Expressing Emotion in Text-based Communication

Jeffrey T. Hancock
Dept of Communication
& Faculty of Information Science
Cornell University
jeff.hancock@cornell.edu

Christopher Landrigan
Dept of Communication
Cornell University
crl26@cornell.edu

Courtney Silver
Dept of Communication
Cornell University
ces58@cornell.edu

ABSTRACT

Our ability to express and accurately assess emotional states is central to human life. The present study examines how people express and detect emotions during text-based communication, an environment that eliminates the nonverbal cues typically associated with emotion. The results from 40 dyadic interactions suggest that users relied on four strategies to express happiness versus sadness, including disagreement, negative affect terms, punctuation, and verbosity. Contrary to conventional wisdom, communication partners readily distinguished between positive and negative valence emotional communicators in this text-based context. The results are discussed with respect to the Social Information Processing model of strategic relational adaptation in mediated communication.

ACM Classification Keywords

H.5.m Information Interfaces and Presentation (HCI):
Miscellaneous
J4 Social and behavioral systems: Psychology

Author Keywords

computer-mediated communication, emotion, affect

INTRODUCTION

Our ability to express and accurately assess emotional states is central to human life. A vast array of research has examined the relationship between emotions and nonverbal behaviors, including facial expressions, gestures, and acoustic features. Indeed, some scholars have argued that there are universal and distinctive markers of emotions in our nonverbal behaviors (e.g., [2]). The face, for example, is capable of expressing a range of emotions, and generally people have little difficulty identifying the expressed emotion.

In contrast to the substantial work focusing on the nonverbal expression of emotion, surprisingly little research has examined how emotions are reflected verbally [3]. Understanding the relationship between verbal communication and emotions, however, is particularly important in text-based communication environments, such as instant messaging and email, because the nonverbal behaviors typically associated with emotion are eliminated. The fact that mediated communication lacks nonverbal cues has frequently led to the assumption that text-based communication has a reduced capacity for emotional exchange.

Initial work in the area of Computer-Mediated Communication (CMC), for example, concluded that mediated exchanges lacked emotional tone or content, primarily because of the reduction in nonverbal cues thought to carry emotional information, such as facial expression, vocal inflections and body movement [9]. The assumption that mediated communication is less likely to support emotional exchange in text-based interactions continues to be observed in current research. Indeed, in a recent overview, Walther et al [11] observed that "traditional approaches to interpersonal communication research, and the predominance of CMC literature, take as a given the criticality of nonverbal behavior in the communication of interpersonal identity and affect" (p. 38).

An alternative view suggests that people can adapt their expression and assessment of relational information to the constraints of the text-based channel. In particular, the Social Information Processing theory [10] argues that users employ the verbal cues present in CMC to convey relational information that may normally be transmitted via nonverbal cues in face-to-face contexts. In one study examining this hypothesis [11], users were asked to express affinity or disaffinity towards a partner in either a face-to-face or computer-mediated environment. The data suggested that affinity was expressed equally effectively in both communication conditions. Consistent with predictions from the Social Information Processing theory, verbal cues carried a larger proportion of the relational information in the CMC condition than in the face-to-face condition, suggesting that participants can adapt their expression of affinity to the verbal channel. For example, when trying to express affinity for their partner, users offered praise and self-disclosures and avoided disagreements and insults.

If users can effectively express their liking or disliking of one another in mediated environments, then is it also possible for user's to reveal their current emotional state, such as positive and negative valence emotions? That is, can intransitive emotions like happiness or sadness be communicated in text-based interactions without explicit reference to emotion (e.g., "I'm happy!"), and if so, what are the verbal cues related to these emotions? Surprisingly, to the best of our knowledge, these basic questions have not been directly addressed in the HCI and CSCW literatures despite work highlighting the importance of emotion to these domains (e.g., [6,8]). The objective of the present study was to investigate emotion expression and detection in text-based communication by examining the following research questions. First, what strategies do people use to express positive or negative affect in a text-based interaction? To answer this question we asked participants to act either emotionally positive or negative during a text-based interaction. After the interaction we asked participants to describe the strategies they employed to convey their mood. We also examined the linguistic behavior of users expressing positive and negative affect to identify the kinds of verbal cues associated with those emotions in conversation. Based on the predictions flowing from the Social

Information Processing theory and previous empirical work (e.g., [11]), we expected that positive emotion speakers would produce 1) more words and more messages, 2) use fewer first person pronouns and more other-oriented pronouns, 3) agree more with their partner, 4) use more positive affect terms, including emoticons, and 5) have higher levels of immediacy than sad speakers.

The second question of interest was whether communication partners can accurately detect a speaker's emotional state in text-based communication. Given that participants appear to be able to adapt social processes to text-based communication [10] we expected that partners would be sensitive to differences in a speakers' emotional state.

