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Examining the role of emotional valence of mind wandering: All mind wandering is not equal

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ABSTRACT

To evaluate the role of emotional valence on the impact of mind wandering on working memory (WM) and sustained attention, we reanalyzed data from three independently conducted studies that examined the impact of stress on WM (Banks & Boals, 2016; Banks, Welhaf, & Srour, 2015) and sustained attention (Banks, Tartar, & Welhaf, 2014). Across all studies, participants reported the content of their thoughts at random intervals during the WM or sustained attention task. Thought probes in all studies included a core set of response options for task-unrelated thoughts (TUTs) that were negatively, positively, or neutrally emotionally valenced. In line with theories of emotional valenced stimuli on capture of attention, results suggest negatively valenced TUTs, but not positively valenced TUTs, were related to poorer WM and sustained attention in two studies. Neutral TUTs were related to poorer WM but not sustained attention performance. Implications for models of mind wandering are discussed.

1. Introduction

Despite the growing body of research on mind wandering and the ubiquitous nature of the phenomenon in everyday life, our understanding on the phenomenon remains unclear. Mind wandering can be conceptualized as any thought related to personal concerns or goals but unrelated to the current task (Smallwood & Schooler, 2006). Task-unrelated thoughts (TUTs) consume as much as 50% of our waking hours and occur during almost every type of behavior (Killingsworth & Gilbert, 2010). Two dominant accounts of mind wandering differ in their view of the role of working memory in explaining mind wandering, but these models explain different components to mind wandering. The *Executive Control Failures* × *Personal Concerns* model (McVay & Kane, 2010) suggests mind wandering occurs due to a failure of working memory to control mind wandering and a priming of personal concerns. As such, this model can be used to explain why mind wandering occurs. The *Decoupling* model (Smallwood & Schooler, 2006) suggests instances of mind wandering reflect a decoupling of attention from an ongoing task toward an internal train of thought. Attentional resources then support this internal train of thought so the internal thought can be continued (Smallwood, Brown, Baird, & Schooler, 2012). As such, the decoupling model suggests that working memory resources are required to support mind wandering. Given the critical differences between these models in terms of the role of working memory in mind wandering, an alternative view has suggested that the two models are not mutually exclusive but rather explain differing aspects of mind wandering. The *Process-Occurrence* framework suggests

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that the role of working memory may be two-fold, first to prevent mind wandering on tasks demanding external focus of attention and second to support mind wandering once it occurs (Smallwood, 2013).

Impairment in primary task performance is often observed during mind wandering (McVay & Kane, 2010; Smallwood & Schooler, 2006), possibly due to mind wandering competing for working memory resources that would otherwise be directed toward the ongoing task (Smallwood & Schooler, 2006). A recent meta-analysis examining the causes and consequences of mind wandering supported the view that mind wandering results in impairments in ongoing task performance (Randall, Oswald, & Beier, 2014). However, task performance impairments do not always occur as a result of mind wandering (Smallwood, Obonsawin, & Heim, 2003). One explanation for the discrepancy between studies investigating the impact of mind wandering on task performance has to do with the attentional demands of the primary task (Thomson, Besner, & Smilek, 2015). Tasks that require less attentional resources may be less likely to be impaired by mind wandering than tasks that require greater attentional resources.

Thomson et al. (2015) recently proposed a resource control account of sustained attention that blends the decoupling and executive control failure models of mind wandering. The resource control model suggests that the resources devoted to a primary task may be less than the resources available to the individual and as such, additional resources (above and beyond those required by the task) may be directed toward mind wandering. By this account, then, mind wandering may occur simultaneously with the primary task, without impairment in the primary task. However, when the resources devoted to the task are less than the resources required to complete the task, performance on the primary task will be impaired, as could be the case when mind wandering occurs (Seli et al., 2014). This model helps to explain prior findings that individuals with higher working memory capacity mind wander more when engaged in a task with few attentional demands but mind wander less on tasks with greater attentional demands (Levinson, Smallwood, & Davidson, 2012) and when individuals report lower levels of concentration (Kane et al., 2007). The impact of mind wandering on primary task performance should differ based on the amount of available resources to complete the primary task. The availability of resources may be altered by the demands of the primary task, individual differences in working memory, and resources directed toward continuing mind wandering. The degree to which attentional resources are directed toward mind wandering alters the impact on primary task performance, such that greater disengagement from the primary task toward mind wandering results in the greatest performance deficits (Seli et al., 2014).

1.1. Examining the content of mind wandering

Examining the content of mind wandering may be critical for understanding the impact of mind wandering on primary task performance, as not all content is likely to consume similar amounts of attentional resources. A few recent studies have attempted to examine different dimensions of mind wandering, including temporal orientation. Temporal orientation of mind wandering refers to the focus of the subjects' thoughts in time (e.g. thinking about the past, present, or future). The temporal orientation of mind wandering may alter the demands placed on attentional resources, with future oriented thoughts consuming more resources than present or past thoughts (Smallwood, Nind, & O'Connor, 2009). The nature of the prime used to increase mind wandering may impact the temporal orientation of mind wandering that is induced. Specifically, when participants are primed with personal priorities, increases in future-oriented mind wandering have been demonstrated (Stawarczyk, Majerus, Maj, Van der Linden, & D'Argembeau, 2011). Future-oriented mind wandering is related to increases in negative affect for individuals anticipating a stressful speech task (Stawarczyk, Majerus, & D'Argembeau, 2013). However, individuals primed with negative moods demonstrate a shift to a more retrospective orientation of mind wandering (Smallwood & O'Connor, 2011). Although a prime to increase negative mood resulted in increases in mind wandering about the distant past, increasing positive mood did not result in increases in mind wandering about the past or future (Smallwood & O'Connor, 2011). The differences in temporal orientation of mind wandering may be moderated by individual differences in working memory, such that higher working memory individuals experience more future oriented mind wandering (Baird, Smallwood, & Schooler, 2011), reflecting an increase in focus on individuals' ongoing concerns, problems, or goals (Smallwood et al., 2009). However, other work has demonstrated that not only do higher working memory individuals experience less mind wandering but also less future oriented mind wandering than lower working memory individuals (McVay, Unsworth, McMillan, & Kane, 2013).

1.2. Emotional valence

The emotional valence of the content of mind wandering may be a critical moderator for the impact of mind wandering on primary task performance. Recent work has demonstrated a congruence between mood and the content of the mind wandering, such that sadness prior to mind wandering predicted mind wandering with sad content, and anxiety prior to the mind wandering measurement predicted mind wandering with anxious but not sad content (Poerio, Totterdell, & Miles, 2013). Likewise, mind wandering with positively valenced content predicts subsequent positive mood (Ruby, Smallwood, Engen, & Singer, 2013). However, the impact of emotional valence of mind wandering on future mood may be altered by the temporal orientation of the thought, such that past and "other-related" thoughts are predictive of decreases in mood, even when the emotional valence of the thought is positive. Mind wandering focused on the future or self is related to increases in positive affect, even when the emotional valence of the thought is negative (Ruby et al., 2013). Response patterns in the medial orbitofrontal cortex (mOFC) to affective stimuli can be used to successfully predict affective valence