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An Experimental Test of Processes Underlying Self-Disclosure in Computer-Mediated Communication

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Abstract

A consistent finding in computer-mediated communication (CMC) and Internet research is that, compared to face-to-face communication, CMC results in higher levels of self-disclosure. We identified four possible mediators that may carry the influence of CMC on self-disclosure: self-presentation, similarity, self-awareness, and direct questioning. The validity of these mediators was tested in an experiment in which 81 cross-sex dyads were randomly assigned to three experimental conditions: a text-only CMC condition, a visual CMC condition, and a face-to-face condition. Self-disclosure was lower in the face-to-face condition than in the text-only CMC condition and the visual CMC condition. Between the two CMC conditions, no differences in self-disclosure were found. Of the four possible mediators, only direct questioning mediated the effect of CMC on self-disclosure. CMC dyads engaged in more direct questioning and therefore displayed higher levels of self-disclosure.

Keywords: computer-mediated communication, self-disclosure, question asking, visual cues, webcam

Introduction

Online social interaction has become a pervasive phenomenon. More than 80% of U.S. adults under 40 have Internet access, and communication is the most important online activity (Fox & Madden, 2006). Many Internet users, especially the young, progressively form social relationships online (Boase, Horrigan, Wellman, & Rainie, 2006; Gibbs, Ellison, & Heino, 2006; McKenna & Bargh, 2000). For example, one study found that 35% of adolescents had established one or more online friends via social networking sites, and 8% reported having formed a romantic relationship (Valkenburg, Peter, & Schouten, 2006). These rapidly changing developments in Internet use for social interaction have been accompanied by increased attention to the outcomes of computer-mediated communication (CMC) for relationship formation.

One important outcome of CMC that has received much consideration is its effect on self-disclosure. Self-disclosure is defined as revealing intimate information about oneself (Derlega, Metts, Petronio, & Margulis, 1993). This research focus on self-disclosure has had two motivations. First, self-disclosure is an important factor in the initial stages of relationship formation (Altman & Taylor, 1973; Derlega et al., 1993). Self-disclosure fosters intimacy and creates interdependence between communication partners. Furthermore, self-disclosure is an important strategy to form initial impressions of each other and these impressions are vital for the development of the relationship (Anderson, 1965; Berger & Calabrese, 1975). Because more and more relationships develop online, studying the possible effects of CMC on self-disclosure becomes increasingly relevant.

Second, ever since the onset of CMC research, the effects of CMC on self-disclosure have been controversial. Initially, CMC theories, such as the social presence theory, assumed that CMC was unsuitable to convey the warmth and intimacy of face-to-face interactions (Short, 1974; Siegel, Dubrovsky, Kiesler, & McGuire, 1986). These early studies usually investigated task-based interactions between organizational teams and did not specifically investigate interpersonal interaction. Therefore, these early theories were unable to explain the intimate

social relationships that did develop online, which sparked a large body of subsequent research aimed at demonstrating that CMC-relationships can be at least as intimate as face-to-face communication (Rice & Love, 1987; Spears & Lea, 1992; Walther, 1996).

Four experimental studies have compared self-disclosure among unacquainted individuals in CMC settings and face-to-face settings (Bargh, McKenna, & Fitzsimons, 2002; Coleman, Paternite, & Sherman, 1999; Joinson, 2001; Tidwell & Walther, 2002). All of these studies investigated one-time interactions in two-person groups and compared text-based chat interactions with either a videoconferencing setting (Joinson, 2002) or a face-to-face interaction (Bargh et al., 2002; Coleman et al., 1997; Tidwell & Walther, 2002). Two of the studies simply asked pairs of unacquainted individuals to get to know each other (Bargh et al., 2002; Tidwell & Walther, 2002). The two other studies investigated self-disclosure of pairs of unacquainted individuals while they performed a group task (Coleman et al., 1999; Joinson, 2001). All four studies found self-disclosure to be higher in CMC than in face-to-face settings. These results have been confirmed by several correlational studies on online social interaction, which also showed the Internet as promoting self-disclosure (Henderson & Gilding, 2004; Hu, Wood, Smith, & Westbrook 2004; McKenna & Bargh, 1998; Schouten, Valkenburg, & Peter, 2007).

Research on self-disclosure in CMC agrees that the reduced auditory and visual cues (i.e., nonverbal cues) of CMC are responsible for the higher levels of self-disclosure in CMC compared to face-to-face communication (Bargh et al., 2002; Joinson, 1998). However, most studies have only focused on the direct effects of CMC on self disclosure and did not test the underlying, theoretically assumed processes. Furthermore, each of these studies explained the relationship between CMC and self-disclosure from a different theoretical perspective. As a result, the process of how these reduced nonverbal cues may enhance self-disclosure is not well understood.

The goal of our study is to initially test the processes that underlie self-disclosure in CMC. Based on the theoretical assumptions of the four earlier mentioned experimental studies, we have identified four hypotheses that may explain why CMC results in higher levels of self-disclosure. First, our CMC-encouraged self-presentation hypothesis assumes that the reduced nonverbal cues of CMC allow more control over self-presentation, which in turn stimulates self-disclosure (Bargh et al., 2002). Our second hypothesis, the CMC-encouraged similarity hypothesis, is deduced from Coleman et al. (1999) and poses that participants in a CMC setting see each other as more similar, which in turn increases self-disclosure. Third, our CMC-influenced self-awareness hypothesis has been put forward by Joinson (2001) and states that reduced nonverbal cues raise private and lower public self-awareness, which in turn enhance self-disclosure. Finally, our CMC-encouraged direct questioning hypothesis argues that the reduced nonverbal cues of CMC stimulate the use of more interactive uncertainty reduction strategies (i.e., direct questioning), which in turn enhances self-disclosure (Tidwell & Walther, 2002).