Lastly, we were interested in how gender may affect the expression and detection of emotion in text-based contexts. Research in FtF contexts suggest that women may be more sensitive at assessing others' emotional sates, although women appear to rely on nonverbal cues when making these judgments [4]. Will women maintain their emotional sensitivity in text-based environments that eliminate typical nonverbal cues?

METHODS

Participants
Eighty undergraduate students in 40 same-sex dyads (14 male and 26 female dyads) received course credit for participating in this research. Participants were previously unacquainted with each other, and did not meet face-to-face until after their participation in the study.

Procedure
Participants were told that they would take part in an Instant Messaging conversation with someone they did not know. Their task was to get to know their partner by chatting for 30 minutes via Instant Messaging. Participants chatted from separate rooms using AOL's AIM software.

Participants were randomly assigned to expresser and naïve partner roles. Expressers were instructed to act as if they were experiencing positive ($n = 20$) or negative ($n = 20$) emotion. In particular, expressers were asked to "act happy, as if you had just received excellent news" or "act sad, as if you had just received terrible news", and to enact their positive or negative emotional state without explicitly mentioning anything about the assigned emotion to their partner. Naïve partners were blind to the emotion manipulation and were simply instructed get to know their partner.

Although the "act out" manipulation has been established in previous relational research [11], this procedure may be criticized as potentially eliciting demand characteristics for these particular emotions and limiting validity with respect to experienced emotions. It nonetheless has important offsetting benefits in this initial effort, including the fact that this manipulation permits a full range of natural and spontaneous presentations of cues to emotion compared to the use of trained confederates [11].

After the interaction, participants completed three Likert-scale questionnaires (1 = strongly disagree, 7 = strongly agree). The first included two manipulation checks for expressers ("How happy did you portray yourself in this interaction?" "How able were you to convey your assigned emotion?"). All expressers reported enacting their assigned emotion. However, given that we instructed participants to act positive or negative rather than actually induce affective states, an important question was whether expressers in the two conditions were equally able to express their assigned emotion.

Expressers reported no significant difference in their ability to express their assigned emotion across the two conditions (positive condition, $M = 5.05$, $SE = .38$; negative condition, $M = 4.15$, $SE = .37$, $F(1, 37) = 2.89$, $n.s.$).

The second questionnaire included eight items assessing the speaker's emotional expression strategies (e.g., "I used punctuation to express my emotion", see Table 1).

The third questionnaire included 11 items assessing the naïve partner's ability to detect the expresser's emotional state (e.g., "My partner seemed to be in a good mood" "My partner and I seemed to get along"). A factor analysis with varimax rotation yielded two independent factors with an explained variance of 77.8%. The first factor described the *perceived mood* of a participant's partner and comprised 7 items (*Cronbach's alpha* = .95). The second factor described the participant's perception of the *quality of the relationship* forged during the conversation and was comprised of 4 items (*Cronbach's alpha* = .89).

Linguistic Analysis
In order to examine the linguistic profile of happy and sad expressers the transcripts were analyzed using the Linguistic Inquiry and Word Count (LIWC) program [7]. LIWC analyzes transcripts on a word-by-word basis and compares words against a dictionary of words divided into 74 linguistic dimensions, including pronouns, affect terms, cognition terms, social and communicative processes. LIWC's psychometric properties and external validity have been established in a large number of studies, and has been used to examine the relationship between language and emotion, personality, and deception, among others [7]. For the purposes of this study, only the variables relevant to our predictions were included in the analysis (see Table 2). LIWC produces the percentage of each variable type by dividing the frequency of the observed variable by the total number of words in the sample. Word counts were not reported as percentages, but as frequency totals.

RESULTS
First, we note that no gender effects were observed in any of the analyses described below, suggesting that females' enhanced emotional sensitivity relative to males observed in FtF contexts disappears in text-based environments, perhaps due to the elimination of nonverbal cues.

The self-reported emotion expression strategies are presented in Table 1. Relative to negative affect expressers, positive affect expressers reported that they agreed more with their partner, responded more quickly, and used more punctuation. It is also important to note that they did not report using different amounts of affect terms.

