

Social Presence Effects:

A Study of CMC vs. FtF in a Collaborative Fiction Project

Radhika Kaushik, Prabu David, Susan Kline, D'Arcy John Oaks

Ohio State University

Address correspondence to:

Prabu David

School of Journalism and Communication

3016 Derby Hall

154 North Oval Mall

Columbus, OH 43210

[pdavid@osu.edu](mailto:pdavid@osu.edu)

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Prabu David and Susan Kline are Associate Professors in the School of Journalism and Communication at Ohio State University. Radhika Kaushik (MA 2002) received her Masters degree and D'Arcy John Oaks is a PhD candidate at the same institution.

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## Summary

In this paper we examine collaborative fiction writing in a face-to-face setting and in an online chat environment. To understand the role of social presence in online collaborative work, participants were placed either in a high collaboration task that involved working toward a common team goal or a low collaboration task that involved working toward individual goals. For the high collaboration task, face-to-face communication offered the optimal affordances. The richness of cues that comes with social presence facilitated convergence toward common goals. On the other hand, insufficient social cues in the online chat environment seemed to impede collaboration toward common goals. In a low collaboration task, on the other hand, where interactions were not forced upon participants, high social presence in the face-to-face setting seemed to hinder collaboration. For the same task, however, the low social overheads of online chat facilitated collaboration. These findings are examined within the framework of interactivity and social presence.

## 1 Introduction

Technological advances of the last few decades have changed communication media dramatically. These changes affect both private and public sectors, educational and research organizations, news media, and social relations. The Internet is changing the way we learn and work. As organizations in public and private sectors adopt new communication technologies as part of their normal routine, it becomes increasingly important to examine the impact of technology on the way we work.

Collaborative work is one of the important domains in which FtF and CMC has been directly compared. Collaborative tasks often are intended to emulate real-world situations individuals face at work or school. Data about the effects of CMC on the collaborative work, especially in terms of potential deficiencies or relative advantages over face-to-face communication is quite important in the information economy. For instance, Olaniran's (1995) online groups were instructed to brainstorm and develop university policies concerning such issues as parking and computer literacy. Shirani, Tafti, and Affisco (1999) studied online brainstorming about a bank's corporate strategy and choice about computer operating systems. Much of the research on this topic follows the same vein, with an emphasis on group decision making. In this study, however, our goal was to extend this line of research to a new domain, namely collaborative writing of fiction.

We examine collaborative fiction for several reasons. Many comparisons of CMC and FtF in the area of collaborative work rely on structured tasks, with seemingly right and wrong answers. In other words, these tasks can be categorized as convergent tasks, with a high degree of involvement and interaction, leading to outcomes that benefit the team. But in most real-world situations, collaboration varies from task to task and is contingent upon the situation. To contrast CMC and FtF in collaborative work, then, at least one of the variables that deserves attention is the degree of collaboration imposed on the group by task constraints. In a collaborative writing project, for example, in the early stages of the project when ideas are exchanged and when the project is scoped out, it seems plausible that FtF communication is likely to be preferable to CMC. In the latter stages

of the project, say during the final stages of editing and revising, CMC might be more efficient than FtF.

Therefore, in this study we compare two types of collaborative fiction tasks: a task that demands high collaboration among team members leading to convergence on common team goals, and a task that places low demands on collaboration and encourages divergent goals among team members. Both tasks are evaluated in two modes of communication, namely face-to-face and online chat. Although online chat, which represents computer mediated communication for the purposes of our study, is synchronous and approximates typical face-to-face communication on the temporal dimension, it lacks the visual and audio cues of face-to-face interaction. In short, one could argue that the fidelity of social presence is considerably lower in online chat in comparison to face-to-face communication. Hence, the direct comparison between face-to-face and online chat allows for the study of the role of social presence in collaborative work.

## **2 CMC vs. FtF: Some Theoretical Perspective**

Several theoretical perspectives have emerged from recent research in text-based computer mediated communication. For the purposes of this review, audio and video conferencing are not included. The obvious deficiencies of text-based computer mediated communication are the lack of physical and non-verbal cues present in face-to-face communication (e.g., Kiesler, Siegel, and McGuire, 1984), which has been cast as a cues-filtered-out model (Kim, 2000). According to this position, in the absence of social cues the normative pressures of social desirability and social norms are minimized, which could be quite liberating to the individual. This freedom could make it possible for individuals to think creatively, with restraint, but also lead to more impulsive and aggressive behavior. In short, the absence of clear social cues in CMC levels social status and engenders a democratization effect.

