Attentional Demand and Subliminal Affect Jointly Regulate Task Performance and Mind Wandering

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Abstract

Understanding how attention and emotion shape conscious experience remains a central challenge in cognitive science. The present study examined how perceptual load and subliminal emotional information influence task performance and mind wandering. Participants performed a letter search task under low and high perceptual load while being subliminally primed with task-irrelevant happy or angry faces. Thought probes assessed task-unrelated thought, including deliberate and unintentional forms. High perceptual load slowed responses and reduced accuracy, consistent with load theory. Emotional valence showed limited modulation, with happy faces associated with interference across load conditions and angry faces showing some influence under low load. Mind wandering increased with block length and showed modest modulation by load and emotion, particularly for unintentional task-unrelated thought. Trait mind wandering and ADHD symptoms were associated with higher task-unrelated thought. Overall, the findings suggest that subliminal emotional signals and attentional demands jointly shape performance and conscious thought.

Keywords: Attentional load; emotion; mind-wandering; conscious awareness, subliminal priming

Introduction

Understanding how attention shapes conscious experience remains a central challenge in cognitive science. Although attention and consciousness are often closely linked, converging evidence suggests that they are dissociable processes that interact in context-dependent ways rather than standing in a one-to-one relationship (Lamme, 2003; Koch & Tsuchiya, 2007; van Boxtel et al., 2010). Contemporary frameworks argue that attention does not generate consciousness per se but instead modulates the stability, accessibility, and prioritisation of conscious contents (Tsuchiya et al., 2015; Dehaene et al., 2021). This view motivates the study of how attentional constraints influence not only perceptual awareness but also the broader dynamics of conscious thought, including internally generated experiences such as mind wandering.

One influential account of attentional allocation is perceptual load theory, which proposes that attentional resources are finite and automatically allocated to task-relevant processing (Lavie, 1995, 2005). Under high perceptual load, attentional capacity is largely exhausted, leaving little scope for processing task-irrelevant stimuli, whereas under low load, spare resources permit greater distractor processing. This framework has received extensive empirical support across visual attention paradigms and has been particularly influential in explaining when and why irrelevant information intrudes into perception and behaviour.

Emotional information constitutes a particularly important and theoretically informative class of distractors. Emotional stimuli, especially facial expressions, are highly salient due to their biological and social relevance and are often prioritised in cognitive processing (Vuilleumier, 2005; Pessoa, 2009). Crucially, emotional signals can influence behaviour and cognition even in the absence of conscious awareness. Seminal work using affective priming paradigms demonstrated that subliminal emotional stimuli can bias judgments and preferences (Murphy & Zajonc, 1993), while neuroimaging studies revealed amygdala responses to masked emotional faces presented outside awareness (Whalen et al., 1998; Morris et al., 1999). Subsequent behavioural and neural evidence has confirmed that both positive and negative emotional expressions can be processed without conscious access and can modulate attention and performance (Pessoa, 2005; Kouider & Dehaene, 2007; Tamietto & de Gelder, 2010).

Importantly, emotional processing does not operate independently of attentional constraints. Research integrating emotion with perceptual load theory suggests that emotional distractors can modulate attentional selection in a load-dependent manner (Gupta et al., 2016). While depleting attentional resources typically reduces distractor processing, emotionally salient stimuli may still gain access under certain conditions (Pessoa et al., 2002; Bishop et al., 2007). However, emotional valence plays a critical role in determining how such stimuli interact with attentional capacity.

In a series of influential experiments, Gupta et al. (2016) demonstrated a consistent interaction between perceptual load and emotional valence. Under low load, both positive and negative emotional distractors produced comparable interference effects on visual search reaction time. Under high perceptual load, however, interference from negative-valence distractors was reliably reduced, whereas positive-valence distractors continued to interfere with task performance. This asymmetry suggests that positive emotional stimuli may be processed more automatically or

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may rely on attentional mechanisms that are less constrained by perceptual capacity, whereas negative stimuli may require additional resources for sustained processing (see also, Gupta & Srinivasan, 2015). Subsequent work has further shown that motivational salience and reward-related signals can bias attentional allocation even when stimuli are task-irrelevant (Gupta et al., 2019).