These hypotheses will be tested in an experiment in which we compare face-to-face communication and two types of CMC that have become very popular in recent years: Instant Messaging with a webcam (visual CMC) and without a webcam (text-only CMC). Most CMC theories were developed at a time when CMC interaction was mainly based on text. However, nowadays CMC is not necessarily based on text alone. In fact, a considerable proportion of young people now add visual or auditory information to CMC (Lenhart, Madden, & Hitlin, 2005; Peter, Valkenburg, & Schouten, 2007). These developments provide new opportunities for CMC theorists to more specifically investigate the exact nonverbal cues that may affect self-disclosure in CMC.

The CMC-Encouraged Self-Presentation Hypothesis

Our first hypothesis poses that the reduced nonverbal cues of CMC allow more control over self-presentation. This, in turn, may stimulate self-disclosure. We thus expect a mediated effect of CMC on self-disclosure through self-presentation. The reduced nonverbal cues of CMC allow individuals more control over their self-presentation, because in CMC individuals are not hindered by cues unintentionally presented, such as physical appearance, facial expressions or gestures (Walther, 1996). There is ample evidence that CMC allows for self-presentation in ways not possible in face-to-face settings (McKenna & Bargh, 1998, 2000). Because individuals feel more in control over their self-presentation and the ways in which they express themselves they are more likely to disclose their "true self", which refers to those aspects of the inner self that are not easily disclosed in real life (Bargh et. al., 2002, p. 34; McKenna, Green, & Gleason, 2002). Therefore, our first hypothesis is: H1: (a) CMC allows more control over self-presentation, which (b) in turn increases self-disclosure.

The CMC-Encouraged Similarity Hypothesis

Our second hypothesis states that the reduced nonverbal cues of CMC stimulate feelings of similarity, and thereby self-disclosure. In this hypothesis perceived similarity mediates the relationship between CMC and self-disclosure. In comparison to face-to-face partners, CMC partners have less access to nonverbal cues such as clothing, accent, and physical appearance, which often uncover interpersonal differences in face-to-face settings. This forces CMC partners to focus on whatever minimal cues are available, which may result in an over-reliance on available cues (Spears & Lea, 1992; Walther, 1996). As a result, CMC partners may feel more similar to their communication

partner than face-to-face partners do (Coleman et al., 1999; Dubrovsky, Kiesler, & Sethna, 1991; Spears, Postmes, Lea, & Wolbert, 2002; Walther & Parks, 2002). In addition, perceived similarity with CMC partners may increase self-disclosure (Brockner & Swap, 1976; Byrne, London, & Reeves, 1968). Therefore, it is possible that perceived feelings of similarity will mediate the effect of CMC on self-disclosure. Our second hypothesis is: H2: (a) CMC stimulates perceived feelings of similarity, which (b) in turn increase self-disclosure.

The CMC-Influenced Self-Awareness Hypothesis

The CMC-influenced self-awareness hypothesis assumes that CMC increases private self-awareness and decreases public self-awareness, which positively influences self-disclosure (Joinson, 2001). Private and public self-awareness are cognitive states that may be activated by the reduced nonverbal cues of CMC. Individuals who are in a state of high private self-awareness are more attentive to inner aspects of themselves, such as feelings, values and beliefs. Individuals who are more public self-aware are more attentive to how they are perceived and assessed by others (Fenigstein, Scheier, & Buss, 1975).

Matheson and Zanna (1988) assume that CMC enhances private self-awareness because CMC partners generally communicate in a reduced-cue setting. The reduced cues of a CMC setting allow them to pay more attention to the private aspects of their selves than they would do in a face-to-face setting. Matheson and Zanna also assume that CMC lowers public self-awareness because the reduction in nonverbal cues of CMC makes partners feel less accountable, and less concerned about the others' opinions (Joinson, 1998; Schouten, Valkenburg, & Peter, in press). In Matheson and Zanna's study, both assumptions were experimentally supported: participants in CMC settings felt more private self-aware and less public self-aware than participants in face-to-face settings.

There is evidence that higher private self-awareness and lower public self-awareness lead to higher levels of self-disclosure. Those who are high in private self-awareness are more attentive to their inner feelings, making self-disclosures more readily available (Franzoi & Davis, 1985; Joinson, 2001). Moreover, those low in public self-awareness are less attentive to how others perceive them, and thus feel fewer inhibitions in disclosing themselves (Joinson, 2001, p. 180). However, although there is evidence for the relationship between CMC and private and public self-awareness, and for the relationship between both types of self-awareness and self-disclosure, no study has tested the CMC-influenced self-awareness hypothesis as a whole. Therefore, we tested the following hypothesis:

H3: CMC leads to (a) a higher private self-awareness and a lower public self-awareness, which (b) in turn increase self-disclosure.

