



## Personality and mental time travel: A differential approach to auto-noetic consciousness

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### ARTICLE INFO

#### Article history:

Received 14 November 2007  
Available online 27 May 2008

#### Keywords:

Episodic future thinking  
Auto-noetic consciousness  
Mental time travel  
Personality

### ABSTRACT

Recent research on auto-noetic consciousness indicates that the ability to remember the past and the ability to project oneself into the future are closely related. The purpose of the present study was to confirm this proposition by examining whether the relationship observed between personality and episodic memory could be extended to episodic future thinking and, more generally, to investigate the influence of personality traits on self-information processing in the past and in the future. Results show that Neuroticism and Harm Avoidance predict more negative past memories and future projections. Other personality dimensions exhibit a more limited influence on mental time travel (MTT). Therefore, our study provide an additional evidence to the idea that MTT into the past and into the future rely on a common set of processes by which past experiences are used to envision the future.

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### 1. Introduction

“Mental time travel” (MTT), i.e., the capacity to remember our past experiences and to project ourselves into possible future events, is considered as a crucial ability for human-beings (Gilbert & Wilson, 2007; Schacter, Addis & Buckner, 2007; Suddendorf & Corballis, 1997; Suddendorf & Corballis, 2007; Wheeler, Stuss & Tulving, 1997). Mental time travel importantly involves auto-noetic consciousness, i.e., “the kind of consciousness that mediates an individual’s awareness of his or her existence and identity in subjective time extending from the personal past through the present to the personal future” (Tulving, 1985, p. 1). Auto-noetic consciousness is thought to allow not only the subjective experience associated with re-experiencing a past event but also the ability to project oneself forward in time to mentally “pre-experience” an event (Wheeler et al., 1997). However, although the ability to consciously remember past events (i.e., episodic memory) has been extensively investigated (Tulving, 2002; Wheeler et al., 1997), relatively few studies have examined what Atance and O’Neill called “episodic future thinking,” which is “the ability to project the self forward in time to pre-experience an event” (Atance & O’Neill, 2001, p. 537). As argued by previous researchers, mental time travel into the future and into the past may rely on a common set of processes by which past experiences are used adaptively to imagine perspectives and events beyond those that emerge from the immediate environment (Atance & O’Neill, 2001; Buckner & Carroll, 2007; Hassabis & Maguire, 2007; Okuda et al., 2003; Wheeler et al., 1997). The past may indeed constrain the generation of possible and likely futures, by supplying expectancies and determining what is plausible (Johnson & Sherman, 1990). Additionally, imagining future events involves combining some basic elements (e.g., actors, objects,

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and actions), some of which are extrapolations from past events while others come from general semantic knowledge, to generate potential scenarios (D'Argembeau and Van der Linden, 2006).

Findings suggesting a relationship between episodic memory and episodic future thinking can be summarized as follows. First, developmental research suggests that episodic memory and episodic future thinking emerge approximately at the same time (around age of three to four) (Atance & O'Neill, 2005; Busby & Suddendorf, 2005; Levine, 2004; Suddendorf & Busby, 2005). Second, patients with brain damages who are unable to recall their personal past typically have difficulties in imagining possible future experiences (Hassabis, Kumaran, Vann & Maguire, 2007; Klein, Loftus & Kihlstrom, 2002; Tulving, 1985). Third, some functional neuroimaging data suggest that common cerebral substrates might underlie thinking about the future and past (Addis & Schacter, 2008; Addis, Wong & Schacter, 2007; Botzung, Denkova & Manning, in press; Okuda et al., 2003; Szpunar, Watson, & McDermott, 2007) although there are specific areas in the frontal pole and medial temporal lobes that are more involved with the future than with the past (Okuda et al., 2003). Finally, the factors that influence the phenomenal characteristics associated with remembering, such as the emotional valence of the events and their temporal distance from the present, have similar effects on the phenomenal characteristics associated with projecting oneself into the future (D'Argembeau and Van der Linden, 2004).

An additional important element of validation for linking past and future thinking is to investigate the relationship between MTT into the past and into the future from a personality theory perspective. This is the purpose of the present study.

