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The chicken or the egg? Systematic investigation of the effect of order of administration of Memory Questionnaires and Well-being Scales

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Narrative research claims that episodic/autobiographical memory characteristics and themes represent stable individual differences that relate to well-being. However, the effects of the order of administration of memory descriptions and well-being scales have never been investigated. Of importance, social cognitive research has shown that trivial contextual factors, such as completing a self-report measure, can influence the type of memories recollected afterwards and that memory recollection can transiently affect subsequent self-report ratings—both of which underscore that transient contextual effects, rather than stable individual differences in memory could be responsible for the correlation between memory characteristics and well-being. The present study examined if the order in which (positive or negative) memory and well-being scales are completed affects the characteristics and themes of the memory described, the scores of well-being reported and the relationship between the two. The results revealed some effects of order of administration when memories were described before completing well-being scales, but only on a situational measure of well-being, not on a trait measure. In sum, we recommend assessing memory-related material at the end of questionnaires to avoid potential mood-priming effects.

Keywords: Order of administration; Episodic memory; Well-being; Narrative; Contextual effect.

The study of individual differences in autobiographical and episodic memories has developed at a fast pace in the last decades. Many researchers now collect autobiographical narratives or personal episodic memories in addition to self-reported attitudinal or mental health scales. These studies seek to examine the association between stable individual differences in memories or in memory narratives and well-being or mental health. However, based on past research on factors that can affect memory retrieval processes

and on how memory retrieval can affect immediate cognitions and mood, transient effects induced by the order of administration of the memory questionnaires could explain the relationship between memory characteristics and well-being. Although research in the field of individual differences in memory narratives is burgeoning, there has never been any systematic exploration of this critical methodological issue. The first purpose of the present research will be to examine if the order of administration of a

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memory questionnaire can affect ratings on well-being scales and if well-being ratings can immediately affect the type of memory retrieved (its characteristics) and its narratives (e.g., included themes, coherence and structure). A second related purpose will be to examine what memory characteristics and themes relate to well-being, and if their relationship is dependent on the order of administration of the questionnaires

Research on individual differences in memories

The investigation of individual differences in the way people recall past events has gained broad interest recently, especially in personality, social and developmental psychology. This research has largely examined how these individual differences relate to adaptive functioning such as well-being (e.g., Adler, 2011; Bauer, McAdams, & Sakaeda, 2005), maturity (e.g., King, Scollon, Ramsey, & Williams, 2000) and identity integration (e.g., Pals, 2006). The originality of this research is that participants are invited not only to complete self-report scales assessing their well-being but also to write down or tell the story of a past event that is significant for them (e.g., marked by great difficulties, a life transition period, a turning point and a self-defining event). Trained judges blind to participants' self-report data, code these narratives for particular themes or structural aspects of the described memory. Participants can also be asked to report on different properties characterising their memory (e.g., vividness and significance) or its related experiential components (e.g., emotions, psychological need satisfying nature or motives experienced when the event described in the memory occurred).

The guiding principle of this research is that the content of significant memories, their characteristics and the way they are told, reflect an important part of who people are, of their identity and of its level of integration. It has also been suggested (McAdams & Pals, 2006) that how people narrate and tell the story of important past experiences reflect a specific level of their personality, distinct from traits, goals, values and beliefs. Consequently, it is theorised that the way themes derived from the content of these memories or their characteristics correlate with self-report measures of well-being can reflect (1) that people who show high levels of well-being interpret or integrate their life events in particular

ways (e.g., Bauer et al., 2005), (2) that these memories have a directive force which influences their well-being over time (e.g., Philippe, Koestner, Beaulieu-Pelletier, Lecours, & Lokes, 2012; Pillemer, 2003), or (3) that the way past events are integrated and structured promote an integrated identity or a maturity, which is in turn reflected in well-being (e.g., King & Noelle, 2005; McAdams, Reynolds, Lewis, Patten, & Bowman, 2001; McLean & Breen, 2009; McLean & Lilgendahl, 2008).

BRIDGING TWO FACETS OF MEMORY RESEARCH

A basic, but fundamental, issue is the order in which the memory and the self-report scale of well-being are collected. It is basic in the sense that it is a simple methodological problem. However, it is fundamental because there is evidence from the socio-cognitive literature that the order in which these measures are collected can lead to dramatically different findings. In some studies on individual differences in memories, participants complete the self-report scales of well-being first (e.g., McLean & Breen, 2009; Philippe, Koestner, Beaulieu-Pelletier, & Lecours, 2011) and are then asked to describe in detail one or more memories. In other studies, these self-report scales appear to be completed last, after the description of the memory (e.g., Bauer et al., 2005; McLean & Lilgendahl, 2008). Sometimes the order of completion is left to the participants' choice and is therefore unknown (e.g., Adler, 2011). Other times, the specific order of completion is not mentioned in the article.

