

The Odyssey of Episodic Memories: Identifying the Paths and Processes Through Which They Contribute to Well-Being

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Abstract

Objective: This research highlights the processes through which lasting episodic memories and their characterized level of need satisfaction (autonomy, competence, and relatedness) can impact well-being, both at the situational level and over time.

Method: Study 1 ($N = 92$, $M_{\text{age}} = 42.07$ years, 72% female) investigated the effect of the unconscious activation of a personal episodic memory on situational well-being using a subliminal priming procedure. Study 2 ($N = 275$, $M_{\text{age}} = 22.45$ years, 84% female) followed the odyssey of an episodic memory by examining at various points over time its abstraction into perceptions of general need satisfaction and its long-term effect on well-being.

Results: Study 1 revealed that the activation of a need-satisfying memory produced an immediate increase in well-being, whereas the triggering of a need-thwarting memory led to an immediate decrease in well-being compared to controls. Study 2 revealed little influence of individual differences, but need satisfaction in episodic memories had a significant cumulative impact on well-being at different points in time over months and was abstracted into greater perceptions of general need satisfaction over time.

Conclusion: Results provide convincing evidence for the directive function of memories on well-being, both at the situational level and over time.

Keywords: Episodic memories, well-being, need satisfaction, subliminal priming, memory function

The death of my dog. I was only a little girl when this event occurred. I remember waking up in the morning and looking for my dog without finding her. My father then told me that my aunt had come and had taken her. Then, I went to the orthodontist and coming back from my appointment, my father confessed that my dog died during the night and that he had put her body in the garage so that I wouldn't know. Since then, I stopped trusting people. My dog was my best friend since I was born. (18-year-old female participant's memory of an event that occurred 8 years ago)

Conflict with the administration of the senior residence where I live. After several attempts at resolving the conflict and no result, I made a complaint at the provincial housing authority for non-peaceful enjoyment of the property where I live. The administration responded a couple of months later, requesting my eviction under false motives. I won everything and obtained an important compensation. The judge saw the dishonesty of the administration. I keep from

those times a memory that has been painful, but what I keep today is the pride of having had the courage to fight for myself. (69-year-old female participant's memory of an event that occurred 4 years ago)

What is the magnitude of the impact of those kinds of memories on people's well-being? And through what mechanisms do they influence well-being and for how much time? Is it only the immediate consequences of experiencing a significant life event that impacts well-being, or does the memory of that event continue to influence well-being over time, several months or years after the event has occurred? The present research seeks to provide elements of response to these questions and highlight the

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paths and processes through which memories can influence well-being.

Access to several episodic memories is typically quickly lost in a day or two, as most of them only serve short-term goals (Conway, 2009), such as helping you track whether you already brushed your teeth or ate your lunch. However, some other episodic memories will be remembered for weeks, months, or years (Brewin, Gregory, Lipton, & Burgess, 2010; Conway, Singer, & Tagini, 2004). These memories are mostly about significant, unique, and affectively charged past events, such as the ones presented in the introduction of this article. They are experience-near; that is, they include images and other sensory details of a specific event, as well as the affective and motivational components (i.e., experiential components) representative of what has been experienced during this event and how (Brewin et al., 2010; Conway, 2009; Philippe, Koestner, Beaulieu-Pelletier, & Lecours, 2011; Philippe, Koestner, Beaulieu-Pelletier, Lecours, & Lekes, 2012). Just as memories lost in a few days help orient people toward their immediate or short-term goals, these memories are kept in long-term memory because they have personal significance for the person, as they are related to the person's current medium- or long-term goals, concerns, or self-images (Conway et al., 2004; Singer & Salovey, 1993).

These memories get integrated within various levels of abstraction of the self-memory system and contribute to new self-knowledge (Conway, 2009; Conway & Pleydell-Pearce, 2000). For example, the memory of a social event where you have been particularly talkative can contribute to building stable perceptions of yourself as an extraverted person or stable world-views (e.g., people are friendly). Once this self-knowledge has emerged or the goal has been achieved or is not relevant to the person anymore, access to the episodic memory is typically lost and only the stable, abstract conceptual self-knowledge remains accessible (e.g., I am an extravert).

Thus, episodic memories represent transient processes of personality that orient the development of new self-knowledge over time. Some memories will quickly turn into that self-knowledge in a matter of weeks or months, while others will take years. However, for the time that the episodic elements are preserved and remain accessible, they can be activated by environmental cues matching their content or whenever the person deliberately retrieves the memory (Brewin et al., 2010; Conway & Pleydell-Pearce, 2000) and can orient people's behavior, attitudes, and feelings, and, overall, their psychological adjustment and well-being. As such, episodic memories represent unique information that does not entirely reflect the person's current conceptual self-knowledge (Klein, Cosmides, Tooby, & Chance, 2002; McAdams & Pals, 2006). Consequently, they have a unique predictive value for people's future behavior, adjustment, and well-being, over and above people's current conceptual self-knowledge variables, such as traits, attitudes, or general perceptions (Kuwabara & Pillemer, 2010; Philippe, Koestner, Beaulieu-Pelletier, et al., 2011; Philippe et al., 2012; Philippe, Koestner, & Lekes, 2013).

Episodic memories are expected to have an effect on well-being through various processes. A first way is through the nar-

rated and reconstructive processing of memories. Much research has shown that the way people frame and structure, through personal narratives, key episodic memories of their lives into autobiographical memories and life stories can strengthen identity and provide greater self-coherence, which translates into greater well-being (McAdams, 2001). These narratives can also yield pessimistic or diffuse self-views, which hinder well-being (e.g., McAdams, Reynolds, Lewis, Patten, & Bowman, 2001). This process typically occurs consciously and deliberately through autobiographical reasoning (Habermas & Bluck, 2000) and involves key or turning point memories of one's life. A second process, which has received much less attention, and that is the focus of the present research, is that memories can influence well-being through their frequent daily activation. According to the self-memory system (Conway & Pleydell-Pearce, 2000; also see Brewin et al., 2010), sensory-based episodic memory elements get constantly triggered in the self-memory knowledge base without necessarily coalescing into a reminiscence experience. These memories, however, can direct people's attitudes, intentions, and behaviors mostly without their awareness, through what Pillemer (1998, 2003) calls a directive function. In addition, this effect can occur for all types of episodic memories preserved, although a greater effect can be expected from more important memories, such as self-defining memories (Singer & Salovey, 1993) or memories at the core of one's life story (McAdams, 2001).

