that is, each discussion text was divided into remarks, where a remark was defined as a single thought or message contained in a word, phrase, or sentence(s). Total number of remarks were counted, and frequencies of particular kinds of remarks were expressed as percentages of the total for each pair.

One measure of expressive behavior was uninhibited social behavior. As in previous studies of computer-mediated communication, we counted the percentage of remarks which contained (1) impolite statements (e.g., "You are a jerk.") and (2) swearing. We also counted (3) flirting (e.g., "Can we meet after this experiment?"), (4) exclamations (e.g., "Hooray!"), (5) expressions of personal feelings toward the other (e.g., "I like you."), and (6) use of superlatives in expressing evaluations (e.g., "I like him best."). A second measure of expressive behavior was self-disclosure; that is, how many remarks revealed intimate and personal information about the speaker (e.g., "I fell in love with my

instructor."). These, coders rated on 3-point scales (low-, medium-, and high-intimacy disclosure).

To assess mediating or associated processes, we used the following measures. We measured communication difficulty/efficiency by counting the number of questions from the discussion guide that the subjects were able to complete. We measured focus of attention by counting the number of remarks containing self-referent pronouns (I, me, mine, and my). Also, we evaluated attention to and concern for others as reflected in the responsiveness of the partners (counting how often the partners commented on each others' remarks) and in the frequency with which the partners asked each other questions or otherwise sought information not contained in the discussion guide. We measured depersonalization by evaluating the "negativity" of the discussion (counting how many remarks contained complaints and negative statements), the task-relatedness of the discussion (calculating the percentage of questions which were taken directly from the discussion guide), and percentage use of nonintimate phrases such as "please" and "thank-you." Finally, we obtained, from the questionnaire, an estimate of subjects' own evaluations of the communication setting.

3. EXPERIMENTAL RESULTS

All of the subject pairs interacted successfully for 20 minutes. In general, the face-to-face pairs said 9 times as many words as did the computer-conversing pairs (3,871 vs. 432, on average), and they made 6 times the number of remarks (492 vs. 73), but answered just twice as many questions directed by the guide (15.9 vs. 7.2). The flavor of the interchanges in both conditions was generally positive. All of the pairs began their sessions telling each other mundane things about themselves; some of the pairs later disclosed quite a lot about themselves. An example of a typical early exchange, this one from a face-to-face session is:

Person A: *I really love lots of movies and I read a lot.*

Person B: *I'm like you there. I guess I spend a lot of time with tennis, swimming, and sailing in the summer. I also read all the time. Occasionally I go skiing but I am not good at that yet.*

An example of a highly personal exchange taken from a computer-mediated session is:

Person A: *. . . well mostly Alcoholics Anonymous. . .*

Person B: *Oh, no! I thought you were about to say you were a big partier. At least you recognize your situation. That says a lot about your character.*

Person A: *Well, it's not that bad really, but as a matter of fact I hope you're not the judgmental type.*

Person B: *Not me. Lord knows I have enough problems and I hate to admit it, but I'm no saint.*

Person A: *Well you're not the only one with problems. I don't know any saints.*

Person B: *They say our time is up. Hope to meet you sometime.*

In several cases, pairs seemed to have found reason to interact further. One such exchange on the computer:

Person A: *I like* An Officer and a Gentleman *because I like romantic stories.*

Person B: *We have that in common.*

Person A: *It seems like we have a lot in common.*

Person B: *Your priorities are the same as mine.*

Person A: *Great!*

Person B: *Which floor do you live on in Morewood? I will look you up.*

We will now describe differences among the experimental conditions.

3.1. Physiological Arousal

Pulse scores from one subject and palmar sweat scores (pore counts) from 9 subjects could not be read reliably due to unclear staining of the slides, but these subjects did not differ in other ways from those whose physiological data could be read. For the remaining subjects, the means from two measures of arousal (pulse and palmar sweat) taken on three trials were evaluated using repeated measures analyses of variance. (Repeated measures analyses of variance on the trial difference scores did not change the findings and are not reported.)