Given the large corpus of research on how retrieval of memories can affect subsequent self-reports and on how attitudinal ratings can immediately affect memory retrieval, this methodological issue appears to be of the utmost importance in the study of stable individual differences in memories and of their relationship with well-being. Unfortunately, there has never been any systematic investigation of the order of administration of such questionnaires or interviews. Therefore, apart from the few studies existing in the literature showing a longitudinal relationship between memory characteristics and well-being (e.g., Adler, 2011; Lodi-Smith, Geise, Roberts, & Robins, 2009; Philippe et al., 2012; Sutin & Robins, 2005), it is impossible to know if this relationship reflects the actual effect of

individual differences in memories corresponding to a different level of the self and of personality, or if it is only the result of a transient effect of the immediate context in which these memories are retrieved and described. It could also be argued that even the longitudinal studies provide unclear results since the initial self-report scores and memory measures could be biased by their order of administration, which renders it difficult to interpret changes on these scores over time.

Factors influencing memory retrieval

This research question is important since not only stable personality factors can influence memory retrieval processes but also memory content. The social cognitive literature is replete with studies showing how external contextual factors as trivial as a sunny or a cloudy day can influence the type of memory that people will retrieve when prompted (e.g., Parrott & Sabini, 1990, Study 2). For instance, there is a vast literature on how current mood can influence memory retrieval. People induced with a specific mood are more likely to recall memories tainted with that specific mood—a mood-congruent effect (e.g., Blaney, 1986; Bower, 1981; Singer & Salovey, 1988). This effect is also complicated by various other factors such as the related self-aspect of the memory retrieved (Sakaki, 2007), personality traits (McFarland & Buehler, 1998; Rusting & DeHart, 2000) or mood-regulation strategies. For instance, it has been shown that when participants are not aware that their mood is affected or is important for a subsequent task, they are more likely to show incongruent memory recall (Parrott & Sabini, 1990) since they apparently try to regulate their current mood by recalling memories of opposite valence (Josephson, Singer, & Salovey, 1996).

Therefore, initially responding to self-report scales, such as those assessing well-being, may affect people's mood and, in turn, the type of memories that are retrieved, and may influence the correlation between well-being and the characteristics of the memory retrieved. Consequently, a positive correlation between well-being and certain memory characteristics may only imply that initially reporting low well-being primes people to report consistent negative memories, whereas reporting high well-being may subsequently prime people to report positive memories. People could also be less (more) motivated

to write about their memories, showing a lower (higher) number of motivational themes in their memory narratives and reduced (increased) narrative coherence, for instance. These relationships would not reflect actual and stable individual differences representing personality aspects, but would only be a transient effect induced by reporting on one's current level of well-being first.

Memory retrieval influences scale ratings

The reverse effect is also well known—recalling memories influences mood and attitude. It has been frequently shown that recalling autobiographical memories has an effect on one's immediate emotional experience, including physiological arousal (e.g., Schwartz, Weinberger, & Singer, 1981) and triggers specific patterns of brain activation related to emotional processing (e.g., Labar & Cabeza, 2006; LeDoux, 1992). In fact, the effect of personal memory recollection on mood is so strong and lasting that it is often used as a general mood induction procedure in research (e.g., Baker & Gutfreund, 1993). Furthermore, there is evidence that memory sharing or writing, while evoking emotions, may also help downplay their intensity and facilitate their regulation, especially in the case of negative memories (e.g., Pasupathi, 2003; Pennebaker & Chung, 2011). There is also evidence that recollecting memories can affect scores on various subsequent questionnaires. For instance, Salancik and Conway (1975) showed that recalling proreligious vs. antireligious memories could subsequently affect the scores on a scale measuring attitudes towards religion. When proreligious memories were retrieved, a more positive attitude towards religion was subsequently reported as compared to when antireligious memories were initially made salient. Another study found that recalling memories about introversion vs. extraversion subsequently influenced people to rate themselves as more introverted than recalling memories about extraversion (Fazio, Effrein, & Falender, 1981).

From a broader perspective, it has been shown that when specific information is requested first and then more general information is collected second, the general information is more likely to be influenced by the specific information provided first than if the questions were asked in the reverse order. For instance, Schwarz, Strack, and Mai (1991) found that the answers to questions

about general life-satisfaction (general) and marital satisfaction (specific) were more strongly correlated when the marital satisfaction question preceded the life-satisfaction question. This is because the marital-satisfaction question brought marriage-related aspects to mind, which were more heavily weighted as compared to other life domains when responding to the subsequent life-satisfaction question. Given that episodic memories constitute specific information, memory retrieval is likely to affect subsequent ratings on more general self-knowledge scales. For example, retrieving a memory of a particular valence may influence subsequent ratings on self-report scales of well-being.

However, relative to the field of narrative research, these studies in the field of social cognition have not focused on personally significant memories as much. Memories collected from this latter field of research are sometimes generic or constitute simple thoughts or feelings about a past event. At the opposite, memories collected from the field of narrative research correspond to key, mostly self-defining life events, which are usually highly significant and vivid. As such, simple scale ratings or contextual mood factors may not be sufficient to alter the memory retrieval process of these types of memories. Conversely, recalling those memories may be so intense and emotional that any scales completed subsequently could be biased by the type of memory retrieved. This calls for a systematic investigation of the effects of the order of administration of significant memory recollection tasks and well-being scales.

