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Mental Logout: Behavioral and Neural Correlates of Regulating Temptations to Use Social Media

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Abstract

Individuals sometimes use social media instead of sleeping or while driving. This fact raises the crucial need for—and challenge of—successfully self-regulating potent social-media temptations. To date, however, empirical evidence showing whether social-media temptations can be self-regulated and how self-regulation can be achieved remains scarce. Accordingly, the present within-participants study ($N = 30$ adults) provided causal evidence for self-regulation of social-media content and identified a potential underlying neural mechanism. We tested the premise that successful self-regulation requires limiting the mental representation of temptations in working memory. Specifically, we showed that loading working memory with neutral contents via attentional distraction, relative to passively watching tempting social-media stimuli, resulted in reduced self-reported desire to use social media, reduced initial attention allocation toward social-media stimuli (reduced late-positive-potential amplitudes), and reduced online representation of social-media stimuli in working memory (reduced contralateral-delay-activity amplitudes). These results have important implications for successfully navigating a social-media-saturated environment.

Keywords

self-regulation, social media, attentional distraction, desire, working memory, open data

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Scientists, social-media companies, and public policymakers widely agree that controlling or regulating the potent urge to use social media is crucial yet challenging (for reviews, see Hofmann et al., 2017; Lyngs et al., 2019). The difficulty of this regulatory challenge is readily apparent when one looks at how strongly social-media temptations compete with individuals' most basic needs (Hofmann et al., 2012). Consider, for example, nighttime and wake-up routines. Alarming statistics indicate that 51.7% of teenagers regularly use electronic devices instead of going to sleep (Royant-Parola et al., 2018), and 55% of users report checking their smartphone (mainly for social networking) before getting out of bed in the morning (e.g., Jilisha et al., 2019).

Even more important than the challenge of regulating social-media temptations to protect basic needs is that, in extreme cases, failures to control potent social-media urges may put individuals' lives at risk. Studies using police crash reports indicate that up to 18% of fatal accidents are the result of mobile-phone usage while driving (Overton et al., 2015). Further, 53.5% of young drivers report regularly using Facebook, among other distracting mobile-phone options, at the wheel (Gauld et al., 2017). Other studies show that getting social-media updates is the main reason pedestrians report for using their phones while crossing the street (Byington & Schwebel, 2013).

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The notion that millions of people struggle to control their social-media usage is congruent with the well-established finding that self-regulation can be effortful and may break down, especially when one is dealing with potent temptations such as the urge to use social media (for a review, see Lyngs et al., 2019). Therefore, it is crucial to examine whether the desire to succumb to potent social-media temptations can be self-regulated and how successful self-regulation can be achieved.

Surprisingly, evidence from existing research remains indirect because most studies have not examined social-media content as the target of self-regulation (i.e., self-regulation of social-media temptations). Rather, it has examined how social media is used as a means to regulate other negative emotions such as worry or distress (e.g., Elhai et al., 2017) or how the general (non-social-media related) ability to regulate negative emotions is associated with problematic social-media usage (e.g., Casale et al., 2016; Pontes et al., 2018).

To fill these gaps, we aimed in the present study to provide direct causal evidence for self-regulation of potent social-media content and to also identify a possible underlying neural mechanism. Building on canonical self-regulation models (e.g., Barrett et al., 2004; Hofmann & Van Dillen, 2018), we posited that successful self-regulation is strongly influenced by the ability to control or limit the mental representation of temptations in working memory (WM), an on-line limited-resource buffer that maintains relevant information in an active state (Engle, 2002). Specifically, strong mental representation of tempting stimuli can hijack the limited resources of WM to focus attention on initiating concrete behavioral intentions (action plans) that may result in giving in to tempting objects (Hofmann & Van Dillen, 2012). Fortunately, however, certain control mechanisms can operate early and substantially limit the mental representation of temptations in WM and the associated behavioral intentions to yield to temptations.

One potent control mechanism is *attentional distraction*, which involves loading WM with neutral content, thereby restricting the mental representation of temptations and their associated consumption intentions (for a review, see Hofmann & Van Dillen, 2018). Multiple studies have shown that attentional distraction successfully reduced food cravings (Van Dillen et al., 2013), processing of smoking-related cues (Littel & Franken, 2011), romantic feelings toward ex-partners (Langeslag & Sanchez, 2018), and sexual desire (Shafir et al., 2018). Going beyond the importance of regulating such distractions, the present study directly investigated (a) whether social-media temptations can be regulated or (b) what neural WM processes underlie social-media self-regulation.