In general, the analyses of these data indicate that physiological arousal decreased over time, trials $F(2, 150) = 13.5, p < .001$, for palmar sweat; trials $F(2, 134) = 6.14, p < .003$, for pulse. In addition, the manipulation of evaluation anxiety seemed effective in that pulse rates were elevated significantly in the high-anxiety condition on the second trial, after the arousal manipulation was introduced, trial X anxiety interaction $F(2, 150) = 3.06, p < .05$. On the first trial, pulse rates for the high-anxiety condition averaged 78.7, and for the low-anxiety condition, 77.3. But on the second and third trials, the means for the high-anxiety condition were 83.0 and 77.2, respectively, and for the low-

anxiety condition they were 78.0 and 75.5. For palmar sweat, the variance was very high (mean = 14.6, s.d. = 12.6) and no significant effect of the evaluation anxiety manipulation was found. Finally, while the mean levels of arousal were somewhat higher in the computer-mediated communication conditions than they were in the face-to-face communication conditions, there were no significant main effects or interactions involving communication modality. Hence there is no statistical support for the hypothesis that computer-mediated communication alters physiological arousal.

3.2. Subjective Affect

Because pairs of subjects interacted, all analyses of subjective affect and interaction behavior were performed with pairs as the unit of analysis. Hence the findings may reflect the impact of the situation on individuals, on individuals' responses to each other, or both. The main results are shown in Figure 2.

Emotionality. The subjects' emotional state was assessed in a repeated measures analysis of variance on four items (calm-anxious, bored-amused, relaxed-apprehensive, and pleased-annoyed). In general, the subjects reported mildly pleasant emotional states but no significant differences were found among the experimental conditions. Also, for three items asking for subjects' self-evaluations ("I did a good job," "My social skills are good," "I am well-adjusted"), there were no differences among conditions.

Partner Evaluations. Negatively and positively worded evaluations of the partner were assessed separately. Negative attributions to the partner were reported in three items, "The partner made me angry," "nervous," or "frustrated." A marginally significant item X evaluation anxiety X communication mode interaction, $F(2.72) = 2.87, p = .06$, appears to reflect the case that anger was blamed on the partner in the face-to-face condition, whereas frustration was blamed on the partner in the computer-mediated communication condition. Finally, the subjects attributed their nervousness to their partner in the low-evaluation anxiety/face-to-face condition (perhaps because they had no other reason for feeling nervous). The findings for the positively worded evaluation items clearly favored the face-to-face communication setting. Overall, the subjects evaluated their partners more favorably in the face-to-face setting than they did in the computer-mediated setting, $F(1, 36) = 5.09, p < .05$. This effect was consistent across 6 items, although the advantage of the face-to-face condition was greatest for subjectively knowing the partner (7.4 vs. 5.2), how happy the partner made the subject feel (7.5 vs. 5.8), for the subject's evaluation of the partner's adjustment (9.7 vs. 8.4) and liking the partner (10.3 vs. 9.2), and least for how interesting the partner seemed (9.6 vs. 9.1) and thinking the partner liked the subject (8.1 vs. 8.0), item X communication mode

Figure 2. Mean pair response totals for communication mode and anxiety on feelings and interpersonal behavior of new acquaintances.

Measure	Communication Mode	
	Computer-mediated	Face-to-face
Subjective Affect		
Emotionality	5.8	6.3
Negative evaluations of partner	3.2	3.1
Positive evaluations of partner	7.6*	8.7
Self-evaluation	8.5	8.9
Expressive behavior		
Uninhibited remarks (% of total remarks)	4.6**	1.9
Self-disclosure (% of total remarks)	4.3	2.0
	Evaluation Anxiety	
	High	Low
Subjective Affect		
Emotionality	6.0	6.1
Negative evaluations of partner	3.1	3.1
Positive evaluations of partner	8.4	8.0
Self-evaluation	8.8	8.6
Expressive behavior		
Uninhibited behavior (% of total remarks)	3.6	2.9
Self-disclosure (% of total remarks)	2.8	3.5

*$p < .05$. **$p < .01$.

$F(5, 180) = 2.39, p < .05$. In all, these findings support the hypothesis that evaluations of others will be less positive in computer-mediated communication than in face-to-face communication.

3.3. Expressive Behavior

The findings on expressive behavior are also shown in Figure 2.