THE PRESENT STUDY

The purpose of this study was twofold. A first objective was to examine if the order in which a (positive or negative) significant memory and well-being scales are completed affects the characteristics and themes of the memory described and the scores of well-being reported. A second objective was to examine the relationships between memory characteristics and themes and well-being as a function of the valence of the memory and the order of their administration.

Participants were randomly assigned to describe a positive or a negative memory. In addition, they were also randomly assigned to describe their memory first and complete well-being scales right after—or the opposite—complete well-being scales

first and describe their memory immediately afterwards. Each memory narrative was also rated and coded according to several characteristics and themes. A recent literature review has shown that thematic content of memory narratives can be divided into four broad areas: motivational, emotional, integrative themes and structural aspects (Adler, Lodi-Smith, Philippe, & Houle, 2014). We selected key themes within each area that have been shown to correlate with well-being in past cross-sectional studies. Motivational themes were need satisfaction (autonomy, competence and relatedness), emotional themes were composed of contamination and redemption, integrative themes corresponded to intrinsic and integrative memories and structural aspects were coherence and word count. Each of these themes is defined in the method section. Furthermore, we collected self-report data about several memory characteristics that are frequently assessed in memory research: the age of the memory, its vividness, significance, its level of rehearsal and sharing with others, as well as how frequently it spontaneously comes to mind (e.g., Alea & Bluck, 2007).

The following rationale guided us. Asking for a memory first represents the scores on memory characteristics unaltered by any previous responses. Conversely, the scores on memory characteristics that are described after having responded to a well-being scale represent scores that are potentially altered by the initial completion of a well-being self-report. Similarly, responding to a scale of well-being first represents the “true” score that should be obtained on this scale, unaltered by any previous memory description. However, the score on a well-being scale obtained after a memory description represents a score that is potentially altered by a previous memory description. As such, it will be possible to compare the scores on well-being scales obtained before and after a memory description. Similarly, scores on each memory characteristic will be compared as a function of whether the memory was described before (true score) or after responding to well-being scales (biased score). Furthermore, it will be possible to examine whether the relationship between each memory characteristic and well-being differs as a function of the order of administration of the tasks and according to the valence of the memory.

Finally, to examine potential biases on well-being assessments, we used two types of scales. The first scale is a situational measure of well-being (vitality), which may be more sensitive to subtle changes created by describing a memory

prior to responding to the scale. The second scale is a measure of trait well-being, which should reflect a more stable assessment of well-being (life satisfaction). In addition, this type of scale is typically used in research on individual differences in memories (e.g., Bauer et al., 2005; Philippe et al., 2011), thus providing an adequate basis for comparative purposes.

METHOD

Participants, procedure and design

Final sample was composed of 262 undergraduate/graduate students (192 females and 70 males) from a Canadian university with a mean age of 27.58 years ($SD = 7.58$ years). A total of three participants were not included because they did not report a memory. Sample size was determined as the minimal required number of participants to perform all analyses reported in this manuscript with a power of .80 at an alpha of .05 for small effect sizes of $f^2 = .04$. Participants were contacted through their university email and informed that we were conducting an online study on well-being. We opted for an online study, given that telling a memory to an interviewer within laboratory settings can affect memory retrieval as a function of the characteristics of the interviewer (Pasupathi, 2001) and context. Since the purpose of this research was to examine the influence of the order of administration of questionnaires on memory reconstruction, it was deemed important to avoid other systematic contextual factors of influence. As an incentive, participants were entered into a draw of three prizes of \$125. Participants were randomly assigned by an online script to complete the well-being scales before describing their memory ($n = 124$) or after ($n = 138$). Participants were also randomly assigned to describe either a positive ($n = 124$) or a negative memory ($n = 138$). Given that participants were randomly assigned to each experimental group by a script, the number of participants in each condition slightly differs. To summarise, the design of this experiment is a 2 (Valence: positive or negative) \times 2 (Order of administration: before or after). Participants completed the trait followed by the situational well-being scale. Following the description of their memory, they were asked to rate a number of characteristics of their memory (described below).

Measures

Trait and situational well-being. Two types of well-being were assessed. Trait well-being was measured with the 5-item Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985), $\alpha = .83$ (e.g., “I am satisfied with my life”) and situational well-being was assessed with a 6-item scale of vitality (Ryan & Frederick, 1997), $\alpha = .91$. The vitality scale asked participants to rate each item as a function of how they were feeling *right now* (e.g., “I feel alive and vital”). Participants were asked to rate all items on a 7-point Likert scale (1 = *do not agree at all*; 7 = *totally agree*).

Episodic memory. Instructions were derived from past research on self-defining memories, that is, a type of memory that is frequently activated and recalled and that is highly significant to the participant (Philippe et al., 2011; Singer & Salovey, 1993; Sutin & Robins, 2005). The questionnaire asked the participants to describe “a [positive/negative] personal memory of an event that is at least one year old which was significant (important) for you. This memory should reflect your identity or who you are and should reveal something about how you perceive yourself generally. Choose a memory that often comes to your mind”.

