Consciousness and Cognition 20 (2011) 1604–1611

Contents lists available at SciVerse ScienceDirect

Consciousness and Cognition

journal homepage: www.elsevier.com/locate/concog

Back to the future: Autobiographical planning and the functionality of mind-wandering

Benjamin Baird [a,*,1], Jonathan Smallwood [b,1], Jonathan W. Schooler [a]

[a] Department of Psychological and Brain Sciences, University of California, Santa Barbara, CA 93106-9660, United States
[b] Department for Social Neuroscience, Max Planck Institute for Human Cognitive Brain Sciences, Leipzig, Germany

ARTICLE INFO

Article history:
Received 25 February 2011
Available online 13 September 2011

Keywords:
Mind-wandering
Task unrelated thought
Prospection
Future
Self-reference
Working memory capacity
Experience sampling
Autobiographical planning

ABSTRACT

Given that as much as half of human thought arises in a stimulus independent fashion, it would seem unlikely that such thoughts would play no functional role in our lives. However, evidence linking the mind-wandering state to performance decrement has led to the notion that mind-wandering primarily represents a form of cognitive failure. Based on previous work showing a prospective bias to mind-wandering, the current study explores the hypothesis that one potential function of spontaneous thought is to plan and anticipate personally relevant future goals, a process referred to as autobiographical planning. The results confirm that the content of mind-wandering is predominantly future-focused, demonstrate that individuals with high working memory capacity are more likely to engage in prospective mind-wandering, and show that prospective mind-wandering frequently involves autobiographical planning. Together this evidence suggests that mind-wandering can enable prospective cognitive operations that are likely to be useful to the individual as they navigate through their daily lives.

1. Introduction

The capacity of consciousness to engage in mentation that is unrelated to the demands of the moment confers a great amount of mental freedom, enabling the individual to go beyond the information contained in the immediate perceptual environment (Frith & Frith, 2006; Smallwood, Obonsawin, & Heim, 2003). Given that as much as half of human thought arises in this stimulus independent fashion (Killingsworth & Gilbert, 2010; Klinger, 1999), it would seem intuitive that such thoughts would play some functional role in our lives (Schooler et al., 2011). However, evidence linking the attentional decoupling that occurs during mind-wandering to performance decrements (Smallwood, 2011; Smallwood & Schooler, 2006) has led to the suggestion that stimulus independent thought represents a form of cognitive failure that interferes with rather than contributes to accomplishing the goals of daily life (McVay & Kane, 2010).

While mind-wandering can undoubtedly derail the goals associated with accomplishing one's current task (McVay & Kane, 2009; Reichle, Reineberg, & Schooler, 2010; Smallwood, Beach, Schooler, & Handy, 2008; Smallwood, Mcspadden, & Schooler, 2008; Smallwood, O'Connor, Sudberry, & Ballantyre, 2004), the functional value of stimulus independent thought may be found in the service of more general socio-cognitive goals (Baars, 2010; Baumeister & Masicampo, 2010). Indeed, the close coupling between spontaneous thought and an individual's current concerns (Klinger, 1999; McVay & Kane, 2010; Smallwood, O'Connor, et al., 2004) led to the suggestion that the mind-wandering state is often goal-directed (Smallwood & Schooler, 2006). Furthermore, in terms of frequency, a significant proportion of the imaginative opportunities afforded

* Corresponding author.
E-mail address: baird@psych.ucsb.edu (B. Baird).
[1] Both authors contributed equally to this work.

1053-8100/$ - see front matter © 2011 Elsevier Inc. All rights reserved.
doi:10.1016/j.concog.2011.08.007

by the mind-wandering state are devoted to prospection (D'Argembeau, Renaud, & Van der Linden, 2009; Smallwood, Nind, & O'Connor, 2009). If mind-wandering is in part goal oriented, then such properties may be best served by prospective thought (Smallwood, 2010). Therefore, one functional value of mind-wandering could be its role in enabling the anticipation and planning of personally relevant future goals, a process referred to as autobiographical planning.