The absence of social cues, while liberating to some could also be constricting, especially when individuals feel a need to shift toward a group identity at the expense of the individual identity. This phenomenon has been labeled the social identity model of

depersonalization. From this perspective, CMC constricts individuals into tight, group-dominated behaviors and communication patterns.

These conflicting positions associated with CMC, that is the empowerment of the individual or the empowerment of the group, have significant implications for collaborative work. If CMC actually removes social barriers and allows a team member to be true to self, it is likely that ideas generated in the discussion are more original and creative. On the other hand, if the depersonalization process is in play, then individuals might be inhibited to express radical ideas and might settle for more conservative, mainstream ideas that seem to fit the group norm. Cast differently, for the purposes of collaborative work, one could argue that CMC is best suited for tasks that encourage individuality rather than consensus building or a strict convergence toward a team goal. On the other hand, the depersonalization argument suggests exactly the opposite; CMC might be best suited for a task in which the team goal trumps individual goals.

Instead of viewing the democratization and depersonalization as conflicting and mutually exclusive outcomes tied to a particular mode of communication, it would be more productive if these outcomes were tied to situational parameters, such as the attributes of the task, dynamics of the team, and the affordances of the communication environment. In short, a constructivist approach, rather than a deterministic model, is likely to yield better dividends at this early stage of CMC research. Kim's (2000) Adaptive Structuration Theory (AST) is an effort in this direction, which emphasizes that the technological dimension of CMC cannot be separated from its contextual dimension. Communication, whether mediated or not, must occur in the context of the communicators. Kim argues that CMC is open-ended, much like FtF, and that communicators in CMC are able to transform their actions creatively and contextually. This view of CMC is similar to models of situation cognition used in human-computer interaction and cognitive science, which highlight the importance of the environmental variables.

Another approach to CMC is Walther's (1996) social information processing perspective. Here, text-based CMC is perceived as hyperpersonal rather impersonal. In the absence of

social and visual cues, Walther argues that CMC facilitates impression management, allowing an individual to deliberately construct a socially favorable image, which could lead to unrealistic, idealized perceptions. This exaggeration effect is amplified in asynchronous CMC systems, such as email, which provide the opportunity for more extensive message planning and editing.

In all these theoretical perspectives, the common thread is how an individual relates to a group via a mode of communication. While the underlying mechanisms of human communication are not changed, the attributes of a medium constrain certain aspects of communication and facilitate other aspects. Some of these impacts on collaborative work are reviewed in the next section.

### **3 FtF vs. CMC in Collaborative Work**

Despite the growing body of research on comparisons between FtF and CMC in collaborative work, the findings are varied and contradictory. A number of studies support the basic thesis that the quality of decision making is comparable in FtF and CMC contexts (Adrianson & Hjelmquist, 1991; Straus & McGrath, 1994; Daly, 1993). However, in completing tasks that require increasing interdependence (Straus & McGrath, 1994) or socio-emotional conversation (Kiesler, Zubrow, & Moses, 1985), FtF groups were found to do better than CMC groups. For tasks that required negotiation and intellectual activity, Hollingshead, McGrath, and O'Connor (1993) found CMC groups were outperformed by FTF groups, but if CMC groups were given time to become accustomed to the medium, FTF groups and CMC groups were equivalent.

Moreover, the underlying mechanisms of CMC and FtF are not clear either. Gallupe, Bastianutti, and Cooper (1991) found that in a brainstorming session, members of CMC groups were more comfortable and less apprehensive than FTF group members. However, other studies report the opposite, with more social pressure (Weisband, 1992) and less agreement (Hiltz, Johnson, & Turoff, 1986) in CMC groups. Further, contrary to the expectations of the depersonalization argument, Adrianson and Hjelmquist (1991) found more conformity in FtF groups rather than the CMC groups.

Given the current state of research on this topic, an overarching theoretical framework that accommodates a range of contextual variables could help organize the conflicting findings. Although we do not attempt such an integrative framework in this paper, we would like to introduce social presence as a broad construct within which various theories of collaborative work in CMC can be couched.