Ratings of memory characteristics. After describing their memory, participants were asked to rate a number of items. A first set of six items used in past research (Philippe et al., 2011) asked the participants to rate the degree of need satisfaction they experienced at the moment the event of their memory occurred. Participants made their ratings 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. They were provided with two items assessing each of the three 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 skillful or capable”; and for relatedness: “I felt connected to

one or more people". All items were averaged in an index measuring need satisfaction, $\alpha = .86$.

Participants were also asked to rate on a Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) various characteristics related to their memory, such as vividness ("the memory I have of this event is clear in my mind and detailed"), significance ("this memory is important/significant for me"), rehearsal ("I frequently think about this memory"), sharing ("I frequently talk about or share this memory with others") and involuntary recall ("Since it happened, the memory has popped up in my mind by itself, without me trying to recall it"). The first four items were drawn from the Memory Quality Questionnaire (Alea & Bluck, 2007), whereas the fifth was taken from Rasmussen and Berntsen (2009). Finally, participants were asked to report in years and months when the event described in their memory occurred. However, this measure will not be used in the present article.

Memory coding. Three external trained judges independently coded all memory narratives for the presence/absence of several themes: Redemption and contamination, intrinsic and integrative themes and coherence. Contamination is found in memory description that moves from an affectively positive situation to an affectively negative situation, in which good things turn into bad outcomes. Redemption is the opposite: The description of the memory starts in a negative light, but by the end of the description, the narrator has underscored the positive things and feelings brought by the initially negative situation. Contamination and redemption were coded for the presence (1) or absence (0) of such a sequence in the memory narrative (for further coding detail, see McAdams et al., 2001). Memories coded as intrinsic are those that include themes of personal growth, meaningful relationships and contribution to society. Integrated memories are those mentioning how the person has grown out of the experience, learned something about himself/herself or came to a new or deeper understanding of self or others. Intrinsic and integrated themes were coded for the presence (1) or absence (0) of such themes in the memory narrative (for further coding detail, see Bauer et al., 2005). Coherence was coded following Adler's coherence coding system (2011), which divides into four categories: Orientation (sufficient background information to understand the story), structure (story flow and scenes are

presented in a causally and temporally logical way), affect (use of an appropriate emotional language which underscores why the event is worth telling) and integration (the participant shows how the event relates to his/her broader sense of self). As in previous research (Adler, 2011), each dimension was assigned a score of 0 (low coherence) to 3 (high coherence) and all four dimensions were averaged in a coherence index. Finally, a word count was performed on each memory narrative using a specific formula in Microsoft Excel. A second judge coded 25% of the material to obtain inter-judge reliability, which was revealed to be adequate for each coding (redemption, kappa = .59; contamination, $k = .58$; intrinsic themes $k = .90$; integrated themes, $k = .70$; coherence, intra-class correlation = .77).

RESULTS

Valence and order of administration on trait and situational well-being

Two 2 (Order: 0 = well-being first; 1 = memory first) \times 2 (Valence: 0 = Negative; 1 = Positive) analysis of variances (ANOVAs) were conducted to compare the effect of the order of the description of the memory (before or after completing well-being measures) and its valence on scores of situational and trait well-being (dependent variables). Results of these ANOVAs are shown in Table 1. All effects pertaining to trait well-being were not significant, and there was no interaction between order and valence. This stable form of well-being was not influenced by the order of administration of the measures or by the valence of the memory described before. In the case of situational well-being, order of administration showed a significant main effect. Situational well-being was rated higher after a memory description ($M = 4.73$, $SD = 1.24$) (positive or negative memory) than before ($M = 4.28$, $SD = 1.17$)—a difference of a medium effect size, $d = .37$. There was no significant main effect of valence or significant interaction between order and valence. In sum, the description of a memory before responding to well-being scales appears to affect the mean reported level of situational well-being, but does not seem to impact trait well-being. Given that situational well-being was rated higher after describing both a positive or a negative memory, it appears that a mood-congruent

TABLE 1
F-values of 2 × 2 ANOVAs between Order and Valence on trait and situational well-being and memory characteristics

Terms	Well-being		Memory characteristics								
	Trait	Situational	Need satisfaction	Significance	Rehearsal	Vividness	Sharing	Involuntary recall	Age	No. of words	Coherence
Order	1.18	9.21**	0.05	0.41	0.83	0.06	0.16	0.71	0.00	1.08	3.42
Valence	0.11	2.76	257.28**	16.69**	0.83	4.81*	12.63**	0.71	3.90*	5.42*	0.12
Order × Valence	0.08	1.46	0.08	0.03	0.24	0.01	1.15	0.21	0.33	0.44	0.55

* $p < .05$, ** $p < .01$.

Degrees of freedom for each effect are $F(1, 258)$.

effect occurred after describing a positive memory and a mood-incongruent effect occurred after describing a negative memory.