The CMC-Encouraged Direct Questioning Hypothesis

The fourth hypothesis assumes direct questioning to mediate the relationship between CMC and self-disclosure. The hypothesis is derived from Tidwell and Walther (2002), who based their study on uncertainty reduction theory (Berger & Calabrese, 1975). Uncertainty reduction theory argues that when strangers meet, they have a basic need to form impressions of one another and to reduce uncertainty about the behavior of the other (Berger & Calabrese, 1975). Berger (1979) identified three types of uncertainty reduction strategies: passive (e.g., passive observation), active (e.g., inquiring about the other person), and interactive (e.g., direct questioning). Tidwell and Walther have argued that face-to-face communication allows for a wider range of uncertainty reduction strategies than CMC. In CMC, one cannot rely on passive and active uncertainty reduction strategies and is thus forced to turn to interactive strategies, such as direct questioning.

According to Tidwell and Walther (2002), direct questioning, which is often seen as impolite in face-to-face settings, may be more acceptable in a CMC setting, because of the lack of alternative strategies. In an experiment, Tidwell and Walther found that dyads interacting via CMC used a greater proportion of direct intimate questions. CMC dyads that posed more direct intimate questions also displayed a greater proportion of intimate self-disclosures. It is plausible to assume that CMC partners who pose more direct intimate questions also receive more intimate answers. Therefore, our fourth hypothesis is:

H4: (a) CMC leads to more direct questioning, which (b) in turn increases self-disclosure.

The Role of Visual Cues

All theories of CMC consider the lack of nonverbal cues the cause of enhanced self-disclosure in CMC (Walther & Parks, 2002). In recent years, CMC less often involves text-only communication. A considerable proportion of young people now use audio or video devices while communicating online, such as webcams (Lenhart et al., 2005). These developments pose important challenges for CMC researchers because they create a need to more specifically test which nonverbal cues affect the outcomes of CMC.

The effects of adding video to CMC interactions on interpersonal behavior has been remarkably little investigated (Peter, Valkenburg & Schouten, 2007; Whittaker & O'Conaill, 1997). Most studies that compare video with text-

based chat and face-to-face are conducted amongst virtual teams and, as a result, focus mostly on task-related outcomes. These studies generally find that initial trust and satisfaction is lower in text-only environments (e.g., Rockmann & Northcraft, 2008). Moreover, most studies that investigate the effect of visual information in contract to text-based interaction, but not as an addition to text-based interaction. Most studies investigate audiovisual videoconferencing as a substitute for face-to-face interaction, and compare this to text-based chat. Few studies, however, investigate the addition of video information to text-based chat interactions.

Most studies that investigated the relationship between CMC and self-disclosure compared face-to-face communication with text-only CMC. Only Joinson (2001) compared self-disclosure in a text-only CMC condition with a visual CMC condition in which the faces of the interactants were visible through a video system. Self-disclosure was higher in the text-only CMC condition. Furthermore, the level of self-disclosure in the visual CMC condition in Joinson's second study was equal to that in the face-to-face condition in his first study. This suggests that the absence of visual cues about the face alone suffices to stimulate self-disclosure. Other research also shows that adding visual cues to text-only CMC has significant effects, for example on interpersonal attraction (Walther, Slovacek, & Tidwell, 2001) or group identification (Lea, Spears, & De Groot, 2001).

Compared to face-to-face communication, however, visual CMC still lacks several cues, such as clothes, gestures, body language, speech, and intonation, which still may foster self-disclosure. Based on the hyperpersonal approach (Walther, 1996), we could argue that self-disclosure will gradually increase as cues become scarcer. The lowest level of self-disclosure should therefore occur in face-to-face communication and the highest in text-only CMC, with visual CMC being in between. Because this assumption has never been investigated, in addition to a text-only CMC condition and a face-to-face condition we also included a visual CMC condition, supported by a webcam, in our experiment. We therefore investigate the following research question:

RQ1: How does the visual CMC condition differ from the text-only CMC condition and the face-to-face condition regarding its effect on control over self-presentation, perceived similarity, private and public self-awareness, question asking (the mediating variables), and self-disclosure (the dependent variable)?

Method

Sample

A total of 168 university students, between 17 and 31 years of age (M = 21.07, SD = 2.61), participated in the experiment. 70% of the respondents were recruited from a first year introductory course in communication science in which a total of 350 students took part, divided over 15 separate classes. 30% of respondents were recruited from a database with first and second year students from the University of Amsterdam who had agreed to participate in research projects. To form cross-sex dyads, participants were asked to sign up for a one-hour time slot. Only one male and one female could sign up in one slot. Students were specifically asked not to sign up with someone they already knew. Wherever possible, we paired students from different classes and communication science students with students from other departments. This reduced the likelihood that communication partners would already know each other. After the experiment, none of the participants stated that they knew their conversation partner beforehand.

It is important to note that CMC theories are not addressed in the first two years of the curriculum, so knowledge of these theories could not have influenced our experimental outcomes.

We formed cross-sex dyads in our experiment, because self-disclosure varies depending on gender composition of the group (Dindia & Allen, 1992; Hacker, 1981). Due to possible power problems, we did not want to include gender composition (i.e., male-male, female-female, and male-female groups) in our experiment. The individual scores of the dyad's male and female participants were collapsed because the scores of the individuals in a dyad are not independent of each other. The scores are likely to correlate, which can lead to biased results, such as inflated p values (e.g., Kenny, 1996). Therefore, we used the dyad as the unit of analysis. The dyads were randomly assigned to one of the three experimental conditions (i.e., text-only CMC, visual CMC, and face-to-face). Three dyads were excluded because of technical difficulties during the experiment. Hence, the analyses of this paper are based on 81 cross-sex dyads (27 dyads per condition).