#### **4 Social Presence and Interpretive Resources**

Originally introduced by Short (1974), social presence was used to compare differences among face-to-face communication, audio transmissions, and video transmissions. The construct of social presence, further elaborated by Short, Williams, and Christie (1976), has become an important area of research in computer-moderated communication. Social presence was originally defined as a *quality* of a medium to convey the presence of a sender. In this simple framework, the more the contextual cues, the higher the social presence. And, when the sender employs more channels, say audio and visual, attention to the social presence of the sender increases. Thus face-to-face represents high social presence, whereas text-based communication represents lower social presence. Based on these simple rules of thumb, CMC was considered inferior to face-to-face communication. Palmer (1995) indicates that all communication media, in fact, attempt to replicate face-to-face communication, as FtF communication is the ideal context, with high social presence.

Biocca (1997) attempted to reconceptualize social presence, especially as videoconferencing and other computer-based audio-visual technologies have become more prevalent. According to Biocca a “ minimum level of social presence occurs when users feel that a form, behavior, or sensory experience indicates the presence of another intelligence. The amount of social presence is the degree to which a user feels access to the intelligence, intentions, and sensory impressions of another.” This conceptualization is an interesting shift from the earlier definitions offered by Short, Williams, and Christie (1976), who placed the emphasis on the characteristics and cues that could be delivered by the sender and the sending channels. In contrast, Biocca’s definition is grounded on idea



of interaction, without a priori demarcations of the sender and receiver, which is the norm in interactive communication technologies.

In summary, the emerging definition of social presence leads to a two-dimensional layout with structural affordances of the medium as one dimension and the experiential aspects of social presence as the other dimension. Some of the key components of both these dimensions are discussed in the next section.

## **5 Interactivity and Social Presence**

Tied to the concept of social presence are the interactional and interpretive resources available to users to form perceptions of self and other, as well as perceptions of intended and inferred meanings. One view of interactional resources has recently been developed by Burgoon and her colleagues (e.g., Burgoon, Bonito, Bengtsson, Ramierz, & Dunbar, 2000). Their “Principle of Interactivity” defines human communication processes and outcomes as varying systematically with the “degree of interactivity that is afforded and/or experienced.”

According to Burgoon (Burgoon et al, 2000), there are two types of interactivity. The first type of interactivity is driven by structural affordances that foster a certain type of interdependent interaction between people. These affordances fall under the following categories – Contingency (the ability to immediately respond to the next person), Participation (whether the role of users is participative or observant), Synchronicity (whether messages are exchanged in real time or are delayed), Proximity (the geographical location of users), Mediation (whether communication is mediated or not), Parallelism (whether the format permits concurrent communication) and Richness (whether non-verbal cues are being used to understand the contextual information available). The second type of interactivity is interpersonal in nature. It is comprised of all those dynamic qualities by which the medium is experienced as being interactive-- the degree of involvement (cognitive and emotional engagement), coordination (ease of interaction – difficulty, awkwardness, naturalness), mutuality (extent of connectedness and similarity) and richness (spontaneity, desirability and receptivity).

Bonito (1999) further found that interactivity is a function of a variety of factors and that it is value neutral; whether interactivity helps or hinders is a function of the nature of the interaction itself, the interactors and the various objectives to be accomplished by them. When interactivity is seen as resulting from the structural affordances of the design there is the possibility that the design of interfaces could play a critical role on achievements in a collaborative environment.

In general, the premise is that interfaces that are perceived to be more useful, attractive and credible should produce better outcomes in collaborative tasks. Conversely, interfaces that are perceived as less useful, cumbersome and less believable should produce outcomes that are lower in quality. In the case of the collaborative fiction project it would mean that people, as they get more comfortable with the communication environment, would be better able to perceive the communication as “natural” rather than one that is artificially created.

Interactivity has also been shown to affect the accuracy of information processing, the quality of decisions, perceptions and evaluations of one’s own contributions as well as one’s evaluations of partner contributions on tasks (Bonito, 1999; Burgoon et al., 2000, Kenny, 1996). Often in collaborative tasks, interactivity affects perceptions of oneself and one’s partner as well. It was found that individual behaviors and cognitions are not only affected by one’s own behavioral and cognitive states (actor effect) but also by partner’s states as well (partner effect). In other words, perceptions of self are affected both by previous experiences as well as the impressions and experiences of the partner. Therefore, the interactivity of FtF and the collaborative fiction environment will in turn affect the way groups collaborate in the building of stories as well as their perceptions of others and self.