Uninhibited Remarks and Self-disclosure. The relative proportion of remarks coded as uninhibited behavior in the computer-mediated condition was significantly higher than it was in the face-to-face condition, 4.6% versus 2.0%, $F(1, 35) = 17.0, p < .001$. Specifically, a higher proportion of total remarks in the computer-mediated condition than in the face-to-face condition were impolite (.45% vs. .11%), swearing (1.10% vs. .90%), explicit statements of high-positive regard (.24% vs. .70%), outbursts (.60% vs. .20%), and used superlatives (3.20% vs. 2.00%). (These percentages are small because they use total remarks as the denominator. But uninhibited behavior is not rare. In each category just mentioned, 13%–95% of the pairs made at least 1 remark, and 33% made remarks in 5 or more categories.) These findings support hypothesis 4, and they replicate previous findings of uninhibited behavior in computer-mediated communication. There were no main effects of conditions on self-disclosure (but see the discussion of gender effects).

3.4. Mediating Variables

The findings on possible mediating factors are shown in Figure 3.

Efficiency. One mediating variable we examined was communication efficiency, assessed by counting the number of discussion guide questions that the subjects were able to address. This frequency was approximately twice as high in the face-to-face condition as in the computer-mediated condition, $F(1, 35) = 57.1, p < .001$, confirming the hypothesis that communication is less efficient when it is computer-mediated. (Also, note that the subjects reported that they had learned less about their partners in the computer-mediated condition.)

There are at least two possible reasons for inefficiency in computer-mediated communication—typing and lack of feedback. In a two-way conversation, typing and reading are more time-consuming than speaking and listening, and this would slow the pace of information exchange. The inability to give nonverbal feedback also slows conversation, and it increases the subjective ambiguity of information (Kraut & Lewis, in press). In another study (Kiesler & Sproull, 1984) we have found that people compensate somewhat for these limitations. That is, when time is short or when rapid typing is required,

Figure 3. Some factors mediating social interaction as a function of communication mode and anxiety.

Measure	Communication Mode	
	Computer-mediated	Face-to-face
Communication efficiency (mean questions answered)	7.2**	15.9
Focus of attention (% personal pronouns of total words)	7.2	7.2
Responsiveness to partner (mean % of total remarks)	10.2**	15.7
Depersonalization		
Negativity (mean % of total remarks)	0.2	0.3
Formal expressions (mean % of total remarks)	1.8*	0.3
Spontaneity (ratio of spontaneous to guided questions)	0.4	0.8
Negative evaluation of setting (item means)	3.5	3.7
	Evaluation Anxiety	
	High	Low
Communication efficiency	11.7	11.4
Focus of attention	7.9**	6.5
Responsiveness to partner	14.3	11.7
Depersonalization		
Negativity	0.3	0.2
Formal expressions	1.2	0.9
Spontaneity	0.4	0.7
Negative evaluation of setting	3.7	3.6

*$p < .05$. **$p < .01$.

people make their main points in fewer words. In the present study, this is seen by comparing the relative production of words, exchanges (turns taken), remarks (ideas), and directed questions answered by the pairs in the face-to-face condition versus the computer-mediated condition. The advantage of face-to-face conversation over computer conversation for word production was 9:1; the advantage of face-to-face for exchanges was 9.4:1; the advantage of face-to-face for remarks was 6.7:1; and the advantage of face-to-face for directed questions answered was 2.2:1. These data suggest that people using computer-mediated communication complete their task of asking and answering questions relatively efficiently given the constraints. In the process, what might have been lost was informal and spontaneous information exchange; we discuss this point later.

Focus of Attention. Another mediating variable was focus of attention. Self-focus was greater in the high-evaluation anxiety condition than in the low-anxiety condition, as has been found previously, $F(1, 35) = 8.4$, $p < .01$. Self-focus of attention did not differ between communication mode. However, in the computer-mediated communication condition, a smaller proportion of the subjects' remarks were a comment on, or a direct response to, something their partners had just said, $F(1, 35) = 8.2$, $p < .01$. We believe this tendency to talk in parallel with the partner, rather than in response to the partner, indicates reduced focus of attention on the other person in computer-mediated communication.

Depersonalization. Finally, we evaluated the hypothesis that computer-mediated communication is more depersonalizing than is face-to-face communication, finding support for the hypothesis in 2 of 3 behavioral measures and partial support in subjective reports. We did not find there to be a higher proportion of negative remarks (such as complaints) in the computer-mediated discussions, but the computer-mediated discussions were significantly more impersonal. That is, in the computer-mediated condition as compared to the face-to-face condition, the subjects used a higher proportion of formal expressions, $F(1, 35) = 6.8$, $p < .05$. One explanation of these findings is that typing (whether on a computer or on paper) invites more formality and a more impersonal style than speaking does. However, we found more than simple formality. In computer-mediated communication, the subjects asked their partners a smaller ratio of spontaneous questions to directed questions (questions listed on the discussion guide), $F(1, 35) = 3.8$, $p < .06$. We have already noted that subjects in computer-mediated communication were less responsive to one anothers' ideas.