The existence of relations between personality and emotion is well documented, especially between personality dimensions associated with the Behavioral Activation System (BAS) (e.g., extraversion and novelty seeking) and positive affect, and between personality dimensions associated with the Behavioral Inhibition System (BIS) (e.g., neuroticism and harm avoidance) and negative affect (Corr, 2002; Gable, Reis & Elliot, 2000; Heponiemi, Keltikangas-Jarvinen, Puttonen & Ravaja, 2003). Many studies reported also that personality consistently modulates the interactions between emotion and cognition (Bradley & Mogg, 1994; Gomez & Gomez, 2002; Rusting, 1999). For instance, Gomez and Gomez (2002) found that high-BIS subjects generated more negative words in a word-fragmentation task, recognized more negative words in a word recognition task and recalled more negative words in a free word-recall task than low-BIS subjects, whereas high-BAS subjects displayed, recognized and recalled more positive words in the three tasks than low-BAS subjects. These results indicate that BIS is mainly associated with the processing of unpleasant information, while BAS is mainly associated with the processing of pleasant information, and more generally, that cognitive processing of emotional information is modulated by personality.

The majority of the studies on this topic investigated the relationships between personality and emotion with tasks involving mainly semantic rather than episodic memory. However, episodic memory is a central feature of auto-noetic consciousness, i.e., a crucial element of self-representation in time. Indeed, a few studies have shown that neuroticism is particularly associated with the preferential processing of negative information about the self (Furnham & Cheng, 1996; Martin, Ward & Clark, 1983; Ruiz Caballero & Bermudez, 1995). However, it should be mentioned that all information related to the self is not necessarily episodic and may instead be personal semantic. Instead, episodic memory (and auto-noetic consciousness) refers to memory for events that are specific in time and place that can be (p)re-experienced. Recent data also indicate that some personality dimensions are related to the phenomenology of episodic memory. Rubin and Siegler (2004) found that, of all the domains and facets of personality assessed by the NEO PI (Costa & McCrae, 1992), openness to feelings showed by far the strongest relation to the phenomenology of memory for past events, correlating with measures of belief in the accuracy of memories, sense of recollection, amount of sensory details, and feeling of emotions while remembering.

As opposed to neuroticism, neither the role of extraversion nor the other personality dimensions on positive information about the self have ever been investigated. Moreover, no study has ever investigated the role of neuroticism and extraversion on the ability to project oneself into the future. Therefore, this study aims to investigate the influence of personality traits (especially neuroticism and extraversion) on episodic past and future thinking.

More specifically, based on previous findings we hypothesize that people with high levels of neuroticism will generate a greater amount of negative projections during a verbal fluency task, i.e., the quantity task (*hypothesis 1a*) and will write projections with a more negative content in a story completion task, i.e., the preferential content task (*hypothesis 1b*). Conversely, we hypothesize that people high in extraversion will generate a greater amount of positive projections during the quantity task (*hypothesis 2a*) and will write projections with a more positive content in the preferential content task (*hypothesis 2b*). By extension, we also hypothesize to find the same links for harm avoidance (HA) and novelty seeking (NS) dimensions of Cloninger's model as these two dimensions are strongly related to neuroticism and extraversion, respectively (De Fruyt, Van De Wiele & Van Heeringen, 2000). Thus HA should be related to a greater number of negative projections (*hypothesis 3a*) and projections with a more negative content (*hypothesis 3b*) while NS should be related to a greater number of positive projections (*hypothesis 4a*) and projections with a more positive content (*hypothesis 4b*). The investigation of the influence of the other personality dimensions is purely exploratory.

As regards the phenomenal characteristics associated with MTT, we hypothesize that people with high levels of openness (*hypothesis 5*) and self-transcendence (ST; *hypothesis 6*) will report more phenomenal characteristics for both past and future. Indeed, Rubin and Siegler (2004) have found that openness was related with the phenomenology of autobiographical memory. Moreover, ST relates to imagery abilities (Cloninger, Svrakic & Przybeck, 1993) which in turn affects phenomenal characteristics of MMT (D'Argembeau and Van der Linden, 2006). The investigation of the influence of the other personality dimensions on phenomenal characteristics is exploratory.

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