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Social Media Use and Emotional Reactivity to Negative Stimuli: An ERP Investigation

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ABSTRACT

Introduction: Exposure to violent media has long been associated with reduced emotional reactivity, empathy, and moral sensitivity, which is a phenomenon commonly referred to as emotional desensitization. Although numerous studies have explored this process in video games and films, its neural correlates in social media contexts remain insufficiently examined. This study aimed to examine whether individual differences in social media use are associated with neural responses to negative emotional stimuli.

Methods: Fifty-six healthy young adults participated in an electroencephalography (EEG) experiment, during which they passively viewed negative, neutral, and positive images selected from the International Affective Picture System (IAPS). Emotional processing was assessed using two event-related potential (ERP) components: the Early Posterior Negativity (EPN, 200–300 ms) and the Late Positive Potential (LPP, 300–800 ms). Amplitude differences across stimulus categories and brain regions were analyzed using repeated-measures ANOVA.

Results: Negative images elicited significantly greater LPP amplitudes compared to neutral and positive images, particularly across central, parietal, and temporal regions, indicating sustained emotional engagement. In contrast, EPN amplitudes did not differ significantly across conditions, suggesting that early attentional mechanisms were not modulated by emotional valence. No group differences were observed between participants with high and low levels of social media use.

Conclusion: The findings indicate that typical social media exposure was not associated with reduced neural responsiveness in this sample. Emotional engagement with negative stimuli remains intact, supporting the notion that desensitization is a gradual, context-dependent process influenced by the nature and intensity of digital exposure.

Keywords: arousal, electroencephalography, emotions, event-related potentials, neuropsychology, social media

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INTRODUCTION

Exposure to violent media has long been associated with reductions in emotional reactivity, empathy, and moral sensitivity, which is a phenomenon broadly referred to as emotional desensitization (1,2). Desensitization is conceptualized as a gradual reduction in emotional and physiological responsiveness to aversive content, accompanied by cognitive normalization processes that render violent stimuli increasingly familiar and less affectively significant over time (2,3). This process is thought to unfold across multiple dimensions, encompassing changes in physiological arousal, attitudinal responses to violence, and the sustained neural engagement with affectively significant stimuli (4,5). Critically, desensitization is not considered an all-or-nothing phenomenon; rather, it is better understood as a gradual, context-sensitive adaptation shaped by the nature, intensity, frequency, and modality of exposure (2,4).

Media Violence Exposure, Desensitization, and ERP Findings

Neuroscientific research, particularly using event-related potentials (ERPs), offers a temporally precise means of examining the distinct stages of emotional processing that may be altered by repeated exposure to violent content. ERPs allow for the separation of early automatic attentional processes from later, controlled evaluative responses, making them particularly well-suited to detecting subtle changes in affective reactivity that may not be apparent at the behavioral level (6).

Highlights

- **Social media use and reactivity to negative stimuli were assessed via ERP (EPN, LPP).**
- **Negative content elicited robust LPP responses, reflecting sustained engagement.**
- **ERP responses did not differ between high and low social media use groups.**

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Two components are especially relevant to this line of inquiry. The early posterior negativity (EPN; 200–300 ms) is a negative deflection over temporooccipital scalp regions reflecting rapid, automatic attentional orienting to emotionally salient stimuli; it is reliably enhanced for affectively arousing relative to neutral content, indicating preferential early processing of motivationally significant material (7–9). The late positive potential (LPP; 300–800 ms) indexes sustained evaluative and motivational processing and is similarly amplified in response to emotional stimuli, with greater amplitudes observed for content of higher arousal and evolutionary significance (6,10). The LPP is considered a particularly sensitive index of individual differences in emotional reactivity and has been employed across a wide range of affective paradigms as a robust marker of sustained engagement with emotionally salient material (6,10).

Research examining ERP responses in the context of violent media exposure has yielded important and consistent findings. Studies of habitual violent video game players have documented reduced ERP amplitudes to violent stimuli, indicating blunted evaluative processing of aversive content relative to nonviolent game players (11). Crucially, this neural attenuation has been shown to predict subsequent aggressive behavior, providing direct evidence that electrocortical indices of desensitization are functionally linked to downstream behavioral outcomes (11,12). Moreover, studies have further demonstrated that even brief, acute exposure to violent content can produce measurable reductions in ERP responses, suggesting that desensitization processes can be initiated rapidly rather than requiring prolonged chronic exposure (12). At the behavioral and physiological level, parallel findings show that repeated viewing of violent material produces diminishing empathic responses and increasing tolerance for violent content within a single exposure session, consistent with a rapid pattern of affective adaptation (5).