These findings challenge a strict interpretation of perceptual load theory and instead point toward a more nuanced account in which emotional valence modulates the allocation of attentional resources. From this perspective, positive and negative emotions may differentially shape both external attentional selection and internal cognitive dynamics, with potential consequences for conscious thought.

Beyond perceptual performance, attentional allocation plays a critical role in shaping the contents of conscious experience. Mind wandering, often defined as task-unrelated thought (TUT), reflects spontaneous shifts of attention away from the external task toward internally generated content (Smallwood & Schooler, 2013, 2015). Rather than being a mere failure of attention, mind wandering is increasingly conceptualised as a fundamental mode of conscious experience, occupying a substantial proportion of waking life (Killingsworth & Gilbert, 2010). Importantly, mind wandering is heterogeneous. Distinctions between deliberate and unintentional TUT highlight the role of cognitive control, with unintentional mind wandering reflecting lapses in attentional regulation rather than strategic disengagement (Seli et al., 2016; Robison and Unsworth, 2018).

Perceptual load has been shown to systematically influence mind wandering. Consistent with load theory, higher task demands are associated with reduced TUT, presumably because fewer resources remain available for internally generated cognition and metacognition (Forster & Lavie, 2009; Konishi et al., 2021). However, this relationship is not fixed. Emotional context can modulate mind wandering, with affective states and emotional stimuli influencing both the frequency and content of spontaneous thought (Smallwood et al., 2009; Ruby et al., 2013). Negative affect, in particular, has been linked to increases in unintentional and intrusive thought, whereas positive emotion may broaden attentional scope without necessarily increasing cognitive disengagement (Webb et al., 2022; Seli et al., 2017; Fredrickson and Branigan, 2005).

Furthermore, individual differences in attentional control are also closely linked to mind wandering. In particular, ADHD symptomatology has been associated with increased frequency of TUT, especially unintentional mind wandering (Shaw & Giambra, 1993; Seli et al., 2016; Franklin et al., 2017). Individuals with higher ADHD traits show greater attentional lapses during demanding tasks, which can increase susceptibility to spontaneous thought under conditions of reduced external constraint. These findings motivate the inclusion of ADHD symptom measures in the present study.

Despite extensive research on perceptual load, emotion, and mind wandering independently, few studies have examined how these factors interact within a unified experimental framework. In particular, it remains unclear how subliminal emotional information could shape mind wandering under varying levels of attentional load. While prior studies demonstrate that perceptual load constrains mind wandering and that emotional stimuli can bias attention outside awareness, no study to date has combined masked emotional priming, load manipulation, and experience-sampling of conscious thought.

The present study addresses this gap by investigating how perceptual load and subliminally presented emotional face primes (happy and angry) jointly influence behavioural performance and mind wandering during a letter search task (Lavie, 1995). Mind wandering was assessed using thought probes that distinguished between deliberate and unintentional TUT. To reduce the predictability of probe occurrence, block length was varied across the task. By integrating load manipulation, subliminal emotional priming, and experience sampling of conscious experience, the present work aims to clarify how attentional demands and non-conscious emotional signals interact to shape both perceptual performance and the dynamics of conscious thought.

Methodology

Participants

30 participants were recruited from the IIT Bombay campus using convenience sampling via social media advertisements and received monetary compensation. All participants were at least 18 years old, reported no history of psychiatric or neurological disorders, and had normal or corrected-to-normal vision (See Table 1 for demographics and questionnaire scores). Written informed consent was obtained from all participants before the experiment. Before the experimental session, participants completed three questionnaires: the Mind-Wandering Questionnaire (MWQ; 5 items; Mrazek et al., 2013), the Autism Spectrum Quotient–10 (AQ-10; Allison et al., 2012), and the Adult ADHD Self-Report Scale v1.1 (ASRS; 18 items; Kessler et al., 2007).

Apparatus

The experiment was conducted using PsychoPy (version 2024.2.4) on a Lenovo Legion monitor (1920 × 1080 resolution, 240 Hz refresh rate). Participants were seated approximately 60 cm from the screen in a dimly lit testing room.

Stimuli

The primary task was a visual letter search task adapted from Lavie's perceptual load paradigm (Lavie, 2006). Targets were the uppercase letters X or N, presented among six letters arranged circularly around fixation (Figure 1). In the low-load condition, the target appeared among five identical non-target letters (O). In the high-load condition, non-target letters consisted of heterogeneous angular letters (H, M, K, W, and Z), increasing attentional demands.

