An Event-Related Potential Study of Social Media Use and Emotional Processing

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INTRODUCTION

- The increasing use and popularity of social networking sites such as Facebook has changed how we communicate and how we achieve our socio-emotional goals.
- Research findings on the impact of computer-mediated communication (CMC) like social media on social-emotional functioning have been mixed and sometimes contradictory.
- In early studies, researchers hypothesized that more psychosocially distressed and socially isolated individuals would prefer greater use of CMC (Caplan, 2003) and that CMC may even promote maladaptive social-emotional functioning (Caplan, 2003; Walther, 1996, 2007) such as decreased empathy (Konrath, O'Brien, & Hsing, 2010).
- Yet, two methodological issues call this conclusion into question:
  - Previous studies relied upon general measures of CMC (e.g., hours of CMC use/week) instead of measures that reflected preferences and goals of CMC use, which may have more direct relevance for social-emotional functioning (Carpenter, 2012; DeAndrea & Walther, 2011).
  - Social-emotional functioning was measured almost exclusively via self-report.
- In this study, a novel self-report measure of CMC was used in which participants reported on their preferences to use CMC versus face to face communication in three distinct domains: positive social communication, expressing distress, and casual communication.
- In addition, neurophysiological measures of emotional functioning were used to examine preferences for CMC use in relation to emotional reactivity (N110) and the ability to regulate emotional responses (the LPP).
- The current study was exploratory, with the goal of generating new hypotheses for use in future studies. However, if CMC is associated with greater emotional vulnerabilities, we might expect to see the following associations emerge:
  - Greater preference for CMC versus face-to-face communication will be associated with greater amplitude N110 and LPP during a passive viewing task, indicating increased reactivity to emotional images.
  - Greater preference for CMC versus face-to-face communication will be associated with blunted ability to intentionally increase or decrease emotional responses to emotional stimuli as measured via the LPP in a cognitive reappraisal task, suggesting reduced regulatory flexibility.

METHOD

Participants

Twenty two adults (11 females, 11 males), aged 18-47 (M = 22.95, SD = 6.65), participated in this study.

Social Media and Communication Questionnaire (SMCQ)

The SMCQ assesses participants' preferences to accomplish specific active social communication goals via CMC (e.g. Facebook updates, text messages, blogging) relative to real time face-to face communication (includes video chat online that occurs in real time but excludes phone calls).

Participants reported their communication preferences over the past six months on a Likert-type scale (1 = Only CMC & Never Face-to-face communication, 7 = Never CMC & Only Face to-face communication).

Items were classified into three subscales: positive social communication (e.g., communicate happiness, get to know people, keep in touch with people), expressing distress (e.g., communicate worry, seek emotional support, have a disagreement), and casual communication (e.g., offer advice, communicate interest, communicate boredom).

Big Five Inventory (BFI; John et al., 1991)

The present study used the Neuroticism scale from the 44-item version of the BFI to measure emotional instability, moodiness, irritability, anxiety, and sadness. This study specifically examined neuroticism as a covariate to account for individual differences in personality-based general negativity.

State-Trait Anxiety Inventory (STAI-State; Spielberger, Gorsuch, & Lushene, 1970).

This 20-item measure assesses current anxiety using statements describing feelings, rated on four-point scale from one (not identifying with the statement at all) to four (identifying with the statement very much so). State anxiety was examined as a covariate to account for individual differences in situation-based anxiety.

Social Support Questionnaire

Participants completed a 12-item questionnaire about the quality and amount of social support present in their lives. The amount of social support was the average number of individuals the participant wrote down when asked who he/she can rely on in times of stress, to help him/her feel more relaxed when under pressure, who can be counted on to console him/her, etc. Participants also reported the degree to which they were satisfied with the support they receive from these people on a scale from 0 (very dissatisfied) to 6 (very satisfied).

Passive Viewing Task

Participants passively viewed 75 unpleasant, 75 pleasant, and 100 neutral stimuli from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008). Stimuli were presented for 2000 ms with a 1000 ms interstimulus interval and were randomly presented. Unpleasant and pleasant stimuli were subdivided into categories. Unpleasant categories included: threat (f = 35), mutilation (f = 22), mortality (f = 18). Pleasant categories included: affiliative (f = 42), erotic (f = 27), and other/uncategorizable (f = 6).

Cognitive Reappraisal Task

Following the passive viewing task, participants viewed the same 250 IAPS images during a cognitive reappraisal task. They were given instructions to INCREASE, DECREASE, or MAINTAIN their emotional response to the pictures. The instructions were presented for 2000 ms, followed by an interstimulus interval of 1000 ms, then the picture for 2000 ms. Stimuli were presented in increase, decrease, or maintain blocks; the increase and decrease blocks contained 25 affective pictures (unpleasant or pleasant) and 25 neutral pictures while the maintain blocks were either 25 unpleasant or 25 pleasant pictures.

EEG Recording and Data Reduction

EEG activity was recorded during the passive viewing and cognitive reappraisal tasks via BioSemi 64 Ag/AgCl scalp electrodes, sampled at 512 Hz and amplified with a band pass of 0.16-100 Hz. Eye movements were monitored by electrooculogram (EOG) signals.

