

Autobiographical Memory, Auto-noetic Consciousness, and Self-Perspective in Aging

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In this study, the authors examined the effects of aging on autobiographical memory in 180 participants by means of a new method designed to assess across 5 lifetime periods the nature of memories—that is, specificity and spontaneity—and the phenomenal experience of remembering—that is, self-perspective and auto-noetic consciousness—via the field/observer and remember/know paradigms respectively. Age-related differences were found for the specificity and spontaneity of memories and the phenomenal experience of remembering. There was an increase in observer and know responses with age, but a decrease in field and remember responses and in the ability to justify them by recalling sensory-perceptive, affective, or spatiotemporal specific details. This pattern confirms the existence of a semantic-episodic dissociation in autobiographical memory in aging. Moreover, the data support the view that older participants can subjectively “travel back in time” to relive personal events in the most distant past better than those in the recent past.

Keywords: episodic memory, semantic memory, autobiographical memory, remote memory, aging

Many laboratory studies have demonstrated that aging affects memory systems in different ways. Episodic memory, which refers to autobiographical memory (AM) recollected in the context of a particular time and place and with some reference to oneself as a participant in the episode, is the memory system most severely

affected by aging (Craik, 2000; Moscovitch & Winocur, 1992; Nyberg et al., 2003; Nyberg & Tulving, 1996). However, AM involves one of two different kinds of knowledge pertaining to oneself, either episodic or semantic (Conway, 1996; Larsen, 1992). For example, Tulving, Schacter, McLachlan, and Moscovitch (1988) proposed distinguishing between an episodic subcomponent containing personal, specific events situated in time and space and a semantic subcomponent storing general knowledge of one's past, such as names of acquaintances, personal addresses, or generic events. More recently, Conway, Singer, and Tagini (2004) claimed that retrieval of autobiographical memories depends on a complex, self-related, goal-driven set of control processes and involves (a) the episodic memory system, which contains event specific sensory-perceptual-cognitive-affective details, and (b) the long-term self, which contains a more abstracted autobiographical knowledge base and the conceptual self.

Few studies have investigated the effects of age on the two subcomponents of AM. Most of the research in older adults has focused on the quantity of memories recalled with free recall or the cue-word technique and, far more rarely, on the quality of memories (for reviews, see Cohen, 1998; Piolino, 2003; Piolino, Desgranges, & Eustache, 2000). Piolino, Desgranges, Benali, and Eustache (2002) administered a semistructured autobiographical questionnaire that assessed each participant's ability to recall both general information (semantic component) and detailed specific events situated in time and space (episodic component) from between six and nine time periods (from the current year and the

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1990s to the 1920s). By administering this questionnaire to participants aged 40–79 years old, Piolino et al. (2002) demonstrated that episodic AM declines with age and remoteness. By contrast, the data suggest the persistence of a permanent memory store of a personal semantic nature (i.e., information, generic events) that is, compared with episodic memories, unrelated to either the participant's age or the time interval. These findings suggest that in aging, the components that make AM episodic, namely specificity and details, are affected regardless of remoteness but are compensated for by an increase in semanticized memories (i.e., generic events memory). This view is consistent with the data recorded by Levine, Svoboda, Hay, Winocur, and Moscovitch (2002), who showed that older adults recalled fewer episodic AM details reflecting happenings, locations, perceptions, and thoughts and more semantic details that were not connected to any particular time or place than did younger adults. All these studies found that episodic AM deteriorated more with age than did personal semantic memory regardless of the time periods being tested. Other studies, however, have produced contradictory results, showing no effect of age on the ability to recall remote episodic memories (Bluck, Levine, & Lauhere, 1999; Davidson & Glisky, 2002; Howes & Katz, 1992). Differences in the definition of episodic AM, as well as in methodology, may be partly responsible for these discrepancies (Cohen, 1998).

With the development of the theory of episodic memory, the essence of this memory system has shifted away from specificity to the phenomenal experience of remembering (Baddeley, 2001; Brewer, 1996; Gardiner, 2001; Tulving, 2001, 2002; Wheeler, Stuss, & Tulving, 1997). Phenomenal experience (i.e., perceptual, affective, and spatiotemporal contextual details) gives the rememberer the feeling that a representation is the recollection of an event that belongs to her or his personal past instead of an item of semantic knowledge. Recent formulations have emphasized the state of consciousness accompanying the recollection of an event (Tulving, 1985, 2002; Wheeler et al., 1997). Autonoetic consciousness, which is central to episodic memory, is the feeling of reexperiencing or reliving the past and mentally traveling back in subjective time. By contrast, noetic consciousness, which characterizes semantic memory, is the capacity of being aware of information about the world in the absence of any recollection. Subjective reports of memories can be assessed with the remember/know (R/K) procedure (Gardiner, 1988; Tulving, 1985), which makes it possible to differentiate between episodic and semantic memory retrieval. If participants recall or recognize a previously encountered item, they are required to give a "remember" response (R response) when they retrieve an item based on the recollection of details of the source of acquisition or a "know" response (K response) when they just have a feeling of familiarity. Previous studies that have used the R/K paradigm in aging have consistently showed that age affects R responses (Bastin & Van der Linden, 2003; Clarys, Isingrini, & Gana, 2002; D'Argembeau & Van der Linden, 2004; Fell, 1992; Parkin & Walter, 1992; Perfect & Dasgupta, 1997; Perfect, Williams, & Anderson-Brown, 1995). However, this evidence was obtained under conditions that had little to do with the complex and self-relevant nature of AM and the long retention intervals of real life (Conway, 2001). Very few studies have used the R/K procedure to assess state of consciousness in remote memory. The use of this paradigm in young participants has revealed a shift in the phenomenal experience of

autobiographical remembering from R responses to K responses with the passage of time (Conway, Gardiner, Perfect, Anderson, & Cohen, 1997). This shift is in accordance with the idea that most parts of the memory are semanticized throughout time (Cermak, 1984). Rybash and Monaghan (1999) have demonstrated that older participants can give either R or K responses for their remote autobiographical memories. Rybash and Monaghan used the Galton-Crovitz method (Crovitz & Schiffman, 1974), in which the participant is asked to provide the first specific AM that comes to mind for each cue word (e.g., *vacation*) and then to date each of their memories. The researchers' findings suggest that older participants can use their episodic and semantic memory equally well to carry out a task of recalling autobiographical events from across their whole lifetime. However, the researchers did not have any criteria for checking episodicity. Moreover, this study failed to tackle the issue of age-related differences in AM.

Besides autonoetic consciousness, vivid visual imagery is also crucial in episodic memories, although the study of vivid visual memory has received relatively little attention in the literature on AM (Greenberg & Rubin, 2003). Indeed, the sense of remembering almost invariably involves some sort of visual reexperiencing of a personal event (Brewer, 1996; Conway, 2001; Dewhurst & Conway, 1994). The assessment of visual imagery during autobiographical recollection can be based on the viewpoint associated with the mental representations, known as the field/observer (F/O) perspective paradigm (Nigro & Neisser, 1983; Robinson & Swanson, 1993). In a field (F) perspective, the participant keeps the same viewpoint as in the original event, whereas in an observer (O) perspective, the participant sees him- or herself in the event from the same viewpoint as an external observer. Recently, Crawley and French (2005) provided support that remembered remote autobiographical memories are usually viewed from an F perspective, whereas known ones are usually viewed from an O perspective. Nigro and Neisser (1983) showed that recalling recent memories implies something like the original perspective, whereas recalling old memories involves seeing oneself as if one were a spectator. This shift from one point of view to the other may correspond to the shift in state of consciousness, from autonoetic to noetic state, with the passage of time (Robinson & Swanson, 1993). These data suggest that the F/O perspective paradigm could make it possible to distinguish between the episodic and semantic aspects of AM. In total, episodic AM can be characterized as enabling someone to "travel back in time" to relive specific events and to view these events as they would have originally been seen through his or her own eyes (Crawley & French, 2005).

The purpose of this study was to further investigate AM in aging combined with the viewer perspective and the state of consciousness. We developed a new method of assessment whereby the R/K paradigm was used to measure the ability to achieve autonoetic consciousness, whereas the F/O paradigm was used to gauge the ability to reinstate the original self-perspective. Given that previous research into AM has shown that aging specifically affects the episodic component but preserves the semantic component, we hypothesized that aging would negatively affect not only the specificity of memories but also the autonoetic consciousness and the self-perspective accompanying their retrieval. Consequently, we expected a decrease with age in the number of R responses and F perspectives but an increase in the number of K responses and O perspectives. Lastly, we set out to examine the effects of the

retention interval, which can complicate the interpretation of age effects.