Philippe and his colleagues (Philippe, Lecours, & Beaulieu-Pelletier, 2009; Philippe, Koestner, Beaulieu-Pelletier, et al., 2011; Philippe et al., 2012) have suggested that one component of memories that orients this effect is their experiential component, representing (although not necessarily fully corresponding) what the person has experienced during the initial event (Conway, 2009; Wheeler, Stuss, & Tulving, 1997). People's recalled emotional experiences of a past event or its valence (e.g., Comblain, D'argembeau, & Van der Linden, 2005; Kuwabara & Pillemer, 2010), and the satisfaction or the thwarting of three core psychological needs (autonomy, competence, relatedness) identified by self-determination theory (Deci & Ryan, 2000), appear to correspond to such experiential components (Philippe, Koestner, Beaulieu-Pelletier, et al., 2011; Philippe, Koestner, Lecours, et al., 2011).

Accordingly, a rising number of studies have shown that memories' valence or memories' need satisfaction can affect future attitudes, intentions, behaviors, and well-being, possibly without people's awareness. Kuwabara and Pillemer (2010) found that, controlling for preexisting attitudes toward the university, students who reminisced about a positive university memory were more likely than controls to donate to their university rather than to another charity. In addition, when students were asked to provide the reasons of their donation, no students invoked the recall of their memory as having influenced their donation, which provides some evidence that this effect occurred outside of their awareness. Similarly, Biondolillo & Pillemer (2014) found that students asked to recall a positive memory that would motivate them to exercise actually reported

higher levels of exercise in the week following the recall compared to controls. Again, when asked how they had motivated themselves to exercise, no participants mentioned having used or brought to mind the memory recalled 1 week before as a motivator. There is also evidence that memories can alter well-being in a similar fashion. Using a scrambled sentences task, Philippe et al. (2012) supraliminally exposed participants to keywords derived from an episodic memory they had described 2 weeks before. Participants exposed to keywords of their own need-satisfying memory—compared to controls exposed to keywords derived from the need-satisfying memory of someone else—reported an immediate increase in well-being. In contrast, participants exposed to keywords of their own need-thwarting memory reported decreases in well-being compared to controls. The few participants (4%) who had noticed that some of the keywords to which they were exposed were derived from their memory were removed from the analyses, thus ensuring that the effect obtained occurred outside of the participants' awareness. In all these studies, however, unawareness of the participants was only inferred. The possibility that participants did notice the effect of their memory or did recall a memory purposefully to motivate them, but forgot about it, remains plausible. The methods used in those studies could not guarantee that the effect occurred unconsciously, since a memory was purposefully recalled or keywords derived from a memory were explicitly shown. The present research will address this shortcoming by using for the first time a subliminal priming method, wherein stimuli are only briefly shown for milliseconds. The immediate effect of this unconscious activation on well-being will be assessed.

On the Long-Term Impact of Memories

If memories have an immediate effect on situational well-being upon their activation, some memories that are frequently activated in a person's life should therefore frequently exert their effect and, over time, lead to enduring changes in well-being. These memories could be more frequently activated because they are more frequently thought about or because various external cues in the person's environment are more likely to activate them (Conway & Pleydell-Pearce, 2000; Philippe et al., 2012). Recently, Philippe, Koestner, Beaulieu-Pelletier, et al. (2011) showed that need satisfaction in self-defining memories, that is, memories that are frequently activated or thought about, was positively associated with various measures of well-being. Other studies have also shown that the presence of narrative themes similar to the need satisfaction components in memory descriptions, such as agency (Adler, Skalina, & McAdams, 2008), communion (Bauer & McAdams, 2004), or intrinsic themes (Bauer, McAdams, & Sakaeda, 2005) were associated with well-being. However, only two studies to our knowledge have shown that experiential components of specific memories could predict long-term changes in well-being over months (Milyavskaya, Philippe, & Koestner, 2013) and years (Philippe et al., 2012).

Both studies showed that need satisfaction in significant memories could predict increases in well-being over time, even after controlling for traits or people's general perceptions of need satisfaction in life.

While these studies provide some evidence for the long-term impact of experiential components of memories on well-being, a number of issues remain unresolved. First, all studies start investigating the effect of a memory after the memory is formed and after the event of the memory has occurred. Therefore, it has been yet impossible to know whether certain characteristics of the person, such as his or her traits or general perceptions (self-knowledge), orient the encoding or the recall of memories characterized by certain affective and motivational components. A second issue is that it is unknown for how much time a memory has an effect on well-being, from the initial aftereffects of the experienced event encoded in memory to several months later. The present research proposes to follow the odyssey of an episodic memory even before the event of that memory is experienced and encoded as a memory, examine its immediate aftereffects, and continue following its cumulative impact on well-being over months.

The Present Research

The present research has two purposes. A first objective was to investigate whether a memory can be activated unconsciously through a subliminal priming procedure and to examine its immediate effect on situational well-being. Study 1 will use a subliminal priming procedure and expose participants to keywords derived from a key episodic memory that they have described 1 week before. It will then be investigated whether the level of need satisfaction of the memory primed predicts situational well-being as assessed following the priming. A second purpose of the present research was to better understand how long a specific memory can prospectively influence well-being, while controlling for various person- and memory-level variables measured prior to the occurrence of the event of the memory. Study 2 measured traits, general perceptions of need satisfaction, and well-being, as well as need satisfaction in a past holiday memory prior to the current year's holidays. Immediately after the holidays, participants described a significant event that occurred during those recent holidays and were assessed on general need satisfaction and well-being and again at 1 and 2 months after the holidays. Study 2 therefore allowed us to highlight the precise path through which memories influence well-being over time and how need satisfaction in a specific holiday memory can translate into general perceptions of need satisfaction and into well-being over months.