Statement of Relevance

The fact that individuals sometimes use social media instead of sleeping or while driving raises significant public-health concerns. Scientists and tech companies agree that individuals need to be able to control or regulate potent social-media temptations and that such self-regulation is challenging. The present study provides causal empirical evidence for successful self-regulation of social-media temptations together with a potential underlying neural mechanism. We tested the premise that effective self-regulation entails limiting the mental activation of social-media temptations in working memory—a cognitive system that maintains tempting information in an active state and can bias behavior toward giving in to temptations. Specifically, we showed that employing attentional distraction—directing attention to neutral thoughts during the presentation of tempting Facebook stimuli—resulted in reduced experienced desire to use social media and decreased neural activation of Facebook stimuli in working memory. These findings have implications for how to successfully navigate a social-media-saturated environment.

To fill this gap, we developed a novel paradigm that integrates elements from self-regulation tasks (e.g., Shafir et al., 2018; Van Dillen et al., 2013) with classic visual WM measures (Vogel & Machizawa, 2004). In this task, participants' electrophysiological responses are monitored while they view social-media-related images that have been previously shown to activate amygdala-striatum reward pathways (Turel et al., 2014). We focused on Facebook stimuli because Facebook remains one of the most popular and most empirically studied social networks (for a review, see Snelson, 2016). Facebook images were presented in two conditions: (a) *temptation*, in which social-media-related thoughts and associated intentions to use social media were allowed to be mentally represented and consume limited WM resources, and (b) *attentional distraction*, focusing on neural, non-social-media-related thoughts in an attempt to restrict the WM representation of social-media thoughts and associated intentions to use social media (Shafir et al., 2018; Van Dillen et al., 2013). Following the offset of Facebook images, participants reported their current desire to use Facebook.

Our paradigm uses state-of-the-art electrophysiological measures that have excellent temporal precision.

These temporal advantages allow the accurate detection of the outcome of cognitive processes engaged in rapid attentional distraction. Specifically, we focused on the canonical contralateral delay activity (CDA) electrophysiological component—a negative slow wave that provides a snapshot of the degree to which active information is represented in visual WM (for a review, see Luria et al., 2016). Of relevance for the present study, it has been shown that the enhanced online WM representation of affective stimuli (e.g., Sessa et al., 2011) and of social-media stimuli (Sternberg et al., 2018) is manifested in elevated CDA amplitudes. In the present study, we examined whether attentional distraction would result in reduced online WM representation of social-media information. This would manifest in lower CDA amplitudes in the attentional-distraction condition relative to the temptation condition.

In addition to the CDA, we examined a second electrophysiological measure, the late positive potential (LPP). The LPP is a well-established positive slow-wave centroparietal component that provides a snapshot of the degree to which initial attention is allocated to affective and appetitive stimuli. Accordingly, LPP modulation is widely considered as representing self-regulatory success (e.g., Shafir et al., 2018). Of relevance for the present study, several past studies have shown that relative to allowing appetitive information to be processed, using attentional distraction resulted in substantial LPP modulation (Langeslag & Sanchez, 2018; Schönfelder et al., 2014; Shafir et al., 2018). Extrapolating these prior studies, we predicted that relative to allowing social-media information to be processed, attentional distraction would result in reduced allocation of initial attention to tempting stimuli, as manifested in LPP modulation.

In addition to examining the CDA and LPP electrocortical markers, we measured self-reported desire to use social media following the temptation and attentional-distraction conditions. Consistent with the electrophysiological hypotheses, our prediction was that relative to the temptation condition, attentional distraction would successfully reduce the self-reported desire to use social media.

Method

Below, we report how we determined our sample size as well as all data exclusions, manipulations, and measures used in the study (additional background information collected for pilot purposes is described in the Supplemental Material available online). All experimental procedures were approved by the institutional review board of Tel Aviv University and were performed in accordance with the approved guidelines.

Participants

Sample size was predetermined using a formal power analysis for paired-samples *t* tests (*MorePower* Version 6.0; Campbell & Thompson, 2012), applying a conventional α of .05 and 80% power. We determined the expected effect size (Cohen's $d = 0.54$) on the basis of a related prior study (Sessa et al., 2011) that shared the following design characteristics with the present study: the involvement of symbolic affective (albeit negative) stimuli, the same number of stimuli presented on each trial, two within-participants experimental conditions, and our main CDA marker as an outcome. It is worth noting that the observed CDA effect size in the present study (Cohen's $d = 0.6$) confirmed the expected effect size.