METHOD

Participants

One hundred eighty healthy volunteer participants were divided into three age groups (see Table 1): those aged between 21 and 34 (young), those aged between 60 and 69 (old), and those over 69 (very old). The inclusion of participants was based on the absence of neurological or psychiatric medical history and, for the old and very old participants, on the absence of memory complaints, signs of depression (Geriatric Depression Scale; Yesavage et al., 1983), and symptoms of dementia as assessed via the Mattis scale (Mattis, 1976). No medication known to impair memory was allowed. The participants had at least 8 years of education and were all living in their own homes. It is notable that the young adults were on average more highly educated than the old and very old ones, $F(2, 177) = 23.17, p < .0001$ —a pattern often observed in aging studies—but the three groups did not differ, $F(2, 177) < 1, p < .10$, on verbal abilities according to the 44-item Mill Hill test (Raven, Court, & Raven, 1993), a multiple-choice synonym vocabulary test. The scores obtained by the old and very old participants on the Mattis test and the Geriatric Depression Scale reflected the absence of dementia and depression, respectively. The participants gave their informed consent to the experimental procedure.

AM Investigation

This investigation was based on a new AM test (Test Episodique de Mémoire du Passé autobiographique [TEMPau]; Piolino, Desgranges, et al., in press) that relies on the specific mode of subjective experience accompanying the retrieval of information by means of a first-person approach (Gardiner, 2001). Therefore, the TEMPau was specially designed to assess strictly episodic memories, taking into account not only their specificity (uniqueness, spatiotemporal location, details) but also the subjective experience of remembering. This test is a semistructured questionnaire based on previous ones (Borrini, Dall'Ora, Della Sala, Marinelli, & Spinnler, 1989; Kopelman, Wilson, & Baddeley, 1989; Piolino et al., 2003a; Piolino et al., 2003b; Piolino et al., 2002) designed to assess the ability to recall detailed, specific events situated in space and time. The TEMPau's originality lies in the way it addresses the issue of the state of consciousness and the self-perspective accompanying memory retrieval across the entire life span by incorporating two kinds of measures of episodic reexperiencing via the R/K and F/O paradigms (see the introduc-

tion). Given that one feature of episodic memory is the pulling together into a single episode of what, where, and when something happened, the test was designed to probe the different aspects of recollective experience, particularly the factual, spatial, and temporal features of memories. Figure 1 presents the general framework of the test and the different scores that were recorded.

The Autobiographical Recall Memory Task

The participants were asked to recall autobiographical memories, from five periods covering their entire life span from past to present, which were relevant to their personal lives (i.e., 0–17 years old [hereafter referred to as Period A], 18–30 years old [Period B], more than 30 years old except for the last 5 years [Period C], the last 5 years except for the last 12 months [Period D], the last 12 months [Period E]). Of note, the young participants recalled memories from three periods (i.e., Periods A, D, and E) instead of five. There was no time limit, but the test generally lasted 2 hr at most.

Each period, except for the last one, was assessed by means of four themes (a meeting or event linked to a person; an event that occurred during the participant's schooling, working life, or retirement; a journey; a family event). For the most recent period, eight questions were asked about Period E: That is, participants had to recall a specific event that took place last summer, on Christmas or New Year's Day, last week, last weekend, 2 days ago, yesterday, or today. Each memory, therefore, was cued by a theme or question and a specific period (e.g., "an event linked to a person—the last 5 years"). Participants were given precise instructions, available during the task, to recall "a personal event which occurred only once, at a particular place and date, and lasted several minutes or hours but less than a day." They had to locate it in time and space and give as many details as they could. If the participant could not spontaneously recollect an event, cues and/or encouragement were provided. In the case of a failure to produce any memories, the participants were prompted with many general clues about each theme relative to a period (e.g., "A striking day with a teacher or a school friend at the primary or secondary school; when taking a written or oral exam such as school leaving certificate"). These sentences-cues were selected from a previous AM experimental study on healthy participants (Piolino et al., 2000, 2002). After recall, either spontaneous or not, the participants were prompted up to three times to give more details if necessary and/or to be more specific if they recalled a generic event (e.g., "Do you remember a particular day?" "Did this only take place once?") without a time constraint. Thereafter, the test switched to another theme or question regardless of the nature of the recall. In order to check each response, we carried out a retest procedure 15 ± 2 days after the test, which consisted of a cued recall task. The participants were asked

Table 1
Demographic Data of the Population

Variable	Young			Old			Very old		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Number	75			55			50		
Female	39			24			27		
Male	36			31			23		
Age (years)		24.85	3.29		62.34	2.31		74.76	5.72
Education (years)		12.54	1.32		9.82	2.81		9.62	2.75
Mill Hill scores		35.37	4.99		35.74	6.04		34.17	6.37
Mattis scores ^a					140.52	2.48		139.00	2.89
GDS scores ^b					5.48	3.27		6.65	3.40

Note. The young group age range was 21–34 years. The old group age range was 60–69 years. The very old group age range was 70–89 years. Mill Hill = Echelle de Vocabulaire de J. C. Raven (Raven et al., 1993); Mattis = Mattis Scale (Mattis, 1976); GDS = Geriatric Depression Scale (Yesavage et al., 1983).

^a The cutoff score is 134. ^b The cutoff score is 10.

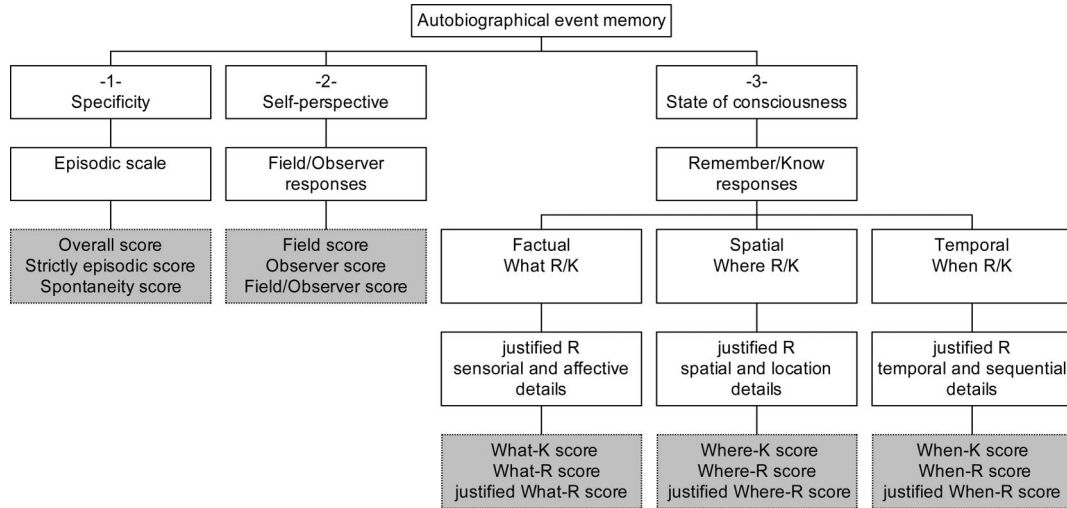


Figure 1. The framework of the Test Episodique de Mémoire du Passé autobiographique and recorded scores. For each of the five lifetime periods, the Test Episodique de Mémoire du Passé autobiographique assesses the following: (a) the specificity of memories (autobiographical recall memory task), (b) the self-perspective via the field/observer paradigm, (c) the state of consciousness via the remember/know (R/K) paradigm, and (d) the ability to justify the R responses. After each recalled event, the participant estimates first his or her self-perspective accompanying mental imagery and then his or her state of consciousness accompanying the retrieval, with separate assessment for the retrieval of the factual, spatial, and the temporal contents. When the participant gives an R response, he or she must add sensory-perceptual and contextual details. Different scores are recorded (see shaded boxes) to assess (1) the specificity, (2) the self-perspective, and (3) the state of consciousness. What R/K, Where R/K, When R/K, What-R, Where-K, Where-R, When-K, and When-R refer to the content of the remember and know responses.

to recall in random chronological order each recollected event at the test from a sentence-cue (e.g., “Can you recall the day you broke your leg?”). The reliability of the participant’s recollections was assessed according to their consistency regarding the content and the spatiotemporal situation over the test and retest procedure. More specially, for remote specific events, the date was considered correct if the difference between test and retest did not exceed ± 2 years, and for generic events, the date was considered as correct when situated in the same time period at test and retest.

