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Short Communication

Involuntary future projections are as frequent as involuntary memories, but more positive

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ABSTRACT

Mental time travel (MTT) is the ability to mentally project oneself into one's personal past or future, in terms of memories of past events or projections of possible future events. We investigated the frequency and valence of involuntary (spontaneously arising) MTT in the context of trait worry. High ($N = 18$) and low ($N = 16$) worriers recorded the frequency and valence of involuntary memories and future projections using a structured notebook and completed measures probing individual differences related to negative affectivity. Involuntary future projections were as frequent as involuntary memories. We found a positivity bias for both past and future MTT, in that fewer negative events were reported than positive or neutral ones. This positivity bias was greater for future than for past events. Individual differences related to negative affectivity were positively associated with the proportion of negative events, indicating a reduced positivity bias in individuals with a general tendency to experience negative affect.

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1. Introduction

Mental time travel (MTT) is defined as the ability to travel mentally through time, to relive events in one's personal past through autobiographical memories or to prelive possible events in one's personal future through future projections (Tulving, 2002; Wheeler, Stuss, & Tulving, 1997). MTT can be either initiated voluntarily or arise spontaneously or involuntarily (Berntsen & Jacobsen, 2008). According to an emerging view in the literature, past and future MTTs are constructive processes based on the same memory system (Suddendorf & Corballis, 2007), and it is suggested that autobiographical memory may have evolved primarily because it enables us to envision our future (e.g., Schacter & Addis, 2007; Schacter, Addis, & Buckner, 2007). This view has been supported by both neuroimaging and behavioral studies showing that remembering past events and imagining future events is largely based on the same neural networks (e.g., Addis, Wong, & Schacter, 2007), is affected in similar ways in response to a variety of experimental manipulations (e.g., D'Argembeau and Van der Linden, 2004; Larsen, 1998) and shows similar deficits in mental disorders (e.g., D'Argembeau, Raffard, & Van der Linden, 2008; Williams et al., 1996). Based on this, we could expect past and future MTT to show many similarities and to be affected similarly by experimental manipulations as well as everyday conditions.

The present study examines the frequency and emotional valence of spontaneously arising MTT, past and future. Below, we describe the phenomenon of involuntary MTT and related thought processes, such as mind wandering and daydreaming. We review research that has examined the frequency and valence of these thought processes and relate this to individual differences measures, such as personality and trait worry, before making predictions for the present study.

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1.1. Frequency of involuntary MTT

Involuntary memories and future projections belong to a category of spontaneous thought processes, such as daydreaming, task irrelevant thought, mind wandering, fantasy or stimulus independent mentation, that arise in the absence of specific situational demands (Johannesen & Berntsen, 2010). In contrast to voluntary MTT, involuntary MTT is an associative and direct retrieval process, relying less on executive and attentional processes and more often occurring when a person is not concentrating on a certain task (Berntsen, 2009; Conway, 2005; Heeren, Van Broeck, & Philippot, 2009; Williams et al., 2006). Studies on involuntary memories indicate that they are common in everyday life (e.g., Berntsen, 1996; Rubin & Berntsen, 2009) with individuals experiencing on average around 20 a day, but with great individual variability (Rasmussen & Berntsen, 2011). Little is known about the frequency of involuntary future projections. Observations reported by Berntsen and Jacobsen (2008) suggest that they are as common in everyday life as involuntary memories. However, in that study, participants assessed the frequency of involuntary MTT retrospectively and quite casually as part of an interview following a diary study. D'Argembeau, Renaud, and Van Der Linden (2011) examined the frequency of future-oriented thoughts on a given day and found that participants experienced on average 59 future-oriented thoughts, although there was high individual variability in the numbers reported. However, as participants in that study did not separate recordings for involuntary versus voluntary thought, the frequency of involuntary future projections compared to involuntary memories is still unknown. In line with the view that past and future MTT are constructive processes, based on the same memory system, we expect future projections to be at least as common as their memory counterparts. On the other hand, studies on mind wandering indicate that the mind wanders more to the impending future than to the past (Smallwood, Nind, & O'Connor, 2009). Therefore, it is possible that future involuntary MTT is more frequent than past involuntary MTT. The primary purpose of the present study was to examine the frequency of future involuntary MTT compared with past involuntary MTT.