Importantly, however, desensitization does not appear to involve a uniform suppression of emotional responding across all processing stages. Event-related potential evidence indicates that emotional stimuli may continue to elicit enhanced neural responses even following repeated exposure, suggesting that sustained motivational processing retains at least partial resistance to habituation (7,9). This points to a more nuanced and stage-dependent modulation, in which early attentional and later evaluative stages may be differentially affected depending on the specific characteristics of the exposure context (4,13). Emerging evidence from naturalistic settings further supports this view: longitudinal analysis of social media responses to repeated gun violence events has documented overall declines in negative emotional expression over time, while simultaneously revealing increases in anxiety, suggesting that desensitization is not uniform across emotional dimensions and that certain affective responses may intensify even as others diminish (14,15).

Despite these advances, the existing ERP literature has focused predominantly on violent video games, which involve active engagement and immersive, aggression-related scenarios. Comparatively little attention has been directed toward social media, one of the primary contemporary environments through which individuals routinely encounter emotionally arousing and potentially violent content in daily life. Social media exposure differs qualitatively from video game or film-based exposure in that it tends to be passive, fragmented, and embedded within a continuous stream of varied content that also includes neutral and prosocial material. These structural differences raise important questions about whether the desensitization processes documented in experimental research generalize to the more diffuse and ecologically common patterns of social media use, and whether habitual exposure to such content is associated with measurable differences in the neural correlates of emotional processing.

Current Study

Building on prior research, the present study assumes that repeated exposure to emotionally salient content influences neural markers of emotional processing (EPN, LPP), and that individual differences in social media use may be associated with systematic variation in these markers consistent with desensitization. The present study examines EPN and LPP responses to negative, neutral, and positive stimuli in individuals with differing levels of social media use, with the aim of clarifying whether habitual social media exposure is associated with altered early attentional and sustained evaluative processing of emotional content.

Hypotheses

H1 (Emotional modulation): Negative stimuli will elicit larger EPN and LPP amplitudes than neutral and positive stimuli, reflecting typical patterns of emotional processing.

H2 (Desensitization effect): Individuals with higher levels of social media use will exhibit reduced EPN and LPP amplitudes in response to negative stimuli compared to individuals with lower levels of use, indicating attenuated emotional processing consistent with neural desensitization.

METHODS

Research Design

This study was designed as a quasi-experimental between-groups design within a quantitative research framework. Participants were categorized into groups based on their levels of social media use, as measured by the Social Network Addiction Scale (SNAS). The study examined whether naturally occurring differences in social media use were associated with variations in neural responses to emotional stimuli, as indexed by event-related potentials (EPN and LPP). This design does not permit causal inferences but allows examination of associations between social media use and neural responses.

Participants

Participants were recruited through a convenience sampling procedure from Istinye University and through the researcher's social media postings. The study group consisted of 56 participants between the ages of 18 and 33, including undergraduate and graduate students as well as individuals who had already completed their university education. The majority of the participants were women (N=38). A prerequisite for participation was being an active social media user, which all participants fulfilled. Participants were divided into high and low social media use groups based on their scores on the Social Network Addiction Scale (SNAS). A median split procedure was employed to categorize participants into two groups. Individuals scoring above the sample median were classified as the high social media use group, whereas those scoring below the median were classified as the low social media use group.

Eligibility criteria required that participants were right-handed, had no history of neurological disorders, and had not used any medication affecting the central nervous system within the past six months. To control for potential hormonal effects, female participants were asked to participate at least one week before or after their menstrual period. Prior to EEG recording, the Acute Posttraumatic Stress Disorder Scale was administered as a screening measure to exclude individuals with elevated trauma symptoms; only participants scoring below 24 were included in the study. Research sessions were scheduled according to participants' self-reported availability. Informed consent was obtained from all participants.

A post-hoc power analysis conducted using GPower (version 3.1) indicated that a sample size of 28 participants was sufficient to detect a large effect with α=0.05 and power=0.80 for a repeated measures ANOVA with within-between interaction. The present sample of 56 participants, therefore exceeded the minimum required sample size, providing adequate statistical power for the primary analyses.

Ethics Approval Statement

This study was reviewed and approved by the Istinye University Human Research Ethics Committee and found ethically appropriate at the meeting dated 29 December 2022, session number 2022/08, with Protocol No: 22-133. All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional research committee and with the Helsinki Declaration and its later amendments or comparable ethical standards.