Strategy Type	Positive		Negative		
	M	SE	M	SE	p
Punctuation	**4.22**	**.45**	**2.95**	**.43**	**< .05**
Typed More	4.56	.40	3.95	.38	.28
Emoticons	4.00	.53	3.15	.50	.25
Explicit Emotion Statements	4.06	.41	3.00	.39	.07
Encourage Partner	3.28	.36	3.40	.34	.80
Respond Quickly	**4.72**	**.37**	**3.20**	**.36**	**< .01**
Self-disclosure	4.50	.37	4.30	.36	.70
Agreement	**5.00**	**.36**	**2.85**	**.34**	**< .01**

Table 1. Self-reported strategies for expressing emotion

Linguistic Category	Positive		Negative		
	M	*SE*	*M*	*SE*	*p*
Word Count	**590.40**	**44.08**	**458.70**	**42.94**	**< .05**
Affect	**4.44**	**.24**	**5.27**	**.33**	**< .05**
Positive feeling	.80	.12	.63	.11	.30
Negative feeling	**.11**	**.14**	**.55**	**.53**	**< .01**
Emoticons	.26	.09	.15	.07	.34
Pronoun					
1st-Person	7.31	.38	6.72	.45	.33
3rd Person	1.38	.22	1.70	.28	.37
Agreement					
Negations	**1.58**	**.15**	**2.29**	**.20**	**< .05**
Assents	1.69	.20	2.51	.35	= .05
ExclamationPoints	**7.45**	**2.04**	**1.20**	**.69**	**< .05**
Msgs Per Minute	2.64	.22	2.37	.26	.43

Table 2. Linguistic profiles of happy and sad expressers. Variables are reported as % of word count.

Linguistic cues

The linguistic analysis of the texts revealed that several verbal dimensions differed significantly across the two emotion conditions, although not necessarily in the manner that expressers reported in their questionnaire responses. Relative to negative expressers, positive expressers used more words, fewer affect terms (especially affect terms relating to negative feelings), fewer negations and marginally fewer assents. Interestingly, emoticons (small icons that depict a facial expression) were not frequently used (overall only .2% of the word count), nor did their use differ across conditions. Pronouns, an important indicator of immediacy, also did not differ across conditions. Nonetheless, taken together, these data suggest that the participants' verbal behavior changed systematically and predictably according to the emotional state they were enacting.

Detection of emotion

The data revealed that naïve partners were able to detect the expresser's emotional state. Participants perceived the expressers in the sad condition (*M*=3.36, *SE*=.27) as significantly less happy than participants in the happy condition (*M*=5.77, *SE*=.26), $F(1,36)=41.16$, *p*<.001. Similarly, assessors perceived the relationship with expressers in the sad condition (*M*=4.35, *SE*=.23) less positively than in the happy condition (*M*=5.69, *SE*=.23), $F(1,36)=16.77$, *p*<.001 That is, partners of sad expressers were less likely to enjoy their conversation or desire to meet their partner again relative to partners of happy expressers.

Linguistic cues to emotional assessment

Given that assessors successfully differentiated between positive and negative emotion communicators, what were the linguistic cues that assessors relied on to make their judgment? A regression model with the assessor's emotional assessment as the criterion variable and the expresser's linguistic dimensions that varied significantly across conditions (word count, negative affect, negations, exclamation points) profile as the predictor variables accounted for a 34.6% of the variance in the assessor's affect judgment, $F(4,35)$ = , *p* < .005). The only significant linguistic dimensions in the model were negations ($B = -.28$, *p* < .05) and exclamation points ($B = .27$,

p < .05), suggesting that these linguistic cues were relied on most heavily by assessors when judging their partner's affective state.

DISCUSSION

In general, the data support the Social Information Processing model's [10] view of mediated communication as participants developed strategies to adapt their emotional expression to the text-based communication environment. The data suggest that the expressers relied on at least four methods for differentiating between their positive and negative emotional states.

The first strategy involved changing the degree to which the expresser agreed with their partner. Positive affect users reported trying to agree more with their partner, which is consistent with strategies used to express liking and disliking [11]. The linguistic analysis, however, revealed that this was not exactly the case. ; positive affect users *disagreed* significantly less frequently than negative affect users. These data suggest that, rather than the frequency of agreements, it is the frequency of *disagreement* that is an important verbal cue to differentiating positive versus negative emotion in text-based communication.

The second strategy was more direct and involved simply using more or less negative affect terms, but not positive affect terms. Negative expressers used 5 times more negative affect terms in their conversations than happy expressers. It is important to note that this difference was not observed in the expressers' self-reported strategies, suggesting that negative expressers may have been unaware that they were increasing their use of sad terms.

The third strategy was an increase in the use of punctuation by positive emotion expressers. The linguistic analysis revealed that the increased punctuation strategy was enacted through the use of exclamation points. Positive users used approximately six times the number of exclamation marks than negative users. This strategy is particularly interesting given that punctuation is not strictly a verbal cue. Punctuation has been referred to as the "prosody of online communication" [5], an interesting analogy given the fact that prosody (e.g., tone of voice) is an important cue to emotion in face-to-face contexts [2].

