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Involuntary autobiographical memories are relatively more often reported during high cognitive load tasks

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ABSTRACT

Recent studies on involuntary autobiographical memories (IAMs) in daily life have shown that they are most frequently reported during daily routines (e.g. while ironing). Such studies have suggested that reporting IAMs may be influenced by the level of the ongoing task demands and availability of cognitive resources.

In two studies, we investigated the effects of cognitive load on reporting IAMs. To examine the presumed cognitive load dependency of IAMs, we utilised an often-employed experimental paradigm (Schlagman & Kvavilashvili, 2008) to elicit IAMs under conditions that differed in cognitive load. When performing a vigilance task, participants had to interrupt the task each time they experienced any spontaneous mental contents and write them down. We manipulated the level of cognitive load by either instructing (cognitive load group) or not instructing (control group) participants to perform an additional demanding task.

We compared the groups on the number of IAMs and other mental contents (non-IAM contents) recorded, as well as on the frequency of IAMs that was calculated as a proportion of IAMs in all mental contents reported by the participant. We expected that if reporting IAMs depends on the level of cognitive demands, then we should observe lower frequency of IAMs in the cognitive load group compared to the control group.

Consistently across studies, we observed a lower number of IAMs and non-IAM contents in the cognitive load group. However, IAMs unexpectedly constituted a higher percentage of all mental contents when participants were cognitively loaded. Further implications of the cognitive load effects for IAMs research and experimental methodology are discussed.

1. Introduction

Involuntary autobiographical memories (IAMs) come to mind without any conscious attempt at retrieval (Berntsen, 2010; Mace, 2007), and appear to be retrieved effortlessly in a non-strategic way (e.g. Uzer, Lee, & Brown, 2012). They are distinct from voluntary memories that are the result of an intention to retrieve a memory and typically, although not always (see Barzykowski & Staugaard, 2016, 2017; Uzer et al., 2012), involve an effortful search (Botzung, Denkova, Ciuciu, Scheiber, & Manning, 2008; Conway & Loveday, 2010).

While IAMs are presumed to be retrieved automatically, little is known about their accompanying cognitive mechanisms (e.g. cognitive load dependency). According to Berntsen (2009, p. 86), the question of how and why IAMs come to mind may be considered as one of the most intriguing issues in relation to understanding IAMs. Although there is a growing body of research concerning cognitive load and involuntary thoughts (e.g. Forster & Lavie, 2009; McKiernan, D'Angelo, Kaufman, & Binder, 2006; Smallwood, Nind, & O'Connor, 2009) or intrusive memories (e.g. Krans, Langner, Reinecke, & Pearson, 2013; Nixon, Nehmy, & Seymour, 2007), to the best of the authors' knowledge there are only two studies that addressed the cognitive load dependency of IAMs (Ball, 2007; Vannucci, Pelagatti, Hanczakowski, Mazzoni, & Paccani, 2015).

Extending knowledge about the cognitive mechanisms that underlie IAMs is an important step toward gaining insight into the nature and functioning of memory processes and human cognition. For example, involuntary memory processes may have a significant effect on emotion regulation (e.g. Gross, 2001), mood, and well-being (e.g. Kvavilashvili & Schlagman, 2011). They are also important in relation to identity (Rasmussen & Berntsen, 2009) and mental disorders, such as depression (Moulds & Krans, 2015; Watson, Berntsen, Kuyken, & Watkins, 2013) or PTSD (Berntsen, 2015). The empirical examination of IAMs under well-controlled experimental conditions may thus contribute to everyday life. The aim of the present study was to compare the frequency with which IAMs are reported during cognitively-demanding and cogni-

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tively-undemanding activities (Berntsen, 1998, 2009; Schlagman, Kvavilashvili, & Schultz, 2007).[1]

1.1. Cognitive load dependency of reporting involuntary autobiographical memories

Vannucci et al. (2015) pointed out that the issue of why IAMs come to mind pertains to a broader question; namely, given that IAMs occur automatically in response to incidental external and internal cues, why are we not constantly flooded by them in daily life? It is intriguing to ask what keeps these spontaneous memories at bay and enables us to carry on with our daily activities uninterrupted. The present paper aimed to verify one possible answer to this question; namely, that cognitive load related to many everyday activities may preclude reporting IAMs. IAMs should thus be reported more frequently in less cognitively-demanding conditions compared to more demanding conditions. This approach may be called the *cognitive load dependency view* (also *cognitive load hypothesis* by Vannucci et al., 2015). The results of existing studies on IAMs in which a naturalistic diary method was used (e.g. Berntsen, 1996) are in accordance with this view. They have shown that involuntary retrieval is more likely to be reported when attention is diffuse (Berntsen, 1996, 2009), and the individual is engaged in an automatic activity with low attention and cognitive resource demands (e.g. washing-up, walking, ironing). Also, results from studies on task-unrelated thoughts have shown that their frequency declines as cognitive load increases (McKiernan et al., 2006).