The power analysis indicated that a sample of 30 participants was required to detect a reliable effect. Accordingly, 30 participants completed the experimental session. We set an a priori criterion that if more than 30% of any participants' trials were rejected because of electroencephalogram (EEG) artifacts, they would be excluded from analysis (Shafir et al., 2018; Sternberg et al., 2018). This resulted in the exclusion of one participant (who had a mean rejection rate of 48% of trials). Applying a Mahalanobis-distance multivariate-outlier analysis yielded the same exclusion decision (for full details, see the Supplemental Material). The final sample therefore consisted of 29 participants (22 female; age: $M = 25.07$ years, $SD = 2.70$). Inclusion criteria involved having normal or corrected-to-normal visual acuity and normal color vision and having an active Facebook account that was being used on a daily basis.

Stimuli

Following prior studies that used social-media stimuli (e.g., Sternberg et al., 2018) and that demonstrated the activation of amygdala-striatum reward pathways (e.g., Turel et al., 2014), we selected 100 images (10 images for instructing participants, 90 images in the actual experiment). All images were obtained via the Internet and contained central elements that are well known to Facebook users (e.g., Facebook icon, unread-notification icon, unread-message icon, new-friend-request icon, Facebook wall, and Facebook Messenger). To optimize stimuli for CDA analyses (Sessa et al., 2011; see explanation below), we scaled images so they would fit in a 3.3° × 4.5° (width × height) rectangle from a viewing distance of approximately 70 cm.

Procedure

Twenty-four hours prior to the experiment, we deactivated participants' access to Facebook for 48 hr by changing their Facebook password (cf. Sternberg et al., 2018, 2020). This procedure was followed to enhance the value and saliency of Facebook stimuli, and it guaranteed that participants would not use Facebook immediately prior to or immediately following the main EEG experiment. In general, deprivation procedures are well-established in animal and human studies across many fields (e.g., Grimm et al., 2001), including Facebook usage (Sternberg et al., 2018, 2020). Importantly, Sternberg et al. (2018) showed that this deprivation procedure does not bias naturally occurring social-network usage, as revealed by finding a significant medium-size positive correlation between deprived Facebook usage time in the laboratory and nondeprived Facebook usage time at home.

In the main experiment, following EEG setup, we explained to participants that during the task, they would view well-recognized social-media-related images under two conditions: (a) a temptation condition that involved naturally watching social-media stimuli and allowing social-media-related thoughts and associated intentions to use social-media (e.g., freely thinking about one's Facebook profile, recent activities, and content) and (b) an attentional-distraction condition that involved trying to control the influence of social-media stimuli and associated thoughts by directing attention to absorbing neutral thoughts unrelated to Facebook stimuli (i.e., thinking about geometric shapes or daily routine activities). The instructions for both conditions are considered the gold standard in self-regulation research; multiple prior studies show the efficacy of similar attentional-distraction manipulations in regulating unpleasant emotions and appetitive desires (Shafir et al., 2018; for a review, see Sheppes, 2020).

The experimenter taught the participants how to implement the instructions in both conditions (giving two examples for each condition). Then, during a four-trial learning phase, participants were asked to talk out loud about how they implemented each instruction (two examples for each instruction), and they were corrected by the experimenter whenever they implemented the instructions in either condition incorrectly. Specifically, in the attentional-distraction condition, participants were corrected by the experimenter if their produced thoughts were not perceived as neutral for them, if these thoughts were somehow related to Facebook stimuli, or if these thoughts did not fit one of the two categories (geometric shapes or daily routine activities). In the temptation condition, participants were corrected if their thoughts and feelings were not related to their personal Facebook usage or if they tried to control or regulate their naturally occurring thoughts and feelings (cf. Shafir et al., 2018). Following this part, we explained to participants the general structure of each trial, followed by a 20-trial practice phase.

The actual task consisted of 16 blocks that were separated by short breaks; each block contained 25 trials (yielding a total of 400 analyzed trials). Each trial (see Fig. 1) started with a fixation cross in the middle of the screen, followed by a screen containing the required instruction ("Distraction" for the attentional-distraction condition or "Watch" for the temptation condition). Then arrow cues pointing right or left (with an equal probability) indicated which side of the screen the participant should attend. This screen was followed by the presentation of two Facebook stimuli (randomly selected with equal probability to appear in each of the two experimental conditions), one on each side of the screen. The bilateral presentation of Facebook stimuli is required for CDA analysis (see CDA Analysis section below; for a review, see Luria et al., 2016). During the presentation of Facebook stimuli, participants implemented the required instruction ("watch" social-media content or "distract" oneself from social-media content). Following stimuli offset, participants were asked to rate their current desire to use their own Facebook profile on a scale ranging from 1 (*not feeling a desire at all*) to 5 (*feeling extreme desire*).