Measures

Social Network Addiction Scale (SNAS)

The Social Network Addiction Scale (SNAS) was developed by Karaca, Yıldırım, and Kulaksız (16). The scale consists of 26 items rated on a 5-point Likert scale and is divided into five subdimensions: attention-seeking [items 1–6], mood modification [items 7–11], withdrawal symptoms [items 12–15], conflict [items 16–20], and relapse [items 21–26]. Possible scores range from 26 to 130, with higher scores indicating higher levels of social network addiction.

The reliability of the scale was found to be high, with a Cronbach's alpha of 0.95 for the total scale. Subdimension reliabilities were also high: attention-seeking (0.87), mood modification (0.93), withdrawal symptoms (0.87), conflict (0.89), and relapse (0.87). Item analyses based on upper–lower group means revealed statistically significant differences [t (154)=30.839, p <0.001].

International Affective Picture System (IAPS)

Stimuli were selected from the International Affective Picture System (IAPS), a standardized database of emotion-eliciting color photographs widely used in affective science research (17). The database includes over 1,000 images representing diverse human experiences, systematically classified by valence, arousal, and dominance ratings. All images were selected from the licensed IAPS database available to the research institution. A total of 105 images were selected across three categories (negative, neutral, and positive) based on normative valence and arousal ratings provided in the IAPS manual. Each category consisted of 35 images.

Negative stimuli included scenes of interpersonal and structural violence (e.g., assaults, war, child and gender-based violence), whereas positive stimuli were drawn from categories such as nature, food, adventure, and erotica. Neutral images depicted everyday objects and scenes.

To ensure content validity, all selected images were rated by a panel of seven faculty members and research assistants from the Department of Psychology. Only images receiving a mean score above 5 on a 7-point Likert scale were retained for use in the experiment.

The IAPS database was used in accordance with its standard research usage guidelines and was accessed through institutional authorization. The specific IAPS image codes used in the study are provided in IAPS Image Codes (Table 1).

Procedure

Following the completion of self-report measures, an electrophysiological recording was conducted. Scalp electrodes were positioned according to the international 10–20 system, with reference electrodes attached to both earlobes. An electrooculography (EOG) electrode was placed above the right eye to detect and correct for eye movements. Electrode sites were cleaned with alcohol swabs and conductive gel (Quick Gel) was applied to reduce skin impedance, and all electrodes were adjusted to maintain impedance below 10 kΩ.

Electroencephalography (EEG) recordings were obtained using a BrainAmp DC amplifier (Brain Products GmbH, Munich, Germany) and recorded with BrainVision Recorder software. A 20-channel electrode cap arranged according to the international 10–20 system (Fp1, Fp2, F7, F3, Fz, F4, F8, T7, C3, Cz, C4, T8, P7, P3, Pz, P4, P8, O1, Oz, O2) was used. The sampling rate was set to 500 Hz, and signals were filtered online using a 0.1–30 Hz band-pass filter. Electrode impedance was kept below 10 kΩ. Electrooculography (EOG) was recorded to monitor eye movements and blinks, and trials containing excessive artifacts were excluded from analysis using threshold criteria.

Participants were seated comfortably in a dimly lit room and instructed to passively view images displayed on a screen positioned 100 cm in front of them. Each stimulus was presented for 3000 ms, with a 1000 ms interstimulus interval. A fixation cross was displayed 4 seconds before the onset and 4 seconds after the offset of the image sequence, during which participants were asked to maintain their gaze to minimize eye movement artifacts. The total duration of the experimental session was approximately 7–9 minutes (Figure 1).

Data Analysis

Prior to statistical testing, assumptions of normality and homogeneity were examined. Given the limited sample size (N=56), the Shapiro-Wilk test was employed (18). Normality was further assessed using skewness and kurtosis values and Q–Q plots. According to George and Mallery (2010), values between -2 and +2, and according to Tabachnick and Fidell (2013), values between -1.5 and +1.5, indicate normal distribution (19,20). In line with both criteria, the Social Network Addiction Scale scores were normally distributed. Therefore, independent samples t-tests were conducted.

Table 1. International affective picture system (IAPS) image codes

Category	Image codes
Negative	2694, 3001, 3010, 3060, 3071, 3500, 3550, 6230, 6571, 2683, 2691, 6825, 9254, 9403, 9420, 9424, 9495, 9635.1, 3180, 3181, 3225, 6313, 6530, 6540, 6550, 6560, 9253, 2345.1, 2703, 2900, 3053, 6212, 6220, 6520, 9410
Neutral	2038, 2393, 5510, 7000, 7003, 7004, 7006, 7009, 7010, 7012, 7017, 7026, 7031, 7035, 7040, 7041, 7050, 7052, 7053, 7059, 7060, 7080, 7090, 7150, 7161, 7175, 7179, 7185, 7205, 7233, 7234, 7490, 7491, 7950, 9360
Positive	1460, 1540, 1630, 1721, 1722, 5210, 5660, 5825, 7492, 7200, 7230, 7250, 7260, 7270, 7291, 7405, 7451, 7461, 5621, 5623, 5626, 5628, 5629, 8160, 8180, 8186, 8490, 4006, 4090, 4525, 4597, 4598, 4599, 4619, 4641