STUDY 1

Participants took part in an online study and were initially asked to describe a self-defining episodic memory (a highly significant memory that they frequently think about) and to rate the extent

to which they experienced during the event of their memory the thwarting or the satisfaction of the three psychological needs core to self-determination theory.¹ One week later, participants completed an online task in which they were subliminally primed with keywords derived either from their own episodic memory or from the episodic memory of another participant. Priming of a need-satisfying episodic memory should immediately increase situational well-being as compared to a control group of participants primed with the need-satisfying memory of another participant. Conversely, priming of a need-thwarting memory should immediately decrease situational well-being as compared to a control group primed with the need-thwarting memory of another participant. To increase the external validity of our study, we recruited participants from the general population. Furthermore, to rule out a number of alternative explanations, we enforced a number of controls. First, we assess life satisfaction (a general well-being measure) to control for initial individual differences in well-being. Second, at the end of the experiment, we showed participants the keywords to which they were subliminally exposed during the priming task and asked them to rate the personal valence of these words in their life. These ratings were then used to examine whether the self-related valence of the primed words to which participants were exposed drove the effect or if it is rather the need satisfaction characterizing the memory primed by those keywords, as expected in theory.

Method

Participants. Sample size was determined based on the effect size ($\eta^2 = .081$) reported by Philippe et al. (2012), who examined the supraliminal priming effect of a memory on well-being. A sample size of 92 participants was therefore deemed adequate to detect a significant 2×2 interaction with a power of .80 and an alpha of .05. A total of 92 participants (66 females and 26 males) from the general population were recruited to take part in a study on personality and memories. They were between the ages of 18 and 74 years old ($M = 42.07$, $SD = 17.53$). One participant reported technical difficulties during the study and was therefore excluded from analyses (final $N = 91$).

Measures Phase 1

Life Satisfaction. Life satisfaction was assessed using the five-item Satisfaction With Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985) to serve as a general measure of well-being (1- to 7-point scale). Cronbach's alpha was .84.

Episodic Memory. Participants were asked to describe in detail a positive or negative (or both) self-defining memory that had occurred at least 1 year ago and that they frequently think about. This memory had to reveal something about their identity and how they generally perceive themselves. Participants were free to recall any type of memory and were not guided in select-

ing a memory of a particular valence (see Philippe, Koestner, Beaulieu-Pelletier, et al., 2011, for the full instructions).

Memory Need Satisfaction. Participants indicated the level of psychological need satisfaction they experienced during the event of their memory on a 7-point Likert scale ranging from -3 (*Strongly disagree*) to $+3$ (*Strongly agree*), with 0 representing *Do not agree nor disagree or not applicable*—this latter option indicating that there was both need satisfaction and need thwarting in the event or that need satisfaction was not present in the event. Autonomy refers to the need to feel volitional and authentic in one's actions. Competence is defined as the need to feel effective and efficacious. Relatedness refers to the need to feel connected, to care for others, and to be cared for by others in turn. Two items assessed each of the three basic psychological needs postulated by self-determination theory (i.e., autonomy, competence, and relatedness). A sample item for autonomy is "I felt free to do things and to think how I wanted"; for competence, "I felt capable or skillful"; and for relatedness, "I felt connected to one or more people." An index of need satisfaction was created by averaging all six items together. Cronbach's alpha was .84. Following the procedures outlined by Philippe et al. (2012), participants were split into two groups as a function of whether they had described a need-satisfying memory ($M > 0$ on the index) or a need-thwarting memory ($M \leq 0$ on the index).

Measures Phase 2: One Week Later

Subliminal Memory Priming (Bunnies and Lions Task). To subliminally prime the episodic memory, the Bunnies and Lions Task was used (Philippe & Bernard-Desrosiers, 2015). This task is programmed with a combination of HTML5, Javascript, and jQuery, which are all open-source web programming languages. The task is presented to the participants as an amusing task that will help them remove their daily thoughts before completing other scales. It thus shows pictures of a teddy lion and bunny. These pictures help convince the participants that the task is amusing and not scientific, thus reducing participants' potential concerns about other purposes that task could serve. Below these pictures, a successive series of rapidly changing uppercase words appears on the screen in blue text of a 30-point font size. Half of these words are animal words (e.g., ELEPHANT, CHICKEN), including the word BUNNY and the word LION presented seven times each, whereas the other half includes nonwords (e.g., XMARALDO). Embedded within these words and nonwords are six priming words shown randomly and repeatedly for a duration of 60 ms. The participant's task is to separately count the number of times the word *lion* and the word *bunny* appear on the screen. This dual task serves as a cognitive load that monopolizes participants' attention, thus highly reducing the possibility that the primes are consciously perceived. The initial practice task lasts 20 seconds. Participants are then invited to do the same task again, this time lasting 36 seconds. Demonstrations, material, and instructions for installation can be freely downloaded at <http://www.elaborer.org/bunnies&lions.html>.

A research assistant, blind to the participants' other data, selected six keywords derived from each participant's memory description. Following Philippe et al. (2012), keywords representing the visual images of the event in the memory were chosen (e.g., beach, sun, sand, mother), but not valence words or adjectives (e.g., love, proud, happy). Participants were primed with these keywords using the Bunnies and Lions Task.

Situational Well-Being. Situational well-being was assessed using the six-item scale of vitality (Ryan & Frederick, 1997; e.g., "I currently feel alive and vital"), and three positive ("I am joyful") and three negative (e.g., "I am nervous") affect items. These three scales were combined to form an index of situational well-being ($\alpha = .88$).

Words Valence. At the end of Phase 2, participants were presented with the six keywords to which they were exposed during the priming task and asked to rate the personal valence those words had in their life in general on a -3 (*very negative*) to $+3$ (*very positive*) Likert scale. This measure served to control for the semantic personal valence these words could have in the participants' lives and to ensure that an episodic memory was primed rather than self-related words of a particular valence. In the event that participants in the experimental group recognized that those words were derived from their memory and that they responded to the question suspiciously, they were told that the words had been derived from their memory and were asked to rate the personal valence (the emotional charge) those words had in their life in general, irrespective of their memory. Participants in the control group were just asked to rate the personal valence these words had in their life in general. Word valence ratings were averaged ($\alpha = .77$).