Valence and order of administration on memory characteristics

The same two-way ANOVA was conducted again with each memory characteristic as the dependent variable (see Table 1). These analyses sought to examine if reporting on one's well-being before describing a memory would influence the characteristics of the memory described. Results revealed a significant main effect of valence on need satisfaction, significance, vividness, sharing, age of the memory and word count. Compared to participants who wrote about a negative memory, those who wrote about a positive memory reported a memory characterised by a higher level of need satisfaction ($M = 2.02$, $SD = 0.81$ vs. $M = -0.41$, $SD = 1.49$, $d = 1.72$), greater significance ($M = 6.41$, $SD = 0.94$ vs. $M = 5.81$, $SD = 1.35$, $d = .52$), greater vividness ($M = 6.06$, $SD = 1.11$ vs. $M = 5.72$, $SD = 1.31$, $d = .28$) and as being more often shared with others ($M = 4.92$, $SD = 1.84$ vs. $M = 4.14$, $SD = 1.75$, $d = .43$). Positive memories also contained a fewer number of words ($M = 122.98$ words $SD = 89.10$ vs. $M = 152.52$ words, $SD = 103.55$, $d = .31$) and were more recent in age ($M = 39.02$ months, $SD = 45.94$ vs. $M = 49.14$ months, $SD = 53.04$, $d = .24$)¹ than negative memories. There were no main effects of valence regarding the amount of rehearsal of the memory and its frequency of involuntary recall. There were also no main effects of order and no significant interactions between order and valence on all memory

characteristics. Logistic regressions were conducted on intrinsic and integrative memories, contamination and redemption because of their dichotomous scores. Result revealed no significant effect of order on all variables and only one significant effect of valence on intrinsic memories. Positive memories were more likely to contain intrinsic themes than negative memories (see Table 2). There was one significant order × valence interaction on redemption. Significantly more redemptive themes were found in negative memories when people had reported their well-being before describing their memory than after. No such order effect was found for positive memories.

Taken together, although several memory characteristics differed as a function of the valence of the memory (need satisfaction, significance, vividness, sharing, number of words, age and intrinsic memories), there was only one effect of order of administration on all memory characteristics. It should be noted that at least one such order effect could be expected by chance (13 ANOVAs and regressions × 2 terms including order (order and order × valence) = 26 tests, $1/26 = p < .05$). These largely null results suggest that whether a memory is described after completing some well-being scales or before, the type of memory selected by the participants and its description is unlikely to be affected by the order of administration.

Relationships between memory characteristics and well-being as a function of valence and order of administration

Several hierarchical regression analyses were conducted according to the following sequence.

¹Untransformed means are reported.

TABLE 2
Logistic regressions of order and valence on dichotomously scored memory characteristics

Terms	Intrinsic		Integrative		Contamination		Redemption	
	B	Wald	B	Wald	B	Wald	B	Wald
Order	-.66	1.66	.25	.22	-19.04	.22	.40	1.07
Valence	2.21	26.93**	.76	2.10	.25	.00	-.61	1.65
Order × Valence	-.07	.01	-1.01	1.82	16.74	.00	-1.68	4.41*

* $p < .05$, ** $p < .01$.

At Step 1, valence of memories, order of administration and their interaction term (order × valence) were entered. At Step 2, one memory characteristic was entered. At Step 3, the two interaction terms between the memory characteristic and order and valence (order × memory characteristic, valence × memory characteristic) were entered. Finally, at Step 4, the three-term interaction between the memory characteristic, order and valence was added to the equation (order × valence × characteristic). This hierarchical regression was repeated for each type of well-being as the dependent variable and for each memory characteristic separately as the independent variable.

Situational well-being

Main effects. There were several main effects of various self-reported memory characteristics on situational well-being. Significance, vividness, involuntary recall and need satisfaction were all positively associated with situational well-being (see Table 3). Several coded characteristics were also associated with situational well-being (see Table 4). Integrative and intrinsic memories and word count were positively associated with situational well-being, whereas it was negatively associated with contamination.

Interaction effects with both order and valence. Overall, four memory characteristics revealed different relationships with situational well-being, depending on both the order of administration and valence of the memory.

There was a significant *three-way* interaction between amount of rehearsal, valence and order of administration of the memories in predicting situational well-being ($t = 2.04$, $p < .05$). Simple effect analysis of this interaction revealed a

significant Valence × Rehearsal when the memory was described before completing well-being measures ($B = .42$, $t = 2.10$, $p < .05$), but not after ($B = .20$, $t = 0.89$, *ns*). Further analysis of this two-way interaction showed that when describing memories before completing well-being measures, rehearsal was positively associated with situational well-being when the memory was positive ($B = .30$, $t = 2.03$, $p < .05$), but not when negative ($B = -.12$, $t = -0.88$, *ns*).

There was a significant *three-way* interaction between sharing of memories, valence and order of administration of the memories in predicting situational well-being ($t = 2.19$, $p < .05$). Simple effect analysis of this three-way interaction revealed that the Order × Sharing interaction was significant when the memory was positive ($B = .47$, $t = 2.20$, $p < .05$), but non-significant when the memory was negative ($B = -.20$, $t = -0.92$, *ns*). Further probing of this two-way interaction showed that frequency of sharing a positive memory was positively associated with situational well-being when the memory was described before completing well-being measures ($B = .38$, $t = 2.51$, $p < .05$), but not after completing them ($B = -.09$, $t = -0.59$, *ns*).