Following standard procedures in CDA experiments that are intended to minimize perceptual differences (e.g., Balaban & Luria, 2015; Luria et al., 2016), we instructed participants to maintain their gaze at the center of the screen during the presentation of Facebook stimuli. Trials that included eye movements were excluded from analyses. Participants were taught to blink in two defined points prior to and following stimuli presentation.

Importantly, the fact that both experimental conditions used the same stimuli and that trials with eye movements were excluded preclude low-level perceptual alternative interpretations for the observed differences between the temptation and attentional-distraction conditions. Specifically, by excluding trials with eye movements, we ruled out the possibility that people used attentional-deployment strategies that entailed bottom-up processes (e.g., closing their eyes or diverting their gaze) rather than the instructed top-down processes (e.g., thinking about shapes or daily neutral activities while maintaining their gaze at the center) to regulate their emotions (for a discussion, see van Reekum et al., 2007).

Several measures were used to ensure that participants concentrated during the task and correctly followed instructions. First, 60 randomly chosen trials were followed by a screen asking participants to report which instruction they had just implemented (Shafir

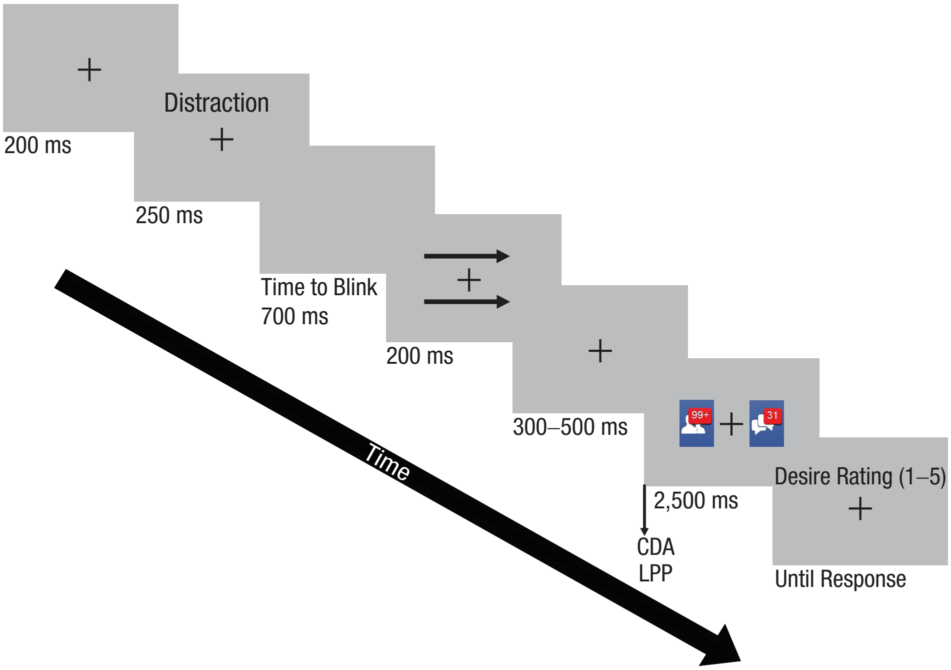

Fig. 1. Example trial from the electroencephalogram task. At the start of each trial, participants saw a fixation cross, followed by an instruction indicating the trial type (attentional distraction, as shown here, or temptation). Subsequent arrow cues indicated which side of the screen the participant should attend. Afterward, two Facebook stimuli appeared (one on each side of the screen), and participants tried to distract themselves or watched the screen, depending on condition. Following stimuli offset, participants were asked to rate their current desire to use their own Facebook profile. Event-related potentials (ERPs) were locked to the onset of the Facebook stimuli. The two ERPs of interest were the contralateral delay activity (CDA) and late positive potential (LPP).

et al., 2018). The average percentage of correct responses was very high (91.66%, *SE* = 4.65%). Second, during breaks between experimental blocks, the experimenter asked participants to give examples of how they implemented the instructions in the two conditions and corrected them as needed. Third, during the experiment, we videotaped and watched participants' faces to make sure they were concentrating on the task. Finally, at the completion of the experimental trials, eight additional trials (four for each of the two instructions) were followed by a screen that asked participants to write down how they implemented the required instruction. A judge who was blind to participants' instructions coded each sentence as attentional distraction or temptation. The level of accuracy was very high (96.5%), indicative of adequate implementation of the instructions (for more information, see Table S1 in the Supplemental Material).