Probing of Explicit Perceptions of the Primes During the Subliminal Priming. In a type of funneled debriefing (see Bargh & Chartrand, 2000), participants were first asked whether they had been disturbed by some words during the Bunnies and Lions Task. They were also asked whether they had seen words other than animal words and nonwords (e.g., DJDHAUUS) during that task. Finally, they were asked to guess how Phases 1 and 2 of the study were related. No participants reported having been disturbed by words or having seen words other than animal words and nonwords, and no one correctly guessed how the two phases of the study were related.

Procedures. Participants were recruited through their personal email, as they had previously agreed to participate in studies. Participants completed an online survey including demographic questions and a scale of life satisfaction, and they were subsequently asked to describe a self-defining memory and to rate the level of psychological need satisfaction they experienced during the event described in their memory. One week later, participants were invited to take part in a second, ostensibly unrelated, online study on attentional processes. They were primed using keywords derived either from their own memory

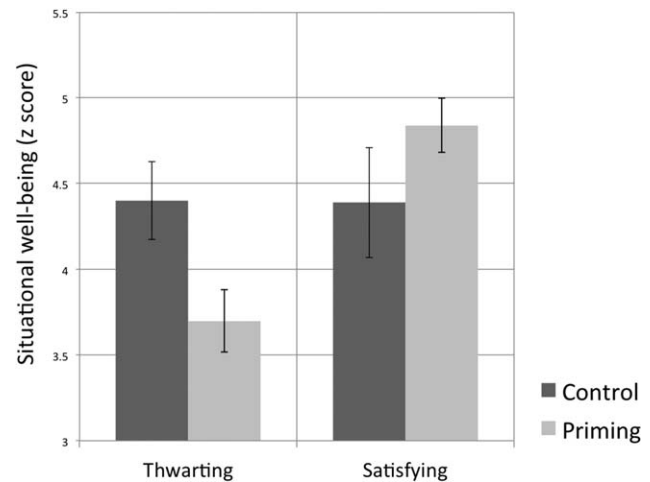


Figure 1 Effect of priming a need satisfying or a need thwarting personal memory on situational well-being. Error bars are standard errors: Study 1.

(experimental group) or from another participant's memory (control group). Participants in the experimental and control groups were yoked based on the level of need satisfaction of their described memory (need satisfying or need thwarting). That is, a participant assigned to the experimental group who had reported a need-satisfying (need-thwarting) memory was primed with the keywords derived from his own memory and was yoked to one participant assigned to the control group who also had reported a need-satisfying (need-thwarting) memory, but who was primed with the keywords from the participant in the experimental group. All participants then reported their situational well-being following the priming task (i.e., the Bunnies and Lions Task). Finally, they were shown the priming words to which they had been exposed and were asked to rate the personal valence of those words in their daily life.

Results

There was no effect of gender (main effect or moderator) on all study variables. Therefore, this variable will not be considered in this study. A 2 (Need Level: Need Thwarting vs. Need Satisfaction) \times 2 (Conditions: Priming [own memory] vs. Control [someone else's memory]) factorial ANOVA was computed to examine the effect of the priming manipulation on participants' situational well-being. Results unveiled a significant main effect of need level on participants' situational well-being. Participants who described a need-thwarting memory reported lower situational well-being ($M = 4.17$, $SD = 1.04$) than participants who described a need-satisfying memory ($M = 4.65$, $SD = .96$), $F(1, 88) = 5.97$, $p < .05$, $\eta_p^2 = .06$. Results also revealed a significant Need Level \times Conditions interaction, $F(1, 88) = 6.18$, $p < .05$, $\eta_p^2 = .07$. Simple effects of this interaction unveiled that participants who described a need-thwarting memory and who were primed with their own memory reported a marginally lower level of situational well-being ($M = 3.70$, $SD = 0.82$)

than participants in the yoked control group ($M = 4.40$, $SD = 1.07$), $t(25) = -1.78$, $p = .08$, $d = -.73$, 95% CI [0.08, -1.48], with a large effect size. Conversely, participants who reported a need-satisfying memory and who were primed with keywords derived from their own episodic memory reported marginally higher scores of situational well-being ($M = 4.84$, $SD = 0.96$) than participants in the yoked control group ($M = 4.39$, $SD = .92$), $t(63) = 1.85$, $p = .07$, $d = .48$, 95% CI [-0.03 , $.92$], with a medium effect size (see Figure 1). Although simple effects showed marginal significance in the expected direction ($ps < .10$), the participants primed with their own need-satisfying memory reported significantly higher well-being than participants primed with their own need-thwarting memory, $t(44) = 3.26$, $p = .002$, $d = .98$, 95% CI [0.42, 1.84] and the two control groups, which did not differ from each other, $t(44) = 0.03$, *ns*, fell in between the two experimental groups. Controlling for participants' age and general life satisfaction did not alter results, and there was no Need Level \times Conditions \times Life Satisfaction interaction.

Multiple regressions were conducted on the priming and control groups, separately, with situational well-being as the dependent variable and need satisfaction in memories (continuous measure) and ratings of the valence of the priming words as independent variables. Results revealed that need satisfaction characterizing the memory was significantly associated with situational well-being for the primed participants, $\beta = .50$, $p < .01$, $B = .32$, $SE = .12$, 95% CI [.08, .56], but not for participants in the control group ($\beta = -.01$, *ns*). Furthermore, analyses revealed that the valence of the priming words was not associated with situational well-being in either group (primed: $\beta = -.14$, *ns*; control: $\beta = .26$, *ns*). Results remained the same when controlling for participants' age and general life satisfaction, and age did not moderate the present findings. Taken together, these results suggest that priming a personal episodic memory had an immediate effect on situational well-being as a function of the need satisfaction level characterizing the memory primed. In addition, results revealed that for the experimental group, the level of need satisfaction characterizing the episodic memory, but not the personal valence of the keywords primed, predicted situational well-being—thus providing further evidence that an episodic memory and its related experiential components were successfully primed and not semantic memory for some personally positive/negative words.