Each event was scored on a 4-point episodic scale based on that used by different authors (Baddeley & Wilson, 1986; Graham & Hodges, 1997; Kopelman et al., 1989; Piolino et al., 2002, 2003a, 2003b). This scale took into account the specificity of the content (i.e., single or repeated event), the spatiotemporal situation, and the presence of internal details (i.e., perceptions, thoughts, feelings). A specific event with sensory details situated in time and space was given a score of 4. A specific event without any details but situated in time and space was scored 3. A repeated or extended event was scored 2 if it was situated in time and space or 1 if it was not. An absence of memory, or only general information about a theme, was scored 0. Specific detailed memories (i.e., scoring 4 points) were the most consistent with the definition of episodic AM as memory for a particular episode, lasting less than a day, and recollected with specific details (Moscovitch, Yachyshyn, Ziegler, & Nadel, 1999). The critical factor that allowed us to differentiate between a specific, detailed event (scored 4) and a specific event (scored 3) was the failure, despite much encouragement, to add details concerning the source of acquisition. It has been demonstrated that the presence of details, particularly phenomenological ones associated with specific memories, is a sensitive episodic criterion (Brewer, 1996; Wheeler et al., 1997), which reveals in a standard autobiographical assessment whether the participant is truly reliving the event and its encoding context. Some examples are presented in the

Appendix. Thus, two different total scores were recorded per time period examined: (a) an overall score (maximum score = 16 or 32 for Period E), which included all the memories (specific and generic) and corresponded to the classic episodic memory score used in the well-known Autobiographical Memory Interview (AMI; Kopelman et al., 1989) and (b) a strictly episodic score (maximum score = 4 or 8 for Period E), which included only the number of specific and detailed memories scoring 4 and thus used a more stringent criterion than the overall score. Moreover, a spontaneity score (maximum score = 16 or 32 for Period E) was recorded on a 4-point scale that conversely took into account the number of cues and/or prompts the participant needed in order to recall a specific event instead of a generic one. For example, the spontaneous retrieval of a specific event was given a score of 4 points, whereas retrieval achieved after three cues and/or prompts was given a score of 1. All these scores were expressed as a percentage of total scores. Moreover, overall and strictly episodic scores were recorded according to the information supplied in the test and checked in the retest, regardless of the results from the remembering experience assessment. It should be noted that the participants enjoyed the test, especially the old and very old participants. They provided no discrepancy between the information supplied in the test and the retest. Two independent experts rated each memory and any difference of opinion between them was discussed until a consensus was reached.

*The Remembering Experience Assessment:
Self-Perspective and State of Consciousness*

After the recall of each event, whatever its level of specificity, the participants were required to report their self-perspective and state of consciousness during retrieval, before the next cue.

The F/O Paradigm

The self-perspective assessment was conducted via the F/O paradigm (Nigro & Neisser, 1983). The participants were required to give either an F response if they saw the scene through their own eyes, as if they were reliving the event from something like the original perspective as an actor would, or an O response if they saw themselves in the scene as a spectator would. They could also give F/O responses if they switched from one perspective to another. In order to make it easier to understand both points of view, we placed two drawings in front of the participant during the task that represented either the F (two eyes) or the O (a camera) perspective.

The F/O paradigm made it possible to record several viewpoint scores corresponding to the total number of perspectives of each kind (F, O, or F/O) per period, expressed in terms of proportion of maximum score (number of responses divided by the number of memories recalled for each period).

The R/K Paradigm

After the F/O paradigm had been applied to each recollection, the participants had to indicate the conscious experience accompanying memory retrieval by means of the R/K procedure (Gardiner, 1988; Tulving, 1985), that is, a sense of remembering or a sense of just knowing the events. Additionally, the participants were asked to provide details that justified their sense of remembering.

Participants were required to give either an R response if they recollected subjective experiences from the encoding context or a K response if retrieval was achieved without any such recollection. The participants were also instructed to report a "Guess" (G) response (Mäntylä, 1993) if retrieval was doubtful. This latter alternative was provided in order to ensure that the K responses did not contain any degree of uncertainty. Indeed, when knowing is the default response, participants may use this type of response to reflect various strategies that do not involve any awareness of information (Gardiner, Ramponi, & Richardson-Klavehn, 1998). Of note, our French translation of the term *guess* was very similar to the term *suppose*, that is, "I can only make a deduction, but I am not sure." The standard instructions were provided for all three categories of response and were very carefully explained to the participants until each kind of response was fully understood. Participants were asked to repeat the instructions to make sure they had understood the nature of the task. During the task, separate R/K/G responses had to be given for the factual (what), spatial (where), and temporal (when) contents of memories. The instructions were displayed on a sheet in front of the participants. First, they were instructed to select one of these categories (i.e., remember, know, or guess) for the factual content (what) of the recalled event according to whether (a) they could remember this specific episode with its encoding context—in which case, they might virtually relive the previous event (e.g., details such as thoughts, feelings, or images related to the recalled event); (b) they just knew this episode had happened to them but could not recall any specific event and could not virtually relive any sensory or affective details related to the recalled event; or (c) they just guessed they could very easily have experienced this episode but neither remembered nor knew it.

Subsequently, the participants were instructed to select the categories regarding the place of the event (where) and then the date of the event (when). They had to indicate whether they remembered, knew, or guessed where and when the episode took place. Given that the kind of response was selected independently for the three contents (what, where, and when), the participants could give, for example, an R response for the factual content, a K response for the spatial content, and a G response for the temporal content.

Thereafter, a procedure was used to check whether the R responses were justified. This procedure had previously been carried out in laboratory studies in order to confirm that participants were obeying instructions when they gave R responses (Gardiner, 1999). Hence, for each R response provided for a given content, the participants were required to explain why

they gave their response by adding sensory and contextual details about the original event, if they had not already done so during the retrieval task (their thoughts, feelings or perceptions concerning the factual content, spatial details and location for the spatial content, and time of day or temporal sequence for the temporal content). Some example of memories with accompanying self-perspective and state of consciousness are presented in the Appendix.

The R/K paradigm made it possible to record several further scores per period:

1. An R score and a K score corresponding to the total number of R or K responses provided (maximum 4) for each kind of information (what, where, and when contents). For example, the where R score corresponded to the number of R responses per period for the spatial features of each event. These scores were expressed in percentages (number of responses divided by the number of memories recalled for each period);

2. A justified R score (maximum 4) concerning the number of R responses correctly associated with the recollection of a single event with contextual details (thoughts, feelings or perceptions for the content, spatial details and location for the place, and time of day or temporal sequence for the date). The justified R scores were recorded according to the information supplied in the test and checked in the retest. This score was expressed as the number of justified R responses divided by the number of R responses per period. The G scores were also recorded, but we focused the analysis on the R/K responses.

Statistical Analyses

We first studied data recorded for the TEMPau with a one-way analysis of variance (ANOVA). We followed that with post hoc tests (Fisher's probable least squares difference tests) to examine the impact of age group as a between factor on the mean of each score, combining all three or five periods tested. Thereafter, we used a repeated measures ANOVA to process statistical analyses of the main data, expressed in terms of a total score per period, followed by planned comparisons to examine the influence of age group (two or three age groups) as a between factor, and period (three or five periods) as a within factor. For the R/K responses, the influence of content (what, where, when) as within factors was also computed. First of all, we carried out the analyses for the three periods (Periods A, D, and E) that had been tested for all the participants, and we compared the three age groups. Then, we conducted analyses for all five periods to compare the old age group with the very old one. In our additional analyses, we used correlations among the main measures recorded and combined all periods in order to investigate the relationship between memory specificity, spontaneity, and the experience of remembering. An alpha level of .05 was used for all statistical tests.