## **6 Collaborative Storytelling**

With a rich tradition in oral and folklore studies, storytelling is an important social activity, very much present in the real world. It is not a solo activity but a fundamental activity that people do together. People tell and exchange stories everyday. In this way, storytelling binds people together both socially and culturally. In the case of the

collaborative storytelling environment, the task demands more than reporting of past events. It is instead a cognitive and creative task. Since stories are an important social activity focused on creativity, involvement in the storytelling process can become highly stimulating.

For storytelling to retain its evolutionary roots as a natural activity, the structural affordances in new media environments play a critical role. Certain combinations of design features can facilitate the process of collaborative storytelling. Some fundamental practices that enable people to tell better stories include interpreting others' intentions and meanings, coordinating others' aims with one's own aims, effectively using sign systems for message design, and knowing practices to help coordinate attention and comprehension. A communication environment that allows these practices to flow without hinderances is most likely to succeed as a collaborative fiction environment.

Work by Bauman (1986) and Labov (1997) done in traditional FtF scenarios found that when people tell stories together a rhetorical form of narrative is produced. This could change in new media environments in ways we are yet to understand. In collaborative fiction, a participant becomes a co-constructor who interacts with the storytelling environment and constructs or builds the various connections which are then realized in a new form by different co-constructors. A naturalistic storytelling environment gives participants considerable flexibility in creating their own interpretation of what is going on and in carrying the story in various directions.

## **7 Research Questions**

Taking into account the processes of storytelling, interactivity was manipulated through task definitions. In one task, team members worked toward a common team goal, requiring high levels of interaction. In the other task, team members worked toward individual goals, requiring low levels of interaction. In both tasks, teams collaborated to produce a piece of fiction. Structural affordances of presence were manipulated through two modes of communication – face-to-face and online chat using MSN Messenger.

With the high and low collaborative tasks set in the two communication modes, two research questions were addressed.

First, with interactivity factors as dependent variables, we expected a two-way interaction between mode of communication and type of collaborative task. In the high collaboration task, due to the high demand on interaction, we predicted that FtF will be rated better than CMC on structural affordances of the environment, on interactions among team members, and on overall satisfaction. However, in the low collaboration task, due to the low demand on interaction, no significant differences were predicted between CMC and FtF on structural affordances, on interaction among team members, and on overall satisfaction.

Finally, we wanted to see if there were any differences in the quality of fiction created in the four experimental conditions. Chafe (1980), researching children's narratives, recommends using "idea units" to delineate cognitive chunking of words by a speaker. In this study, the concept of idea units in narrative texts can be taken to mean the collaborative chunking of words by narrative writers. Therefore, the number of idea units generated in each story will determine the levels of complexity on a strict quantitative basis. Idea units comprise number of words, number of sentences, number of characters, number of scene descriptors and number of themes. The greater the number of underlying ideas, the greater is the web of complexity that arises.

In the high collaboration task, due to better facilitation in FtF, it was predicted that the number of story ideas generated in FtF would be greater than the number of story ideas in CMC. In the low collaboration task, however, no significant difference was expected.

## **8 Method**

### **8.1 Design and Participants**

A 2 (CMC vs. FtF) x 2 (High Collaboration, Low Collaboration) between-subjects design was used to examine the differences between CMC and FtF in the high-collaboration and

a low-collaboration tasks. In total, 109 students participated in the study for extra credit in an introductory communication course at a large midwestern American university.

## **8.2 Collaborative Fiction Task**

The fiction task initially involved presenting all participants with a brief storyline extracted from a longer piece of fiction. The storyline was approximately 500 words in length and offered many loose ends, which allowed for various extensions of the plot. Participants were asked given 30 minutes to extend the storyline and submit their entry via an online submission window.

Immediately after the submission, students were given another 30 minutes to revise and improve the first submission by collaborating with other team members. During the revision stage, participants were assigned to one of two collaborative tasks: a high collaboration task that emphasized strong interactions among team members, or a low collaboration task that did not emphasize strong interactions among team members. The revised entry that emerged after the collaboration was resubmitted via the online submission window.

## **8.3 Procedure**

Students were recruited in groups of 10. However, some groups had 8 or 12 participants. When students arrived at the lab, they were randomly assigned to one of two groups, namely Face-to-Face (FtF) or Computer Mediated Communication (CMC) conditions. Students in the FtF condition were sent to a lab that had no partitions between computers, whereas students in the CMC condition were sent to a lab that was partitioned into private cubicles. Once the students were assigned to one of the two modes of communication, they were assigned to one of the two collaboration tasks. This assignment was determined using a random start. The first group was assigned to the high collaboration condition and the second group to the low collaboration condition. This pattern was used successively for the groups that followed.