There may be several possible effects of cognitive load on the frequency of IAMs. Various effects may operate simultaneously, and thus the explanations proposed below are not mutually exclusive. First, Berntsen (2009, p. 97) suggested that IAMs may be generated through the same processes that are involved in monitoring and control of cognitively-demanding activities. IAMs and control mechanisms may thus compete for the same cognitive resources (see Mandler, 1994 for a similar argument). More specifically, Schlagman and colleagues proposed (Schlagman, Kliegel, Schulz, & Kvavilashvili, unpublished) that the ongoing activity that requires cognitive control reduces the frequency of IAMs by limiting the amount of working memory needed to process them. Second, Kvavilashvili and Mandler (2004) suggested that a diffuse state of attention induced by low cognitive load boosts the likelihood of processing cues that may act as potential triggers for IAMs, thereby enhancing spreading activation. Support to this idea comes from several studies that indicate that the retrieval of IAMs relies strongly on the priming and spreading activation mechanisms (e.g. Barzykowski & Niedźwieńska, 2017; Mace, 2005). Third, Baird and colleagues suggested (Baird, Smallwood, Fishman, Mrazek, & Schooler, 2013) that the participant's ability to monitor their flux of awareness and extract content of thoughts from the stream (including autobiographical contents) may be impaired by cognitively demanding tasks. Lending support to this suggestion, they found that cognitive load indeed undermined the ability to notice the content of thoughts. In a similar vein, a recently published study by Barzykowski and Staugaard (2017) suggests that any autobiographical memory needs to pass an awareness threshold to reach one's consciousness and this threshold may be modified by different factors. One of the factors is the expectation that a memory will occur which results in monitoring the stream of awareness more extensively. Barzykowski and Staugaard (2017) demonstrated (for similar results see also Barzykowski & Niedźwieńska, 2016; Vannucci, Batool, Pelagatti, & Mazzoni, 2014) that when an individual expects memories to occur and monitors the flux of thoughts more thoroughly, IAMs are more likely to be retrieved. Cognitive load related to the ongoing activity may be another factor that influences the awareness threshold. It contrast to the expectations that memories will appear, cognitive load should elevate the threshold. Whatever processes are actually induced by cognitive load, all the above explanations imply that reporting IAMs may be substantially limited by the high level of the ongoing task demands.

A definite test of the cognitive load dependency of reporting IAMs requires a study in which cognitive load is experimentally manipulated during the retrieval of IAMs. Ball (2007, Experiment 2) was the first who manipulated cognitive load in a laboratory setting. As he himself pointed out, the study was designed "to examine the role of attention in the elicitation of involuntary autobiographical memories by using the same word-association task under two different attention conditions" (Ball, 2007, p. 142).[2] He expected that if IAMs are more likely to be retrieved under low attention load, then they should be faster reported in that condition compared to a condition of high attention load. He found that involuntary memories were indeed more quickly elicited under the condition of low cognitive load. This finding lent first support to the notion that IAMs are affected by attention load. However, as Ball (2007, Experiment 2) measured only the speed with which IAMs were retrieved rather than the frequency of reporting them, his study did not directly address the aforementioned need of testing the cognitive load dependency of reporting IAMs.

A recent study by Vannucci et al. (2015) partially addressed the need of such test. They employed an often-used experimental procedure designed to elicit involuntary memories in the laboratory (Schlagman & Kvavilashvili, 2008). The procedure is a modification of the word-cue method (Crovitz & Schiffman, 1974), in which participants are exposed to short verbal phrases, some of which may incidentally trigger involuntary memories. Vannucci et al. (2015) experimentally manipulated the number of cues presented during the experimental session (i.e. the frequency/rate with which verbal cues were presented) and interpreted this manipulation as leading to different levels of cognitive load. As a result of the experimental manipulation, there were three conditions: (1) frequent cues (high cognitive load), (2) infrequent cues (low cognitive load), and (3) infrequent cues, but with additional tasks involving arithmetic operations (high cognitive load). As the authors expected, more IAMs were reported by the participants in the low cognitive load condition (infrequent cues) compared to the high cognitive load conditions (frequent cues and infrequent cues with arithmetic operations). Vannucci et al. (2015, p. 1082) interpreted these results as 'unequivocal support for the cognitive load hypothesis'. However, as their study "was designed to assess the effects of changing the cue frequency in the IAMs task" (Vannucci et al., 2015, p. 1079) rather than the effects of the direct manipulation of cognitive load, it can be argued that they provided only partial support for this hypothesis. As they manipulated the rate with which cues were presented, their findings are more open to explanations that are not related to cognitive load. For example, it may be speculated that slowing down the presentation of cues would render IAMs more likely because it would be easier for the participants to mentally time travel between different contexts and periods of time at a slower rate.

Therefore, the present study was designed to test the cognitive load dependency of IAMs in a manner that would overcome limitations of the interpretation of Vannucci et al. (2015) and Ball (2007, Experiment 2) findings. Most importantly, in order to directly manipulate cognitive

[1] Please note that it is unclear whether cognitive load may influence the retrieval of IAMs (e.g. forming and developing an involuntary autobiographical memory) or/and the ability to extract autobiographical content from the stream of consciousness and report it (i.e. post-retrieval processes). For this reason, throughout the present paper we decided to use the term 'reporting IAMs' to refer to giving a verbal (e.g. written or spoken) account of IAMs that one has experienced. The procedures employed in previous studies of IAMs (including the present study) do not allow us to unequivocally distinguish between the effects of cognitive load on the retrieval and post-retrieval processes (see the General Discussion section for a detailed explanation).

[2] The word-association tasks involves the experimenter presenting a word to the participant who must immediately provide the first thought that comes to mind associated with this word. Ball (2007) used the continuous word-association task that requires the participant to provide an initial association/response and then to continue giving a new association to each response that preceded it.