Letter arrays were presented at six fixed positions around fixation (approximate eccentricities ranging from −0.25° to +0.25° of visual angle). On each trial, an emotional face distractor was presented centrally as a subliminal prime for 17 ms and was forward- and backward-masked (100 ms each) using Fourier phase–scrambled versions of the same face. The face stimuli subtended approximately 0.5° × 0.5° of visual angle.

Emotional face stimuli were selected from the Karolinska Directed Emotional Faces (KDEF) database (Lundqvist et al., 1998). A total of 24 identities (12 male, 12 female) displaying happy and angry expressions were used. Images were cropped using an ellipsoidal mask to remove non-facial features (e.g., hair, neck) and were matched for arousal across emotion categories ($t(11) = 0.235$, $p < 0.819$, $d = 0.068$).

Design

The experiment employed a 2 × 2 × 3 within-subjects factorial design with perceptual load (low, high), subliminal emotional distractor (happy, angry), and block length (24, 36, 48 trials) as independent variables. Block length was varied to reduce the predictability of thought probes and was treated as an additional factor in the design. The primary dependent measures were self-reported thought states, classified as task-related thought (TRT), TUT, deliberate TUT, and unintentional TUT.

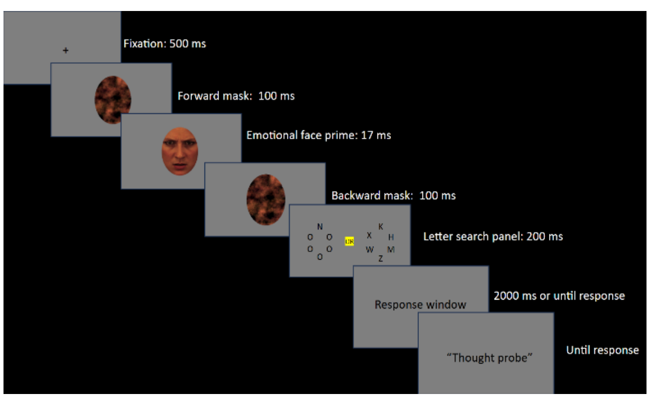

Figure 1: Screen progression of each trial. All stimuli were counterbalanced across trials.

Procedure

The experiment consisted of three phases: briefing, practice, and the main task, followed by a visibility test. Participants were informed that they would perform a visual letter search task requiring them to identify whether the target letter was X or N among other letters presented briefly in a circular arrangement. They were instructed to respond as quickly and accurately as possible by pressing the left arrow key for X and the right arrow key for N. Participants were asked to ignore any distractors, if noticed.

Participants were also introduced to the different types of thoughts that might occur during the task. They were informed that occasional thought probes would appear, asking, "What were you thinking about just now?" Participants indicated whether their thoughts were task-focused or task-unrelated by keypress. If a task-unrelated response was selected, a follow-up question appeared asking whether the TUT was deliberate (intentional) or unintentional, to which participants responded by keypress again. Participants were instructed to report the mental content experienced immediately before the probe appeared. It was emphasised that there were no right or wrong answers and that honest responses were appreciated.

Each trial began with a central fixation point presented for 500 ms, followed by a forward mask (100 ms), a face prime (17 ms), and a backward mask (100 ms). The letter search array was then presented for 200 ms, followed by a response window of up to 2 s. Each trial ended with a 1.9 s inter-trial interval. Participants completed four practice blocks corresponding to each load × emotion condition (high/low load × happy/angry distractor), with 12 trials per block. Visual feedback was provided for incorrect or missed responses during practice. Participants were required to achieve at least 65% accuracy to proceed to the main experiment.

The main experiment consisted of 24 blocks: six blocks each for the four load × emotion conditions. A thought probe appeared at the end of every block. To reduce predictability, block length varied pseudo-randomly between 24, 36, and 48 trials across blocks and conditions. No feedback was provided during the main task. Trial order within blocks and block order were randomised and counterbalanced across participants.