Consistent with the notion that future thinking during the mind wandering state involves autobiographical planning, Smallwood et al. (2011) found that a period of self-reflection increased the frequency of prospective mind-wandering. This finding is consistent with evidence showing that the process of imagining personal future events depends heavily upon the autobiographical memory system (Buckner, 2010; Schacter, Addis, & Buckner, 2007; Spreng & Grady, 2010; Suddendorf & Corballis, 2007; Tulving, 2005). Lesion studies, for example, indicate that problems in autobiographical memory retrieval are accompanied by deficits in future related thought (e.g., Klein, Loftus, & Kihlstrom, 2002; Williams, 1996) and neuroimaging studies show overlapping brain activation when individuals remember events from the past and imagine experiences that have yet to occur (Addis, Wong, & Schacter, 2007). Thus it is hypothesized that the autobiographical memory system provides key aspects of the content of prospective thought in general, and specifically in the mind wandering state. In the current context, we propose that this autobiographical information may primarily be invoked in the service of processing personal goals.

While autobiographical memory contributes to thought content, executive mechanisms are likely to be important in transforming self-memory into detailed, structured trains of thought, particularly thoughts that involve planning for the future. At a process level, future orientated thought entails a strong control component because situations that involve a working memory load reduce the frequency of future related thinking to a greater extent than thoughts of the past (Smallwood, Brown, Baird, & Schooler, 2011; Smallwood et al., 2009; Smallwood et al., 2011). Likewise, neuroimaging evidence indicates that, similar to mind wandering (e.g. Christoff, Smith, Gordon, Smallwood, & Schooler, 2009), experimenter induced future planning engages neural substrates of working memory, including the dorsolateral prefrontal cortex (Gerlach, Spreng, Gilmore, & Schacter, 2011; Spreng, Stevens, Chamberlain, Gilmore, & Schacter, 2010). Together these lines of evidence lead to the suggestion that autobiographical planning in the mind-wandering state is supported by a cooperation between the autobiographical memory system (providing the content) and executive control processes (allowing buffering and co-ordination of information) (Smallwood, Brown, et al., 2011).

2. Current study

During completion of a choice reaction time task known to be conducive to prospective mind-wandering (Smallwood et al., 2009; Smallwood et al., 2011; Smallwood, Brown, et al., 2011), participants were intermittently interrupted and asked to enter any thoughts they were having directly into an on-screen text box with the keyboard. After the conclusion of the testing session, these free-response experience sampling reports were coded by a panel of independent judges for task focus (*on task*, *off task*), temporal focus (*past, present*, *future*) and the cognitive dimensions under empirical investigation (*self-related*, *goal-directed*) using a method closely linked to previous studies (e.g. Smallwood et al., 2003).

There were three aims to the current study. Our first aim was to evaluate whether the content of off-task thought would be predominantly future-focused, as previous forced-choice experience sampling studies have suggested (e.g. Smallwood et al., 2009). Second, based on the fact that future thinking is suppressed by situations requiring attentional control (Smallwood et al., 2009), we examined whether greater working memory capacity allows for greater future thought during the mind-wandering state. Finally, our primary aim was to examine the content of experience sampling reports to assess the extent to which mind-wandering about the future involves autobiographical planning. We hypothesized that off-task future thoughts would entail a form of autobiographical planning in which goal-directed operations were executed on personally relevant content. Several predictions follow from this hypothesis: (1) individual differences in self-related thought should not account for unique variance in prospective mind-wandering when controlling for individual differences in goal-directed thought, and (2) experience sampling reports of prospective mind-wandering should involve the combination of goal-directed and self-related content.

3. Methods

3.1. Participants

Forty-seven participants completed this experiment (age range 17–32 years). All participants had normal or corrected to normal vision.

3.2. Procedure

In a counterbalanced order, participants completed a Choice Reaction Time Task (Smallwood et al., 2009) and an automated version of the Operation Span (OSPAN) task (Turner & Engle, 1989; Unsworth, Heitz, Schrock, & Engle, 2005).

3.2.1. Choice Reaction Time Task

Stimuli for this task were numeric digits, 1–9. Stimulus presentation rate was 1 item every 1750 ms (followed by 1250 ms fixation cross) and the stimuli were presented in five blocks each with a quasi-random order of presentation. Non-targets