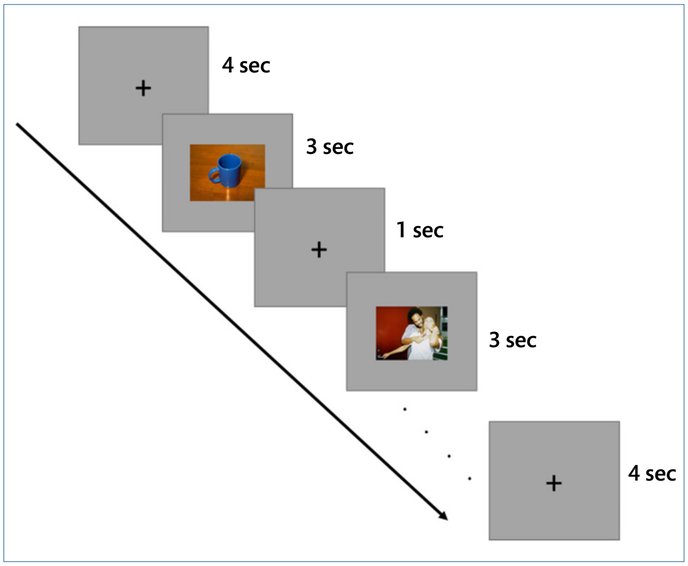

Figure 1. Stimulus presentation paradigm.

All statistical analyses were performed using IBM Statistical Package for Social Sciences (SPSS) program version 26.0. Electroencephalography data were segmented into epochs of -200 to 800 ms relative to stimulus onset. For each participant, average waveforms were computed separately for negative, neutral, and positive conditions (35 stimuli per category, 105 in total). After artifact rejection, a minimum of 30 epochs per condition was retained for analysis.

The event-related potential (ERP) components were analyzed as follows: the Late Positive Potential (LPP, 300-800 ms) and the Early Posterior Negativity (EPN, 200-300 ms). To obtain a more robust measure of sustained activation, the area under the curve (AUC) was calculated (6).

To account for regional differences, electrodes were grouped into frontal (F3, Fz, F4), central (C3, Cz, C4), parietal (P3, Pz, P4), temporal (T7, T8, P7, P8) and occipital (O1, Oz, O2) regions. Repeated-measures ANOVAs were conducted to compare amplitude and latency values across stimulus categories and electrode regions between groups.

RESULTS

Early Posterior Negativity (EPN)

When ERP findings were examined regardless of social media addiction scores, no statistically significant difference was observed among the types of visual stimuli (F (2,110)=0.680, p=0.509, ηp^2=0.012). The area under the curve (AUC) values were -14.639±230.37 for negative visual stimuli, -34.456±236.59 for neutral stimuli, and -16.736±224.54 for positive stimuli (Figure 2).

To further investigate the regional effects of these differences across conditions independently of social media addiction scores, repeated-measures ANOVA was conducted across brain regions. The analysis revealed a significant condition × region interaction (F (8,440)=3.055, p=0.002, ηp^2=0.053). To determine which conditions and regions contributed to this effect, one-way ANOVAs were performed across conditions for each region (Table 2).

Frontal region: No significant difference across conditions was observed (F (2,110)=2.062, p=0.132, ηp^2=0.036). There is no significant difference between AUC for negative stimuli (-318.96±234) and neutral stimuli (-325.34±242.06; p=1.0); negative and positive stimuli (-279.88±196.63; p=0.224) or between positive and neutral stimuli (p=0.216).

Central region: There was no significant difference across conditions (F (2,110)=0.234, p=0.792, ηp^2=0.004). There is no significant difference between AUC for negative stimuli (-225.15±236.9) and neutral stimuli (-227.22±249.57; p=1.0); negative and positive stimuli (-210.67±226.04; p=1.0) or between positive and neutral stimuli (p=1.0).

Temporal region: There was no significant difference across conditions (F (2,110)=2.805, p=0.065, ηp^2=0.049). There is no significant difference between AUC for negative stimuli (159.1±145.9) and neutral stimuli (125.2±149.85; p=0.167); negative and positive stimuli (125.7±140.96; p=0.156) or between positive and neutral stimuli (p=1.0).

