Consciousness and Cognition xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Consciousness and Cognition

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

Daydreams incorporate recent waking life concerns but do not show delayed ('dream-lag') incorporations

Elaine van Rijn[a,*], Alexander M. Reid[a,b], Christopher L. Edwards[a], Josie E. Malinowski[c], Perrine M. Ruby[d], Jean-Baptiste Eichenlaub[a], Mark T. Blagrove[a]

[a] Department of Psychology, Swansea University, Swansea, UK
[b] Department of Psychology, University of York, York, UK
[c] School of Psychology, University of East London, Stratford, UK
[d] Lyon Neuroscience Research Center, INSERM, CNRS, University of Lyon, Lyon, France

ARTICLE INFO

Keywords:
Daydreaming
Mind wandering
Dreaming
Day-residue
Dream-lag
Memory consolidation
Functions of dreaming
Functions of sleep
REM sleep

ABSTRACT

This study investigates the time course of incorporation of waking life experiences into daydreams. Thirty-one participants kept a diary for 10 days, reporting major daily activities (MDAs), personally significant events (PSEs) and major concerns (MCs). They were then cued for daydream, Rapid Eye Movement (REM) and N2 dream reports in the sleep laboratory. There was a higher incorporation into daydreams of MCs from the previous two days (day-residue effect), but no day-residue effect for MDAs or PSEs, supporting a function for daydreams of processing current concerns. A day-residue effect for PSEs and the delayed incorporation of PSEs from 5 to 7 days before the dream (the dream-lag effect) have previously been found for REM dreams. Delayed incorporation was not found in this study for daydreams. Daydreams might thus differ in function from REM sleep dreams. However, the REM dream-lag effect was not replicated here, possibly due to design differences from previous studies.

1. Introduction

Daydreaming is a form of non-directed or task irrelevant thinking (Antrobus, Singer, & Greenberg, 1966; Christoff, Ream, & Gabrieli, 2004; McMillan, Kaufman, & Singer, 2013; Singer, 1975), in which attention shifts to internal stimuli (Cunningham, Scerbo, & Freeman, 2000). A related concept is mind wandering, which occurs when thoughts are not controlled, but instead drift off to inner thoughts, fantasies and feelings (Foulkes & Fleisher, 1975; Smallwood & Schooler, 2006). Mind wandering and daydreaming can occur both when a task is present or is not present (Christoff, 2012). A distinction has been made between mind wandering and focused daydreaming. Mind wandering is believed to lack purpose, involves decreased control over thought flow, is more spontaneous and has frequently changing content. Focused daydreaming, on the other hand, occurs when one actively imagines situations, objects and events. In the latter, the order and content of the thoughts is directed and has a narrative structure (Dorsch, 2015). The terms mind wandering and daydreaming are often used interchangeably, even though they do not always have exactly the same meaning (Christoff, 2012; Fox, Nijeboer, Solomonova, Domhoff, & Christoff, 2013). In the present study, daydream reports are collected from quiet wakefulness and can be both directed, as in focused daydreaming, or spontaneous, as in mind wandering. The terms daydreaming and mind wandering are thus used interchangeably in the current study.

Daydreaming is often related to an individual's future-related concerns (Andrews-Hanna, Reidler, Huang, & Buckner, 2010;

* Corresponding author at: Centre for Cognitive Neuroscience, Duke-NUS Medical School, 8 College Road, 169857, Singapore.
E-mail address: elaine.van.rijn@duke-nus.edu.sg (E. van Rijn).

http://dx.doi.org/10.1016/j.concog.2017.10.011
Received 17 January 2017; Received in revised form 21 September 2017; Accepted 16 October 2017

Klinger, Barta, & Maxeiner, 1980; Stawarczyk, Majerus, & D'Argembeau, 2013), and the amount of daydreaming increases with induced negative affect relating to a future concern (Stawarczyk, Majerus, & D'Argembeau, 2013). For example, Antrobus et al. (1966) played a mock news broadcast to male participants, which stated they would be drafted to the Vietnam War. Participants' subsequent daydreams involved increased concern about the implications of this broadcast for their future, and included feelings such as panic, despair, hopelessness, worry, fear, terror, anxiety, and anger. Similarly, Jordano and Touron (2017) examined the effect of priming personal, performance-related concerns on mind wandering. Female participants were primed with a math-gender stereotype threat and were subsequently probed for mind wandering during a mathematical task. This priming was found to increase task-related mind wandering, and to decrease task performance.

Whereas the general conclusion from the literature is that daydreaming predominantly relates to people's recent past and immediate future (e.g., Andrews-Hanna et al., 2010; Klinger, 2013; Stawarczyk, Majerus, & D'Argembeau, 2013), hitherto, the timescale of incorporation of waking life events and concerns into daydreams has not been systematically investigated. The first aim of the current study is to investigate the time course of such incorporations, using the sophisticated designs and methods that are used in dream research.