Procedure

For the experimental task, we used a get-acquainted exercise (Frank & Gilovich, 1989). Participants were instructed to get to know each other during the conversation. They were free to talk about anything they wanted. To prevent the participants from encountering each other before the experiment, one member of the dyad was invited to the lab and the other to an office room from where he/she was led to the lab. The subjects received the instructions for the experimental task separately.

The face-to-face condition took place in an observation room that resembled a living room and was equipped with two comfortable couches where the participants were seated. After 12 minutes, the experimenter re-entered the room. Both participants were then guided to separate computer cubicles, where they were asked to fill in an online questionnaire.

In the visual CMC condition and text-only CMC condition, participants communicated with each other in two separate cubicles. Both participants logged on to a synchronous online java-based Instant Messaging application, especially programmed for the experiment. The visual CMC condition was similar to the text-only condition, but as in Instant Messaging software, such as Yahoo! and MSN messenger, participants saw each other's face on a screen at the upper right side of the monitor. The webcam screen was a high quality 320x240 pixel full-color screen running at 30 frames per second. After 24 minutes the chat automatically stopped and participants were redirected to an online questionnaire.

Different time periods were allocated for the face-to-face condition and the CMC conditions because CMC is relatively slow in comparison with face-to-face communication (Tidwell & Walther, 2002; Walther et al., 2001). Therefore, in the text-only CMC and the visual CMC condition, dyads interacted for 24 minutes. In the face-to-face condition, dyads interacted for 12 minutes.

The IM conversations were logged and the face-to-face conversations were recorded (audio only). Participants were asked permission to use the conversations for possible analysis. None of the participants refused. Finally, the participants were paid a small fee and were asked not to discuss the experiment with anyone else. The participants were debriefed orally right after the experiment and via e-mail one week later.

Measures

Self-disclosure. Participants were asked to indicate how much they told their partner during the conversation about six relatively intimate self-disclosure topics (Altman & Taylor, 1973; Jourard, 1971), measured on a scale from 1 (nothing) to 7 (everything): "relationships," "love," "how you feel about your physical appearance," "sex," "secrets," and "dating." We took the mean of the six items as a measure of participants' overall self-disclosure. Cronbach's alpha of the scale was .70.

Self-presentation. We measured the extent to which the participants felt they could control their self-presentation during the conversation with five items based on the Revised Self-Monitoring Scale (Lennox & Wolfe, 1984), and its adapted version for adolescents (Pledger, 1992). The five items were: "During the conversation, I could adapt my behavior to every situation," "During the conversation, I had control over what I said," "During the conversation, I could act the way I wanted," "During the conversation I could control how my conversation partner perceived me," and "During the conversation I could control how I presented myself." Response categories ranged from 1 (completely disagree) to 5 (completely agree). Cronbach's alpha of the scale was .71.

Similarity. To measure similarity we used four items of the Perceived Homophily Measure (McCroskey, Richmond, & Daly, 1975): "My conversation partner thinks like me," "My conversation partner behaves like me," "My conversation partner is similar to me," and "My conversation partner looks like me." The response categories for each of the items ranged from 1 (completely disagree) to 5 (completely agree). Cronbach's alpha was .85.

Private and public self-awareness. As in earlier CMC research (Sassenberg, Boos, & Rabung, 2005), items from the Fenigstein Self-Consciousness Scale (Fenigstein et al., 1975) were adapted to measure both private and public self-awareness. Four items measured private self-awareness: "During the conversation I reflected about myself," "During the conversation I thought about what I said," "During the conversation I was attentive to my inner feelings," and "During the conversation I constantly examined my motives." Another four items measured public self-awareness: "During the conversation I was concerned about the way I presented myself," "During the conversation I was self-consciousness about how I came across," "During the conversation I was worried about making a good impression," and "During the conversation I was concerned about what my conversation partner thought of me." Both scales were measured on a five-point scale ranging from 1 (completely disagree) to 5 (completely agree). Private self-awareness had a Cronbach's alpha of .70 and public self-awareness of .88.

Direct questioning. To measure direct questioning, participants were asked how much they asked their conversation partner about four intimate topics: "relationships," "sex," "dating," and "secrets." The response categories varied from 1 (nothing) to 7 (very much). As with the self-disclosure measure, we took the mean of the four items as a measure of participants' overall question asking. The items formed a weak scale, with a Cronbach's alpha of .46. To test for possible multidimensionality of the scale, we conducted a factor analysis. This revealed only one dimension, explaining 43% of the variance with factor loadings all above .50. The low scale reliability indicates that the amount of questions asked on a certain topic does not correlate heavily with the amount of questions asked on a different topic. This is likely to happen when investigating self-disclosure and question asking. When a topic is introduced in a conversation, more and more questions are likely to be asked on that topic, resulting in less

questions on other topics. In other conversations, the discussion may be much broader, and questions on several topics will be asked. The items measuring question asking and self-disclosure are therefore formative indicators of the construct, not reflexive indicators (Diamantopoulos, 2008).