Using Brain Vision Analyzer, data were referenced offline to the average of the mastoids and filtered with a low-cutoff frequency of .1 Hz and a high-cutoff frequency of 30 Hz. Stimulus-locked data were segmented into epochs from 200 ms before stimulus presentation to 2000 ms after stimulus onset, with a 200 ms baseline correction.

Following ocular correction (Gratton & Coles, 1983), artifacts were identified using the following criteria and removed from analyses: data with voltage steps greater than 50 µV, changes within a given segment greater than 300 µV, and activity lower than .5 µV per 100 ms. In addition to this semi-automatic identification of artifacts, trials were also visually inspected for any further artifacts and were removed on a trial-by-trial-basis.

The N110 was quantified as the mean amplitude from 90-120 ms over Fz during the passive viewing task. **Difference scores were calculated to quantify early reactivity to emotional versus neutral stimuli.** For all N110 conditions (affiliative, erotic, threat, mutilation, mortality), amplitudes to neutral images were subtracted from amplitudes to emotional images. Larger (more negative) differences indicate greater reactivity to the emotional versus neutral images.

The LPP was quantified as the mean amplitude from 200-800 ms over P3/P5/PO3/PO7 and P4/P6/PO4/P08 during the cognitive reappraisal task. **Difference scores were calculated to quantify the degree to which CR resulted in increased or decreased LPPs, suggesting regulatory capacity.** For CR conditions (pleasant – maintain, pleasant – increase, pleasant – decrease, unpleasant – maintain, unpleasant – increase, unpleasant – decrease), amplitudes to the neutral – maintain condition were subtracted from amplitudes to emotional conditions.

The LPP was also quantified over the same time window and electrodes during the passive viewing task. Difference scores were calculated to quantify the degree to which amplitudes to emotional stimuli differed from neutral stimuli. For PV conditions (affiliative, erotic, threat, mutilation, mortality), amplitudes to the neutral condition were subtracted from amplitudes to emotional conditions.

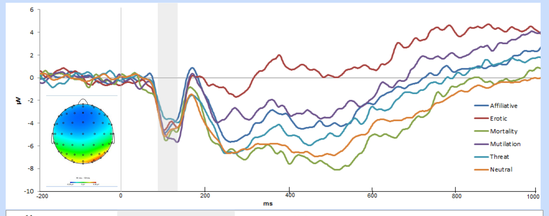


Figure 1. Waveforms by condition depicting the N110 between 90 ms and120 ms. The headshot illustrates the grand average for the N110 across all conditions (affiliative, erotic, threat, mutilation, mortality, neutral).

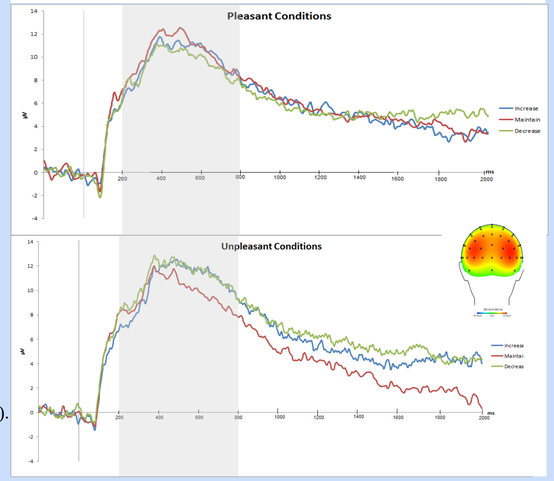


Figure 2. LPP waveforms for pleasant-increase, pleasant-maintain, and pleasant-decrease conditions.

Figure 3. LPP waveforms for unpleasant-increase, unpleasant-maintain, and unpleasant-decrease conditions. The headshot illustrates the grand average for the LPP across all conditions (unpleasant-increase, unpleasant-decrease, pleasant-increase, pleasant-decrease, and neutral-maintain).

RESULTS

Table 1.
Descriptive Statistics for the SMCQ Scale

SMCQ Scale	Minimum Score	Maximum Score	*M (SD)*
Positive Social Communication Scale	1.71	5.14	3.79 (0.98)
Expressing Distress Scale	2.17	6.50	4.82 (1.12)
Casual Communication Scale	2.25	6.20	4.33 (0.98)
Average Communication Preference Scale	2.65	5.90	4.33 (0.87)

Note: Scores lower than 4 indicate a preference for computer-mediated communication.

SMCQ Preferences and Social Support

Individuals who preferred to use CMC rather than face-to-face communication to express distress reported lower numbers of people available to them for social support (r = .46, p < .05). Similarly, a CMC preference for casual communication was also associated with fewer people available for social support (r = .44, p < .05). Furthermore, those who preferred to use CMC for positive communication reported decreased satisfaction with their social support (r = .494, p < .05). **In summary, a CMC preference was associated with reduced quality and satisfaction with social support networks.**

Regression Analyses

A series of regressions were conducted to examine associations between CMC preferences and ERP responses. To control for personality-based general negativity as well as situation-based anxiety, self-reported neuroticism and state anxiety scores were entered as a covariates (neuroticism: 1st step, state anxiety: 2nd step) for all regressions. SMCQ scores (positive social communication, expressing distress, and casual communication) were entered in the 3rd step and each ERP condition difference score was then entered separately as the dependent variable.