STUDY 2

While a certain number of studies have shown that aspects of memory can predict increases in well-being over time, a number of issues remain unresolved. First, all studies start investigating the effect of a memory once that memory is formed and not before. Therefore, it has been yet impossible to know whether certain characteristics of the person orient the encoding or the recall of certain memories is characterized by certain experiential components. A second issue is that all studies have only one

or two measurement time points. While a minimum of two measurement points of well-being is a must to show that a memory leads to increases in well-being over time, only two time points cannot show the accumulative effects of a memory on well-being over time or when this effect stops and that stable changes in well-being can be observed. Several measurement points also make it possible to differentiate between the immediate effect of the event experienced on well-being and the continued effect of the memory over time on well-being.

Study 1 showed the immediate aftereffect of activating an episodic memory on situational well-being. While this activation was experimentally manipulated in Study 1, we expect that people's episodic memories are constantly and naturally activated by various cues of their living environment without necessarily coalescing into a reminiscence (Conway & Pleydell-Pearce, 2000). As shown in Study 1, this unconscious activation nevertheless influences well-being, and, over time, frequent activations should leave a stable and enduring mark on well-being. In Study 2, we wanted to highlight this long-term effect of memories on well-being by observing their odyssey, starting with pre-well-being and pre-general need satisfaction measures before a significant event that will be encoded as a memory even occurs in participants' lives. We followed the participants over the winter holidays and asked them to select an event that occurred during the holidays that was the most significant for them. We then followed the odyssey of that memory over 2 months and examined how it translated over time into increases in general perceptions of need satisfaction and in well-being. Obviously, given the strict time frame of our design (2 weeks to experience a significant event), the memories collected may not be self-defining memories, such as the one collected in Study 1. Nevertheless, these memories should be significant enough memories that are at least preserved over weeks and months in long-term memory. As such, they are unlikely to be mundane or trivial events. In addition, we selected the winter holidays, which includes Christmas and New Year's Eve in Canada, given that this period is often characterized by highly emotional events, such as warm family gatherings or strong interpersonal conflict. These memories should have a cumulative impact on well-being over time.

We hypothesized that need satisfaction in a key holiday memory would predict increases in general perceptions of need satisfaction and in well-being over time, beyond the immediate increases that are expected to occur following the experience of the event of that memory. Given that memories represent transient aspects of people's personality that initiate changes in outcomes over time, we expected the above effects to hold even while controlling for people's personality traits, which rather represent stable individual differences that do not instantiate changes in well-being over such a short period of time (Soto, 2014). Memories and traits should therefore represent fairly independent constructs (Adler, Lodi-Smith, Philippe, & Houle 2016). In addition, to control for the type of memories people typically retrieve and for how they typically rate them, need satisfaction in a significant past years' holiday memory was also controlled for. Finally, we also controlled for pre-event well-being and general need

satisfaction measures. It was not the purpose of Study 2 to track whether the holiday memory was activated unconsciously (which would not be possible) or whether people thought about it deliberately, but rather to ascertain the long-term, accumulative impact of need satisfaction in a memory on changes in perceptions of general need satisfaction and well-being over time.

Method

Participants and Procedure. Participants were 275 undergraduate and graduate students (230 females, 45 males) aged 22.45 years ($SD = 4.26$) on average. Following Kline's (2010) recommendation of using at least five cases per estimated parameter, we determined that this sample size was adequate to estimate a path analysis of 55 parameters ($5 \times 55 = 275$). All study phases were completed online. At Time 1, participants completed the Big Five and general need satisfaction and well-being scales. They also described a significant memory from past years' winter holidays. At Time 2, in the second week of January, participants were contacted again and were asked to again complete scales of general need satisfaction and well-being and to describe the memory of a significant event that occurred during the last winter holidays. Finally, participants were contacted again in the second week of February and the second week of March to complete the same scales of general need satisfaction and well-being. Given the longitudinal nature of this study, there were missing data (9.4% of missing data). Little's missing completely at random (MCAR) test was non-significant, $\chi^2(22) = 25.88, p = .26$, thus suggesting that missing data patterns were not related in any ways to the other independent or dependent variables. The model presented in this study was conducted with Mplus 7.3 (Muthén & Muthén, 1998–2015) using maximum likelihood estimation under MCAR (Little & Rubin, 2002).

Measures

Big Five Traits. The Big Five Inventory (John & Srivastava, 1999) was used to assess the five traits of personality. This well-validated measure requires participants to rate on a 5-point scale the extent to which each of 44 items describes themselves. In this study, alphas were .77 and above for each of the five traits.

Well-Being. Five scales were used to assess well-being at each measurement time point: a short scale of the Beck Depression Inventory (0- to 3-point scale; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), a short Beck Anxiety Inventory (0- to 3-point scale) measuring the subjective state of anxiety (Osman, Kopper, Barrios, Osman, & Wade, 1997), the 10-item Symptom Checklist (0- to 4-point scale; Rosen et al., 2000), the Satisfaction With Life Scale (1- to 7-point scale; Diener et al., 1985), and three short subscales (Growth, Acceptance, and Purpose) of the Psychological Wellbeing Scale (PWB; 1- to 7-point scale; Ryff & Keyes, 1995).² All short scales have been used successfully in past research and have displayed adequate evidence of validity and reliability (e.g., Philippe, Koestner, Beaulieu-

Pelletier, et al., 2011; Philippe et al., 2012). A factorial analysis (maximum likelihood) on the present study data revealed one factor, with all measures saturating this single factor with loadings higher than .50. Therefore, all scales were standardized and averaged in an index assessing well-being. Alphas were all above .81 across all four measurement time points.