After filling out a social desirability scale and short questionnaire on computer use and preference for fiction, participants read a storyline and spent the next 30 minutes

extending that storyline. See the Appendix for the storyline that was presented as the starting point.

In the next part of the study, participants were given a few moments to read the story extensions developed by the other members in their group. At this point, experimental condition to which a group was assigned, one of the following four instruction sets was administered.

*Face-to-Face, High Collaboration.* In this condition, the participants were asked to collaborate together to develop one team entry that took into account the contributions of the team members. Participants gathered around a conference table and shared their thoughts about one another's stories. Then they figured out a way to collaborate and also nominated one of the members to type their team entry. After this they went to the computer to enter their team story. During this step, no restrictions were imposed in terms of the nature of interactions among members.

*CMC, High Collaboration.* This condition was similar to the Face-to-Face, High collaboration condition, with one exception. Group members were allowed to interact with one another only through online chat using MSN Instant Messenger. Each group nominated a team member to submit one team entry after exchanging ideas and thoughts and integrating the work of the team members.

*Face-to-Face, Low Collaboration.* The procedure was identical to the Face-to-Face, High Collaboration condition, except students not required to submit a team entry. Instead, using the suggestions offered by the team members, each participant submitted a revised entry. Team members, however, were encouraged to actively interact with each other to improve their own stories. They were told that their entries would be evaluated as five submissions from one team.

*CMC, Low Collaboration.* Participants interacted and provided suggestions only via MSN Instant Messenger. In other respects, this condition was similar to the Face-to-Face, Low Collaboration condition. The key similarity was that each of the team members submitted his or her own final entry.

## 8.4 Measures

A number of measures were employed in this study. These measures served as covariates, manipulation checks and dependent variables.

*Social desirability.* Social desirability was introduced as a covariate. A shortened form (10 items) of the Marlowe Crown Social Desirability Scale presented in Reynolds (1982) was used. The scale seeks to differentiate individuals in terms of their tendency to describe themselves so as to gain the social approval of others. Items were rated on a seven-point scale, where “1 = Never,” and “7 = Always.”

*Familiarity with Computers.* Three items were developed to determine level of familiarity with basic computer skills, such as word-processing, online-chat, and doing creative work on the computer. Two items, for instance, were “I like doing creative work on the computer,” and “I am very comfortable using online chat.” These items were rated on seven-point strongly disagree/strongly agree scales.

*Interest in Fiction.* Interest in fiction was evaluated through five items that were designed to tap participants’ interest in reading and writing fiction. A representative item here was “I think the idea of online collaborative fiction is interesting.” Again, these items were rated on seven-point strong disagree/strongly agree scales.

*Interactivity Indices.* Fourteen items were used to evaluate participants’ perceptions of their communication with their team members. These items were drawn from the interactivity indices presented in Burgoon et al. (2000) but modified to fit this study. Items covered participants’ perceptions of their communication with others, awareness of themselves in relation to others, and overall evaluations of their experience; sample items were “I was able to easily understand others,” “I found the experience fun,” and “I felt a part of the group.” These items were rated on 7-point agree/disagree scales.

*Writing Outcomes.* Finally, writing outcomes were based on four quantitative measures: number of actors/characters in the story, number of scenes, number of words and the number of idea units. Idea units were defined as the number of independent thought units within a sentence (Chafe, 1980). For example, the sentence, “Paul reached the airport and

took a taxi to the city,” has two idea units: (1) Paul reached the airport, and (2) took a taxi to the city. Writing outcomes were calculated twice for each participant – once for the first submission and again for the revised submission after the collaboration. In the low collaboration condition, the first submission and the revised submission were coded separately for each participant and the difference between the two was calculated as the improvement score. In the high collaboration condition, each participant’s first submission and their team’s submission were coded as outcome variables. The revised score for the team submission was averaged by the number of team members. The difference between the average score for the revised entry and initial score were calculated to determine the improvement score. In sum, the number of characters in the story, number of scenes, number of words, and number of idea units were created as empirical indicators of writing.

## **9 Results**

The data was analyzed in several steps. The first step involved conducting a series of preliminary analyses on the measures of computer use, social desirability, and interactivity. Then analyses of variance were conducted to test our hypotheses and research questions.

### **9.1 Preliminary Analyses**

Facility with use of computers was examined with two items, “I am very comfortable using computers for basic word processing operations,” and “I am comfortable using online chat.” These items, which were significantly correlated,  $r = .34$ ,  $p < .001$ , were averaged to create an index of computer proficiency in relation to the collaborative fiction task.