There was a *three-way* interaction between integrative themes, valence and order of administration of the measures in predicting situational well-being ($t = 2.19$, $p < .05$). Simple effects analysis of this interaction showed that there was significant Valence × Integrative memories in predicting situational well-being when the memory was described before completing well-being scales ($B = 1.32$, $t = 2.02$, $p < .05$), but not when the memory was described after ($B = -.64$, $t = -1.05$, *ns*). Further probing of the significant two-way interaction revealed that when describing memories before completing well-being measures, integrative themes were positively

TABLE 3

Hierarchical regressions analyses of order, valence and self-rated memory characteristics on situational and trait well-being

Steps	Characteristics	Situational well-being			Trait well-being		
		B	β	t	B	β	t
1	Valence (Val)	-.07	-.03	-0.31	.09	.04	0.44
	Order (Ord)	.64	.26	3.09**	.20	.09	1.01
	Order \times Valence	-.36	-.13	-1.21	-.08	-.03	-0.30
2	Rehearsal	.09	.08	1.23	.08	.07	1.12
3	Val \times Rehearsal	.16	.09	1.07	.08	.05	0.55
	Ord \times Rehearsal	-.05	-.03	-0.34	.10	.07	0.68
4	Ord \times Valence \times Rehearsal	.62	.26	2.04*	.41	.18	1.37
2	Significance	.18	.18	2.87**	.16	.13	2.10*
3	Val \times Significance	.40	.18	2.40**	.20	.09	1.22
	Ord \times Significance	.03	.02	0.18	.17	.10	1.13
4	Ord \times Valence \times Significance	.35	.11	1.07	.47	.15	1.43
2	Vividness	.22	.18	2.93**	.17	.15	2.35*
3	Val \times Vividness	.19	.10	1.24	.08	.04	0.53
	Ord \times Vividness	-.04	-.02	-0.27	.03	.02	0.23
4	Ord \times Valence \times Vividness	.03	.01	0.11	.52	.21	1.70
2	Sharing	.12	.10	1.59	.18	.15	2.42*
3	Val \times Sharing	.04	.02	0.24	.16	.10	1.11
	Ord \times Sharing	.14	.08	0.91	.34	.19	2.29*
4	Ord \times Valence \times Sharing	.67	.27	2.19*	.21	.09	0.73
2	Involuntary recall	.22	.18	3.03**	.21	.18	2.87**
3	Val \times Involuntary recall	.06	.03	0.39	.06	.04	0.39
	Ord \times Involuntary recall	.04	.02	0.23	.23	.14	1.56
4	Ord \times Valence \times Involuntary	.23	.10	0.77	.15	.07	0.52
2	Age of memory	.09	.07	1.15	.05	.04	0.63
3	Val \times Age of memory	-.03	-.06	-0.72	.06	.04	0.40
	Ord \times Age of memory	.06	.03	0.37	.04	.03	0.25
4	Ord \times Valence \times Age	-.35	-.16	-1.15	.02	.01	0.07
2	Need satisfaction	.58	.47	5.86**	.47	.40	4.76**
3	Val \times Need satisfaction	.02	.01	0.09	.07	.03	0.29
	Ord \times Need satisfaction	.10	.06	.47	.14	.08	0.68
4	Ord \times Valence \times Need	-.20	-.07	-.41	.40	.14	0.80

* $p < .05$, ** $p < .01$.

associated with situational well-being when the memory was positive ($B = 1.13$, $t = 2.32$, $p < .05$), but not when negative ($B = -.19$, $t = -0.44$, ns).

There was a *three-way* interaction between intrinsic themes, valence and order of administration of the memories in predicting situational well-being ($t = 3.05$, $p < .05$). Simple effects analysis of this interaction showed that there was a significant Order \times Intrinsic themes interaction when memories were negative ($B = -1.63$, $t = 2.77$, $p < .01$), but not when memories were positive ($B = .61$, $t = 1.39$, $p = .17$). Further analysis of this two-way interaction revealed that intrinsic negative memories were positively associated with situational well-being when the memories were described after completing well-being measures

($B = 1.30$, $t = 3.53$, $p < .01$), but not when described before ($B = -.34$, $t = -0.73$, ns).

Interaction effects with valence. Two memory characteristics were differently associated with situational well-being, depending on the valence of the memory.

There was a significant two-way interaction between significance and valence. Simple effects analyses revealed that significance of a positive memory was positively associated with situational well-being ($B = .48$, $t = 3.13$, $p < .01$), but not significance of a negative memory ($B = .09$, $t = 0.19$, ns).

