I'm Sad You're Sad: Emotional Contagion in CMC

Jeffrey T. Hancock,[1,2] Kailyn Gee,[2] Kevin Ciaccio[2] & Jennifer Mae-Hwah Lin[1]
[1]Information Science
[2]Department of Communication
Cornell University
jth34, kg95, kac83, jml232 @cornell.edu

ABSTRACT
An enduring assumption about computer-mediated communication is that it undermines emotional understanding. The present study examined emotional communication in CMC by inducing negative affect in one condition and neutral affect in another. The results revealed that 1) participants experiencing negative affect produced fewer words, used more sad terms, and exchanged messages at a slower rate, 2) their partners were able to detect their partners emotional state, and 3) emotional contagion took place, in which partners interacting with participants in the negative affect condition had significantly less positive affect than partners in the control condition. These data support a relational view of CMC.

Author Keywords
Computer-mediated communication, Emotion, Affect

ACM Classification Keywords
J4 Social and behavioral systems: Psychology

INTRODUCTION

One of the most enduring assumptions about technology in human communication is that it undermines emotional expression. Like the introduction of earlier technologies, text-based forms of computer-mediated communication (e.g., email, instant messaging, chat etc.) have lead to speculations that emotion is more difficult to communicate, and that many misunderstandings online are a result of emotional miscommunication. For example, Goleman [5] argues that email may encourage emotional miscues because "there are no online channels for the multiple signals the brain uses to calibrate emotions." This view is grounded in the fact that text-based communication lacks the nonverbal cues often associated with emotion, including facial expressions, gestures, physiological indicators, like blushing, and acoustic indicators, like a rising voice.

Although early research in CMC seemed to support this view (for review, see Walther [10]), more recent empirical research suggests that emotional communication is not necessarily undermined in CMC. For example, in one study, participants were asked to act nicely or meanly to a communication partner during a get to know you type task that took place either FtF or in CMC [11]. The results revealed that the partners could discern the likable and dislikable participants as accurately in the CMC condition as in the FtF condition. In a second study that more directly examined emotional expression, participants acted either happy or sad while interacting with a partner through Instant Messenger [7]. After the interaction, partners were easily able to determine whether their partner seemed happy or sad. The study also provided some indications of how emotion is communicated through text: participants acting sad used fewer words, agreed less with their partner, used less punctuation, and responded less quickly than participants acting happy (see also work by Gill et al, [4]).

These studies support a view of relational communication in which interlocutors can adapt their emotional expression and sensitivity to the verbal channels of text-based communication. For example, Social Information Processing theory (SIP, [10]) argues that with time people can express their attitudes, thoughts and feelings in text-based interaction with their word choice, punctuation use, and timing. Poets and writers have long known how to engage a reader's emotions and to provide empathic insight into a character's feelings with words alone. SIP assumes that this is also possible in text-based interpersonal communication.

Although the two studies described above support SIP, they suffer from several important limitations that the present study seeks to address. The first and most obvious is that previous research has involved acted out emotions, in which participants are asked to act happy or sad, likeable or unlikeable. Given the role-playing nature of their emotional expression, their behavior may have been unnatural or exaggerated. Two important questions are addressed here: 1) how are emotions expressed in CMC when participants are actually feeling an emotion? and 2) can their partner sense this emotion?

A second limitation is that previous work has focused primarily on the behavior of only one participant, namely the participant asked to act emotional. Boehner and colleagues [3] argue that a more interactional approach to emotion is required, one that considers how emotion can be jointly constructed between interlocutors. This approach is

CSCW'08, November 8–12, 2008, San Diego, California, USA.

consistent with the behavioral phenomenon of *emotional contagion*, in which the mood of one person can infect the mood of others interacting with that person. Emotional contagion has been conceptualized as a non-conscious tendency to imitate the behaviors of another person, resulting in the convergence of the two people's emotions [8].

Research to date on emotional contagion has focused exclusively on the transmission of emotion in situations where non-verbal cues act as the primary emotional signals [2,8]. For example, Barsade et al [2] examined emotion contagion in group dynamics by placing a trained confederate in the groups that acted pleasant or unpleasant with high or low energy. They found that both positive and negative moods, as displayed by the confederate, induced a similar emotion in other participants. These data suggest that in communicative environments with non-verbal cues emotions can be contagious.

The question in the present study is whether emotional contagion also takes place in text-based CMC where non-verbal cues are largely stripped out. If the assumptions about technology undermining emotional expression described above are correct, emotional contagion should not operate in a communication setting like instant messaging, in which nonverbal and vocalic cues are eliminated.