Next, the factor structure of the short-version of the social desirability scale was examined. Unfortunately, Cronbach’s alpha for the scale was below .3 and the factor structure was not clear. Hence social desirability was dropped from further analysis.



After examining the items measuring social interactivity and presence, it was apparent that the items could be reduced to four key components. Given the exploratory nature of the study, these factors were derived on the basis of exploratory factor analysis and some intuitive grouping of items to fit theoretical constructs examined in this experiment.

The first interactivity component focused on the ease of communication and the extent to which team members were able to relate to one another. This component was created by averaging the ratings on the following four items: “I was easily understood by others,” “I was able to easily understand others,” “I felt a part of the group,” and “I felt similar to other group members.” These four items were correlated, with a Cronbach’s alpha of .83.

Next, items that focused on different aspects of the environment were analyzed. Four items were used to address the role of environmental affordances in CMC vs. Face-to-Face. These items were: “I felt the environment allowed me to easily interact with others,” “I felt the environment allowed natural collaboration to take place,” “I felt spontaneous in the environment,” and “I felt the environment allowed me to express my ideas clearly.” An index for environmental affordances was calculated by averaging the four ratings, with a Cronbach’s alpha of .86.

Awareness of self in relation to other team members was determined by averaging “I was often aware of others in the environment,” and “Others were often aware of me in the environment,” which were correlated,  $r = .67$ ,  $p < .001$ . Overall evaluation of the task was calculated by averaging two items, “I was satisfied with my work,” and “I found the experience fun,” which were correlated,  $r = .63$ ,  $< .001$ .

In sum, the interactivity and social presence items were reduced to four components: environmental affordances of CMC and FtF, awareness of self and others during the task, ease of communicating with and relating to team members, and overall evaluations of the experience.

## **9.2 Analysis of Interactivity and Social Presence Components**

Data were analyzed using a 2 (High collaboration, Low collaboration) x 2 (Face-to-Face, Computer Mediated Communication) between-subjects design, with two covariates,

namely computer proficiency and one item from the social desirability scale. Because social desirability did not yield a satisfactory scale structure, one item (“I am always courteous even to people who are disagreeable”) that was closest to the intent of the study was entered as a covariate.

The 2 x 2 analysis of variance with two covariates was run four times, each time with a different component of interactivity as the dependent variable. The summary of means for these dependent variables by the four experimental conditions is presented in Table 1. In general, the means for Face-to-Face were higher than the means for CMC in the high-collaboration condition, whereas in the low-collaboration condition, the means for CMC were higher than those for the Face-to-Face condition. In essence, this pattern translates into an interaction between Mode of Communication (CMC vs. Face-to-Face) and the level of Collaboration (high vs. low).

When the measure, ease of communicating and relating to team members, was analyzed, only the Mode of Communication x Collaboration was significant,  $F(1, 94) = 6.8, p < .01, MSe = 1.04$ . Similarly, for environmental affordances, only the Mode of Communication x Collaboration was significant,  $F(1, 94) = 9.14, p < .01, MSe = 1.34$ . When self-other awareness was tested as the dependent variable, only the main effect for Collaboration,  $F(1, 94) = 8.45, p < .01, MSe = 1.72$ , was significant. Finally, when overall evaluation was entered as the dependent variable, again only the Mode of Communication x Collaboration interaction was significant,  $F(1, 94) = 6.4, p < .01, MSe = 1.72$ . In all the analyses, main effects and interactions not mentioned were not statistically significant.

To better understand the interaction between CMC and Mode of communication, we ran some mean comparisons between CMC and Face-to-Face. In the high collaboration condition, face-to-face was rated higher than CMC for three of the four interactivity components: for overall evaluation, FtF ( $M = 5.3$ ) was greater than CMC ( $M = 4.5$ ); for understanding and relating, FtF ( $M = 5.5$ ) was greater than CMC ( $M = 4.8$ ); and for environmental affordances, FtF ( $M = 5.3$ ) was greater than CMC ( $M = 4.2$ ). These differences were significant at  $p < .05$ .

In the low collaboration condition, however, the pattern was reversed and the CMC was rated higher than face-to-face for three of the four interactivity factors: for evaluation, CMC ( $M = 5.4$ ) was greater than FtF ( $M = 4.6$ ); for understanding and relating CMC ( $M = 5.5$ ) was greater than FtF ( $M = 4.8$ ); for environmental affordances CMC ( $M = 5.2$ ) was greater than FfF ( $M = 4.7$ ). All differences were significant at  $p < .05$ .