Perceptions of General Need Satisfaction. The Balanced Measure of Psychological Needs scale (Sheldon & Hilpert, 2012) was used to measure the extent to which the participants felt that their needs for autonomy (e.g., "I feel free to do things my own way"), competence (e.g., "I take on and master hard challenges"), and relatedness (e.g., "I feel lonely") were satisfied in general in their life. Eighteen items assess all three needs with six items each on a 1- to 7-point Likert scale. General need satisfaction was measured at each of the four measurement time points. Alphas for this complete short scale were all above .86 across time points.

Past Years' Holiday Memory. At Time 1, participants were asked to describe a memory that occurred during the winter holidays in the past years. Overall, 25% of the participants shared a memory that occurred last year, 35% described a memory that occurred between 2 and 5 years ago, and 40% told about memories that were dated more than 5 years ago, most of the time from their childhood. A sample memory is as follows:

It was Christmas, I was about 8 years old. We were celebrating with my family (my father, mother, brother) at my aunt's place, uncle, and cousins. It was the moment where we were opening the gifts. Like every year, it was happening in my aunt's living room, where there was a nice hearth and a large Christmas tree. My particular memory is when my brother and I opened our gift: a Nintendo! We were so happy. All our friends had one since a long time ago and we were going to have one too. It is probably the gift I received that I have been the happiest with in my life. And my father (the funny guy) made the bad joke of hiding the game cartridge that was coming with the Nintendo and told us that we would have to wait to have a game. I believe that he quickly realized that we were disappointed and gave us the game.

Participants were then asked to rate their memory for need satisfaction using the same six items used in Study 1. Alpha was .81. This memory served as a control variable for the way participants rate holiday memories in general.

Current Year's Holiday Memory. Immediately after the current winter holidays, at Time 2 (the second week of January), participants were asked to describe in detail a significant event they experienced during the holidays (between December 24th and January 5th). They also rated it for need satisfaction using the same items they had used to rate their past years' holiday memory. Alpha was .80. A sample memory is as follows:

Table 1 Means, Standard Deviations, and Correlations Among all Study Variables

	M	SD	1	2	3	4	5	6	7	8	9
1. NS in past years' holiday memory T1	1.43	1.51	—								
2. General NS _{PH} T1	5.33	0.75	.24**	—							
3. Well-being _{PH} T1	0.02	0.72	.24**	.76**	—						
4. NS in current holiday memory	1.66	1.39	.12	.27**	.20**	—					
5. General NS _H T2	5.31	0.75	.22**	.84**	.70**	.31**	—				
6. Well-being _H T2	0.00	0.79	.15*	.72**	.81**	.28**	.80**	—			
7. General NS _{1m} T3	5.28	0.84	.26**	.84**	.68**	.39**	.86**	.73**	—		
8. Well-being _{1m} T3	0.05	0.76	.21**	.68**	.77**	.31**	.70**	.80**	.77**	—	
9. General NS _{2m} T4	5.27	0.86	.30**	.80**	.69**	.35**	.83**	.69**	.88**	.70**	—
10. Well-being _{2m} T4	0.01	0.83	.23**	.69**	.76**	.28**	.74**	.83**	.75**	.81**	.81**

Note. NS = need satisfaction; T1 = Time 1; T2 = Time 2; T3 = Time 3; T4 = Time 4; PH = Preholidays; H = immediately after holidays; 1m = 1 month after holidays; 2m = 2 months after holidays.
 **p < .01. *p < .05.

The Christmas family meeting. This year is special because it has been one year that my grandfather passed away and it is the first Christmas that we spend outside of his house, in a luxurious hotel. This year, no gift, except the illusion that rich people's style brings happiness. In all cases, it is mostly superficial anyway. During the dinner, I notice that the family is divided in two very distinct categories, those that try to look good to the high society and those who want to show to what extent they can be ridiculous. Miserable show that my grandfather would have probably stopped in the first place, because he was fervent of traditions like turkey and Christmas at home . . . and not in a superficial environment.

Results

Table 1 reports the means, standard deviations, and correlations among all study variables. Particularly striking in the correlations table is that the only nonsignificant correlation is between need satisfaction in the past years' holiday memory and need satisfaction in the current holiday memory. This suggests that each memory is fairly distinct from each other and does not massively reflect general personality variables.

A path analysis was conducted with Mplus 7.3 (Muthén & Muthén, 1998–2015) to examine the odyssey of the current holiday memory in predicting increases in perceptions of general need satisfaction and increases in well-being. Past years' holiday memory, T1 general need satisfaction, and T1 well-being were modeled as exogenous variables. They were modeled to predict need satisfaction in the current holiday memory to estimate what variables would predict the encoding of a more need-satisfying memory and their effect sizes. In return, need satisfaction in the current holiday memory was expected to predict increases in general need satisfaction and well-being following the holidays (i.e., T2 measures). At T3, one month after the holidays, all variables were expected to predict general need satisfaction and well-being measured at T3, which were further modeled to predict general need satisfaction and well-being 2 months after the holidays (T4). Because we did not have hypotheses about how the non-memory variables would

behave, we included all paths in the model, yielding a just-identified model. We also ran the same model while controlling for all five traits as exogenous variables and report the results below when appropriate.

Figure 2 shows the final model, which for clarity only includes the paths for which the coefficients were significant. As can be shown, the only variable predicting need satisfaction in the current year's holiday memory was general need satisfaction at Time 1. This association was only weak to moderate in size. Preholidays well-being did not lead to memories characterized by greater need satisfaction, and, again, need satisfaction in past years' holiday memory was not associated with need satisfaction in the current year's holiday memory. All five traits were also unrelated to need satisfaction in the current year's holiday memory, thus suggesting that traits did not influence the experience of holiday memories.