Visibility test

Following the main experiment, participants completed a visibility test to assess conscious awareness of the subliminal face stimuli. The trial structure was identical to the main task, but participants responded to the face stimuli rather than the letter task. After each trial, participants selected one of nine response options: no face seen, no emotion seen, or one of seven emotion categories (happy, angry, sadness, fear, surprise, disgust, contempt). Participants were instructed to report an emotion only if they perceived a human face, and not to base responses on the masks. The no face seen option indicated no perceptual awareness of a face, while no emotion seen indicated perception of a neutral face. Each response was accompanied by a confidence rating on a 1–4 scale (1 = pure guess, 4 = completely confident). The visibility test consisted of 96 trials (1 block of 48 high-load trials, 1 block of 48 low-load trials), with happy and angry faces intermixed. Visibility was assessed using a 2AFC signal detection analysis of emotion discrimination (happy vs angry). Only trials in which participants explicitly reported one of the two emotions were included.

Results

Data preprocessing and statistical analyses were conducted using RStudio, Microsoft Excel, and JASP. Trials with reaction times (RTs) shorter than 200 ms or longer than 2000 ms, as well as trials exceeding ±3 SD from the participant's mean RT, were excluded. Thirty participants were included in the final analyses (18 males; age range = 22–33 years, M = 25.77, SD = 2.78). A post-hoc power analysis in G*Power (Faul et al., 2007) indicated high power for the Load × Emotion interaction for the dependent variable TUT (Cohen's f = 0.54, α = .05, N = 30; 1 − β ≈ .98). Participant characteristics and questionnaire scores are reported in Table 1.

Trait-level mind wandering, as measured by the Mind Wandering Questionnaire (MWQ), was positively correlated with overall TUT reports (Pearson's r = 0.461, p = 0.010). The Adult ADHD Self-Report Scale (ASRS) Part A, which is most predictive of ADHD diagnosis, and the ASRS total score positively correlated with TUT (Pearson's r = 0.414 & 0.393, p = 0.023 & 0.032, respectively). Higher ASRS Part A scores were associated with greater load-related performance costs, as measured by the difference in accuracy between high- and low-load conditions (Pearson's r = 0.461, p = 0.010). AQ-10 scores did not show reliable associations with behavioural or thought-report measures (p > 0.098).

Table 1. Demographics and Questionnaire Scores

N = 30	Mean (SD)	Range
Age (in years)	25.77 (2.78)	22 – 33
MWQ - 5	3.57 (1.13)	1 - 6
ASRS - 18	34.33 (10.14)	0 – 72
Part A	12.73 (3.96)	0 – 24
Part B	21.6 (7.32)	0 – 48
AQ10	4.13 (1.76)	0 - 10

Behavioural Measures Analysis

All dependent variables: reaction time (RT), accuracy, TUTs, deliberate TUTs (DTUT), and unintentional TUTs (UITUT) were analysed using repeated-measures ANOVAs with Load (low, high), Emotion (happy, angry), and Block Length (24, 36, 48 trials) as within-subject factors. Follow-up paired-samples t-tests were conducted where interaction effects were significant.

Reaction Time: A repeated-measures ANOVA revealed a significant main effect of perceptual load on RT, with slower responses under high load compared to low load ($F(1,29)$ = 346.868, *MSE* = 8.438×10^6, $p < 0.001$, $\eta_p^2 = 0.923$). The Load × Emotion interaction was marginally significant ($F(1,29)$ = 3.424, *MSE* = 8730.53, p = 0.074, $\eta_p^2 = 0.106$).

Further paired-samples t-tests indicated robust load-related differences across emotion conditions. Specifically, RTs were significantly slower in the high-load compared to the low-load condition for happy trials ($t(29) = 16.903$, $p < 0.001$, $d = 3.086$) and angry trials ($t(29) = 18.832$, $p < 0.001$, $d = 3.438$). Additional contrasts showed significant differences between happy high-load and angry low-load trials ($t(29) = 17.284$, $p < 0.001$, $d = 3.156$), as well as between happy low-load and angry high-load trials ($t(29) = 18.777$, $p < 0.001$, $d = 3.428$). A smaller but significant difference was observed between happy and angry trials under low load ($t(29) = 2.405$, $p = 0.023$, $d = 0.439$). All remaining comparisons were non-significant ($p > 0.05$).