Parietal region: There was no significant difference across conditions (F (2,110)=0.765, p=0.468, ηp^2=0.014). There is no significant difference between AUC for negative stimuli (140.03±258.84) and neutral stimuli (106.2±115.33; p=0.804); negative and positive stimuli (115.33±280.8; p=1.0) or between positive and neutral stimuli (p=1.0).

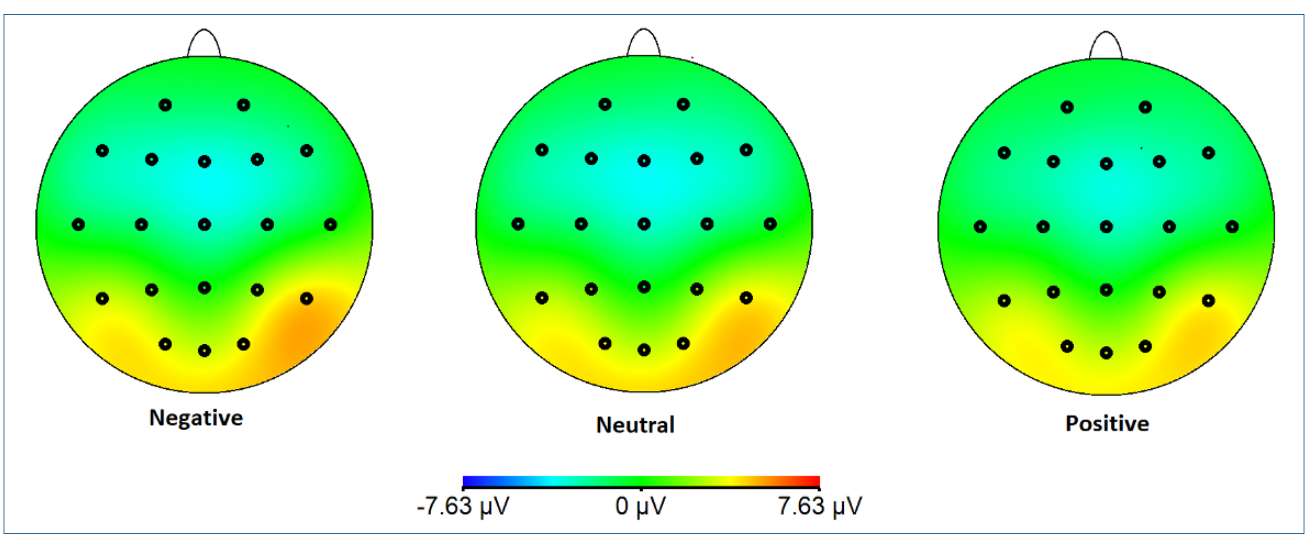

Figure 2. Comparison of EPN (200-300 ms) responses resulting from different image types, regardless of groups.

Table 2. Early posterior negativity (EPN): pairwise comparisons of regions across conditions

Condition	Region 1	Mean	Region 2	Mean	p
Negative	Frontal	-318.96	Central	-225.16	0.000***
			Temporal	159.11	0.000***
			Parietal	140.03	0.000***
			Occipital	343.58	0.000***
	Central	-225.16	Temporal	159.11	0.000***
			Parietal	140.03	1.0
			Occipital	343.58	0.000***
	Temporal	159.11	Parietal	140.03	0.000***
			Occipital	343.58	0.000***
	Parietal	140.03	Occipital	343.58	0.000***
Neutral	Frontal	-325.34	Central	-227.22	0.000***
			Temporal	125.2	0.000***
			Parietal	106.2	0.000***
			Occipital	327.21	0.000***
	Central	-227.22	Temporal	125.2	0.000***
			Parietal	106.2	1.0
			Occipital	327.21	0.000***
	Temporal	125.2	Parietal	106.2	0.000***
			Occipital	327.21	0.000***
	Parietal	106.2	Occipital	327.21	0.000***
Positive	Frontal	-279.88	Central	-210.67	0.003**
			Temporal	125.7	0.000***
			Parietal	115.33	0.000***
			Occipital	324.36	0.000***
	Central	-210.67	Temporal	125.7	0.000***
			Parietal	115.33	1.0
			Occipital	324.36	0.000***
	Temporal	125.7	Parietal	115.33	0.000***
			Occipital	324.36	0.000***
	Parietal	115.33	Occipital	324.36	0.000***

Occipital region: There was no significant difference across conditions ($F(2,110)=0.345$, $p=0.709$, $\eta p^2=0.006$). There is no significant difference between AUC for negative stimuli (343.58±282.68) and neutral stimuli (327.21±300; p=1.0); negative and positive stimuli (324.36±319.33; p=1.0) or between positive and neutral stimuli (p=1.0).