Further shown in this model is that need satisfaction in the current holiday memory predicted increases in both general need satisfaction and well-being at Time 2. This suggests that the experience of a need-satisfying event during the holidays immediately led to an increase in both perceptions of general need satisfaction and well-being. These effects were small—both around 1%. One month later (Time 3), the model shows that need satisfaction in the current holiday memory predicted further increases in general need satisfaction and well-being. These increases occurred way past the experience of the original event and even after taking into account the aftereffects of that event (Time 2 measures). Yet, the memory of that event continued to have an effect on people's perceptions of general need satisfaction and on their well-being. These effects were also of small size (~1%). These effect sizes represent the effect of need satisfaction in the current holiday memory on well-being and general need satisfaction total scores. However, more informative effect sizes would be to calculate the amount of variance in well-being changes and general need satisfaction changes occurring over 2 months that is explained by need satisfaction in the current holiday memory. Results show that 6.2% of the variance of change in well-being (4.1% at Time 2 and 2.1% at Time 3) and 5.7% of change in general need satisfaction (2.3% and 3.4%

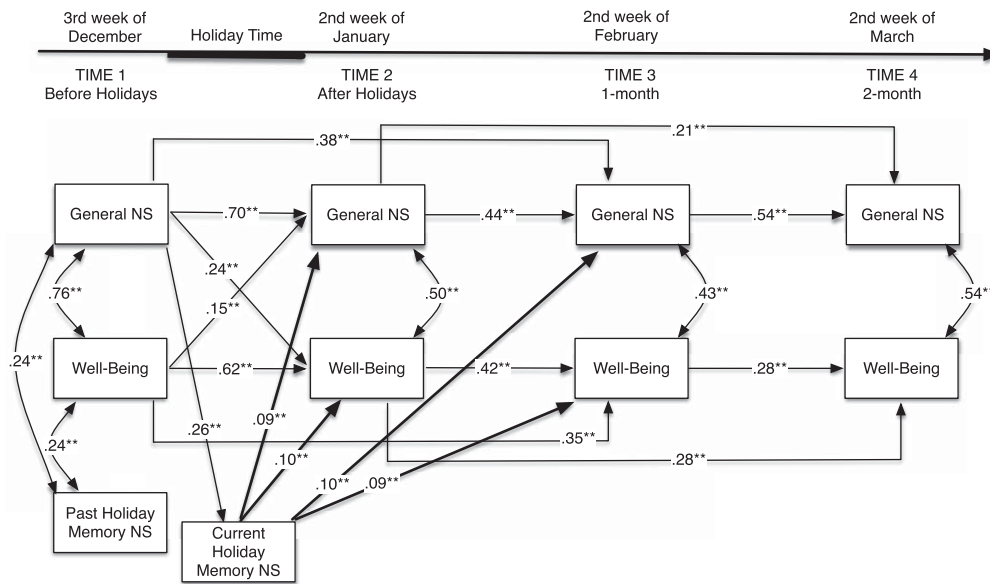


Figure 2 Path analysis displaying the effect of current year’s holiday memory need satisfaction on changes in well-being and general need satisfaction over time. Non-significant path coefficients are not shown for clarity. NS = Need satisfaction. ** $p < .01$.

at Times 2 and 3) is uniquely accounted for by need satisfaction in the current holiday memory.

More than 2 months later, the direct effect of the current year’s holiday memory was not significant anymore on general need satisfaction and well-being. Yet, this memory continued to have an indirect effect through the double increases in general need satisfaction and in well-being that occurred at Times 2 and 3, thus showing stable increases in both variables. Bootstrapping using 5,000 resamples was used to estimate the significance of the indirect effects of need satisfaction in the current year’s holiday memory to well-being and perceptions of general need satisfaction 2 months after the holidays (Time 4). Results revealed (see Table 2) small estimates, but all 95% confidence intervals excluded the value of zero, therefore suggesting that all indirect effects were significant at $p < .05$. All five traits were unrelated to all endogenous variables and did not predict any increases in well-being or in general need satisfaction over time, with two exceptions: Conscientiousness predicted increases in general need satisfaction from Times 1 to 2 ($\delta = .07, p < .05$), and

Neuroticism predicted decreases in general need satisfaction from Times 2 to 3 ($\delta = -.10, p < .05$). However, in all cases, controlling for all five traits did not alter the associations among the other variables. Age also did not moderate any of the reported effects.

GENERAL DISCUSSION

The present research was twofold. The first purpose was to investigate the impact of an unconscious activation of a memory on situational well-being. Expecting that this unconscious effect of a memory on well-being can occur frequently, the second purpose was to examine the impact of memories on stable changes in well-being over several months, while controlling for pre-event measures of all kinds. Two studies provided convincing evidence supporting the directive function of episodic memories on well-being.

Study 1 highlighted for the first time that memories could be triggered by subliminal external cues. Depending on the

Table 2 Bootstrap Estimates and 95% Confidence Intervals for All Indirect Effects Involving Current Holiday Memory

	Unstandardized Estimates	Standardized Estimates	95% Confidence Intervals
Memory _H → WB _{H-T2} → WB _{2m-T4}	.021	.037	[.007, .043]
Memory _H → WB _{1m-T3} → WB _{2m-T4}	.014	.024	[.001, .038]
Memory _H → WB _{H-T2} → WB _{1m-T3} → WB _{2m-T4}	.006	.011	[.002, .017]
Memory _H → GNS _{H-T2} → GNS _{2m-T4}	.011	.019	[.002, .027]
Memory _H → GNS _{1m-T3} → GNS _{2m-T4}	.033	.055	[.011, .061]
Memory _H → GNS _{H-T2} → GNS _{1m-T3} → GNS _{2m-T4}	.013	.021	[.003, .030]

Note. H = immediately after holidays; 1m = 1 month after holidays; 2m = 2 months after holidays; T2 = Time 2; T3 = Time 3; T4 = Time 4; WB = well-being; GNS = general need satisfaction.

experiential components of that memory, they will orient situational well-being accordingly, such that need satisfaction in a triggered memory will increase well-being, whereas need thwarting will decrease it. A counterargument could be that people saw the primes, but forgot about them when asked whether they had seen words other than animal words and nonwords. However, this alternative appears unlikely. Based on extensive pilot studies using the Bunnies and Lions Task (Philippe & Bernard-Desrosiers, 2015), about one participant in 200 reports having seen one prime when asked about non-animal words immediately after the task (which lasts about a minute), and that ratio includes all potential computer malfunctioning situations. So it is very unlikely that conscious perceptions drove the effect in Study 1.