Results

Conversation Output of Face-to-face Versus CMC Conditions

Following earlier CMC studies (e.g., Tidwell & Walther, 2002), we allowed CMC partners twice as much time (24 min) as face-to-face partners (12 min) to converse. To check for differences in the quantity of output in the face-to-face and CMC conditions, we counted the total number of words and the total number of turns in each dyad. A turn is the contribution of one partner in the dyad to which the other partner subsequently reacted. The two CMC conditions and the face-to-face condition did not differ in the number of turns, $F(2, 78) = .03$, $p = .97$, $\eta^2 = .01$ (text-only CMC: $M = 194.63$, $SD = 76.77$; visual CMC: $M = 198.70$, $SD = 54.01$; face-to-face: $M = 195.93$, $SD = 50.68$). However, there was a significant difference in the total number of words between the two CMC conditions (text-only CMC: $M = 1113.19$, $SD = 261.33$; visual CMC: $M = 1124.74$, $SD = 231.55$) and the face-to-face condition ($M = 2117.74$, $SD = 410.33$), with $F(2, 78) = 92.80$, $p < .001$, $\eta^2 = .70$. These results suggest that although CMC and face-to-face partners did not differ in the number of turns, CMC partners produced shorter sentences than face-to-face partners to express their thoughts.

Mediation Analyses

We largely followed the procedure described by Baron & Kenny (1986) to test the mediated relationships proposed in our hypotheses. In the first step, we investigated whether a direct relationship existed between the independent (condition) and dependent variables (self-disclosure). In the second step, we investigated whether the independent variable (experimental condition) is related to the five mediating variables identified in our hypotheses (i.e., control over self-presentation, perceived similarity, private self-awareness, public self-awareness, and direct questioning). In the third, we investigated whether the relationship between the five mediating variables and self-disclosure held when the independent variable condition was controlled. To establish mediation, all relationships tested in the three preceding steps must be significant (Kenny, 2006). For complete mediation, the direct effect of the independent variable (condition) on the dependent variable (self-disclosure) should no longer be significant, but this step is considered to be overly strict (Kenny, 2006).

Step 1: Direct Effect of Experimental Conditions on Self-Disclosure

To test the direct effect of experimental conditions on self-disclosure, we conducted an ANOVA with the three experimental conditions (text-only CMC, visual CMC, and face-to-face) as the independent variable and self-disclosure as the dependent variable. Table 1 shows the means and standard deviations for self-disclosure in each condition. An ANOVA on the three conditions yielded a nonsignificant overall difference in self-disclosure between the three conditions, $F(2, 78) = 2.75$, $p = .07$, $\eta^2 = .07$. However, direct comparisons between the conditions showed that both the text-only CMC condition, $t(52) = 2.17$, $p = .03$, and the visual CMC condition, $t(52) = 2.06$, $p = .04$, produced significantly higher levels of self-disclosure than the face-to-face condition. Therefore, our results mirror the outcomes of previous studies comparing self-disclosure in CMC versus face-to-face settings (e.g., Tidwell & Walther, 2002). Although the total amount of self-disclosure is relatively low, this can be expected in short term interactions between unacquainted individuals. After all, self-disclosure was measured by asking respondents how much they disclosed about topics such as sex, love and relationships on a scale from 1 (nothing) 7 (very much). Therefore, observing even a small effect size (.07) in self-disclosure between both CMC conditions and the face-to-face condition can be seen as a significant result.

Table 1. Mean Comparison of the Dependent and Mediating Variables for the Conditions

	Text-Only CMC $n = 27$	Webcam $n = 27$	Face-to-Face $n = 27$
Intimate Self-Disclosure	2.20[a]	2.15[a]	1.76[b]
	(0.87)	(0.78)	(0.62)
Self-Presentation	3.60	3.66	3.76
	(0.31)	(0.38)	(0.20)
Similarity	2.57	2.52	2.67
	(0.51)	(0.52)	(0.38)
Private Self-Awareness	2.65	2.61	2.67
	(0.54)	(0.51)	(0.47)
Public Self-Awareness	2.10	2.20	2.12
	(0.60)	(0.55)	(0.45)
Direct Questioning	2.23[a]	2.21[a]	1.68[b]
	(0.82)	(0.63)	(0.57)

Note. Standard deviations in parentheses. Subgroup comparisons with different superscripts are significantly different at least at $p < .05$.

Step 2: Effect of Experimental Condition on Mediating Variables

The second step involved a test of the influence of experimental condition on the five mediating variables. Table 1 shows the means and standard deviations of the mediating variables in each of the three experimental conditions. For control over self-presentation, no effect of condition was found, $F(2, 78) = 1.95$, $p = .15$, $\eta^2 = .05$. For perceived similarity, private self-awareness and public self-awareness, no significant differences were found between experimental conditions (all F's < 1). Finally, direct questioning did significantly differ between conditions, $F(2, 78) = 5.84$, $p < .01$, $\eta^2 = .13$, in that it was lower in the face-to-face condition than in both the text-only and visual CMC condition, with $t(52) = 2.89$, $p < .01$, and $t(52) = 3.33$, $p < .01$, respectively. These results indicate that our first three hypotheses, in which control over self-presentation, perceived similarity, and private and public self-awareness were assumed to act as mediators, were not confirmed.