The significant interaction and the difference in means support our prediction that FtF facilitates interactivity better than CMC for a high collaboration task. In contrast, CMC performed better on interactivity for a low collaboration task. Because of the low demand on interactivity, we thought that mode of communication would not make a difference in the low collaboration task. However, we were surprised to see a significant contrast in the low collaboration task, where participants pursued individual goals.

### **9.3 Analysis of Writing Outcomes**

In the final set of analyses, we examined whether differences in the interactivity factors noted in the previous section had a significant impact on writing outcomes. This question was addressed using a  $2 \times 2$  between-subjects design, with mode of communication (CMC, Face-to-Face) and levels of collaboration (high, low) as the two factors and writing outcome measures as dependent variables. Number of participants in a team was entered as a covariate to account for the differences in the volume of output with group size. This design was used to analyze the four writing outcome variables. The summary of means for the writing outcomes by the four experimental conditions is presented in Table 2.

First, change in the number of characters between the first submission and the revised submission was entered as the dependent variable. Main effects for Collaboration,  $F(1, 101) = 58.14$ ,  $p < .001$ ,  $MSe = 4.49$ , and Group Size,  $F(1, 101) = 5.93$ ,  $p < .05$ ,  $MSe = 4.49$  were significant. When the difference in the number of scenes was entered as the dependent variable, only the main effect for Collaboration was significant,  $F(1, 101) = 135.66$ ,  $p < .001$ ,  $MSe = .97$ .

Next, the change in number of words was examined. Main effects for Mode of Communication,  $F(1, 101) = 8.9$ ,  $p < .01$ ,  $MSe = 9655$ , Collaboration,  $F(1, 101) = 243$ ,  $p < .001$ ,  $MSe = 9655$ , and Group Size  $F(1, 101) = 10.16$ ,  $p < .01$ ,  $MSe = 9655$ , were significant.

The pattern of results for the idea units were similar to the pattern observed for the number of words. The main effects for Mode of Communication,  $F(1, 101) = 4.17$ ,  $p < .05$ ,  $MSe = 156.33$ , Collaboration,  $F(1, 101) = 199.95.12$ ,  $p < .001$ ,  $MSe = 156.33$ , and Group Size,  $F(1, 101) = 14.66$ ,  $p < .001$ ,  $MSe = 156.33$ , were significant.

From Table 2 it is apparent that the length of the stories for the team entries were shorter than the sum of the words of the individual stories submitted in the low collaboration conditions. This difference can be explained in part due to the synthesis and editing that members in the high collaboration task undertook. However, within the high or low collaboration tasks, the face-to-face condition yielded longer stories than the CMC condition. This pattern of findings was also found for the increase in idea units.

In summary, Face-to-Face was better than CMC in the high collaboration condition for all four of the writing outcomes that were tested in this study. In contrast, in the low collaboration condition, Face-to-Face was better than CMC in only one of the four outcomes, namely number of words. Based on these results, it appears that mode of communication is less important in the low-collaboration task in comparison to the high-collaboration task.

## **10 Discussion**

The primary goal of this study was to determine how the two modes of communication, FtF and CMC, differ in high collaboration and low collaboration tasks. The creative task of fiction writing was chosen as the collaborative activity since it seems to be conducive to both group collaboration and individual activity. Since structural affordances were thought to play an important role, we predicted that FtF communication environments would be more favorable for high collaboration tasks as compared to an online chat environment. This prediction was based on the reasoning that FtF modes of

communication are considered to be richer in terms of verbal, non-verbal, and social cues for message interpretation and design. For tasks involving low collaboration, on the other hand, in which students pursued individual goals, we expected no difference between the two communication modes.

### **10.1 High Collaboration Task**

In terms of interactivity components, which were introduced as markers of social presence, we found that FtF communication environments were indeed better for creative tasks that require a high degree of collaboration. Apparently, the conference room setup, which is conducive for brainstorming, provided better affordances for the task of synthesizing individual story entries, negotiation, and convergence toward team goals. In this case, high levels of social presence, with the full menu of audio, visual and social cues facilitated the group task, resulting in stories with more idea units. Another key advantage of face-to-face interaction was the higher involvement from the team members, including those who did not like to write fiction. For example, in the face-to-face conference room environment, it was possible for someone to contribute occasionally to the story-building processing. In other words, collaboration became richer experience with social presence.