Another alternative explanation is that participants were primed with words and that it is the positive or negative valence of those words that drove the effect. Since we used a yoking procedure, all participants in the control conditions received the exact same primes as those in the experimental conditions. Therefore, any effect based on the social meaning of the primed words used is not tenable. However, one may argue that those words may have some personal meaning for those who used them in their memory narrative. To investigate that alternative explanation, we asked participants to rate the personal valence of the words with which they were primed at the end of the study. Those ratings did not predict situational well-being, and controlling for them did not alter the findings. More strikingly, need satisfaction in the memory of those for whom their own memory was primed predicted increases in situational well-being, but not need satisfaction in the memory of those in the control groups, thus providing further evidence that the memory itself and its related experiential components drove the effect on situational well-being. It should be acknowledged, however, that the power was a bit low in that study to conduct the appropriate independent group contrasts. Future research should replicate the present findings in a high-powered study.

Study 2 sought to examine the long-term effect of episodic memories on well-being by following the odyssey of a personal holiday memory over several months. Since measures were taken before the key episodic memory was encoded, it was possible to examine for the first time whether individual differences affect people's encoding of a significant event they are about to experience. Quite interestingly, we found only one significant relationship. First, need satisfaction in a past holiday memory was not significantly correlated with need satisfaction in the current year's holiday memory. This further supports the idea that memories are fairly distinct from one another and that unless they are part of a common memory network, their experiential components are not similar (Philippe et al., 2012). Second, only general need satisfaction was positively associated with need satisfaction in a current-year holiday memory, thus highlighting that participants with greater general need satisfaction tend to rate their future experienced events with greater need satisfaction. However, the effect size of that correlation was small, which presupposes that this effect of general need satisfaction is slight.

Finally, all five traits of the Big Five were not significantly associated with need satisfaction in the current year's holiday memory. These findings underscore that few stable individual differences shape memories and need satisfaction components. Based on these results, we believe that it can be concluded that the effect of these components of need satisfaction—which correspond to a representation of the recorded affective and cognitive experience of a specific event that occurred in people's lives—appear more important and more impactful on well-being than the effect of people's typical way of shaping their memories. These findings also underscore that memories and traits are independent constructs. Traits are slower to change than memories and represent more stable and anchored individual differences. Memories represent the individual differences to stabilize in a near and far future. As such, memories are the dynamic and transient properties of personality, which, depending on how frequently they are triggered by the environment, will orient the emergence of certain novel stable individual differences and outcomes (e.g., well-being) over time. These results should, however, be interpreted with caution. Most of the memories collected in Study 2 will probably not become self-defining memories, like the memories collected in Study 1. These memories were about significant events, but not necessarily turning points or peak moments. It therefore remains possible that person-level variables influence more the encoding of those types of highly significant memories than the types of memories collected in Study 2.

Other findings of importance are that need satisfaction in the current year's holiday memories predicted increases in general need satisfaction and well-being immediately after the holidays, thus confirming that the experience of a significant event does have an impact on well-being in accordance with the level of need satisfaction characterizing the memory of that event. Of even greater importance, need satisfaction in the current year's holiday memories predicted a further increase in general need satisfaction and well-being 1 month later, even after taking into account the initial increase. This is a key finding showing that even after the initial aftereffects of an event, a memory can continue to directly affect perceptions of general need satisfaction and well-being months after the event. This is particularly striking given the restrained range of memories that was investigated. As mentioned above, the selected holiday memory may not be of a self-defining type. It is possible that this episodic memory, although preserved over a couple of weeks, will be forgotten in the next couple of months. Indeed, a quick pilot study 5 months after the holidays with half of the participants of Study 2 revealed that 56% of the participants could no longer remember the memory they had described. Thus, even if the memory was not one of striking importance, like the memories presented in the introduction of this article or the ones defined by the participants in Study 1, it nevertheless impacted perceptions of general need satisfaction and well-being over time. More salient self-defining memories are likely to have a cumulative effect on well-being over a longer period of time.

The direct effects of need satisfaction in the current year's holiday memory on general need satisfaction and well-being were small, all around 1%, and its indirect effects were even smaller. However, these are the effects of only one significant memory that occurred during the holidays over less than 3 months. Considering that someone could experience, for instance, five positive or negative events in a row over a short time span, well-being could vary from about 10% in only 2 months, which is a substantial variation. It is also likely that some events, because of their greater significance for the person, will have an impact over many months, even years (Philippe et al., 2012; Pillemer, 2003). The reader should also keep in mind that this represents the percentage of variance accounted for by need satisfaction in the holiday memory on the full score of well-being, of which about 66% is already explained by the level of well-being people had prior to the holidays. When considering only the variance of changes that occurred between pre- and postholidays, need satisfaction in the holiday memory explained about 6% of those changes, which is important for one single memory. Thus, overall, even if the effect of memories in Study 2 appears small, their effect sizes are nevertheless important.

CONCLUSION

The present research highlighted the processes and the direct and indirect paths through which significant episodic memories and their associated need satisfaction components could influence well-being. Need satisfaction in episodic memories does not seem to reflect stable individual differences in large part, but rather to represent the unique experiential components of the significant events that people experienced throughout their lives. As such, memories correspond to an essential substructure of personality that does not overlap with traits and other abstract self-knowledge (Klein et al., 2002). Memories are likely to be replaced by new ones or to be forgotten over time, but while active, it appears that they can have an influential impact on well-being for weeks, months, or years, and some perhaps for a lifetime.

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Notes

1. Research has consistently shown that need satisfaction in memories is a stronger predictor of well-being than valence (Philippe, Koestner, Beaulieu-Pelletier, et al., 2011), emotions (Philippe, Koestner, Lecours, et al., 2011), or other commonly assessed memory components (see Philippe et al., 2015). Therefore, the present research focuses on need satisfaction as the target experiential component of memory.
2. We did not use the Autonomy, Competence, and Relationship subscales of the PWB because they map on the three needs postulated by self-determination theory.

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