There was a significant two-way interaction between coherence and valence in predicting

TABLE 4
Hierarchical regressions analyses of order, valence, and coded memory characteristics on situational and trait well-being

Steps	Characteristics	Situational well-being			Trait well-being		
		B	β	t	B	β	t
1	Valence (Val)	-.07	-.03	-0.31	.09	.04	.44
	Order (Ord)	.64	.26	3.09**	.20	.09	1.01
	Order \times Valence	-.36	-.13	-1.21	-.08	-.03	-0.30
2	Redemption	.26	.08	1.33	.48	.16	2.48*
3	Val \times Redemption	-.56	-.09	-1.21	-.10	-.01	-0.23
	Ord \times Redemption	-.27	-.06	-0.65	-.51	-.13	-1.29
4	Ord \times Val \times Redemption	.39	.03	0.41	-.56	.05	-0.59
2	Contamination	-1.06	-.21	-3.48**	-.86	-.18	-2.88**
3	Val \times Contamination	.58	.02	0.46	.60	.10	.49
	Ord \times Contamination	-.42	-.07	-0.67	.61	.03	.95
4	Ord \times Val \times Contamination	-. ^a	-	-	-	-	-
2	Integrative	.44	.12	1.96*	.28	.08	1.27
3	Val \times Integrative	.31	.06	0.69	.23	.05	0.51
	Ord \times Integrative	-.04	-.01	-0.09	-.43	-.09	-0.97
4	Ord \times Val \times Integrative	1.96	.26	2.19*	.93	.13	1.05
2	Intrinsic	.68	.26	3.89**	.63	.26	3.71**
3	Val \times Intrinsic	.06	.02	0.16	-.27	-.10	-0.75
	Ord \times Intrinsic	-.17	-.05	-0.49	-.24	-.07	-0.69
4	Ord \times Val \times Intrinsic	2.24	.60	3.05**	.72	.20	0.99
2	Coherence	.15	.09	1.45	.09	.08	1.25
3	Val \times Coherence	.35	.20	2.36*	-.13	-.08	-0.92
	Ord \times Coherence	.08	.04	0.52	-.08	-.05	-0.57
4	Ord \times Val \times Coherence	.38	.15	1.28	.31	.13	1.04
2	Word count	.58	.14	2.30*	.15	.13	2.01*
3	Valence \times Word count	.06	.12	0.80	.08	.04	0.62
	Order \times Word count	-.17	-.25	-1.58	-.37	-.26	-2.39*
4	Order \times Valence \times Word	.16	.37	1.11	.57	.27	1.75

^aThere were not enough contamination codings in the positive memory condition to compute the three-way interaction.
* $p < .05$, ** $p < .01$.

situational well-being ($t = 2.36$, $p < .05$). Simple effects analysis of this interaction showed that coherence was marginally and positively associated with situational well-being when the memory was positive ($B = .25$, $t = 1.91$, $p < .01$), but not when it was negative ($B = -.10$, $t = -0.82$, ns).

Trait well-being

Main effects. Again, there were several main effects of memory characteristics on trait well-being. Significance, vividness, sharing, involuntary recall, need satisfaction, redemption, intrinsic themes and word count were all positively associated with trait well-being, whereas it was negatively associated with contamination. Null main effects were found for rehearsal, age of memory, integrative themes and coherence.

Interaction effects with order. There were only two interaction effects with order and no interaction effects with valence or with both valence and order. There was a significant *two-way* interaction between the amount of sharing of memories and order in predicting trait well-being ($t = 2.29$, $p < .05$). Simple effects analysis of this interaction showed that sharing was positively associated with trait well-being when the memory was described before completing the well-being measures ($B = .28$, $t = 2.09$, $p < .05$), but not when described after ($B = -.06$, $t = -0.48$, $p > .05$).

There was also a significant *two-way* interaction between the number of words in memories and order in predicting trait well-being ($t = -2.39$, $p < .05$). Simple effects analysis of this interaction showed that number of words in memories was positively associated with trait well-being when

TABLE 5
Summary of all order effects with a memory characteristic on situational and trait well-being

Memory characteristics	Situational well-being (SWB)		Trait well-being (TWB)	
	Order effect memory before well-being	Order effect memory after well-being	Order effect memory before well-being	Order effect memory after well-being
Rehearsal	Rehearsal of a <i>positive</i> memory is positively associated with SWB			
Sharing	Sharing a <i>positive</i> memory is positively associated with SWB		Sharing <i>positive or negative</i> memories is positively associated with TWB	
Integrative memories	Integrative <i>positive</i> memories are positively associated with SWB			
Intrinsic memories		Intrinsic <i>negative</i> memories are positively associated with SWB		
Word count			Word count in <i>positive or negative</i> memories is positively associated with TWB	

the memory was described after completing the well-being measures ($B = .36, t = 2.74, p < .01$), but not when described before ($B = -.01, t = -0.08, ns$).