When regional differences within each condition were analyzed independently of social media use level, significant differences were observed in all three conditions. For negative visual stimuli, significant differences across regions were found ($F(4,220)=167.957$, $p<0.001$, $\eta p^2=0.753$). For neutral visual stimuli, significant regional differences were also observed ($F(4,220)=155.908$, $p<0.001$, $\eta p^2=0.739$). Similarly, for positive visual stimuli, significant regional differences emerged ($F(4,220)=118.041$, $p<0.001$, $\eta p^2=0.682$).

There was no statistically significant effect of social media addiction scores on the dependent variable ($F(1,54)=3.65$, $p=0.061$, $\eta^2_p=0.063$) when groups were compared regardless of condition. However, the results indicated a marginal trend, with the high social media addiction group (M=16.54, SE=27.51) showing higher scores than the low social media addiction group (M=-55.30, SE=25.61).

Finally, when groups with low and high levels of social media addiction (based on test scores) were compared across conditions, no statistically significant differences were observed ($F(2,108)=0.566$, $p=0.570$, $\eta p^2=0.010$).

Late Positive Potential (LPP)

When the event-related potential (ERP) findings were examined regardless of social media addiction scores, a statistically significant difference was observed among the types of visual stimuli ($F(2,110)=10.496$, $p<0.001$, $\eta p^2=0.160$). Bonferroni post-hoc tests revealed that the area under the curve (AUC) for negative visual stimuli (890.93±638.75) was significantly higher than that for both neutral (720.458±522.297) and positive visual stimuli (720.186±520.05) ($p<0.003$ and $p<0.002$, respectively) (Figure 3).

To further investigate the regional effects of these differences across conditions independently of social media addiction scores, repeated-measures ANOVA was conducted across brain regions. The analysis

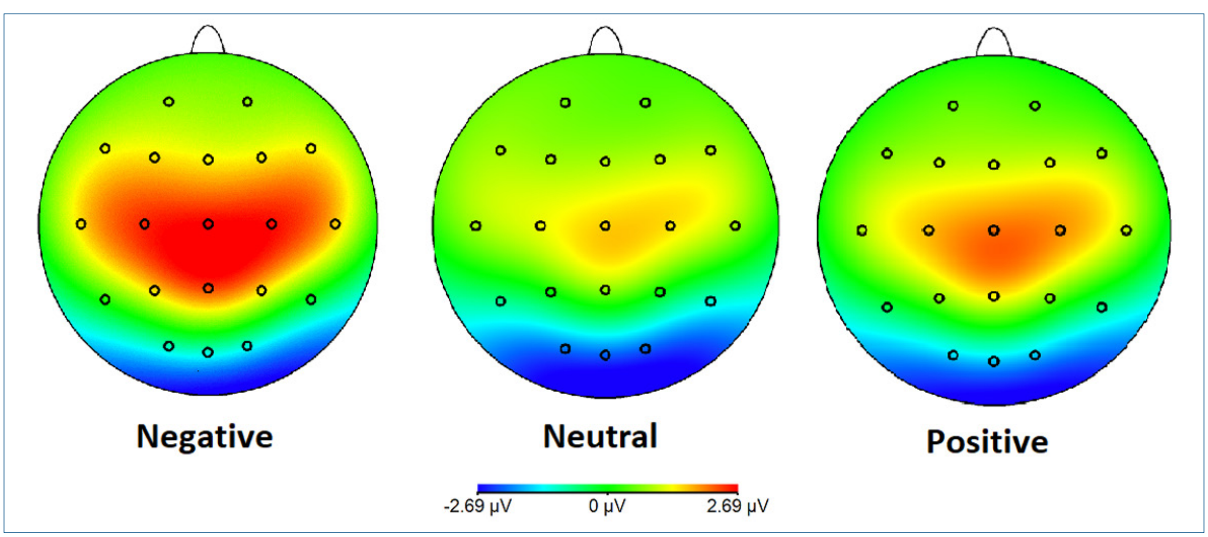

Figure 3. Comparison of LPP (300-800 ms) responses resulting from different image types, regardless of groups.

revealed a significant condition × region interaction (F (8,440)=10.375, p <0.001, ηp^2=0.159). To determine which conditions and regions contributed to this effect, one-way ANOVAs were performed across conditions for each region (Table 3).