Subjects' negative subjective evaluations of the experimental situation also provide some support for depersonalization in the computer-mediated setting. There were 2 positively worded questions about the setting and about the experiment for which there were no differences among conditions. Four ques-

tions measured subjects' negative response to the computer (or discussion room)—whether it made them feel nervous, frustrated, angry, or pressured—and 3 measured their negative response to the experimenter—whether the experimenter made them feel nervous, frustrated, or angry. According to a repeated measures analysis of variance, the experimenter was not evaluated as well on all 3 items in the face-to-face condition as in the computer-mediated condition (2.6 vs. 2.1, respectively) and the face-to-face discussion room made subjects feel more nervous (6.0 vs. 4.8). On the other hand, the computer rather than the discussion room was reported by subjects to have made them feel frustrated, angry, and pressured (across items, 4.6 vs. 4.1), $F(6, 216) = 2.5, p < .025$.

3.5. Effects of Computer-Mediated Communication on Evaluation Anxiety

The data do not suggest that computer-mediated communication influenced subjects' responses to the manipulation of evaluation anxiety. There were only two significant interactions of communication mode and manipulated anxiety (negative evaluations of the partner, and spontaneous question asking). Neither of these effects could be interpreted as supporting either the excitation transfer or the distracted attention hypotheses.

3.6. Gender Differences

Differences among female, male, and mixed-sex pairs, with one exception, were independent of communication mode or evaluation anxiety and they seemed not atypical (e.g., males were more likely to swear; mixed-sex pairs liked each other more than same-sex pairs). The single finding of interest was an interaction effect of gender and communication mode on self-disclosure, $F(2, 33) = 4.6, p < .02$. This interaction reflects very high self-disclosure in the mixed-sex, computer-mediated condition relative to the other conditions (5 times higher than in any other condition). Although the finding may be spurious, it confirms various published anecdotes about the role of the computer in reducing initial shyness and promoting romantic attachments (Van Gelder, 1983).

4. DISCUSSION

The data from this study address the question of whether computer-mediated communication has affective consequences for unacquainted people who use it. At least for the college students we studied, and for the interpersonal task we gave them (getting to know someone they had not met before), computer-mediated communication had no discernible physiological, emotional, or self-evaluative effects. On the other hand, computer-mediated com-

munication did influence the development of new relationships between people. Subjectively, the subjects evaluated each other less positively when they used the computer to meet, and behaviorally, they were more uninhibited.

We formulated our ideas from previous studies both in social psychology and in computer-mediated communication. We argued that computer-mediated communication focuses the task and the person on text, and that social cues and feedback, norms, and nonverbal involvement are weak or lacking. As a result, we believe communication of social information will be reduced, that the focus of attention may turn away from self, and that the situation will be depersonalized. We did not find evidence that the focus of attention on self was different in the two communication settings. But the computer-mediated discussions which took place in this study deflected attention away from the other person and also seemed impersonal. The computer-mediated discussions were observably poor for facilitating the exchange of positive affective information and, subjectively, they seemed relatively uninformative and frustrating (a situation which was also blamed on the partner). Impersonal aspects of the computer-mediated discussion were revealed in some subjective ratings, and in the formality of the discussions and in the lack of spontaneity.

Two major limitations to this study suggest that much more work is needed to establish fundamentally social characteristics of computer-mediated communication. One problem is that neither the technical nor the cultural aspects of computer-mediated communication are stable at this time; changing characteristics of the technology and its users could alter the social effects. Consider the issue of poor social feedback efficiency. Social psychological research suggests that any communication mode which lacks nonverbal involvement will produce inefficiencies in conversation. Even assuming this is the case, one could argue that there is nothing inherent in computer-mediated communication systems that would prevent its developers from introducing nonverbal aspects to the system, such as visual or auditory features. In addition, cultural aspects of communicating by computer could change and reduce communication inefficiency. One possibility is that as users develop codes for communicating by computer (e.g., using a smiling face on its side [:-)] to indicate when the writer is joking), then communication inefficiences will disappear. Our hunch is that the absorption and attentional effects discussed earlier in this paper are not transient effects, and may even increase, but this is an empirical matter.