Event-related potential (ERP) recording and analysis

EEGs were recorded using an ActiveTwo EEG recording system (Biosemi, Amsterdam, The Netherlands). Data were collected using 64 scalp electrodes at locations of the extended 10-20 system and two free electrodes placed on the left and right mastoids. Electrooculograms (EOGs) were recorded using electrodes placed 1 cm to the left and right of the external canthi to detect horizontal eye movements and an electrode under the left eye to detect blinks and vertical eye movements. The single-ended voltage was recorded between each electrode site and the common-mode-sense (CMS) electrode and driven-right-leg (DRL) electrode. Data were digitized at 256 Hz, and off-line signal processing and analysis were conducted using the *EEGLAB Toolbox* (Version 13.5.4b; Delorme & Makeig, 2004), the *ERPLAB Toolbox* (Version 7.0.0; Lopez-Calderon & Luck, 2014), and custom MATLAB scripts (The MathWorks, Natick, MA). The average of the left and right mastoids served as references for all electrodes. Artifact detection was performed using a peak-to-peak analysis based on a sliding window 200 ms wide with a step of 100 ms.

Following CDA-analysis conventions (e.g., Balaban & Luria, 2015; Sternberg et al., 2018), we excluded trials from the averaged ERP waveforms that included any activity exceeding 80 μV from the EOG electrodes because of ocular artifacts and trials containing activity exceeding 100 µV from CDA electrodes (P7, P8, Po7, Po8, Po3, and Po4). Following LPP analysis conventions (e.g., Shafir et al., 2018), we excluded from the averaged ERP waveforms any activity exceeding 80 µV from the EOG electrodes because of ocular artifacts and any trial containing activity exceeding 80 µV from LPP electrodes (Pz, CPz, CP1, CP2, and Cz). The mean rejected rate was 9.57% for CDA analysis and 5.34% for LPP analysis. The continuous data were segmented into epochs from −200 ms, relative to the onset of the memory array, to +2,500 ms, representing the end of the stimulus presentation. The epoched data were then low-pass filtered using a noncausal Butterworth filter (12 dB/octave) with a half-amplitude cutoff point at 30 Hz.

CDA analysis. The CDA component was computed using conventional procedures (Vogel & Machizawa, 2004) by generating separate average waveforms for each condition and then creating difference waves by subtracting the average activity recorded from electrodes ipsilateral to the attended stimulus (assumed to reflect mostly low level and early perceptual processing) from the average activity recorded from electrodes contralateral to the attended stimulus (assumed to reflect both low-level processes together with WM-related activity). The CDA was measured between 500 and 2,500 ms (until the end of stimulus presentation). Starting the measurement window at 500 ms following stimulus onset is congruent with our procedure in a prior study that measured CDAs to Facebook stimuli (Sternberg et al., 2018) and with procedures used in other studies that have measured CDAs to complex stimuli (e.g., polygons, faces, and real-world objects), which require more processing time and are accompanied with later developing CDAs (e.g., Balaban & Luria, 2015). We followed standard procedures and quantified the CDA using activity from PO7/PO8 electrodes, where the CDA is generally most pronounced (for a review, see Luria et al., 2016).

LPP analysis. Following previous studies (for a review, see Hajcak et al., 2010), we quantified the LPP at centroparietal electrodes. Following conventions (e.g., Shafir et al., 2018), we measured the LPP between 300 ms (when it becomes evident) and 2,500 ms (until the end of stimulus presentation) as the average activity of Pz and CPz, where it is frequently observed (e.g., Shafir et al., 2018).

Results

Attentional distraction successfully reduces self-reported Facebook desire

We first ran a paired-samples *t* test on self-reports of Facebook desire with condition (temptation, attentional distraction) as a within-participants independent variable. Confirming our predictions, results indicated that the attentional-distraction condition (*M* = 2.02, *SD* = 0.63) efficiently reduced the desire to use Facebook relative to the temptation condition (*M* = 2.72, *SD* = 0.78), *t*(28) = 8.19, *p* < .001, 95% confidence interval (CI) for the mean difference = [0.52, 0.87], Cohen's *d* = 1.5 (see Fig. 2a). This pattern was evident in 100% (29/29) of participants.