Accuracy: Accuracy analyses revealed a significant main effect of perceptual load, with lower accuracy under high load relative to low load ($F(1,29)$ = 147.595, *MSE* = 28537.112, $p < 0.001$, $\eta_p^2 = 0.836$). A significant Load × Block Length interaction was observed ($F(1,29)$ = 3.393, *MSE* = 41.290, $p = 0.040$, $\eta_p^2 = 0.105$), as well as a significant three-way Load × Emotion × Block Length interaction ($F(1,29)$ = 7.392, *MSE* = 84.903, $p = 0.001$, $\eta_p^2 = 0.203$). Further paired-samples t-tests indicated a significant decrease in accuracy in low-load blocks of 36 trials when compared to 48 trials ($t(29) = 2.490$, $p = 0.019$, $d = 0.455$). Across block-length conditions, all comparisons between high- and low-load trials were significant ($p < 0.001$), indicating that perceptual load primarily drove accuracy effects. Within specific emotion and block-length conditions, in happy high-load trials, accuracy was significantly higher in 24 trials blocks than 36 trials blocks ($t(29) = 2.410$, $p = 0.023$, $d = 0.440$), and in the angry low-load condition, accuracy was significantly lower in blocks of 36 trials than 48 trials ($t(29) = 3.684$, $p < 0.001$, $d = 0.673$). A marginal significance was observed, where

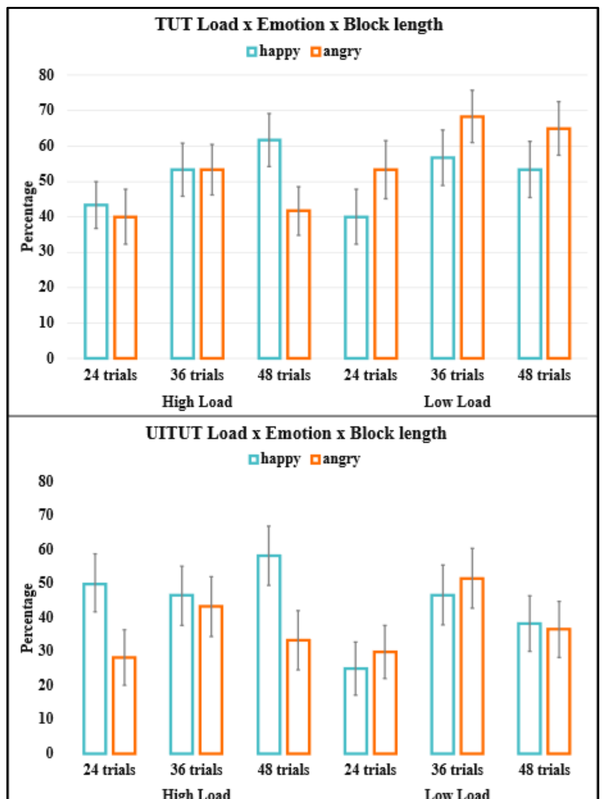

Figure 2: Means and SEM of Task-Unrelated Thoughts (TUT) and Unintentional Task-Unrelated Thoughts (UITUT) for 2 (Load: High and Low) x 2 (Emotion: Happy and Angry) x 3 (Block length: 24 trials, 36 trials and 48 trials). The bars represent SEM.

under low load, happy faces trials had higher accuracy at 36 trials than angry faces ($t(29) = 1.975$, $p = 0.058$). All remaining comparisons within the three-way interaction were non-significant ($p > 0.05$).

Task-Unrelated Thoughts (TUT): For TUT reports, a significant main effect of block length was observed ($F(1,29) = 5.970$, $MSE = 6437.5$, $p = 0.004$, $\eta_p^2 = 0.171$). A significant Load × Emotion interaction was also found ($F(1,29) = 8.419$, $MSE = 9000.0$, $p = 0.007$, $\eta_p^2 = 0.225$). Further paired-samples t-tests indicated higher TUT in 36-trial blocks relative to 24-trial blocks ($t(119) = 3.717$, $p < .001$, $d = 0.339$) and in 48-trial blocks relative to 24-trial blocks ($t(119) = 2.760$, $p = .007$, $d = 0.252$). Under low load, angry trials elicited significantly greater TUT than happy trials ($t(29) = 2.122$, $p = .042$, $d = 0.387$), whereas this contrast was marginal under high load ($t(29) = 1.785$, $p = .085$). Additionally, angry trials produced greater TUT under high load compared to low load ($t(29) = 2.726$, $p = .011$, $d = 0.498$). All other comparisons were non-significant.