Step 3: Effects of Condition and Mediators on Self-Disclosure

The third step required a regression of the mediating variables on self-disclosure, while controlling for experimental condition. Because step 2 is a necessary condition for mediation, we only tested the mediator that was significant in step 2: direct questioning. Moreover, our analyses revealed no differences between the text-only and the visual CMC condition. Therefore, for the mediation analysis, we compare both the text-based CMC and visual CMC to the the face-to-face. To test the difference between the experimental conditions in a regression analysis, two dummy variables were created: one to investigate the difference between text-only CMC (coded as 1) and face-to-face communication (coded as 0) and one to test the difference between visual CMC (coded as 1) and face-to-face communication (coded as 0).

Table 2 shows the results of the mediation analysis. Step 1 shows a significant relationship between the

independent variable (condition) and the dependent variable (self-disclosure), both when comparing the text-only CMC condition to the face-to-face condition (β = .29) and when comparing the visual CMC condition to the face-to-face condition (β = .28). Step 2 shows a significant relationship between the independent variable (condition) and the mediating variable (question asking), both when comparing the text-only CMC condition to the face-to-face condition (β = .36) and when comparing the visual CMC condition to the face-to-face condition (β = .42). Finally step 3 of Table 2 shows that there is a strong positive effect of direct questioning on self-disclosure while controlling for experimental condition (β = .92). Therefore, question asking mediates the relationship between experimental condition and self-disclosure, yielding support for our CMC-encouraged direct questioning hypothesis.

Table 2. Mediation Analyses

	B	SE	β
Step 1. DV: Self-Disclosure			
IV: Face-to-Face (0) vs. Text-Only CMC (1)	.44	.21	.29*
IV: Face-to-Face (0) vs. Visual CMC (1)	.40	.19	.28*
Step 2. DV: Direct Questioning			
IV: Face-to-Face (0) vs. Text-Only CMC (1)	.56	.19	.36*
IV: Face-to-Face (0) vs. Visual CMC (1)	.54	.16	.42*
Step 3. DV: Self-Disclosure; MV: Direct Questioning			
Controlled for Face-to-Face (0) vs. Text-Only CMC (1)	.95	.07	.92**
Controlled for Face-to-Face (0) vs. Visual CMC (1)	1.03	.08	.92**

Note. DV = Dependent Variable; MV = Mediating Variable; IV = Independent Variable.

* p < .05; ** p < .001

Although the significant regression coefficients in Table 2 indicate that the effect of CMC on self-disclosure is mediated by direct questioning, these coefficients do not provide a statistical test for the size and strength of the indirect effects (Preacher & Leonardelli, 2005). Therefore, we tested the significance of the indirect effects with the following formula developed by Sobel (1982):

$$z = \frac{\alpha\beta}{\sqrt{a^2\sigma_\beta^2 + \beta^2\sigma_\alpha^2}}$$

(1)

In this formula, α is the unstandardized regression coefficient for the relationship between independent variable and the mediator, σ_α is the standard error of α, β is the unstandardized regression coefficient for the relationship between the mediator and the dependent variable when controlled for the independent variable, and σ_β is the standard error of β (Kenny, 1996, 2006). When comparing the text-only CMC condition and the face-to-face condition, the Sobel test for the mediated relationship between condition and self-disclosure through question asking was significant (z = 2.88, p < .01). Comparing the visual CMC condition and the face-to-face condition, the Sobel test was also significant (z = 3.26, p < .01). These test results demonstrate that the CMC-encouraged direct questioning hypothesis is a valid hypothesis to explain differences in self-disclosure between the CMC and face-to-

face conditions.

Discussion

The goal of this study was to examine the underlying processes that may explain how the reduced cues of CMC result in higher levels of self-disclosure. In line with previous research, we found a direct positive effect of CMC on self-disclosure (Bargh et al., 2002; Coleman et al., 1999; Joinson, 2001; Tidwell & Walther, 2002). We identified four mediating variables that could carry the influence of CMC on self-disclosure: control over self presentation, perceived similarity, private and public self-awareness, and direct questioning. Based on these mediating variables, we identified four hypotheses that could explain the CMC-self-disclosure relationship. By testing these hypotheses in one study, we were able to identify which hypothesis is the most valid and the best guide for future research.

The CMC-Encouraged Self-Presentation Hypothesis

Our first hypothesis predicted that CMC partners would feel more in control over their self-presentation and, as a result, disclose more intimate information. This CMC-encouraged self-presentation hypothesis was not confirmed. Neither text-only nor visual CMC enhanced control over self-presentation. As a result, self-presentation did not qualify as a mediator in the CMC-self disclosure relationship. Although Bargh et. al. (2002) argued that the cue-reduced setting of CMC allows individuals to express themselves without risks or constraints, our results showed that enhanced self-disclosure in CMC cannot be attributed to control over self-presentation.