Attentional distraction results in reduced attention allocation toward Facebook stimuli, providing neural self-regulation success

We ran a second paired-samples *t* test on LPP amplitudes to Facebook stimuli with condition (temptation, attentional distraction) as a within-participants independent variable. This analysis found reduced LPP amplitudes in the attentional-distraction condition (*M* = −1.72 µV, *SD* = 2.66) relative to the temptation condition (*M* = −1.06 µV, *SD* = 2.89), *t*(28) = 2.54, *p* = .02, 95% CI for the mean difference = [0.13, 1.18], Cohen's *d* = 0.4 (see Fig. 2b). This pattern was evident in 72% (21/29) of participants. These results extend prior findings showing that attentional distraction results in reduced initial attention allocation toward appetitive stimuli and thus provides neural self-regulation success (e.g., Littel & Franken, 2011; Shafir et al., 2018).

Additionally, in order to provide direct evidence for early attentional disengagement in distraction, we examined the early LPP (300–1,000 ms following stimulus onset), which is sensitive to initial attention allocation toward affective stimuli (for a review, see Shafir & Sheppes, 2020). Congruent with this notion, results of a paired-samples *t* test on early LPP amplitudes (300–1,000 ms) to Facebook stimuli with condition (temptation, attentional distraction) as an independent variable found reduced early LPP amplitudes in the attentional-distraction condition (*M* = −2.43 µV, *SD* = 2.20) relative to the temptation condition (*M* = −1.61 µV, *SD* = 2.79), *t*(28) = 3.47, *p* = .002, Cohen's *d* = 0.32. This finding suggests that the attentional-distraction manipulation in the present study is associated with early attentional disengagement as manifested by reduced early LPPs.

Attentional distraction results in reduced mental representation of Facebook stimuli in WM

Turning to the prediction that the main underlying mechanism driving attentional distraction would result in reduced online representation of Facebook stimuli