RESULTS

Age-Related Differences on Measures of AM

Means and standard deviations for all variables recorded in the TEMPau and for all time periods combined are displayed in Table 2. A one-way ANOVA performed on each variable showed differences with age that were expected from our hypotheses based on the memory aging research. With increasing age, the participants had lower levels of performance in AM scores (i.e., overall, strictly episodic, and spontaneity) and autoegetic consciousness scores. The F and F/O responses also showed lower levels of performance across age groups, but these differences failed to reach statistical significance. Besides, with increasing age, the participants showed a higher number of O responses and K and G responses. In general, the effect of age was gradual across the three age groups, but the performance of the old group was sometimes

Table 2
Performance of Participants of Different Ages on Each Average Measure for Periods Expressed in Terms of Proportion of Total Score

Measure	Young		Old		Very old		F(2, 177)
	M	SD	M	SD	M	SD	
Overall recall	.90	.06	.82	.09	.70	.16	50.38**
Strictly episodic	.68	.18	.54	.20	.40	.21	29.64**
Spontaneity	.93	.06	.75	.24	.50	.29	60.85**
F responses	.56	.34	.53	.27	.46	.26	1.58
O responses	.12	.12	.20	.14	.28	.16	12.20**
F/O responses	.32	.30	.27	.22	.26	.18	0.59
What R	.95	.08	.89	.13	.82	.15	16.27**
What K	.04	.07	.09	.11	.12	.11	4.89 ^a
What G	.00	.02	.02	.03	.06	.13	11.37** ^b
What jR	.84	.14	.73	.19	.57	.23	28.93**
Where R	.92	.08	.89	.09	.80	.15	16.92** ^b
Where K	.05	.08	.07	.08	.13	.10	4.81 ^b
Where G	.02	.05	.04	.06	.07	.15	7.12 ^b
Where jR	.80	.19	.71	.22	.57	.26	15.46**
When R	.76	.17	.70	.19	.65	.19	6.04 ^a
When K	.14	.15	.24	.20	.25	.21	6.73 ^a
When G	.09	.11	.06	.08	.10	.17	2.18
When jR	.66	.19	.51	.16	.44	.20	22.55**
Total R responses	.87	.10	.82	.12	.75	.14	14.32**
Total K responses	.08	.07	.13	.11	.17	.13	6.95 ^a
Total G responses	.04	.05	.04	.05	.08	.15	4.96 ^b
Total jR responses	.77	.14	.65	.16	.53	.19	31.72**

Note. Fisher tests indicated gradual age-related differences. F = field; O = observer; F/O = field/observer; What, Where, and When = the content of the responses; R = remember; K = know; G = guess; jR = justified remember according to the content (what, where, when) or combined with the content (total responses).

^a Fisher test results for the old and very old did not differ. ^b Fisher test results for the young and old did not differ.

* $p < .01$. ** $p < .001$.

comparable to that of the young group or to that of the very old one.

Age-Related Differences on Measures of AM as a Function of Lifetime Period

Autobiographical Recall Memory Task

Figure 2 shows the performance of the three age groups on the measures recorded on AM retrieval task as a function of lifetime period. A 3 (group) × 3 (period) ANOVA with repeated measures on the second factor was conducted on the proportion of overall, strictly episodic, and spontaneity scores. The main effect of age was significant for each score, $F(2, 177) = 57.41, 31.91,$ and $66.92,$ respectively, all $ps < .0001,$ as well as the main effect of period, $F(2, 354) = 36.35, 7.21,$ and $42.68,$ respectively, all $ps < .0001,$ and the Age Group × Period interaction, $F(4, 354) = 23.55, p < .0001; 4.86, p < .05;$ and $16.84, p < .0001,$ respectively. The comparison of the performance of the groups at each time period revealed that the scores decreased gradually with age (all pairwise comparisons were significant at least at $p < .05$), except for the most remote period in which the old and very old group performed similarly regarding the overall and strictly episodic scores. Otherwise, the comparison of performance at different time periods within each group mainly revealed that the performance decreased with remoteness for the young age group (all $ps < .05$) but not for

the two older ones. For the very old group, performance indeed declined between Period E and Period D but showed a relative recovery for Period A, producing a profile similar to a U curve, with no difference between the extreme periods. As regards the performance of the old group, this latter profile was significant only for the spontaneity score, the other performance being similar across periods.

In a second set of analyses, a 2 (group) × 5 (period) ANOVA was performed for the old and very old participants on the five periods examined in the test. This ANOVA confirmed the Age × Period interaction for each score, $F(4, 412) = 10.41, p < .0001; 3.07, p < .05;$ and $5.07, p < .0001.$ Post hoc tests showed that the very old participants performed lower than did the old ones regarding Periods B and C ($p < .05$). Moreover, as regards the old group, the overall and strictly episodic scores on Period B were better than those on the surrounding remote periods (i.e., corresponding to a reminiscence bump, each pairwise comparison significant at $p < .05$).

The Remembering Experience Assessment

Self-Perspective

Figure 3 shows the proportion on the F/O responses. Regardless of the period and the age group, the participants accompanied their recall more with F than with O or F/O responses. A 3 (group) ×

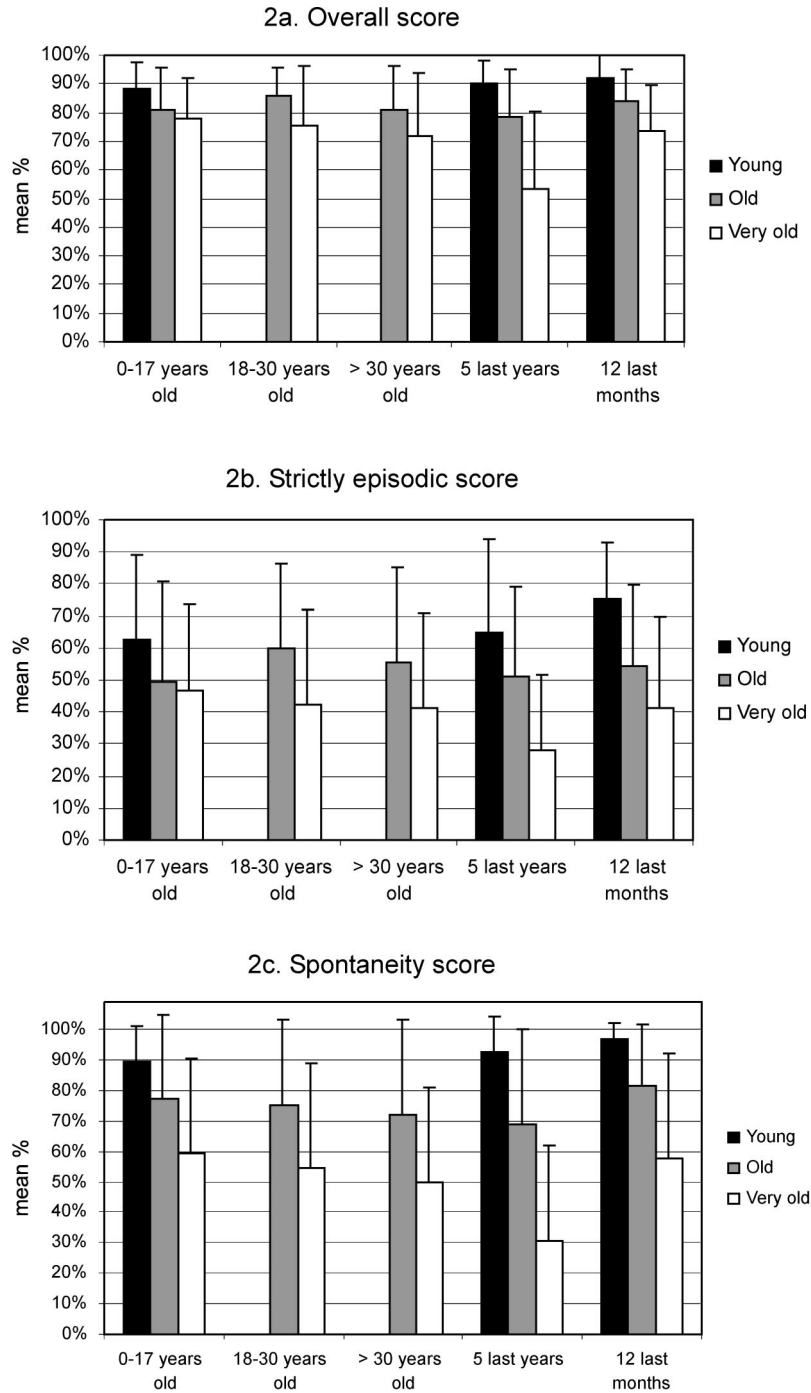


Figure 2. The figure shows performance on the autobiographical memory retrieval task as a function of age group and lifetime period (mean overall, strictly episodic, and spontaneity scores). The error bars represent the standard deviation of the means.