The CMC-Encouraged Similarity Hypothesis

The CMC-encouraged similarity hypothesis was not confirmed. CMC partners did not feel more similar to each other than face-to-face partners. Increased feelings of similarity can therefore not account for the increased self-disclosure in CMC. Although it is often hypothesized that CMC enhances feelings of similarity (Spears et al., 2002; Walther, 1996), this presupposition has rarely been empirically tested (Dubrovsky et al., 1991). A possible explanation for why our CMC-encouraged similarity hypothesis was not accepted could be that our sample consisted mainly of communication science students. Our participants might already feel so similar that this distorted the effect of our experimental conditions on similarity. Similarity, however, had a mean score of 2.59 (below the scale midpoint of 3) and standard deviation of .47, which precludes possible ceiling effects. Our finding that CMC does not result in perceived feelings of similarity is in line with a recent study by Lee (2004), who found that visual cues per se are not enough to simulate perceptions of similarity. According to Lee, perceived similarity during CMC can only be accomplished when specific cues that enhance similarity are included in the CMC setting. An interesting question for future research is whether this "cue-triggered similarity" results in greater or less self-disclosure between CMC partners than between face-to-face partners. On the one hand, the cue-triggered similarity could lead to increased self-disclosure, because feelings of similarity between interaction partners enhance self-disclosure (Brockner & Swap, 1976). On the other hand, participants might form an impression of each other based on the cues that triggered similarity. As a consequence, there will be less need for direct questioning and self-disclosure to reduce uncertainty (cf., Spears et al., 2002). For example, the cue that triggers similarity might be that both participants are member of the same student organization, which may cause them to see each other as typical members of that organization. Therefore, they will already have formed a relatively good impression of each other and, subsequently, have less need for self-disclosure in order to reduce uncertainty.

The CMC-Influenced Self-awareness Hypothesis

The CMC-influenced self-awareness hypothesis stated that CMC would raise private self-awareness and reduce public self-awareness. This hypothesis was also not confirmed: Both private and public self-awareness did not differ between the CMC and face-to-face conditions. Although it is commonly assumed that CMC affects self-awareness (Joinson, 2001; Kiesler, Siegel, & McGuire, 1984), this presupposition has hardly been tested. An exception is the study by Matheson and Zanna (1988), who found that text-only CMC results in higher private and lower public self-awareness. A possible explanation for the discrepancy between these findings and ours could lie in the type of conversation assignment used in the two studies. In Matheson and Zanna's study, a task-oriented assignment was used. Participants had to discuss a problem in a small group in order to arrive at a solution. In our study, we used a socially-oriented task in which participants received the assignment to get to know an opposite-sex partner. It is possible that, in comparison to a task-oriented assignment, basic levels of private and public self-awareness are already high when partners are informally talking to an opposite-sex partner. Future research should further investigate the circumstances surrounding the relationship between CMC and self-awareness, for example by including the CMC-assignment as a factor in the experiment.

The CMC-Encouraged Direct Questioning Hypothesis

Our fourth hypothesis was confirmed. Both text-only and visual CMC resulted in more direct questioning than the face-to-face condition. In addition, direct questioning was significantly related to self-disclosure. A simple explanation for this finding would be that CMC dyads asked more questions about cues not available to them, such

as looks or clothing. However, our measures of self-disclosure and direct questioning consisted of rather intimate topics. Therefore, our results indeed suggest that CMC dyads used more direct intimate questioning to form impressions and reduce uncertainty than face-to-face dyads, resulting in more intimate self-disclosure. One of the CMC conversations gave a good example of direct question asking and the resulting self-disclosure:

Male respondent: "In my last class, 80% were women."

Female respondent: "You wouldn't mind having only women in class, would you?"

Female respondent: "Or are you gay?"

Male respondent: "No man, not gay."

Female respondent: "I developed a gay phobia since I fell in love with a homosexual."

Male respondent: "hahahahahaha"

Male respondent: "When did you notice?"

Female respondent: "He turned me down a few times, long story. At a certain moment, I heard some rumors, and he said he was confused and all."

Male respondent: "You have a boyfriend now?"

Female respondent: "No. I always fall in love with gays. Do you have a girlfriend?"

Male respondent: "No, my last relationship was 4 years ago ;-)"

These results could explain other outcomes of CMC research. For example, the CMC-encouraged direct questioning hypothesis could explain the higher interpersonal attraction in CMC compared to face-to-face communication, as is hypothesized in the hyperpersonal approach (Walther, 1996). The process of question asking and reciprocal self-disclosure in initial interactions is strongly related to interpersonal attraction (Albada, Knapp, & Theune, 2002; Collins & Miller, 1994; McKenna et al., 2002). Since both question asking and self-disclosure in CMC are higher in CMC than in face-to-face communication, it follows that interpersonal attraction in CMC should be higher than in face-to-face settings.

Differences between Text-Only CMC and Visual CMC

Finally, our research question asked how the visual CMC condition would differ from the text-only CMC condition and the face-to-face condition. Our study found no differences in self-disclosure between the text-only CMC condition and the visual CMC condition. However, both CMC conditions resulted in significantly higher self-disclosure than the face-to-face condition. The same result was found for direct questioning: In both the text-only and visual CMC conditions, more direct questions were asked than in the face-to-face condition, whereas the number of direct questions did not differ between the two CMC conditions.