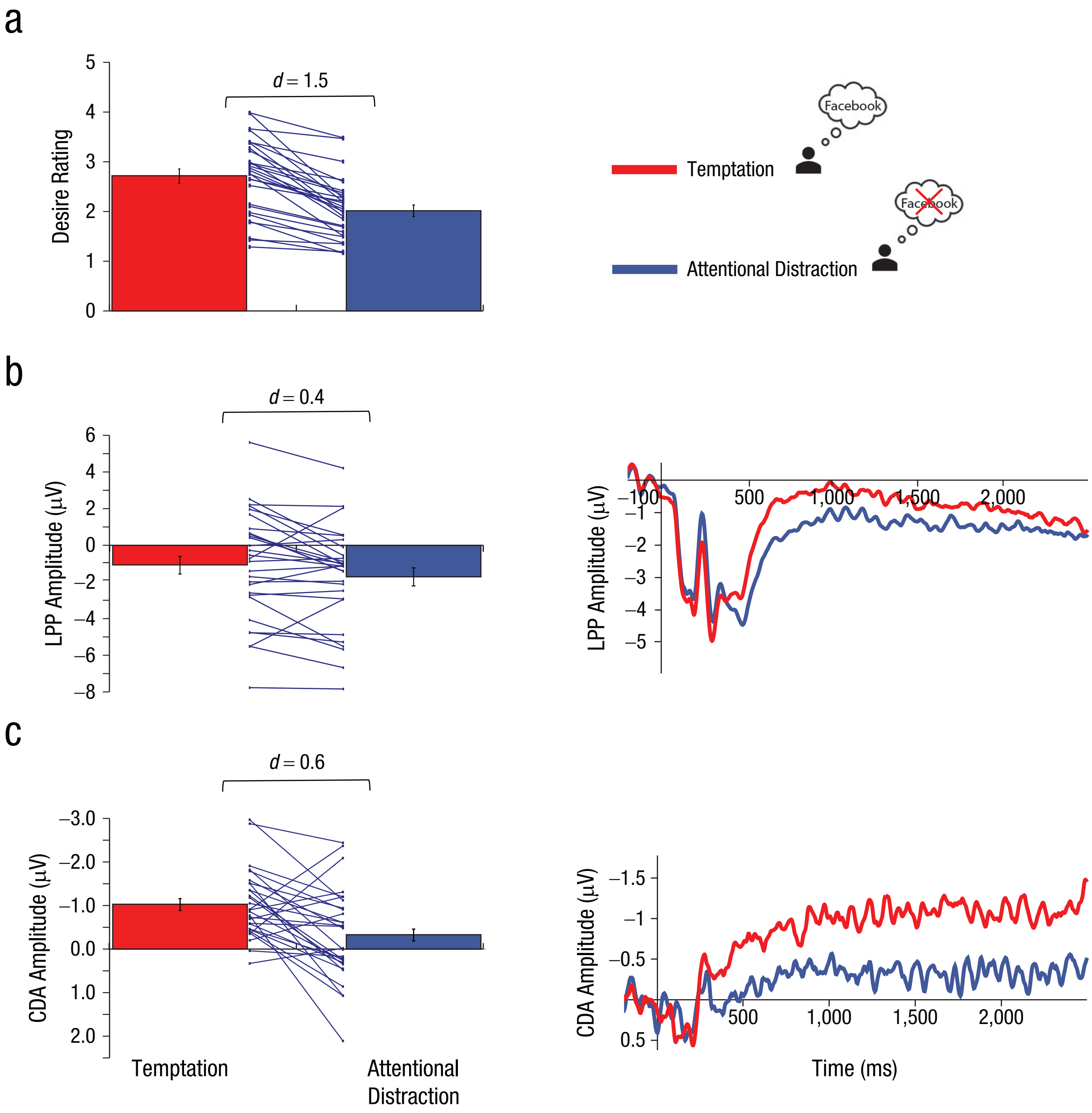

Fig. 2. Self-report and neural findings in the temptation and attentional-distraction conditions. The graphs in the left column show (a) desire ratings, (b) late positive potential (LPP) amplitudes, and (c) contralateral delay activity (CDA) amplitudes. Data bars shown group means, and lines connect means in the two conditions for each individual participant. Error bars represent standard errors. The average effect size is shown above each graph. The waveforms in the right column show event-related potential (ERP) amplitudes for the (b) LPP and (c) CDA. LPP amplitudes were derived from the Pz and CPz electrodes, and CDA amplitudes were derived from the PO7 and PO8 electrodes. The *x*-axes run from the beginning of baseline (−200 ms before picture onset) to the end of picture presentation (2,500 ms). Note that the *y*-axis in (c) is reversed (negative is up), given that higher negative amplitudes denote higher working memory representation of social-media information.

in WM, we ran a paired-samples *t* test on CDA amplitudes to Facebook stimuli with condition (temptation, attentional distraction) as an independent variable. As expected, this analysis found reduced CDA (less negative) amplitudes in the attentional-distraction condition (*M* = −0.33 µV, *SD* = 1.03) relative to the temptation condition (*M* = −1.03 µV, *SD* = 0.75), *t*(29) = 3.55, *p* = .001, 95% CI = [0.30, 1.11], Cohen's *d* = 0.6 (see Fig. 2c). This pattern of findings was evident in 79.3% (23/29) of participants.

Discussion

Social media is a potent temptation that competes with basic needs and, in extreme cases, can put individuals' lives at risk. There is a growing consensus among scientists and social-media companies that social-media temptations need to be regulated and that self-regulation of this potent class of stimuli is challenging. To date, however, it is not clear whether social-media stimuli can be self-regulated and how self-regulation is achieved. To address this basic gap, we provide direct causal evidence in the present study for self-regulation of social-media content while also identifying a potential WM-underlying neural mechanism.

Using insights from self-regulation and neural WM studies, we showed that a central attentional-distraction control mechanism successfully regulated behavioral and neural correlates of social-media temptations. Behaviorally, attentional distraction successfully modulated self-reports of Facebook desire. Neurally, attentional distraction successfully modulated LPP amplitudes, denoting reduced initial attention allocation toward Facebook stimuli and enhanced neural regulatory success. This LPP finding joins results of prior studies showing that distraction results in neural regulatory success (modulated LPPs) for multiple other temptations (for reviews, see Hofmann & Van Dillen, 2012, 2018). Taken together, these findings show that the potent temptation to use social media, which affects millions of people, can be self-regulated via a central attentional-distraction strategy.

Importantly, the finding that attentional distraction modulated CDA amplitudes suggests a potential underlying neural mechanism for successful self-regulation. Loading WM with neutral content by engaging in attentional distraction restricted the online mental representation of Facebook stimuli and their associated social-media consumption behavioral intentions. Given that CDA modulation directly tracks the outcome of reduced online WM representation of tempting information, this finding provides important support for major conceptual accounts that emphasize underlying WM mechanisms in adaptive self-regulation (for reviews, see Hofmann & Van Dillen, 2012, 2018).