If emotion can be expressed in textual communication, however, one possible mechanism is priming, which refers to the effect of simple stimuli, such as words, on subsequent perceptions and behavior. For example, participants exposed to words implying rudeness later interrupted a conversation more often than participants who were exposed to neutral words [1]. If emotions are expressed through affective words (e.g., "sad" "angry") related to the emotional state of a communicator (negative affect), then this may prime a similar emotion in the partner.

Lastly, gender has frequently played an important role in research concerned with both language and emotions. For instance, females tend to produce more first person singular than males [9], and females tend to be more empathic in FtF environments [6]. Our final question was whether gender interacted with the ability to express or sense emotions, or to experience emotional contagion, in CMC.

METHODS

Participants

The participants (N = 88) were students that received class credit for their participation. There were 36 males and 52 females (ranging from 18 to 25 years old) that were combined into a total of 44 same-sex dyads (18 male and 26 female). Twenty-one dyads were randomly assigned to the *neutral affect* group, and 23 to the *negative affect* group.

Procedure

Following the suggestions laid out by a meta-analysis on mood induction [12], emotions in the negative affect condition were induced with three manipulations: 1) viewing a short video clip (sad vs. neutral), 2) listening to music (sad vs. neutral) on headphones, and 3) completing a side-task (frustratingly difficult vs. easy anagram task).

The two members of each dyad arrived at separate locations, and were randomly assigned to rooms in the laboratory to prevent any contact with their partner before the experiment. In each dyad, one person was assigned to the role of the *emotion experiencer* and the other person to the role of *partner*. The experiment involved two phases, the mood induction procedure and the instant messaging conversation, and participants were lead to believe that they would be participating in two separate studies. This deception was designed to prevent associations between the mood induction and the emotion experiment.

Phase I. In the first phase, participants were told that they would be participating in a short study on people's perception of movies. In the negative affect condition, the *experiencer* viewed an emotionally distressing clip from the movie *Sophie's Choice*, in which a mother is forced to give up one of her children to the Nazis. In the neutral affect condition, the *experiencer* viewed an emotionally neutral clip from the movie *Before Sunset* that involved small talk between two friends. In both the sad and neutral conditions, the *partner* was shown an emotionally neutral clip from the movie *Before Sunset*. Both the negative and neutral affect clips were approximately five minutes in length.

After the clip participants filled out a brief questionnaire about the movie and a PANAS emotion scale. The movie questionnaire was used to enhance the sense that this was a separate study and included questions about the effects of movies on viewers. The PANAS scale is an emotional scale containing ten positive affect terms (i.e. enthusiastic, excited, proud, etc.) and ten negative affect terms (i.e. distressed, upset, irritable, etc.). A person rates their mood for each term on a scale from 1 to 5 (with 5 being extremely and 1 being not at all). The negative affect factor of the scale was used for the present study and was reliable (*Cronbach's alpha* = .92)

Phase II. In the second phase, participants were asked to take part in a separate study with the cover story that the experiment was concerned with the effects of multi-tasking on instant messaging. Their task was to have a conversation with a partner for fifteen minutes through AOL Instant Messenger. Because emotional contagion is enhanced by perceived relatedness and attention on the partner [2], participants were asked to 1) learn something they had in common with their partner and 2) discuss something that was worrying their partner. The *experiencer* had an additional set of tasks, listening to music and solving anagrams, which were ostensibly about multi-tasking but were in fact used to maintain the *experiencer's* assigned emotional state. The *experiencer* in the negative affect condition listened to music associated with sadness

(Alexander Nevsky, Op. 79: I. Russia under the Mongolian Yoke) and was frustrated by trying to solve difficult and impossible anagrams. In the control condition, the *experiencer* listened to emotionally neutral music (Brandenburg Concerto No. 3, first and second movement) and solved easy anagrams.

Following the conversation, both members of the dyad were given an emotion and relationship scale used in previous research [7]. This questionnaire contained Likert scale questions (1 = strongly disagree, 7 = strongly agree) asking the participant about their own emotion (e.g. "I feel like I had a good day"), their partner's emotional state (e.g. "I'd describe my partner as being in high spirits"), and their relationship with their partner (e.g. "I enjoyed interacting with my partner"). All three factors of the scale were reliable (for self emotion, Cronbach's alpha = .77; for partner emotion, .74; for relationship, .78), although the relationship data are not reported here. Participants also completed a second PANAS scale. Once again, the negative factor for the PANAS scale was reliable (.90)

After the experiment, participants were fully debriefed. Extra care was taken to ensure that participants in the negative affect condition did not feel upset after the interaction.