3 (period) ANOVA carried out for the perspectives of each kind showed a main effect of period for the F and O responses, $F(2, 354) = 12.56$ and 15.01 , $ps < .0001$, but not for the F/O ones, $F(2, 354) = 2.56$, $p = .08$. The ratio of F responses decayed with the remoteness (all pairwise comparisons were significant at $p < .05$), whereas the ratio of O responses increased (the remote period was

higher than the other periods, $p < .0001$). There was an effect of age on the proportion of O responses, $F(2, 177) = 7.59$, $p < .0001$, reflecting that the old and very old participants gave more O responses than did the young ones ($p < .01$), but no effect of age on the proportion of F responses, $F(2, 177) = 1.32$, $p > .10$, and F/O responses, $F(2, 177) < 1$. The interaction of Group \times Period

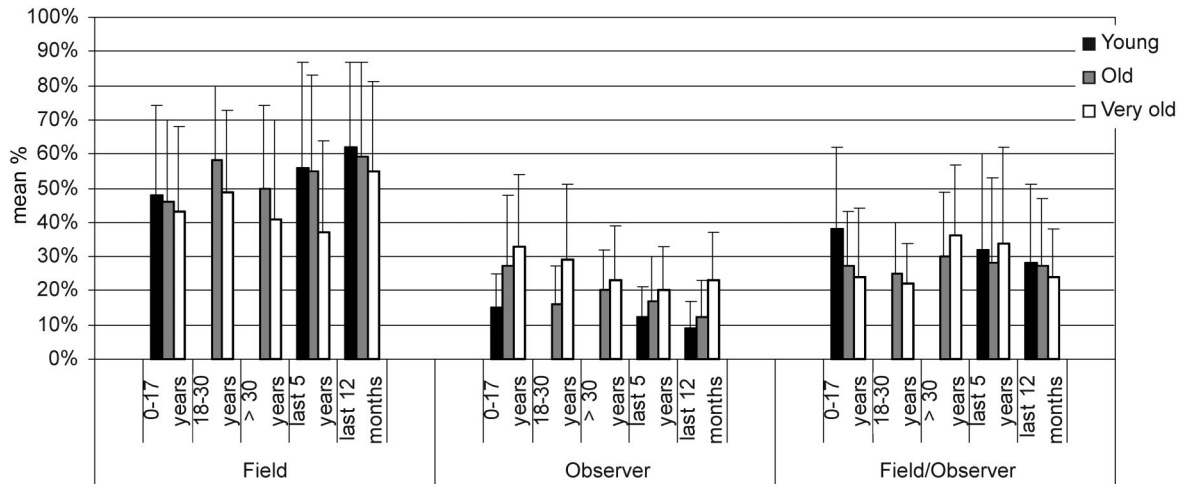


Figure 3. The proportion of each kind of point of view (mean) as a function of age group and lifetime periods. The error bars represent the standard deviation of the means.

was significant for the F response only, $F(4, 354) = 2.84, p < .05$, and occurred because the very old group provided less of this type of response than did the other age groups, for Period D only ($p < .05$). The comparison of performance at different time periods within each group revealed that for the young adults the ratio of F responses did not decline with remoteness unlike that of the old and very old adults.

In a second set of analyses, a 2 (group) \times 5 (period) ANOVA revealed no significant age effect on these responses but did reveal an effect of period. The post hoc tests showed that, irrespective of their age, the old and very old adults gave more O responses for Period A, $F(4, 412) = 6.10, p < .001$, and more F/O for Periods C and D, $F(4, 412) = 3.05, p < .05$. As regards the F responses, the Period \times Age Group interaction, $F(4, 412) = 2.74, p < .05$, occurred because, for the very old, the ratio on Period E was higher compared with that of the other periods ($p < .05$), and for both groups, there was an increase in the ratio for Period B compared with that of the two adjacent periods (i.e., reminiscence bump, $p < .05$).

State of Consciousness

The mean proportions of R/K responses are presented Figure 4. Regardless of the period, content, and age group, the participants accompanied their recall with R responses more than with K responses. These responses were subjected to a 3 (group) \times 3 (content) \times 3 (period) mixed ANOVA with repeated measures on the second and the third factors.

R responses. This ANOVA, conducted on the proportion of R responses, yielded significant main effects of age group, $F(2, 177) = 16.27, p < .0001$; content, $F(2, 354) = 177.41, p < .0001$; and period, $F(2, 354) = 55.21, p < .0001$. Post hoc analyses revealed that a higher proportion of R responses was provided by the young and old participants compared with the very old ones ($p < .001$). The proportion of R responses given for the factual and spatial characteristics of memories was higher than that for the temporal characteristics ($p < .0001$) and was higher for Period E than for the other periods (i.e., recency effect, $p < .0001$). The

Content \times Period, $F(4, 708) = 40.76, p < .0001$, interaction took place because the decline in the proportion of R responses with remoteness was more marked for the temporal content, $F(2, 354) = 80.66, p < .0001$, than for the factual or spatial contents, $F(2, 354) = 17.96, p < .0001$; and $20.29, p < .01$, respectively. Moreover, the Group \times Period interaction, $F(4, 354) = 22.47, p < .0001$, occurred because the difference in disfavor of the old and very old adults concerned Period D (performance of the very old $<$ the old $<$ the young, each pairwise comparison at $p < .05$) and Period E (performance of the very old $<$ other age groups, each pairwise comparison at $p < .0001$) but not the most remote period.

In a second set of analyses, the proportion of R responses was subjected to a 2 (group) \times 3 (content) \times 5 (period) ANOVA that confirmed the previous results. There was a main effect of age group, which interacted with period, $F(4, 412) = 12.06, p < .0001$, because the very old adults gave fewer R responses than did the old ones, regardless of the content, except for the 2 most remote periods (i.e., Periods A and B). There was also a Content \times Period interaction, $F(8, 824) = 18.06, p < .0001$, which occurred because the proportion of R responses was higher for Period E than for the other periods (i.e., recency effect), regardless of the content, and in addition, for the temporal content, this proportion was higher for Period B than for the 2 adjacent periods (i.e., reminiscence bump).

K responses. Both types of ANOVA were also conducted for the proportion of K responses. The 3 \times 3 \times 3 ANOVA indicated an effect of age group, $F(2, 177) = 6.53, p < .01$, because the proportion of K responses was higher for very old participants compared with the old ($p < .05$) and young ones ($p < .0001$), but this effect interacted with content, $F(4, 354) = 3.03, p < .05$, and period, $F(4, 354) = 5.79, p < .0001$, because the very old and old participants gave a similar proportion of K responses for the temporal content and for the most remote period. The Content \times Period interaction, $F(4, 708) = 24.76, p < .0001$, mirrored the results obtained for the proportion of R responses because the proportion of K responses increased with remoteness, especially for the temporal content. The 2 \times 3 \times 5 ANOVA indicated results that confirmed the previous analysis.