Deliberate Task-Unrelated Thoughts (DTUT): No significant main effects or interactions were observed for deliberate TUT reports (all $p > .05$).

Unintentional Task-Unrelated Thoughts (UITUT): For unintentional TUT, the main effect of emotion was marginally significant ($F(1,29) = 3.353$, $MSE = 4340.3$, $p = 0.077$, $\eta_p^2 = 0.104$), and a significant main effect of block length was observed ($F(2,58) = 4.081$, $MSE = 5756.9$, $p = 0.022$, $\eta_p^2 = 0.123$). A significant Load × Emotion interaction was also found ($F(1,29) = 4.772$, $MSE = 8506.9$, $p = 0.037$, $\eta_p^2 = 0.141$). Further paired-samples t-tests indicated higher UITUT in 36-trial blocks than in 24-trial blocks ($t(29) = 2.685$, $p = .012$, $d = 0.490$). Post hoc comparisons within the Load × Emotion interaction were non-significant ($p > .05$).

Visibility Test

A visibility test was conducted to assess participants' conscious access to the emotional identity of subliminally presented faces. Objective discrimination of emotional identity was assessed using signal detection theory (Abdi, 2007). Sensitivity (d′) for discriminating happy from angry faces was close to zero overall (M = 0.06), indicating chance-level performance. Collapsing confidence ratings into Guess (PAS 1–2) and Confident (PAS 3–4) categories revealed no improvement in sensitivity at higher confidence levels (Guess: M = −0.18; Confident: M = −0.08). Thus, subjective confidence was not associated with increased access to emotional identity, consistent with a lack of conscious awareness of the emotional faces.

Discussion

The current study investigated how perceptual load and subliminally presented task-irrelevant emotional faces (happy and angry) influence behavioural performance on the primary task and spontaneous thought during a sustained letter search task (Lavie, 2006). Consistent with prior work, higher trait mind wandering and ADHD-related symptoms were associated with increased TUT and greater load-related performance costs (Smallwood & Schooler, 2006; Seli et al., 2016; Shaw & Giambra, 1993), whereas autistic traits did not show reliable associations with behavioural or experiential measures. Also, a robust perceptual load effect was found on reaction time (RT) and accuracy: high load reliably produced slower responses and reduced accuracy compared to low load, replicating classic load-based modulation of attentional capacity (Lavie, 2005; Forster & Lavie, 2009). We observed that happy faces were associated with slower responses across load conditions; however, evidence for a Load × Emotion interaction was limited and should be interpreted cautiously. Additionally, irrelevant subliminal angry faces did not interfere with the letter search task.

Beyond performance, the present findings extend prior work by demonstrating that emotional context and sustained attention jointly modulate spontaneous thought (Smallwood et al., 2009; Ruby et al., 2013). Specifically, increasing block length (24 → 36 → 48 trials) was associated with progressively higher reports of TUTs and UITUT, suggesting that sustained cognitive engagement leads to greater spontaneous disengagement (as indexed by self-reported thought probes).

Notably, DTUT showed no reliable effects, indicating that the observed increases in mind wandering were not strategic or volitional but rather emerged automatically as cognitive resources were taxed over time. This distinction between unintentional and intentional off-task thought is theoretically important, as it suggests that automatic shifts in attentional state are sensitive to both time-on-task and subtle contextual influences, rather than being consciously orchestrated by participants (Smallwood & Schooler, 2013; Seli et al., 2016).

Although perceptual load dominated task performance, emotional context selectively influenced both behavioural and subjective measures. Under low load, angry faces were associated with relatively faster RTs and elevated TUT compared to happy faces. One interpretation is that negative emotional content, when task demands are low, engages early processing but may subsequently lead to rapid disengagement due to aversive salience. In other words, angry faces may be detected but not sustained in processing, leading to faster RTs yet increased off-task thought. Such a pattern is compatible with affective avoidance or motivational salience accounts, where negative stimuli capture rapid attention but are subsequently suppressed or avoided when attentional resources are available (Gupta et al., 2016).