Manipulation Check

The mood induction appeared to be successful, and was not affected by gender. After phase I participants who watched the distressing movie clip reported having significantly higher negative affect scores on the PANAS (M = 2.74, SD = .84) than participants that watched the neutral clip (M = 1.37, SD = .50), $t(42) = 6.47$, $p < .001$. The induction appeared to be maintained through the interaction as well. After phase II, participants assigned to the negative affect condition again reported higher levels of negative affect on their second PANAS scale (M = 1.60, SD = .57) than participants in the neutral condition (M = 1.20, SD = ..31), $t(42) = 2.84$, $p < .01$.

Linguistic Analysis

The language was analyzed using the Linguistic Inquiry and Word Count (LIWC) program [9]. This program uses a word count strategy to identify the frequency of word use along different psychological dimensions (see [9]). The dimensions of interest in the present study were word count, first person pronouns, negation and assent, punctuation, and words reflecting positive and negative affect, including anxiety, anger and sadness.

RESULTS AND DISCUSSION

Expressing Felt Emotions

The first question of interest was how *experiencers* expressed their emotions. A 2 (gender) x 2 (affect condition) multivariate GLM revealed several effects. First, consistent with other research [9], females produced more first person singular (M = 7.96, SE = .42) than males (M = 6.49, SE = .50), $F(1,40) = 5.02$, $p < .05$. Somewhat surprisingly given the FtF research suggesting that women express emotions more nonverbally than men [6], there was no interaction between gender and affect condition on any of the linguistic dimensions.

The descriptive data and planned univariate analyses of linguistic patterns across affect conditions are provided in Table 1. Note that the linguistic dimensions represent percentages of total words produced. As predicted, *experiencers* in the negative affect condition produced significantly fewer words than controls. They also used more negative affect words (anger, anxiety, sadness), although the sad word dimension was the only one that achieved significance (see Table 1). The *experiencers* did not differ on other predicted linguistic dimensions, suggesting that experiencers' negative affect was reflected in their lower verbosity and increased use of negative emotion words, in particular, sadness related terms.

Experiencers in the negative affect condition also took significantly longer to produce messages than control *experiencers*. Note, however, that there was no difference in the overall time to completion for the negative affect (14.51 mins) and control (15.00) conditions, $t(42) = -.64$, *ns*. Taken together, these data indicate that negative affect *experiencers* typed less, exchanged messages more slowly, and produced more sad words in their dialogue than controls.

Although these effects are theoretically expected and consistent with previous research [7], it is possible that the increased time was a result of the mood induction technique in the negative affect condition, in which participants attempted to complete difficult anagrams. To avoid this potential confound in future research, alternative induction techniques should be used, such as using anagrams that prime negative affect (e.g., c_ff_n -> coffin).

Linguistic Category	Negative		Neutral		
	M	*SE*	*M*	*SE*	*p*
Word Count	**213**	**20.65**	**278**	**20.61**	**<.05**
1st-Person	7.30	.47	7.16	.46	.83
Positive emotion	6.20	.52	6.44	.52	.75
Anger	.47	.11	.23	.11	.12
Anxiety	.89	.13	.76	.49	.47
Sad	**.37**	**.08**	**.07**	**.08**	**<.05**
Negations	1.84	.32	2.18	.32	.49
Assents	4.77	.50	4.66	.50	.88
Punctuation	26.62	1.10	28.62	1.40	.32
Seconds Per Msg	**14 s**	**1 s**	**11 s**	**1 s**	**<.05**

Table 1. Linguistic profiles of emotional experiencers across negative affect and neutral conditions.

Sensing a Partner's Emotion

To determine whether partners could sense emotional states, the partner's assessment of the *experiencer's* emotional state was compared across affect conditions. The analysis revealed that, as predicted, the partners rated *experiencers* in the negative affect condition as significantly less positive (M = 4.39, SD = 1.02) than *experiencers* in the neutral affect condition, (M = 5.37, SD = 1.01), $F(1,40) = 3.97$, $p = .05$. No effect of gender was observed. These data are consistent with previous research suggesting that emotion can be detected in textual communication. However, these results also suggest that when emotions are induced and not acted out they can be communicated in text-based CMC.