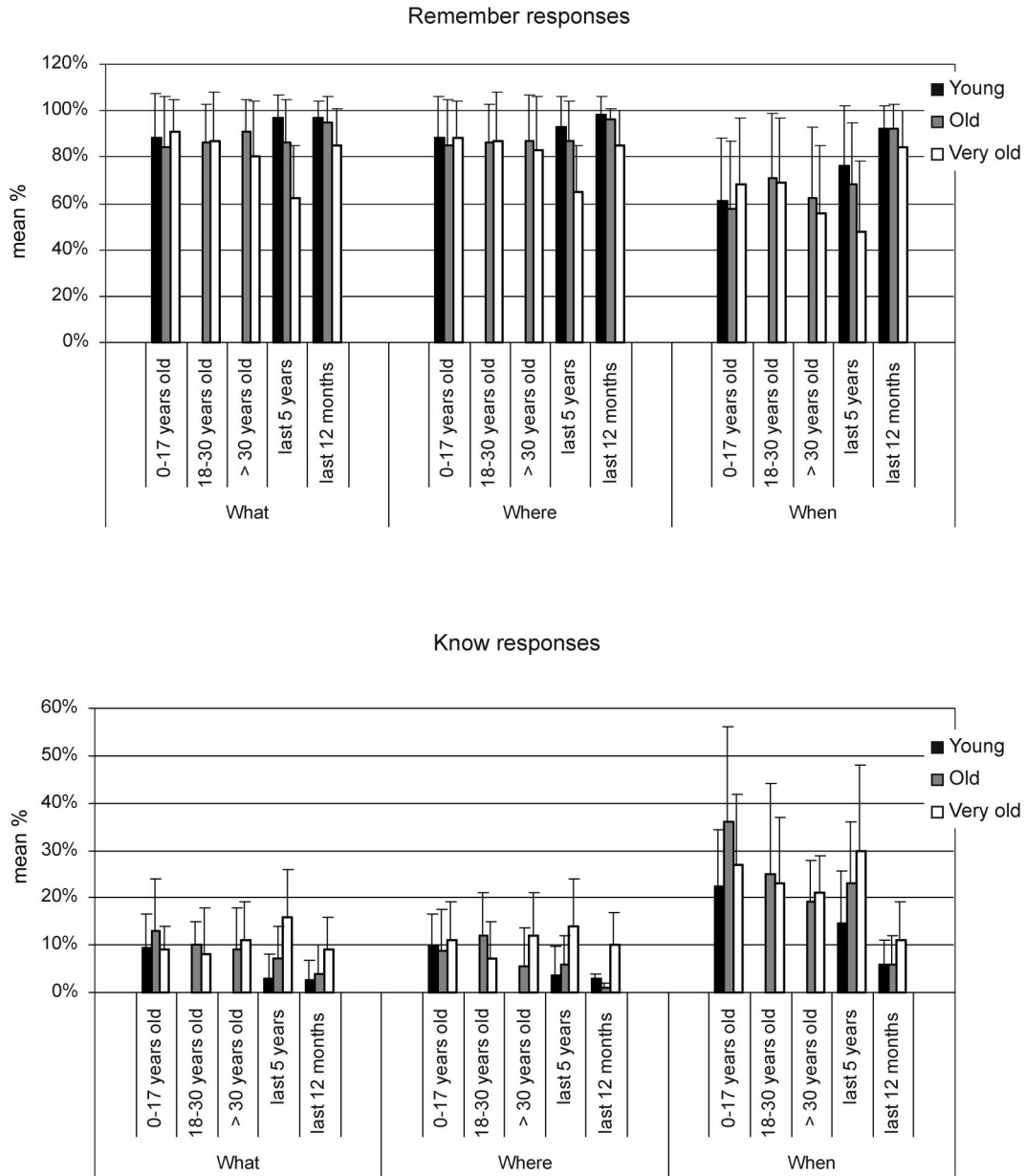


Figure 4. The proportion of the remember/know responses (mean) as a function of age group and the kinds of information (factual, spatial, temporal) tested for lifetime periods. The error bars represent the standard deviation of the means.

Justified R responses. The first $2 \times 3 \times 3$ ANOVA performed on the proportion of justified R responses (see Figure 5) revealed no significant effect of content, $F(2, 354) = 2.74, p = .07$, but did show a main effect of age group, $F(2, 177) = 31.92, p < .0001$, indicating that the ability to justify the R responses decreased with increasing age (each pairwise comparison was significant at $p < .01$). The Age Group \times Period interaction, $F(4, 354) = 6.04, p < .0001$, indicated higher age differences on these proportions for Periods D and E ($p < .001$) than for Period A ($p < .05$), regardless of the content. There was no difference between the old and very old adults as regards the most remote period. Otherwise, there was a significant Content \times Period interaction, $F(4, 708) = 13.14, p <$

$.0001$, which mainly reflected that the participants justified their R responses without any difference across kinds of content, except for the most remote period in which the temporal content was less justified compared with the other contents ($p < .01$).

The second $2 \times 3 \times 5$ ANOVA confirmed that the effect of age interacted with period, $F(4, 412) = 4.74, p < .05$. In addition to previous results, planned comparisons showed that the proportion of justified R responses was lower for the very old participants compared with the old participants as regards Period B ($p = .05$). Moreover for the very old group, the proportion was greater for the three most remote periods than for the two other periods, but there was no significant difference across periods for the old group. The

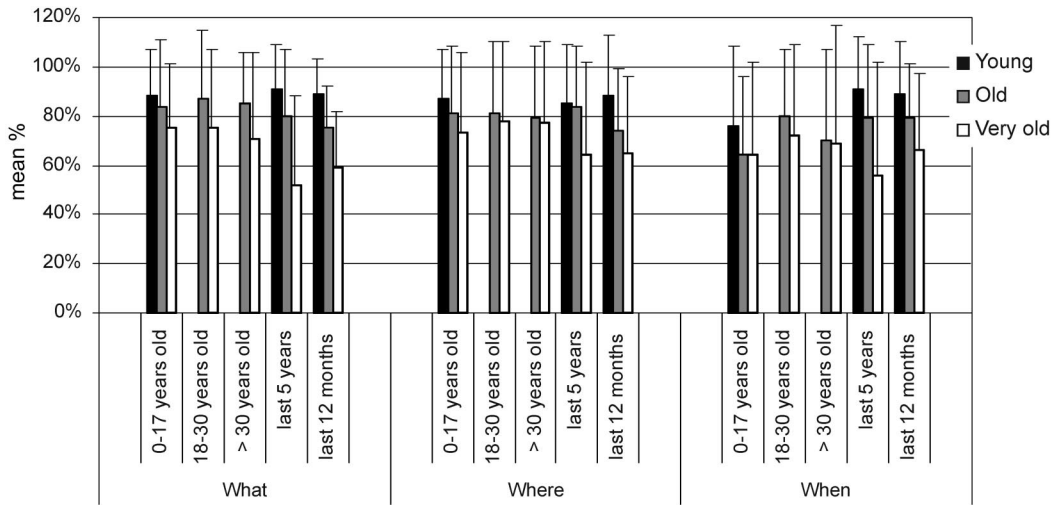


Figure 5. The proportion of justified remember responses to remember responses (mean) as a function of age group and the kinds of information (factual, spatial, temporal) tested for lifetime periods. The error bars represent the standard deviation of the means.

Content \times Period interaction, $F(8, 824) = 4.38, p < .0001$, extended previous results by showing that the proportion of justified R provided for the factual and spatial contents was the highest for the three most remote periods compared with the other periods (all $ps < .01$). There was a reminiscence bump for the temporal content that was significant for the old adults only ($p < .01$).

Correlational Analyses

We looked for relations between main variables in all periods combined, partialled out or not for age (see Table 3). Measures and

age shared correlations in the moderate-to-high range with rs ranging from .19 to .58 ($p < .05$ to $p < .001$), which supported the view that strictly episodic recall, spontaneity, and R and F responses declined gradually with increasing age, whereas K and O responses increased. The intercorrelation coefficients between the autobiographical measures that were modest to high mainly showed that the strictly episodic score and spontaneity were positively correlated with one another. Moreover, the strictly episodic score was not significantly linked to F responses ($r = .04$) but positively correlated to F/O, R, and justified R responses, regard-

Table 3
Relations Among Age and the Average Measures on All Periods Combined ($N = 180$)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Age ^a	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2. Overall recall	-.58	—	.83	.35	.06	.00	.19	.76	.75	.46	.72	.44	.39	-.41	-.30	-.08	.71	.63	-.26
3. Strictly episodic	-.50	.87	—	.29	.06	.00	.22	.59	.53	.48	.66	.44	.43	-.50	-.40	-.25	.60	.63	-.41
4. Spontaneity	-.58	.57	.50	—	.24	-.38	.04	.24	.30	.31	.17	.27	.16	-.36	-.43	-.39	.33	.12	-.45
5. F responses	-.18	.15	.04	.30	—	-.47	-.82	-.06	.01	-.15	.16	-.14	-.18	.11	.01	.11	-.09	-.09	.10
6. O responses	.26	-.31	-.13	-.45	-.49	—	-.02	-.02	-.09	-.09	-.06	-.03	.13	.17	.31	.17	-.08	.04	.24
7. F/O responses	-.10	.21	.24	.09	-.78	-.05	—	.32	.27	.34	.06	.24	.23	-.30	-.24	-.22	.36	.22	-.29
8. What R	-.37	.79	.66	.40	.01	-.12	.33	—	.79	.60	.65	.40	.45	-.74	-.46	-.23	.88	.61	-.49
9. Where R	-.36	.78	.61	.43	.07	-.18	.29	.82	—	.60	.61	.41	.36	-.48	-.57	-.23	.87	.57	-.44
10. When R	-.25	.50	.53	.39	-.10	-.15	.35	.63	.63	—	.39	.17	.57	-.56	-.56	-.76	.88	.45	-.76
11. What jR	-.49	.80	.75	.40	.20	-.18	.10	.71	.67	.45	—	.44	.32	-.46	-.35	-.10	.60	.72	-.30
12. Where jR	-.40	.56	.55	.03	-.05	-.08	.26	.49	.50	.25	.55	—	.65	-.20	-.12	.15	.35	.88	-.01
13. When jR	-.47	.55	.57	.16	-.07	-.01	.25	.54	.46	.60	.48	.72	—	-.36	-.24	-.26	.54	.81	-.32
14. What K	.21	-.45	-.53	-.41	.07	.22	-.32	-.75	-.51	-.58	-.49	-.26	-.41	—	.71	.52	-.67	-.41	.80
15. Where K	.19	-.35	-.43	-.45	-.02	.34	-.25	-.49	-.59	-.58	-.39	-.18	-.29	.72	—	.62	-.61	-.28	.85
16. When K	.24	-.20	-.33	-.45	.06	.22	-.24	-.29	-.29	-.77	-.20	.03	-.33	.54	.64	—	-.53	-.07	.90
17. Total R responses	-.35	.75	.66	.45	-.02	-.16	.37	.89	.89	.89	.66	.44	.61	-.69	-.62	-.56	—	.60	-.68
18. Total jR responses	-.53	.75	.73	.23	.03	-.11	.24	.68	.64	.50	.79	.90	.86	-.45	-.34	-.18	.67	—	-.25
19. Total K responses	.25	-.35	-.47	-.50	.05	.29	-.30	-.53	-.49	-.78	-.37	-.11	-.40	.81	.86	.91	-.70	-.34	—