Subliminal emotional information can bias behaviour without conscious awareness, with masked emotional faces influencing subsequent judgments and neural responses (Murphy & Zajonc, 1993). Positive expressions often produce particularly robust downstream effects (Kumar et al., 2014; Mohan et al., 2016); however, emotional valence interacts with attentional constraints. Prior work shows that while positive distractors continue to interfere under high perceptual load, interference from negative-valence distractors is selectively reduced when attentional resources are limited (Gupta et al., 2016). In line with this, the present findings show that angry faces showed some indication of influence under low load, though this pattern was not strongly supported by interaction effects. Evidence from unconscious threat processing suggests that negative emotional cues can elicit early attentional engagement even without awareness, followed by disengagement when task constraints are weak (Li et al., 2008). The increase in TUT following angry primes under low load may therefore reflect early threat detection that disrupts sustained task focus, promoting attentional decoupling rather than continued engagement.

While Lavie's perceptual load theory predicts reductions in both external and internal distraction under high load, and prior work has demonstrated decreased TUT under high load in visual search tasks, our findings indicate a more nuanced picture (Forster and Lavie, 2009). In the current study, high load reliably impaired performance but did not uniformly suppress subjective off-task thought; instead, the interaction between load and emotion and the effects of block length emerged as central determinants of mind wandering. This suggests that internal distraction is not a simple monotonic function of perceptual load alone, but also depends on emotional context and sustained cognitive engagement. Such an account is consistent with evidence that emotional valence influences patterns of off-task thought beyond simple load effects.

These findings thus converge with Gupta et al. (2016) that attentional allocation is shaped by external affective signals, and that emotional context can modulate spontaneous thought processes of simple capacity limits. In this respect, the present results align more closely with research emphasising the interaction between attention and emotion than with a strict replication of load-only effects in mind wandering.

Limitations and Future Directions

Several limitations of the present study also point to promising directions for future research. First, the absence of a neutral-face condition critically limits the ability to determine whether observed effects are driven by emotional valence per se or by the presence of masked face stimuli more generally. Second, mind wandering was assessed using self-reported thought probes, which offer a well-validated but indirect measure of internal cognition and depend on participants' metacognitive access. Future work could complement this approach with neural or physiological measures to better characterise underlying mechanisms. Third, although a post-experiment visibility test indicated near-chance discrimination of emotional primes, partial or fleeting awareness, as well as low-level perceptual influences inherent to masked priming paradigms, cannot be entirely ruled out. Fourthly, although the number of probes per condition was relatively low, prior work suggests that reliable estimates of TUT can be obtained with as few as ~8 probes per participant (Welhaf et al., 2023). In the present study, participants completed 24 probes, exceeding this threshold; however, condition-level estimates should still be interpreted with caution. Additionally, block length was introduced to reduce the predictability of thought probes, but it also introduces a confound between probe predictability and time-on-task (attentional fatigue), making it difficult to isolate the source of increased mind wandering. Moreover, the perceptual load manipulation may have differed not only in attentional demand but also in the balance of exogenous and endogenous control. Finally, although a post-hoc power analysis indicated high power for the observed interaction, the relatively small sample size (N = 30) limits confidence in interaction effects and individual-difference correlations, which should be interpreted cautiously. Future studies could systematically dissociate these factors and extend the paradigm to a broader range of emotional stimuli and task variants, enabling a more precise account of how emotional context and sustained attention jointly shape spontaneous thought.

Conclusion

The present study suggests that an interaction between attentional demands and non-conscious emotional processing shapes conscious thought. Consistent with perceptual load theory, high perceptual load constrained behavioural performance and reduced TUT, indicating limited availability of attentional resources (Lavie, 2005; Forster & Lavie, 2009). Crucially, subliminal emotional primes showed valence-dependent trends, though effects were not uniformly robust. Happy faces influenced behavioural performance across both load conditions, whereas angry faces exerted stronger effects primarily under low load, aligning with prior evidence that positive emotional stimuli remain robust under high load while negative stimuli are selectively suppressed (Gupta et al., 2016; Gupta & Srinivasan, 2015; Vuilleumier, 2005). Beyond performance, emotional context and sustained task engagement seemed to influence mind wandering, particularly unintentional TUT, supporting models that conceptualise mind wandering as a dynamic interaction between attentional control and affective processing (Smallwood & Schooler, 2015; Seli et al., 2016). Together, these findings extend load-based accounts of attention by demonstrating that non-conscious emotional signals shape both behavioural selection and the contents of conscious experience.

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