1.2. Positivity bias in MTT

Studies have consistently found a positivity bias in autobiographical memory recall, in that when asked to retrieve personal events, 50% or more of them tend to be positive, whereas much fewer tend to be negative or neutral. This positivity bias applies to both voluntary and involuntary recall (see Walker, Skowronski, & Thompson, 2003b for review). Studies also find mind wandering and daydreaming to show a positivity bias. For instance with regards to mind wandering, one study found that in daily life people's minds tend to wander more to pleasant topics than to neutral or negative ones (Killingsworth & Gilbert, 2010), and in the general population, self-report measures of daydreaming style suggest that having a more positive daydreaming style is the norm (Huba, Aneshensel, & Singer, 1981). This positivity bias may reflect a basic motivational tendency for people to seek out positive experiences and avoid negative ones, to maintain or enhance a positive view of oneself, and to protect the self against threatening information (Walker & Skowronski, 2009; Walker, Skowronski, & Thompson, 2003b). Related to this is the notion of "positivity offset," that at very low levels of input into the affective system, the affective output of positivity is greater than the output of negativity. Therefore, at low levels of activation (e.g., when confronted with neutral stimuli) individuals show a consistent tendency to respond in a mildly positive fashion, with the result that the motivation to approach is stronger than the motivation to avoid (Cacioppo & Gardner, 1999). The positivity bias in autobiographical memory recall has been found to be even stronger for future projections than for memories, which may be because of more uncorrected positive illusions for the future than for the past (Berntsen & Bohn, 2010). That is, at the same time our affective system is characterized by positivity offset, the affective system also shows heightened sensitivity to negative information, in that there is a propensity to react more strongly to negative than to positive stimuli, as this increases chances of survival (Cacioppo & Gardner, 1999). Thus, highly negative events are very well remembered (see e.g., McGaugh, 2003 for review), which corrects or balances the positivity illusion. However, as the future is unknown, there are no negative events to correct the positivity illusion for the future, and therefore there are more uncorrected positive illusions for the future than for the past. Indeed, according to Cacioppo and Gardner (1999), the evolutionary tendency of positivity offset manifests itself in the tendency to expect generally positive outcomes for unknown future events.

The positivity bias in MTT is often found to be reduced in the context of negative affect. For instance, the positivity bias in MTT has been found to be reduced in individuals with anxiety, depression or dysphoria, or individuals that generally feel affectively low (e.g., Burke & Mathews, 1992; McLeod & Byrne, 1996; Ritchie, Skowronski, Hartnett, Wells, & Walker, 2009; Walker, Skowronski, Gibbons, Vogl, and Thompson, 2003a), as well as for the tendency to engage in thought suppression (Neufeind, Drischel, Astell, & MacLeod, 2009) and the personality trait neuroticism (Rasmussen & Berntsen, 2010; Rubin, Boals, & Berntsen, 2008). In addition, low attentional control in the in the context of high trait anxiety appears to be associated with a reduced ability to ignore negative and threatening information (Reinholdt-Dunne, Mogg, & Bradley, 2009).

Whereas the personality trait neuroticism has been found to be associated with a reduced positivity bias, the personality traits openness to experience and extraversion have been found to be positively associated with positive emotion in autobiographical memory (Berntsen, Rubin, & Siegler, 2011; Rubin & Siegler, 2004; Rubin et al., 2008; but see Rasmussen & Berntsen, 2010). Thus, it seems that measures related to negative affect (e.g., neuroticism) are related to less positive emotion during past MTT, whereas measures related to positive affect (e.g., extraversion) are related to more positive emotion during past voluntary MTT. Similarly, a more positive daydreaming style has been found to be related to the personality trait openness to experience (Zhiyan & Singer, 1996–1997), whereas a more negative daydreaming style characterizes individuals with

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