Note. Simple correlation coefficients are shown below the diagonal; correlation coefficients with age partialled out are shown above the diagonal. Bold correlations were significant with a minimum level of .05. For coefficients greater than .15, $p < .05$; for coefficients greater than .19, $p < .01$; for coefficients greater than .25, $p < .001$. F = field; O = observer; F/O = field/observer; What, Where, and When, = the content of the response; R = remember; jR = justified remember according to the content (what, where, when) or combined with the content (total responses); K = know.

^a There are no correlations with the age variable.

less of the content (factual, spatial, temporal), and negatively correlated to the O and K responses. The spontaneity was positively linked to the F responses, R responses, and justified R responses and negatively to the O and K ones. The F responses were positively linked to the justified R responses provided for the factual content, whereas the F/O responses were positively linked to the R responses, regardless of the content, and to the justified R responses provided for the spatial and temporal contents. The O responses were positively linked to K responses but negatively linked to R responses. In general, R or justified R, for a given content, was highly correlated with the other contents. Correlation coefficients, with variance associated with age eliminated, remained modest to high, showing a rather similar pattern of correlations, as previously shown.

DISCUSSION

Pursuing our work on the impact of aging in AM (Piolino et al., 2002), our aim in this study was to further address this issue with a first-person approach.

Age-Related Differences in AM

The first purpose of the study was to compare young, old, and very old adults on quantitative and qualitative characteristics of AM across lifetime periods. As predicted (see Borrini et al., 1989; Ghidoni, Poletti, Bondavalli, & Mamoli, 1993; Levine et al., 2002; Piolino et al., 2002), we found an age-related decrease concerning memory specificity, whatever the periods considered, although it was more important for the two most recent periods (especially Period D). The nature of memories for old and very old adults compared with young ones more frequently concerned generic events, either repeated and extended events without specific spatiotemporal situation or events lasting less than a day but retrieved without specific details. Moreover, with increasing age, participants needed more prompts and encouragements that did not eliminate the age effect on the specificity of recall as similarly shown by other studies (Holland & Rabbitt, 1990; Levine et al., 2002). The age-related effect on AM was obtained with a kind of approach in which we equated the remote periods for encoding at that time (which corresponded to different time intervals according to age groups). Piolino et al. (2002) and Piolino, Lamidey, Desgranges, and Eustache (in press) found the same pattern with the reverse approach whereby they equated period for time since acquisition (which corresponded to different encoding ages). This pattern nevertheless could depend on methodological characteristics rather than on mechanisms of aging because the interpretation of age differences in cross-sectional studies of aging is often complicated, all the more so in remote memory (Schuman, Akiyama, & Knauper, 1998). Although we took special care to include participants who were equivalent in several conditions and we provided extensive cuing and prompting and no response time limit, the greater effect of age for Period D might be due in part to possible causes other than aging, like cohort effect. For example, lifestyle differences could have resulted in poorer encoding of recent episodic memories in older people compared with young people. However, we confirmed age differences by investigating the impact of age for the two older age groups when the quality of the events and lifestyle were supposed to be more comparable at

the time the memories were formed as well as investigating the efficacy of cues for memory. Our data, therefore, may argue in favor of per se deficits of specific memory mechanisms in aging.

Age-Related Differences in Experience of Remembering

The second and main purpose of this study was to compare age groups on the phenomenal experience of remembering by considering how participants recall matters as much as what they recall (Brewer, 1996; Conway & Pleydell-Pearce, 2000; Wilson & Ross, 2003). The report provided a rich set of new data on the subjective aspects of AM with increasing age across life span, which was generally in line with the expected results based on theory (see the introduction): The R memories, either subjective or justified ones, and F memories decreased with increasing age, whereas K and O memories increased.

As regards the self-perspective, 52% of the memories recorded in this study were classified as F memories, which is a proportion found by other AM studies (D'Argembeau, Comblain, & Van der Linden, 2003). The observer memories were linked with a growing sense of knowing, less specific memories, and less spontaneity, regardless of the age of the participants. Hence, more numerous O responses in old and very old adults was in line with their difficulty in reporting and reliving episodic details and their inclination to instead report more generic memories. Nevertheless, fewer F and more O memories in aging, linking the former to episodic deficit and the latter to semantic preservation (see the introduction), is a complex issue (Brewer, 1996; Conway, 1996). Indeed, phenomenally experienced viewpoint may not necessarily reflect forms of storage in long-term memory but provide different kinds of information about the affective or cognitive (goals, beliefs) components of memories (Robinson & Swanson, 1993). In particular, emotion is an important factor in determining the viewpoint in memories because a situation when participants try to remember emotional components involves more F memories and fewer O memories than when they try to remember the objective circumstances surrounding the events (D'Argembeau et al., 2003; Nigro & Neisser, 1983). Accordingly, our correlational analyses revealed a relationship, regardless of the age of participants, between more F memories and more R memories justified in terms of perceptual and affective details and between more viewpoint shifts (i.e., F/O) and more R memories justified in terms of contextual spatiotemporal details. Moreover, the relevance of AM for the self may influence the self-perspective and vice versa (Libby & Eibach, 2002; Wilson & Ross, 2003). Indeed, an F perspective usually accompanies a memory relevant for the current self, whereas the participants usually attribute their negative memories or their past to a former self, displaying an O perspective. This tendency, called self-enhancement, is enhancement of the current self by deprecating the former selves. Therefore, most of the memories reported in this study were seemingly relevant for the current self, but increasing O perspective in aging may reflect a defensive function of the self. Further work is needed on this issue because we did not record the relevance or the emotional valence of memories.

As regards the state of consciousness accompanying recollection, our results demonstrate that the vast majority of memories (75% at least) gave rise to a subjective sense of remembering. In line with previous research (Linton, 1986; Wagenaar, 1986), a sense of reliving the past more frequently included thoughts,

perceptions, and spatial locations than date information for most memories (except for Period E). The date instead was more frequently known just by inference based on location and landmark events such as knowing which house one lived in at a particular time in one's life rather than by direct remembering (Larsen, 1996). The findings demonstrate a dissociation in aging between auto-noetic consciousness, R, and noetic consciousness, K, which mirrored the dissociation found between F and O memories, in keeping with our prediction based on Tulving's (1985, 2001) model and R/K paradigm studies (see the introduction). Our results indicate that with increasing age, the semantic component of AM enlarges, whereas its episodic component decreases, in agreement with previous studies (Levine et al., 2002; Piolino et al., 2002), but for the first time this was shown with the R/K and F/O paradigms combined. Moreover, the results extend the data to complex and meaningful autobiographical events and long-term retention intervals, showing that age differences on R responses did not concern the most remote past (i.e., Period A), including the reminiscence bump (i.e., Period B), when comparing old and very old adults. On the whole, the evidence obtained with the R responses may suggest that auto-noetic consciousness, which is "the major distinguishing characteristic of episodic memory" (Wheeler et al., 1997, p. 333), is relatively better preserved in older people with respect to the distant past than with respect to the more recent past.