Frontal region: There was no significant difference across conditions (F (2,110)=2.846, p=0.062, ηp^2=0.049). There is no significant difference between AUC for negative stimuli (818.849±608.636) and neutral stimuli (632.064±450.302; p=0.089); negative and positive stimuli (684.458±491.757; p=0.361) or between positive and neutral stimuli (p=1.00).

Central region: A significant difference across conditions was found (F (2,110)=18.553, p <0.001, ηp^2=0.252). Post-hoc comparisons showed that negative stimuli (1320.69±788.91) elicited significantly higher AUC values than both neutral (801.271±558.56; p <0.001) and positive stimuli (982.936±589.278; p=0.002). Positive stimuli were also significantly higher than neutral stimuli (p=0.021).

Table 3. Late positive potential (LPP): pairwise comparisons of regions across conditions

Condition	Region 1	Mean	Region 2	Mean	p
Negative	Frontal	694.246	Central	1297.367	0.000***
			Temporal	415.781	0.066
			Parietal	901.756	0.458
			Occipital	-512.97	1.0
	Central	1297.367	Temporal	415.781	0.000***
			Parietal	901.756	0.143
			Occipital	-512.97	0.005**
	Temporal	415.781	Parietal	901.756	0.000***
			Occipital	-512.97	0.255
	Parietal	901.756	Occipital	-512.97	0.699
Neutral	Frontal	442.835	Central	715.836	0.017*
			Temporal	1.643	0.012**
			Parietal	117.470	1.0
			Occipital	-1074.058	0.000***
	Central	715.836	Temporal	1.643	0.000***
			Parietal	117.470	0.774
			Occipital	1074.058	0.195
	Temporal	1.643	Parietal	117.470	0.000***
			Occipital	1074.058	0.000***
	Parietal	117.470	Occipital	1074.058	0.003**
Positive	Frontal	503.674	Central	930.056	0.000***
			Temporal	118.749	0.001***
			Parietal	436.074	1.0
			Occipital	-804.728	0.290
	Central	930.056	Temporal	118.749	0.000***
			Parietal	436.074	0.001***
			Occipital	-804.728	1.0
	Temporal	118.749	Parietal	436.074	0.000***
			Occipital	-804.728	0.000***
	Parietal	436.074	Occipital	-804.728	0.844

Temporal region: A significant main effect of condition was found (F (2,110)=9.428, p <0.001, ηp^2=0.146). Post-hoc tests showed that negative stimuli (562.079±379.947) were higher than both neutral (344.117±278.466; p <0.001) and positive stimuli (380.086±369.965; p=0.011). No significant difference was observed between positive and neutral conditions (p=1.00).

Parietal region: A significant difference across conditions was observed (F (2,110)=14.476, p <0.001, ηp^2=0.208). The AUC values for negative stimuli (1100.356±869.759) were significantly higher than both neutral (657.612±499.381; p=0.001) and positive stimuli (685.544±550.186; p <0.001). No significant difference was observed between positive and neutral conditions (p=1.0).

Occipital region: A significant difference was found (F (2,110)=6.744, p=0.002; ηp^2=0.109). Post-hoc tests revealed that the AUC for neutral stimuli (1127.783±757.49) was significantly higher than negative (799.111±610.812; p=0.004) and positive stimuli (-893.685±574.522; p=0.017). However, there is no significant difference between positive stimuli and negative stimuli (p=1.0).

When regional differences within each condition were analyzed independently of social media addiction scores, significant differences were observed in all three conditions. For negative visual stimuli, significant differences across regions were found (F (4,220)=13.984, p <0.001, ηp^2=0.203). For neutral visual stimuli, significant regional differences were also observed (F (4,220)=19.064, p <0.001, ηp^2=0.257). Similarly, for positive visual stimuli, significant regional differences emerged (F (4,220)=13.997, p <0.001, ηp^2=0.203).

There was no statistically significant effect of social media addiction scores on the dependent variable (F (1,54)=2.33, p=0.132, η^2_p=0.041) when groups were compared regardless of conditions. Although the high social media addiction group (M=831.23, SE=48.33) showed higher scores than the low social media addiction group (M=730.36, SE=44.99), this difference was not statistically significant.

Finally, when groups with low and high levels of social media addiction (based on test scores) were compared across conditions, no statistically significant differences were observed (F (2,108)=0.054, p=0.947, ηp^2=0.001).