Similarities have been found in the content and form of dream and daydream reports (Foulkes & Fleisher, 1975), with dreaming being proposed to be an intensified form of daydreaming (Domhoff & Fox, 2015; Fox et al., 2013). Both incorporate references to events and concerns of the individual's life (Malinowski & Horton, 2014), and current waking concerns are incorporated into dreams and daydreams more than are non-concerns (Cartwright, Agargun, Kirkby, & Friedman, 2006; Hoelscher, Klinger, & Barta, 1981; Nikles II Brecht, Klinger, & Bursell, 1998; Klinger, 2013). Both have a typically audio-visual nature (Fox et al., 2013; Stawarczyk, Majerus, Maj, van der Linden, & D'Argembeau, 2011), can contain bizarre elements (Fox et al., 2013) and include both positive and negative emotions (Killingsworth & Gilbert, 2010; Marcusson-Clavertz, Cardeña, & Terhune, 2016; Nielsen, Deslauriers, & Baylor, 1991; Schredl & Doll, 1998). Although there are considerable qualitative similarities between dreaming and daydreaming, these elements appear to be more intense for dreams (Fox et al., 2013). Rapid Eye Movement (REM) nap dreams have higher sensory experience (auditory, visual and movement) than daydreams, which have higher sensory experience than N2 nap dreams. Mechanisms of imagery generation thus seem to differ between sleep and wake (Carr & Nielsen, 2015).

In investigations of the timescale of incorporations of waking life events and concerns into dreams, the occurrence in dreams of references to waking life events from 1 to 2 days before the dream, known as the day-residue effect, has consistently been reported (e.g., Blagrove et al., 2014; Nielsen, Kuiken, Alain, Stenstrom, & Powell, 2004; van Rijn et al., 2015). The current study uses a prospective diary and incorporation identification method, previously used in dream research (van Rijn et al., 2015), so as to investigate the timescale of incorporation of waking life events and concerns into daydreams. The method used here distinguishes between major concerns (MCs) and personally significant events (PSEs), a distinction emphasised by Domhoff (2017), using the structured diary method of Fosse, Fosse, Hobson, and Stickgold (2003). The main hypothesis is that daydreams will show a day-residue effect, that is, recent experiences will have a greater level of representation in daydreams than do older experiences. However, whereas for REM dreams the day-residue effect is found for PSEs and not MCs, we do not specify which of PSEs or MCs will show this day-residue effect, or whether both will.

Importantly, there is a second timescale effect of delayed incorporation into dreams of events from 5 to 7 days before the dream, known as the dream-lag effect (e.g., Blagrove et al., 2011a; Nielsen et al., 2004; see Eichenlaub, Cash, & Blagrove, 2017, for a review). The dream-lag effect is specific to REM dreams (Blagrove et al., 2011a; van Rijn et al., 2015), as it has not been found for Slow Wave Sleep (SWS) dreams (van Rijn et al., 2015) or N2 dreams (Blagrove et al., 2011a). It has been proposed that dreaming reflects the reactivation and consolidation of memories during sleep (Wamsley, Perry, Djonlagic, Babkes Reaven, & Stickgold, 2010a; Wamsley & Stickgold, 2011; Wamsley, Tucker, Payne, Benavides, & Stickgold, 2010b). The dream-lag effect has thus been speculated to represent a shift in memory representations across a series of nights from the hippocampus to neocortical structures (Nielsen & Stenstrom, 2005). Alternatively, it could reflect some other processing of emotionally important events (van Rijn et al., 2015).

The second aim of the present study is thus to assess whether the 5–7 day delayed incorporation of references to waking life also occurs for daydreams, and whether it occurs for PSEs or MCs. The second aim is important for two reasons. Firstly, so as to characterise fully the timescale of incorporations that influence daydream content and the implications of this for possible functions of daydreams. Secondly, to test the speculative possibility that the dream-lag effect might arise because thoughts about events reoccur during wakefulness on the 5–7 day timescale, and references to them thus appear in dreams on the same timescale as a result of their daytime availability (Frankland & Bontempi, 2005; Horton & Malinowski, 2015). This possibility would provide an explanation for the dream-lag effect that is not based on memory-consolidation processes during sleep, as it is possible that the effect results from a more general delayed memory availability, which is also present during wakefulness. Such an endogenous process of memory availability during wake would need to be tested for when attention is not being driven by external stimuli, and hence daydreams were used to test this in the present study.

In this study, daydreams were collected in the sleep laboratory. After daydreams were collected, participants went to sleep and REM and N2 dreams were collected during the night. This enabled data to be collected for the third aim of the current study, to replicate findings that the dream-lag effect is found for REM dreams, but not for N2 dreams (Blagrove et al., 2011a; van Rijn et al., 2015).