Finding that attentional distraction regulates specific Facebook temptations extends prior studies that highlighted the importance of the general (non-social-media related) ability to regulate negative emotions in problematic social-media usage (e.g., Casale et al., 2016; Pontes et al., 2018). The importance of differentiating specific from general self-regulation abilities has been directly demonstrated in a single study showing that low specific (but not general) ability to control the WM representation of tempting Facebook stimuli is associated with maladaptive Facebook usage (Sternberg et al., 2018).

More generally, self-regulation of social-media temptations can provide psychological benefits that transcend existing digital regulatory applications (Lyngs et al., 2019). When successful, self-regulation is associated with feelings of control that are satisfying and internally rewarding (e.g., Tangney et al., 2004). These enhanced positive feelings of agency can reinforce future self-control more than automated digital regulatory solutions, whose success is attributed to external forces.

Our findings have potential practical implications. Now that we have shown that potent social-media temptations can be self-regulated via attentional distraction, this may be targeted to reduce acting on social-media desires in life-threatening contexts. Specifically, future studies should examine whether the clear immediate regulatory benefits of attentional distraction could be used to teach drivers to disengage their attention from tempting mobile-phone distractions (such as notification sounds) back to visual, neutral elements of the road.

Despite the novel features of the study, several limitations warrant comment. First, despite having clear potential benefits, attentional distraction is also associated with clear long-term costs. Early attentional disengagement before temptations are processed and represented in WM does not allow exposure to, and making sense of, temptations that are needed to facilitate gradual habituation (for a review, see Hofmann & Van Dillen, 2018). Future studies should examine the combination of attentional distraction that provides strong short-term efficacy with other self-regulation strategies such as cognitive reappraisal that allow meaning making and provide long-term benefits (for a review, see Sheppes, 2020).

Second, we adopted a well-established experimental manipulation (cf. Shafir et al., 2018) that allowed participants to implement attentional distraction in two ways (thinking about geometric shapes or about daily activities). Future studies should examine whether different ways to distract attention from social-media information might lead to different consequences. It is worth noting that although both distraction subtypes use somewhat different means, both subtypes involve disengaging attention from tempting stimuli and are thus expected to lead to LPP and CDA modulation.

Third, our study focused on specific Facebook stimuli and did not include stimuli from other social-media platforms (e.g., Instagram, Snapchat) or other general temptations (e.g., food). Therefore, we cannot determine whether our results are specific to self-regulation of Facebook temptations or can be generalized to other domains. It should be noted that multiple studies showed that attentional distraction successfully regulates multiple temptations (for a review, see Hofmann & Van Dillen, 2018). Given this general efficacy pattern, our conservative prediction would be that attentional distraction would be effective in regulating desire toward other social-media platforms.

Fourth, although Facebook is an integral part of individuals' daily lives, the Facebook stimuli we used were probably not uniformly tempting for all participants. Future studies should examine whether regulation effects depend on individual-difference factors such as how tempting social media is for participants, how much the temptation to use social media interferes with the pursuit of other goals, and how much social-media temptation is related to problematic social-media usage.

In conclusion, in situations in which social-media temptations strongly compete with our basic needs, downregulating their influence is crucial yet challenging. Our findings show that potent social-media temptations can be successfully self-regulated. Our findings also demonstrate a potential underlying neural mechanism that involves restricting the WM representation of social-media temptations. These findings can help individuals navigate a social-media-saturated environment.

Transparency

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Author Contributions

All the authors developed the study concept and contributed to the study design. N. Sternberg conducted testing and data collection. N. Sternberg analyzed and interpreted the data under the supervision of R. Luria and G. Sheppes. N. Sternberg and G. Sheppes wrote the manuscript, and R. Luria provided critical revisions. All the authors approved the final manuscript for submission.

Declaration of Conflicting Interests

The author(s) declared that there were no conflicts of interest with respect to the authorship or the publication of this article.

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Open Practices

All data have been made publicly available via OSF and can be accessed at https://osf.io/f9sh3. The design and analysis plans for the study were not preregistered. This article has received the badge for Open Data. More information about the Open Practices badges can be found at http://www.psychologicalscience.org/publications/badges.

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Supplemental Material

Additional supporting information can be found at http://journals.sagepub.com/doi/suppl/10.1177/09567976211001316

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