DISCUSSION

The present study examined the neural correlates of emotional processing in relation to social media use by analyzing both early (EPN) and late (LPP) ERP components in response to negative, neutral, and positive pictorial stimuli. The findings revealed a clear dissociation between early and late stages of emotional processing. Overall EPN amplitudes did not differ significantly across stimulus categories, suggesting that early attentional allocation was not differentially modulated by emotional valence at the global level. However, a significant condition × region interaction was observed for the EPN, indicating that regional differences in early processing varied as a function of stimulus type, though no individual region showed a significant main effect of condition. In contrast, the LPP component showed robust modulation by emotional content at the overall level, with negative stimuli eliciting significantly larger amplitudes than both neutral and positive stimuli. No significant differences in either EPN or LPP amplitudes were observed between participants with high and low levels of social media use, indicating that individual differences in social media use were not associated with measurable alterations in neural emotional processing in the present sample.

Emotional modulation (H1) predicted that negative stimuli would elicit larger EPN and LPP amplitudes than neutral stimuli. This hypothesis was partially supported. Early posterior negativity amplitudes did not differ significantly across stimulus categories, which is most parsimoniously explained by the passive nature of the viewing task, as early attentional differentiation of emotional content is more reliably observed in paradigms requiring active stimulus engagement rather than passive observation (6,9). A significant condition × region interaction was nonetheless observed, suggesting subtle regional variation in early neural activity across stimulus categories. In contrast, the LPP fully supported the late processing component of H1, with negative stimuli eliciting significantly larger amplitudes than both neutral and positive stimuli across central, parietal, and temporal regions, consistent with prior evidence that the LPP reflects sustained evaluative processing of emotionally salient material (6,7,10,21).

The enhanced LPP for negative relative to positive stimuli is further consistent with the well-established negativity bias in emotional processing (7). An exception was observed in the occipital region, where neutral stimuli elicited larger amplitudes than negative stimuli, and positive stimuli yielded a negative AUC value. This pattern may reflect polarity reversal at occipital sites, where the spatial distribution of underlying neural generators can produce negative deflections that are not observed at central or parietal locations. Such reversals are consistent with evidence that occipital LPP activity reflects lower-level visual processing rather than higher-order affective evaluation, and that EPN activity, which is maximal at temporooccipital sites and inherently negative in polarity, may dominate the net AUC at these locations (9,22).

Desensitization effect (H2) predicted that individuals with higher levels of social media use would exhibit reduced EPN and LPP amplitudes in response to negative stimuli, consistent with neural desensitization. This hypothesis was not supported. No significant differences were observed between high and low social media use groups in either EPN or LPP amplitudes across any condition, indicating that social media use level was not associated with measurable attenuation of neural emotional processing in the present sample. These findings do not provide evidence that typical social media exposure produces neural desensitization of the kind documented in violent video game research, where habitual exposure has been associated with reduced ERP amplitudes to aversive stimuli and increased aggressive behavior (11,12).

Several factors may account for this null finding. Social media exposure differs qualitatively from video game exposure in ways that are theoretically relevant to desensitization. Video game exposure involves active engagement, repeated aggression-related scenarios, and immersive environments that sustain attentional focus on violent content over extended periods (11,12). Social media exposure, by contrast, tends to be passive, fragmented, and embedded within a continuous stream of varied content that includes neutral, prosocial, and emotionally positive material alongside potentially aversive content (23). Such structural differences may be insufficient to produce the sustained and intense exposure patterns necessary for measurable neural desensitization to develop (2,4). This interpretation is consistent with evidence that desensitization is a gradual, context-sensitive process whose magnitude depends on the nature, intensity, and modality of exposure rather than frequency of use alone (4,13,14). Longitudinal evidence from social media contexts further supports this view, suggesting that emotional responses to repeated violent events do show gradual changes over time, but that these changes are discrete emotion-specific rather than reflecting uniform suppression of affective responding (15).

Several limitations should be acknowledged when interpreting the present findings. The use of a median split procedure may have reduced statistical sensitivity by obscuring continuous variation in social media use, and the Social Network Addiction Scale measures habitual patterns of use rather than the nature or content of exposure, limiting conclusions regarding differential exposure to emotionally arousing content. In conclusion, the present findings indicate that typical social media use is not associated with altered neural emotional processing in young adults. The LPP remained robust regardless of social media use level, suggesting that desensitization processes documented in violent video game research do not straightforwardly generalize to social media contexts, and supporting a conceptualization of desensitization as a gradual, context-dependent process shaped by the qualitative characteristics of media exposure. Future studies examining the specific content and intensity of social media exposure, employing longitudinal designs, and utilizing paradigms that allow for causal inference may provide a more precise characterization of the conditions under which social media use could influence neural emotional processing.

Ethics Committee Approval: This study was reviewed and approved by the Istinye University Human Research Ethics Committee and found ethically appropriate at the meeting dated 29 December 2022, session number 2022/08, with Protocol No: 22-133.

Informed Consent: Informed consent was obtained from all participants.

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