In contrast, the structural affordances of online chat seemed to hinder creative processes at the group level. Simple tasks, such as deciding which of the team members would submit the final entry, became onerous chores, leading to some uncertainty and confusion. Based on our observations, it appeared that participants took some time to get their bearings before proceeding with the task. In other words, participants had to painstakingly arrive at a process of collaboration, which seemed to flow more naturally to the face-to-face condition. Given these differences, it was not surprising that more idea units generated in the face-to-face condition compared to the CMC condition.

### **10.2 Low Collaboration Task**

In the low collaboration task, where students pursued individual goals, the structural affordances of the MSN Messenger chat environment were more suitable than the

affordances of the face-to-face setting. For example, participants could continue to write their stories while chatting with other team members. This meant that they could ignore feedback until they were ready for it. In essence, interruptions during a creative activity were held in abeyance, which was difficult to do in a face-to-face setting when the person offering suggestions is physically present in close proximity. Although we had intended that participants would walk up to another team member and offer suggestions, this behavior occurred rarely. Given that most of the students were not acquainted with one another, the social and psychological demands of walking up to someone and offering suggestions was a challenge for many students. In this case, social presence in the face-to-face condition seemed to inhibit feedback and discussion. After the initial feedback that was provided during an arranged conference, which was part of the instructions, subsequent interactions were minimal.

The inhibitions of social presence in the face-to-face condition of the low collaboration task were easily overcome in the online chat environment. Time and again, students offered suggestions to one another. Perhaps the anonymity of the chat environment eased the uncertainty of how the other person would respond to one's suggestions. It appears that equivalence of status and the democratization in CMC had a positive effect for the low collaboration task in our study. In addition, the convenience of placing these suggestions on hold until the writer is ready provides further utility.

Despite the more convenient structural affordances of the CMC environment in the low collaboration task, less idea units were generated in this setting compared to the face-to-face setting. Although social anxieties inhibited collaboration in this condition, social desirability pressures seemed to have a positive effect. Students in the face-to-face, low collaboration task stayed longer and wrote longer stories, perhaps to appear diligent in the presence of their peers. Participants in the CMC, low-collaboration condition seemed eager finish their work and leave the lab, resulting in shorter story entries in comparison to their counterparts in the face-to-face condition.

## 11 Conclusions

The findings from this study suggest that the superiority of one mode of communication over another is contingent on task criteria and the dynamics of social presence within the group task. For a high collaboration task that demands considerable interaction among team members, face-to-face communication offered the optimal affordances. The richness of cues that comes with social presence facilitated convergence toward common goals in a collaborative fiction project. On the other hand, the lack of sufficient social presence and interactivity in an online chat environment impeded collaboration toward common goals. In a low collaboration task, on the other hand, where interactions were not forced upon participants, high social presence in the face-to-face setting seemed to hinder collaboration. For the same task, however, the low social overheads of online chat facilitated collaboration.

The interaction between social presence and task criteria has significant implications for collaborative work. In this study we examined only one type of task, namely collaborative fiction writing, which was evaluated with two modes of communication. In the future, examination of the effects of social presence on other tasks and outcomes with different modes of computer mediated communication could offer insight into the optimal design of communication interfaces for collaborative work.

**Table 1**

	<u>High Collaboration</u>		<u>Low Collaboration</u>	
	CMC	FtF	CMC	FtF
<i>Interactivity Factors</i>				
Understanding/Relating	4.8	5.5	5.5	4.8
Environmental Affordances	4.2	5.3	5.2	4.7
Sel-Other Awareness	4.8	5.3	4.5	4.0
Overall Evaluation	4.5	5.3	5.4	4.6

*Means measuring Task Interaction under the High Collaboration Condition and the Low Collaboration Condition for the CMC and FtF Fiction Writing Groups*



**Table 2**

	High Collaboration		Low Collaboration	
	CMC	F-t-F	CMC	F-t-F
<i>Change in # of:</i>				
Characters	-2.9	-1.8	1.7	1.0
Scenes	-1.7	-1.5	0.7	0.8
Words	-211.0	-164.0	99.0	158.0
Idea Units	-22.0	-20.0	9.0	19.0

*Means measuring Writing Outcomes under the High Collaboration Condition and the Low Collaboration Condition for the CMC and FtF Fiction Writing Groups*

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