Summary of results

Table 5 summarises all order interactions with a memory characteristic on situational and trait well-being. As can be seen, three order effects in interaction with a memory characteristic occurred on situational well-being when the memory was described before responding to the well-being measures. In addition, these order effects occurred only when a positive memory was described first. No such order effects were detectable when a negative memory was described first. There was only one order effect on trait well-being when the memory was described first. Similarly, there was only one order effect on situational well-being and another order effect on trait well-being when the memory was described after completing well-being scales. At least one significant order effect was expected by chance within each of these conditions. Overall, order of administration had little effect on the relationships between memory characteristics and well-being measures. However, memory descriptions completed before responding to well-being scales significantly increased the

mean level on the situational well-being scale. In addition, this order of administration in interaction with the valence of the memory increased the relationship of three memory characteristics with situational well-being. This number of order effects is greater than what is expected by chance on situational well-being (13 tests \times 2 terms = 26, $3/26, p = .12$).

GENERAL DISCUSSION

Overall, we found that the order of administration of memory and well-being questionnaires matters, but in particular conditions. First, the retrieval of memories seems to affect subsequent ratings of well-being to a greater extent than how well-being ratings affect memory retrieval. However, significant memory retrieval appears to mostly affect situational ratings of well-being ("how do you feel right now"), but much less so trait well-being, such as life-satisfaction scales. Indeed, we found a difference of a medium size in the reported mean level of situational well-being when memories were described before well-being ratings, as compared to after. However, we found no such order effect on trait well-being. We also found that the relationship between certain memory characteristics (rehearsal, sharing and integrative themes) and well-being were increased when the memory had been collected first, but

only for situational well-being, rather than trait well-being. We found more of such order effects than in any other order condition and at a level that was over what was expected by chance—contrary to the other conditions. As such, the immediate effect of memory retrieval appears to affect people's mood or vitality rather than their cognitions (i.e., evaluation of their life). Therefore, our recommendation is to assess memories at the end of questionnaires in order to avoid potential mood-priming effects on subsequent scale ratings, especially if the construct measured by these scales can be affected by subtle mood changes.

The present research additionally contributed to the literature by highlighting that several memory characteristics and themes were found in different proportion within positive and negative memories. Need satisfaction, significance, vividness, sharing, intrinsic themes, age of the memory and the number of words were either rated higher or more present in positive than in negative memories. These valence effects were found regardless of the order of administration. These results extend past research (e.g., Rasmussen & Berntsen, 2009) by providing further information on what memory characteristics differs as a function of valence. This can have important implications for research that seeks to tackle what aspect of a negative memory could be improved to reduce its deleterious effect on well-being. For example, writing about a negative memory, and potentially increasing the number of words from its initial narrative, appears to enhance well-being over time (Pennebaker & Chung, 2011). Greater sharing of negative memories also seems to provide this positive effect (Pasupathi, 2003).

The present research also replicated past research by showing that several of the memory characteristics and themes investigated in this study were related to situational and trait well-being. Of importance, the present investigation also confirmed that most, if not all, of these associations are not transient effects of order of administration, but rather represent the influence of individual differences in memories on well-being. Obviously, the present results to this effect are only correlational. As such, it is impossible to determine if people with high well-being interpret their memories with certain characteristics or themes or if these characteristics and themes in memories foster changes in people that influence their well-being over time. Recent research using longitudinal designs suggests that both influences

exist (Adler, 2011; Lodi-Smith et al., 2009). For example, Philippe, Koestner, and Lokes (2013) found that need satisfaction in couple-related memories collected when both partners were still together at Time 1 predicted union dissolution more than a year later at Time 2 (over and above several other key relational constructs). In addition, at Time 2, when shown again, the memory they had described more than one year ago at Time 1 and asked to rate it again for perceived level of need satisfaction, participants who were still with their partner rated this memory higher on need satisfaction, whereas participants who had broken up during the year rated this same memory lower in terms of need satisfaction. Thus, it seems that memory characteristics can predict future actions and behaviours, but that these actions in turn are likely to affect how people interpret their memories.

Limitations

The present investigation had some limitations. The first limitation is that only self-defining memories were assessed. However, the literature on narrative personality is replete with different types of narrative material, including high-point (McAdams et al., 2001), therapy narratives (Adler, 2011), possible selves (King & Raspin, 2004; King & Smith, 2004) or perceptions of personality change (Lodi-Smith et al., 2009), to name a few. Different results could be expected with a specific type of narrative. In the present investigation, we used self-defining memories, given that they constitute a common form of memories shared by everyone. A second limitation is that our experimental design forced participants to describe a memory of a particular valence. Although such a design provides greater control over potentially contaminating variables, when exploring individual differences in memories, it is most of the time better to let the participant choose what memory best represents himself or herself, which includes freely choosing the valence of that memory. Obviously, the valence of the memory chosen represents an important part of what self-defines the person. Forcing people to describe a positive memory while they would have spontaneously described a negative one (or vice versa) could have potentially lowered the effect sizes of some of the results reported in this paper.

Overall, the present research confirms that several memory characteristics are associated with well-being and that these relationships are not due to simple momentary effects of the order of administration of the questionnaires. However, the description of a memory was shown to affect subsequent ratings of mood-related scales, such as scales of situational well-being. Therefore, our recommendation is to always collect memory-related material at the end of a questionnaire to avoid potential mood-priming effect.

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