Passive View Task

LPP

No significant effects emerged.

N110

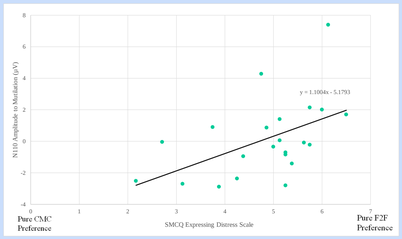


Figure 4. A CMC preference for expressing distress predicted greater amplitude N110 to mutilation images [β = 1.19, t(21) = 2.70, p < .05].

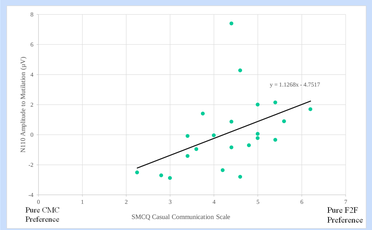


Figure 5. A CMC preference for casual communication predicted greater amplitude N110 to mutilation images [β = 1.19, t(21) = 2.30, p < .05].

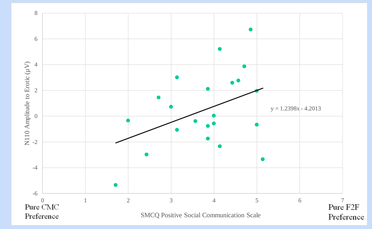
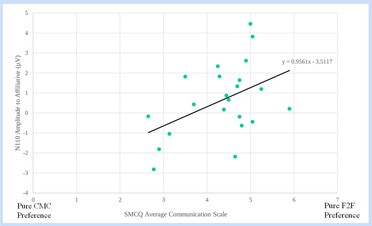
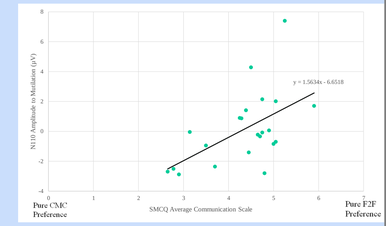


Figure 6. A CMC preference positive social communication significantly predicted greater amplitude N110 to erotic images [β = 1.34, t(21) = 2.57, p < .05].





Figures 7 and 8. An overall CMC preference, averaged across all domains of communication predicted greater amplitude N110 to affiliative [β = 0.92, t(21) = 2.09, p = .05] and mutilation [β = 1.63, t(21) = 3.00, p < .01] images.

In summary, a CMC preference, versus a face-to-face communication preference, was associated with greater reactivity to both pleasant and unpleasant stimuli.

Cognitive Reappraisal Task

LPP

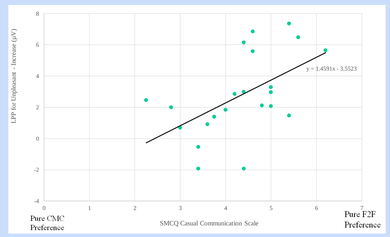


Figure 9. Furthermore, a CMC preference for casual communication predicted reduced LPP amplitudes when participants were asked to increase their emotional response to unpleasant stimuli [β = 1.60, t(21) = 3.16, p <.01]. **In summary, a CMC preference, versus a face-to-face communication preference, was associated with decreased ability to change emotional responses to unpleasant stimuli, possibly indicating reduced regulatory flexibility.**

DISCUSSION

- Preferences for CMC versus face-to-face interactions were associated with low social support, indicating that on average, individuals who either have a low amount of social support/ are dissatisfied with that social support tend to communicate emotions via CMC.
- Preferences for CMC versus face-to-face interactions were also associated with greater emotional reactivity to both pleasant and unpleasant stimuli, as demonstrated by greater N110 amplitudes during the PV task.
  - This finding suggests that CMC preferences may be closely linked to very rapid and relatively automatic attentional biases towards arousing emotional material.
- Similarly, individuals with a preference for CMC interactions appeared to evidence reduced affective flexibility during the CR task as demonstrated by the LPP. That is, they showed reduced ability to *increase* their emotional responding to unpleasant pictures.
- These findings, when interpreted together, suggest that there may be a type of individual for whom social media may be used as a tool to regulate emotions. That is, social media use may be an adaptive response for individuals with low perceived social support, a tendency to be emotionally reactive, and reduced flexibility when trying to control their emotional responses.
- The present study did not suggest that CMC preferences are associated with maladaptive outcomes. However, future research should examine how CMC use can be used to support emotion regulation and whether certain emotional profiles characterized individuals who prefer CMC versus face-to-face interactions to meet some social-emotional goals.

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This research was supported by Grant Number MD007599 from the National Institute on Minority Health and Health Disparities (NIMHD) of the National Institutes of Health (NIH). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIMHD or the NIH.