The fourth strategy involved engagement with a partner through speed of response and verbosity. Although positive expressers reported trying to respond more quickly to their partner than sad expressers as a strategy of emotion expression, this was not born out by the linguistic data (positive and negative expressers produced messages at approximately the same rate per minute). Instead, the linguistic data suggests that positive emotion users produced approximately 29% more words overall than sad expressers. It appears that the amount said is more important than how quickly it is said when trying to convey an emotional state.

These strategies appeared to have been effective in expressing emotional states. The naïve partners were able to detect the expresser's emotional state with little difficulty. In fact, assessors rated their positive emotion partners as 41.8% happier than negative emotion partners. Similarly, partners of sad expressers were less likely to enjoy their conversation or desire to meet their partner again. Importantly, these effect sizes were large (for mood, .54, for relationship, .32), implying that differentiating between positive and negative emotion communicators in this text-based communication environment was not difficult.

The linguistic cues that best predicted an assessor's judgment of their partner's emotional state was the use of negations and exclamation points. Expressers that used few negations and many

exclamation points were rated as having a highly positive emotional state.

Limitations
The present study has at least two important limitations. The first is that the range of emotions examined was limited to positive and negative valenced emotion. Obviously, the range of emotions important to the wide range of interpersonal activities supported by text-based communication is much more complex than this dichotomy. Indeed, recent work has begun to highlight the subtleties and complexities of emotion in the context of HCI and CMC (e.g., [1]). Nonetheless, these two emotional states allowed us to examine how they are differentiated verbally; future work will need to examine more subtle emotions.

As noted above, a second issue is the manipulation of the emotional states. Expressers acted out their assigned emotions, which raises the possibility that these participants were simply enacting their own stereotypical beliefs about communicating positive and negative affect. Although the fact that the linguistic behavior of the participants did not always match their beliefs about their own behaviors suggests that the expresser behaviors were not entirely driven by explicit demand characteristics, additional work using actual emotion induction procedures is clearly necessary to confirm these findings.

Contributions
Although the present study is only an initial effort into understanding emotion expression and assessment in CMC, the contributions of the present paper are twofold. First, the results provide empirical support for theoretical approaches to mediated communication that emphasize the adaptive and strategic qualities of interpersonal and relational communication. In particular, the findings support the Social Information Processing theory [10], and add to a growing body of evidence questioning the assumption that text-based mediated communication lacks emotional tone or content [5,11]. Emotions, at least positive versus negative, appear to be readily communicated in text-based interactions through both verbal strategies (e.g., changes in disagreement, affect terms, and verbosity) and nonverbal strategies (e.g., use of punctuation).

The second contribution is to recent work examining the automatic extraction of affect from text. In general these approaches use statistical classification techniques to automatically identify emotion from large corpora. In some cases these models are built on semantic information (e.g., [6]). For example, sentences about car accidents probably have negative affect associated with them. The present research informs these models by providing insight into the strategies that humans use to express different types of emotion in

text-based interpersonal interaction. This information may lead to improved models of emotion in HCI and improved interfaces that support mediated communication, although the present data suggest that simple text-based communication is certainly capable of allowing us to express our emotions and assess them in others.

REFERENCES
[1] Boehner, K., DePaula, R., Dourish, P., Sengers, P. Affect: From information to interaction. *Proc. Critical Computing* 2005, 59-68.

[2] Ekman, P. *Emotion in the human face*. Cambridge University Press, 1982.

[3] Fussell, S.R. The verbal communication of emotion. In S.R. Fussell (Ed.), *The Verbal communication of emotion: Interdisciplinary perspective*. Mahwah, NJ: Lawrence Erlbaum Associates, 2002.

[4] Hall, J.A. & Bernieri, F.J. *Interpersonal Sensitivity: Theory and Measurement*. Mahwah, NJ: Lawrence Erlbaum Associates, 2001

[5] Hancock, J.T.. Verbal irony use in computer-mediated and face-to-face conversations. *Journal of Language and Social Psychology*, 23 447-463, 2004.

[6] Liu, H., Lieberman, H. and Selker, T. A model of textual affect sensing using real-world knowledge. *IUI'03*, January, Miami, Florida, 2003.

[7] Pennebaker, J.W., & Francis, M.E., & Booth, R.J. Linguistic inquiry and word count: LIWC 2001 [software program for text analysis]. Mahwah, NJ: Lawrence Erlbaum Associates, 2001.

[8] Picard, R. W. *Affective Computing*, Boston, MA: MIT Press, 1997.

[9] Short, J., Williams, E., & Christie, B. *The social psychology of telecommunication*. London: John Wiley, 1976.

[10] Walther, J.B. Interpersonal effects in computer-mediated interaction: A relational perspective. *Communication Research, 19*, 52-60, 1992.

[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. *Journal of Language and Social Psychology, 24*, 36-65, 2005.