An Event-Related Potential Study of Computer-Mediated Communication Preferences and Emotional Reactivity and Regulation

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INTRODUCTION

- The rise of social media and computer-mediated communication (CMC) has transformed social-emotional interactions.
- **Previous studies** have suggested that psychosocially distressed and socially isolated individuals 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, et. al, 2010).
- Yet, two methodological issues call this conclusion into question:
  - Reliance upon general measures of CMC (e.g., hours of CMC use/week) instead of measures that reflected preferences and goals of CMC use (Carpenter, 2012; DeAndrea & Walther, 2011).
  - A lack of assessment of affective-cognitive mechanisms related to CMC use.
- **The current 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.
  - Neurophysiological measures of emotional functioning were used to examine preferences for CMC use in relation to emotional reactivity (N1) and the ability to regulate emotional responses (the LPP).
- This 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:
    (a) decreased quality and satisfaction with social support networks
    (b) greater amplitude N1 and LPP during a passive viewing (PV) task, indicating increased reactivity to emotional images
    (c) blunted ability to intentionally increase or decrease emotional responses to emotional stimuli as measured via the LPP in a cognitive reappraisal (CR) task, suggesting reduced regulatory flexibility

METHOD

Participants

- Twenty two adults (11 females, 11 males), aged 18-32 (*M* = 19.1, *SD* = 2.5), participated in this study.

Social Media and Communication Questionnaire (SMCQ)

- Assesses participants' preferences to accomplish 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).
  - Likert-type scale: 1 = Only CMC & Never Face-to-face communication, 7 = Never CMC & Only Face to-face communication.
  - Subscales: **positive social communication** (e.g., get to know people, keep in touch with people), **expressing distress** (e.g., communicate worry, have a disagreement), and **casual communication** (e.g., communicate interest, communicate boredom).

Questionnaires

- **Big Five Inventory (BFI; John et al., 1991) --** Neuroticism (e.g. emotional instability, moodiness) was used as a covariate to account for individual differences in personality-based general negativity.
- **State-Trait Anxiety Inventory (STAI-State; Spielberger, Gorsuch, & Lushene, 1970) --** State anxiety was used as a covariate to account for individual differences in situation-based anxiety.
- **Social Support Questionnaire --** Participants reported the number of individuals relied on in times of stress (amount of social support) and the degree of satisfaction with the support received.

Passive Viewing (PV) 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 randomly presented for 2000 ms (1000 ms interstimulus interval).
  - Unpleasant stimuli categories included: threat (*f* = 35), mutilation (*f* = 22), and mortality (*f* = 18).
  - Pleasant stimuli categories included: affiliative (*f* = 42), erotic (*f* = 27), and other (*f* = 6).

Cognitive Reappraisal (CR) Task

- Participants viewed the 250 IAPS images. They were instructed 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 contained either 25 unpleasant or 25 pleasant pictures.

EEG Recording and Data Reduction

- EEG activity was recorded during the PV and CR 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.

- **For the PV task, difference scores were calculated to quantify early (N1) and later (LPP) reactivity to emotional versus neutral stimuli.** Amplitudes to neutral images were subtracted from amplitudes to emotional images for each condition (affiliative, erotic, threat, mutilation, mortality).
  - N1 -- mean amplitude from 90-120 ms over Fz
    - Larger (more negative) differences indicate greater reactivity to emotional versus neutral.
  - LPP -- the mean amplitude from 200-800 ms over P3/P5/PO3/PO7 and P4/P6/PO4/P08
    - Larger (more positive) differences indicate greater reactivity to emotional versus neutral.
- **For the CR task, difference scores were calculated to quantify the degree to which CR resulted in increased or decreased LPPs, suggesting regulatory capacity.** Amplitudes to the neutral – maintain condition were subtracted from amplitudes to emotional conditions (pleasant – maintain, pleasant – increase, pleasant – decrease, unpleasant – maintain, unpleasant – increase, unpleasant – decrease).
  - LPP -- the mean amplitude from 200-800 ms over P3/P5/PO3/PO7 and P4/P6/PO4/P08

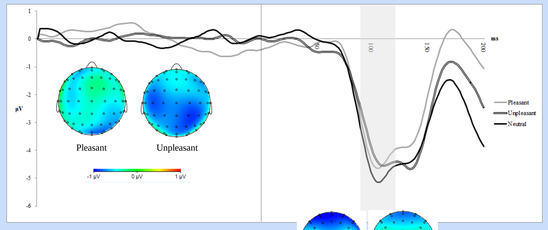

Figure 1. Waveforms by condition depicting the N1 between 90 ms and 120 ms. The headshots illustrate the grand average difference scores for the N1 across the pleasant (minus neutral) and unpleasant (minus neutral) conditions.

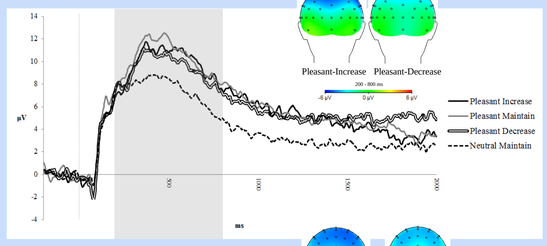

Figure 2. LPP waveforms for pleasant-increase, pleasant-maintain, pleasant-decrease, and neutral-maintain conditions. The neutral-maintain waveform is averaged across pleasant blocks (increase and decrease). The headshots illustrate the grand average difference scores for the pleasant-increase (minus neutral maintain) and pleasant-decrease (minus neutral maintain).