Emotional Contagion

The next question of interest was whether partners experienced emotional contagion. If so, then we would expect *partners* talking to *experiencers* in the negative affect condition to feel more negatively than partners in the neutral condition. An analysis of the *partner's* self-assessment revealed this to be the case. *Partners* talking to negative emotion *experiences* were in a less positive affective state (M = 4.86, SD = 1.10) than *partners* in the neutral condition (M = 5.62, SD = .97), $F(1,40) = 5.43$, $p = .02$. No effects of gender were observed.

How was emotional contagion spread given the lack of nonverbal cues? One possibility is that partners were primed by the words used by the *experiencers*. To examine this possible explanation, the content words produced by *experiencers* described in Table 1 (e.g., positive and negative emotion words, agreement, negation) were correlated with the *partner's* self-reported emotional state. The results revealed that the partner's emotional state consistently became more depressed as more negative emotion terms were used by the *experiencer* (anxiety, $r = -.22$, $p = .09$; anger $r = -.12$, $p = .44$; sad $r = -.24$, $p = .09$). However, these correlations did not achieve significance. Given the low power to detect such a correlation, caution should be used in interpreting this statistical null effect.

A second possibility is that the temporal exchange of messages played a role in supporting emotional contagion. To examine this possibility, we correlated the *experiencer's* messaging rate in seconds with the partner's emotional state. No correlation was observed ($r = .26$, *ns*), suggesting that the timing of messages did not act as a cue for emotional contagion.

CONCLUSION

The present study replicated earlier research suggesting that emotions can be sensed in text-based CMC [7,11]. An important advance was that the emotion detected in this procedure was an experienced emotion rather than an acted emotion, suggesting that emotions can be reflected in CMC even when no goal is in place to express the emotion.

The second, and perhaps most important contribution, was that emotional contagion occurred between partners. To the best of our knowledge, this is the first study to demonstrate emotional contagion in text-based communication. Indeed, the effect of the emotional contagion was observed over a short interaction (approximately 15 minutes), suggesting that emotional contagion can operate quickly.

Unfortunately, we were unable to identify the mechanism by which emotional contagion operates in text-based communication. The data suggest the possibility that priming supports emotional contagion; emotional words were correlated with the partner's mood but did not reach significance. Future research is required to examine more emotions, and to explore other methods by which one person's emotions can spread to another during textually mediated communication.

REFERENCES

1. Bargh, J. A., Chen, M., & Burrows, L. "The automaticity of social behavior: Direct effects of trait concept and stereotype activation on action." *Journal of Personality and Social Psychology, 71*, (1996), 230-244.
2. Barsade, S. G. "The Ripple Effect: Emotional Contagion and Its Influence on Group Behavior." *Admin Sci Qtrly*. 47 (2002), pp. 644-675.
3. Boehner, K., DePaula, R., Dourish, P., & Sengers, P. How emotion is made and measured. *Int'l Jrnl HCI, 65*, (2007) 275-291.
4. Gill, A.J., Gergle, D., French R.M., and Oberlander, J. (2008). Emotion rating from short blog texts. *Proc. CHI 2008*.
5. Goleman, D. E-mail is easy to write (and to misread). *New York Times*, Oct 7, 2007.
6. Gesn & Ickes (1999), The Development of Meaning Contexts for Empathic Accuracy: Channel and Sequence Effects. Jrnl Pers Soc & Psych, 77, 746-761.
7. Hancock, J.T., Landrigan, C., Silver, C. "Expressing Emotion in text-based communication". *Proc. CHI* 2007, 929 – 932.
8. Neumann, R., & Strack, F. "Mood contagion: The automatic transfer of mood between persons" *Jrnl Pers & Soc Psych, 79* (2000), 211–223.
9. Pennebaker, J.W., Chung, C.K., Ireland, M., Gonzales, A. & Booth, R.J. The development and psychometric properties of LIWC 2007. http://www.liwc.net.
10. Walther, J.B. "Interpersonal effects in computer-mediated interaction: A relational perspective". *Comm Res, 19*, (1992), 52-60.
11. Walther , J.B., Loh, T., & Granka, L. "Let me count the ways: The interchange of verbal and nonverbal cues in computer-mediated and face-to-face affinity". *Jrnl Lang &* Soc *Psych, 24*, (2005), 36-65.
12. Westermann, Rainer, Kordelia Spies, Günter Stahl, and Friedrich W. Hesse. "Relative Effectiveness and Validity of Mood Induction Procedures: A Meta-Analysis". *Euro Jrnl Soc Psych, 26*, (1996): 557-580.