A second problem with this study is with the validity of the operationalizations, which we fixed arbitrarily based on previous research in social psychology. Consider, again, communication efficiency. Our measure of communication efficiency (or rather, of inefficiency) was "number of questions completed." Another measure was subjective impressions of information gained about the other person. (Both operationalizations have been used in previous research.) An alternative interpretation, however, is that we actually measured absorption in the communication situation; that is, that the subjects were

so involved with formulating their answers that they completed fewer items and learned less about their partners. We hope in future studies to develop better means for distinguishing among variables operationally.

A clearer understanding of the underlying dimensions of computer-mediated communication technologies may contribute to our understanding of how trust develops, hence how computer-mediated communication may increase the feasibility of long-distance work and management. While the impersonal nature of computer-mediated communication could be detrimental to some new relationships, it might enhance others. If the situation is conducive to intimacy, then people might be atypically positive toward one another, and reciprocate this behavior on both sides, thus strengthening their relationship. These speculations are supported by the revealed preferences of people who actually use computers to communicate. Current network behavior suggests that people communicate with preexisting colleagues or friends, or with strangers who have specifiable interests in common.

Our results suggest some directions for future research in social psychology. One possibility is an improved understanding of deindividuation and crowd behavior. Previous analyses of deindividuation have emphasized the way submergence in a group or crowd, along with social anonymity and lowered salience of social controls or standards, leads to feelings of loss of identity and uninhibited behavior, such as antinormative aggression or, on the prosocial side, altruism (Diener, 1979; Johnson & Downing, 1979; Prentice-Dunn & Rogers, 1980). Our study suggests that submergence in a technology, and technologically induced anonymity and weak social feedback might also lead to feelings of loss of identity and uninhibited behavior. Researchers have not yet examined the possibility that deindividuation might result from attachment or absorption in something other than a group, but what might we predict? From our perspective, people who are absorbed in computer-mediated communication might become deindividuated, leading not just to uninhibited verbal behavior but to other effects we have not yet examined, such as communication across status boundaries and subjective losses of identity.

How do our results speak to the existing experimental literature on the affective results of using computers? This research consists of experiments on arousal and several studies of expressive behavior. Our data support previous experimental evidence of minimal physiological effects of computing (Grandjean & Vigliani, 1980) and they extend these findings to computers used for communication. They also support experimental data from our own laboratory in which groups communicating by computer were more conflictful and verbally uninhibited than they were face-to-face (Kiesler, Siegel, & McGuire, 1984). Finally, our data provide weak support (in the behavior of mixed-sex pairs communicating by computer) for previous research indicating more self-disclosure in computer-mediated communication than in face-to-face communication (Greist, Klein, & Erdman, 1976; Greist, Klein, & Van Cura, 1973).

Much of the literature on using computers for communication, including both analytic articles written for professional computer users and reports of empirical research on computing, does not address the issue of how using a computer might influence the way a person communicates or a person's response to the communications of others. For example, it is widely claimed that electronic mail systems will provide people with more information, more timely information, and more convenient information (Crawford, 1982). As a result, computer-mediated communication is expected to lead to better decisions and actions, and to higher productivity (Price, 1975; Tapscott, 1982). The underlying assumption is that individuals do not respond differently or respond more efficiently to information transmitted using a computer. Hence, if better decisions can be made with no increase in financial cost, the decision will in fact be better. And if more people participate in decisions (because more of them are linked conveniently together) and everyone has access to more information, decision-making will not only be improved, but more democratic as well (Martino, 1972; Rohrbaugh & Wehr, 1978). Our data suggest, however, that individuals' responses to communication situations should not be considered a constant in these analyses; rather, that the same individuals will respond differently in different communication settings.

Although our study was not addressed to the effects of linking many people together electronically, nor to decision-making, our findings suggest that the effects of computer-mediated communication on decision-making or problem-solving may be more complex than has been assumed previously. For instance, existing analyses suggest that computer-mediated decisions will be efficient, but our data imply that access to more information and more people may not lead to more efficient decisions, particularly where these decisions require building knowledge of the other and trust in addition to "hard" data. From our data, people using the computer to learn about each other did so less effectively, and with poorer results for their regard for each other, than people did who met face-to-face. Hence, for situations like the one we studied, where people do not already know each other, the increased efficiency resulting from the broad electronic participation in decision-making or access to more information may be offset by changes in the effectiveness of social communication itself.

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