Our results imply that the absence of visual cues per se does not explain the higher levels of self-disclosure in CMC. After all, if reduced visual cues had been a valid explanation for heightened direct questioning and self-disclosure, the text-only and visual CMC condition would have led to different levels of direct questioning and self-disclosure. An explanation for the similar outcomes between the two CMC conditions is that direct questioning and self-disclosure, which are less appropriate in face-to-face settings, are more accepted in CMC settings, irrespective of whether visual information is added to the CMC setting. Especially among the young who have grown up with CMC technologies, direct questioning and self-disclosure could be seen as acceptable and even normative uncertainty reduction strategies in CMC (Walther et al., 2001). The addition of a webcam to text-only CMC apparently does not change this norm. The content of the conversations seem to point in this direction as well. Respondents in the visual CMC condition hardly refered to the webcam stream. The few comments that were made about the webcam were all made at the start of the conversation. From our observation of the webcam streams, the respondents did look at each other occasionaly, but this did not affect their choice of subjects and their self-disclosure.

Another explanation could be that in our study, the inclusion of a webcam video of the partners' faces did not reduce uncertainty enough to affect self-disclosure. Three reasons are conceivable. First, an important piece of information provided by facial features is a person's gender. In our study, participants in all conditions knew that their interaction partner would be of the opposite sex, so this information had no additional value for uncertainty reduction. Second, most of the time participants in the visual CMC condition were typing messages and were facing the keyboard. Therefore, they paid less attention to the video screen, and may have missed important uncertainty reducing visual information. Third, cues other than facial features could be responsible for uncertainty reduction

and impression formation (cf., Walther et al., 2001; Whittaker & O'Conaill, 1997). For example, impressions about an individuals' lifestyle are largely based on clothing (Keenan, 2001).

Implications for Further Research

An implication of our study is that reduced visual cues per se do not necessarily explain the increased self-disclosure in CMC. CMC theories have always been somewhat ambiguous about which nonverbal cues are precisely responsible for CMC outcomes, often equating lack of nonverbal cues with anonymity. Our results show that visual cues about the facial features of a CMC partner do not decrease self-disclosure in CMC. Future research should elaborate on our findings and investigate which nonverbal cues explain the effects of CMC effects on self-disclosure as well as wider CMC outcomes.

Another implication of our study is that future research should employ more sophisticated effects models. This study investigated four underlying processes that could explain the increased self-disclosure in CMC compared to face-to-face communication. Our CMC-encouraged direct questioning hypothesis proved to be the only viable explanation. This result suggests that other mediating variables that are implicitly assumed in CMC theories, such as perceived feelings of similarity and private and public self-awareness, may appear not be valid in explaining the enhanced self-disclosure in CMC. Future research should investigate the role of these and other mediating variables in examining CMC outcomes, for example effects of CMC on relationship formation, group identification, and task outcomes.

Future research should test our findings in more natural settings. Our respondents were forced to interact with strangers and results may be different when two people interact voluntarily. This may be especially relevant for our similarity hypothesis. In real-life interactions, when people voluntarily meet, similarity may have a significant effect on self-disclosure. When two people meet voluntarily and interact, this is usually in a shared setting such as in a bar or on an online community. In such a setting, people have common cues to rely on and which they can use in the initial phases of a conversation. This may enhance feelings of similarity, resulting in increased self-disclosure (Lee, 2004).

Another suggestion for future research is to study conversational approaches in CMC and face-to-face interactions. In our study, intimate self-disclosure was higher in the CMC condition than in the face-to-face condition. From our observations of the conversations, we noticed that in the face-to-face interactions, participants usually started by asking each other about their studies and the classes they were taking, which is non-intimate self-disclosure and question asking. After starting this conversation topic, participants seldom switched topics in the first phase of the interaction. In the CMC conditions, on the contrary, the first phase of the interaction was much faster paced and comprised a larger number of topics. Therefore, it could be that the initial phase in a conversation partly determines the overall of self-disclosure in a conversation. Future reseach should investigate the exact processes through which self-disclosure and question asking develop in CMC and face-to-face interactions.

Conclusions

Our study found that, compared to face-to-face settings, CMC elicits more direct questioning resulting in more intimate self-disclosure among unacquainted individuals. Our results concur with research conducted in more natural settings, which has also shown that direct questioning and self-disclosure is frequently used to reduce uncertainty about other CMC partners (Gibbs et. al., 2006; Subrahmanyam, Smahel & Greenfield, 2006). This need to reduce uncertainty about a partner is a general need in the initial stages of relationship formation (Berger & Calabrese, 1975). However, uncertainty reduction processes seem to develop at another pace in CMC interactions than in face-to face interactions. In face-to-face settings, uncertainty reduction is usually based on observable aspects of self, such as physical attraction or nonverbal behavior (e.g., Byrne et. al, 1968). Online, uncertainty reduction is more likely to be reduced on the basis of information that is willingly disclosed (McKenna & Bargh, 2000). Whereas in face-to-face settings, you are used to meet people, and then get to know them, "in cyberspace you can get to know people and then choose to meet them" (Rheingold, 1993, p. 27).

This differential uncertainty reduction in CMC and face-to-face communication may have several consequences for how relationships develop. First, relationships that started online may be more intimate at earlier stages than relationships that started offline, and online partners may have a greater degree of interdependence. Therefore, these relationships may be better able to survive setbacks later on in the relationship. Gibbs et. al. (2006), for example, found that self-disclosure on dating sites is an important predictor of perceived relational success. Second, the possibility to form relationships online on the basis of question asking and self-disclosure may be especially helpful for those who are less able to form a relationship offline, for example those who are lonely, socially anxious, or physically unattractive. An interesting question for future research may be how relationships that started online further develop, for example by following and comparing romantic partners who met each other

online and offline over a longer time period.

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