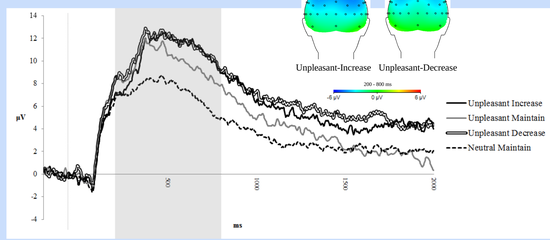

Figure 3. LPP waveforms for unpleasant-increase, unpleasant-maintain, unpleasant-decrease, and neutral-maintain conditions. The neutral-maintain waveform is averaged across unpleasant blocks (increase and decrease). The headshots illustrate the grand average difference scores for the unpleasant-increase (minus neutral maintain) and unpleasant-decrease (minus neutral maintain).

RESULTS

Table 1.
Descriptive Statistics for the SMCQ Scale

SMCQ Scale	Mimimum Score	Maximum Score	*M (SD)*
Positive Social Communication Scale	1.71	5.43	3.68 (1.04)
Expressing Distress Scale	2.17	6.50	4.82 (1.12)
Casual Communication Scale	1.67	6.00	4.19 (1.05)
Average Communication Preference Scale	2.56	5.79	4.27 (0.90)

SMCQ Preferences and Social Support

As predicted, individuals who preferred to use CMC rather than face-to-face communication overall reported lower numbers of people available to them for social support (r = .50, p < .05). Similarly, a CMC preference for expressing distress (r = .46, p < .05) was also associated with fewer people available for social support. Furthermore, those who preferred to use CMC for positive communication reported decreased satisfaction with their social support (r = .43, 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.

- Covariates: Neuroticism (1st step) and state anxiety (2nd step)
- Predictors: SMCQ scores (positive social communication, expressing distress, and casual communication; 3rd step)
- Dependent variables: ERP difference scores for all PV pleasant (affiliative, erotic, and other), PV unpleasant (threat, mutilation, and mortality) and CR conditions

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Passive Viewing Task – LPP and N1

Figure 3. A CMC versus face-to-face preference for casual communication predicted reduced LPP amplitudes to affiliative images [β = 0.866, t(21) = 2.10, p = .05].

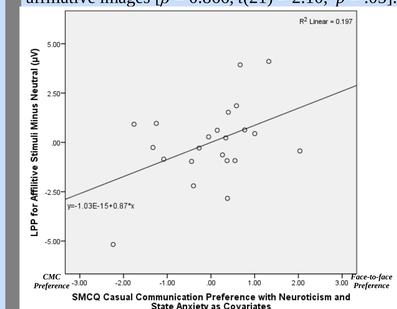
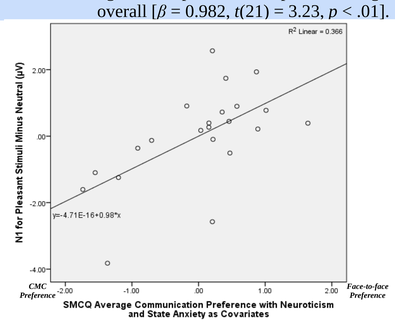


Figure 4. A greater CMC preference, averaged across all domains of communication, predicted greater amplitude N1 to pleasant images overall [β = 0.982, t(21) = 3.23, p < .01].



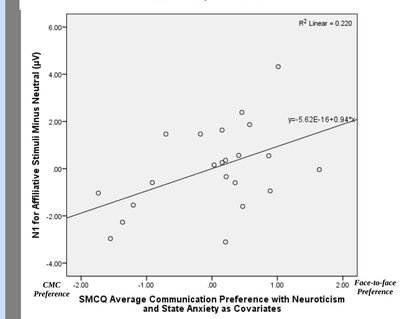


Figure 5. A greater overall CMC preference predicted greater amplitude N1 to affiliative images [β = 0.941, t(21) = 2.25, p < .05].

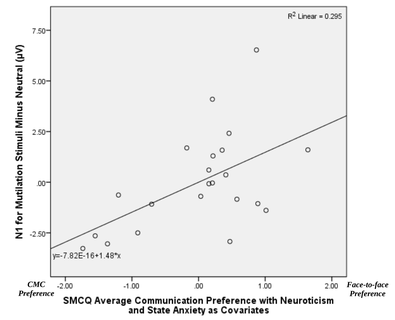
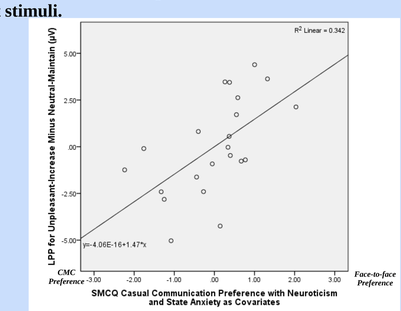


Figure 6. A greater overall CMC preference predicted greater amplitude N1 to mutilation images [β = 1.48, t(21) = 2.74, p < .05].

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. A CMC preference for casual communication predicted reduced LPP amplitudes when participants were asked to increase their emotional response to unpleasant stimuli [β = 1.47, t(21) = 3.06, 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

•Individuals who either have a low amount of social support or are dissatisfied with that social support tend to communicate emotions via CMC.

•In the PV task, preferences for CMC versus face-to-face interactions were associated with *greater* early emotional reactivity (N1) to both pleasant and unpleasant stimuli, and *decreased* later elaborative processing (LPP) to affiliative stimuli.

- CMC preferences may be associated with an emotional profile in which very early and relatively automatic attentional biases towards arousing emotional material are exaggerated, but later, more elaborated processing of positive emotional stimuli is blunted.

•In the CR task, a preference for CMC interactions appeared to evidence reduced affective flexibility (LPP). That is, they showed reduced ability to *increase* their emotional responding to unpleasant pictures.

•Together, these findings suggest that there may be a type of individual for whom CMC may be used as a tool to regulate emotions. CMC 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.

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