Nevertheless, the procedure for checking R responses showed that not only did the old and very old adults provide less of a sense of remembering compared with young adults, especially for the two most recent periods, but that old and very old adults were also less capable of justifying them in terms of details. The effect of age for the justified R responses was gradual, whatever the period and irrespective of the content, although old and very old adults were comparable concerning the most remote period. Therefore, the finding suggests that ability to consciously recollect many specific events and relive the context in which they occurred deteriorates with aging. Strikingly, the discrepancy between the two measures of R memories (either justified or not) increased with age (e.g., for the very old, 75% of R memories and 53% of justified R memories). It may reveal that older people overestimate the episodicity of their memories, especially more recent ones, incorrectly providing R judgments for generic memories instead of K judgments. Regarding everyday situations, Hashtroudi, Johnson, and Chrosniak (1990) have reported that older adults had some difficulties in remembering specific perceptual and contextual details, despite giving similar ratings for these aspects of memories as younger adults, which is in keeping with metamemory difficulties in aging. This kind of error may be because old and very old adults based some of their R judgments on the level of confidence or on phenomenally experienced imagery, a product of multiple episodes, instead of on single ones. As stressed by Brewer (1996), one may experience a recollective memory for a person or place that one is very familiar with and, hence, the recollective memory image may be distorted in the direction of the generic information. As a methodological consequence, this discrepancy highlights the usefulness of checking the R responses in order to apply the R/K paradigm to assess the nature of AM, at least in older adults, as the subjective sense of remembering the personal past may depend on different levels of specificity. Moreover, the special design used in this study (see Figure 1) may have contributed to elevate the number of R responses, especially in old and very old participants

as regards remote periods. In fact Hyman, Gilstrap, Decker, and Wilkinson (1998) showed that when participants are asked to form detailed mental images of the events, they become more confident that known memories may be remembered memories (see also Crawley & French, 2005). Hyman, Gilstrap, Decker, and Wilkinson suggested that the R/K judgment is a source-monitoring decision based on the qualities of the memory that operate at the time of recall rather than on the use of encoded source details. Hence, the focus on viewpoint should be regarded as one of the factors our participants considered in making R/K judgments. Further research is needed in order to shed light on this issue.

Effects of Time on AM

We found several temporal effects on the distribution of AM, which is in keeping with previous research. There was a retention function in young adults characterized by a decline in performance with remoteness (i.e., recency effect), whatever the scores recorded, with the exception of O and F/O perspectives and K responses. For old adults and to a lesser degree for very old ones, the distribution of F responses and R responses (either justified or not) provided for the temporal content was characterized by a recency effect and by the rise in these responses for old memories from Period B. This latter phenomenon, termed reminiscence bump (i.e., the rise of memories from adolescence and young adulthood), is well known in AM studies (Fromholt & Larsen, 1992; Fromholt et al., 2003; Hyland & Ackerman, 1988; Piolino et al., 2002; Rubin, Rahhal, & Poon, 1998); Rubin & Schulkind, 1997a, 1997b; Rubin, Wetzler, & Nebes, 1986). Rybash and Monaghan (1999) found a similar profile of curve with a recency and a reminiscence bump for memories associated with R responses but also for those associated with K responses, unlike the results we found in this study. Our data extend previous studies by emphasizing that this profile concerned both auto-noetic consciousness and F perspective. Different kinds of explanation of the reminiscence bump phenomenon have been reviewed by Rubin et al. (1998) concerning cognitive and neural accounts, genetic fitness, and self (identity formation). As regards the latter account, the rise of both qualities of memories during the reminiscence bump period confirms that it represents a strong landmark for the current self (Conway & Pleydell-Pearce, 2000; Fitzgerald, 1996a, 1996b) and, thereafter, for maintaining a sense of identity in the present, especially for older adults (Haight & Webster, 1995).

Otherwise, our results showed reverse temporal profiles for the F/O responses, which mirrors the result of the R/K responses, in line with the view that there is a shift in the phenomenal experience of remembering real-world events with the passage of time (Conway et al., 1997; Linton, 1986; Robinson & Swanson, 1993). The loss of episodic details and the emergence of a conceptual organization (schema) have been postulated to cause an "R-to-K" shift with time interval, resulting from repeated encounters with similar events (Cermak, 1984; Conway et al., 1997; Linton, 1986). Our results favored the view that very long-term AM is a mixture of schematized knowledge (K responses) and specific experiences (R responses) consistent with a "schema-plus-episodic" view (see Conway et al., 1997). Nevertheless, according to this latter view "just knowing" the past would be the dominant form unlike in the present study. Some methodological features may have contributed to minimize the frequency of K responses. Indeed, on top of the

experimental design (see above), we applied the R/K paradigm to cued-recall instead of recognition and we added G responses; furthermore we tested very few memories by period and thus the most accessible and self-defining ones.

Accessibility of AM in Aging

This study documents age-related differences on AM that encompass spontaneity of retrieval, time and space location (i.e., the specificity of event), phenomenal details (i.e., the specificity of details), subjective experience (i.e., auto-noetic consciousness), and mental visual experience (i.e., self-perspective). This pattern fits well with Conway's self-memory system (Conway, 2001; Conway & Pleydell-Pearce, 2000; Conway et al., 2004), which posits that the recollection of AM requires a complex goal-driven set of control processes (i.e., working self) that provides indirect access to event-specific knowledge (i.e., sensory-perceptual details) from a personal semantic knowledge base (i.e., life story schema, lifetime periods, and generic events). Despite the potential interdependency among our different measures, the intercorrelations interestingly emphasized that lesser spontaneity involved less specific memories, less R responses, and more K responses (also less F perspectives and more O perspectives), which is consistent with the view that the most vulnerable aspects of AM are indices from general events (Conway, 1996). In other words, the more a memory had to be cued by the experimenter, the more that memory was known rather than remembered and generic rather than specific and, inversely, the more spontaneous a memory (i.e., self-generated), the more specific and auto-noetic it was. This pattern is in keeping with Tulving's (1985) framework, which postulates that the more recollective the experience is, the more it is characterized by episodic trace information and the less it is characterized by external semantic cue information. Although specific autobiographical memories decreased with age, our data show they shared the same main features regardless of the age of the participants (i.e., reliving of affective and perceptual details, spontaneity, and mixed F/O perspectives). This aspect may be regarded as reflecting *self-defining memories*, which are a specific type of AM characterized by its density of imagery and affect, high level of rehearsal, linkage to similar memories that share theme and affective quality and accessibility (Conway et al., 2004). In particular, AM that are highly accessible will be those that retain a high level of self-relevance at retrieval. As pointed out by Conway and Holmes (2004), highly accessible memories across the different periods of life provide "a personal, psychological, history of changes to the self" (p. 462).

Difficulties in retrieval processes that depend on frontal and executive function could explain why aged participants more frequently built general memories instead of specific ones. Flawed executive processes have been consistently reported in aging (Moscovitch & Winocur, 1995; Spencer & Raz, 1995; West, 1996; Zacks, Hasher, & Li, 2000) and may have been responsible for the reduction with age in spontaneity of recall and, thus, conscious recollection of specific AM, as previously suggested (Holland & Rabbitt, 1990). A number of converging lines of evidence from neuropsychological (Levine et al., 1998; Piolino et al., 2003b; Piolino, Desgranges, et al., in press) and neuroimaging (Düzel, Yonelinas, Mangun, Heinze, & Tulving, 1997; Piolino et al., 2005; Rugg, Schloerscheidt, & Mark et al., 1998) studies have suggested

that the feeling of reliving an event depends on the frontal lobes (Wheeler et al., 1997). Lifelong specific memories in old participants would be characterized by their lesser contribution of frontal and executive functions because they are a special instance of AM closely linked to emotional and self-relevance influences (Davidson & Glisky, 2002). Several authors have underlined the role of medial temporal lobes in the process of reexperiencing episodes (Knowlton, 1998; Piolino et al., 2003b, 2004; Ranganath et al., 2003; Yonelinas, 2002). We plan to pursue the study of these neuropsychological hypotheses in further research.

Finally, as AM provides knowledge of one's experiences over time, enabling integration of past and present selves, deficits of AM would predict a weakened sense of identity (Bluck, 2003; Conway et al., 2004). Nevertheless, age-related deficits in AM usually fail to weaken the self-coherence in healthy, aged participants as opposed to patients with depression (Fromholt et al., 2003; Lemogne et al., 2006), Alzheimer's disease (Addis & Tippet, 2004; Piolino et al., 2003b), or frontal lobe damage (Piolino, Desgranges, et al., in press; Wheeler & Stuss, 2003; Wheeler et al., 1997) or who present severe retrograde amnesia (Conway & Fthenaki, 2000, for reviews; Piolino et al., 2005; Wheeler & McMillan, 2001). The present study provides further evidence that despite episodic AM deficits in aging, the preservation of (a) personal semantic memory, which is a fundamental component of personal identity (Conway, 1997; Conway et al., 2004; Tulving, 1993; Wilson & Ross, 2003), (b) the subjective sense of remembering for the remote past, and (c) some self-defining episodic memories enables older healthy people to "travel into their past," thereby ensuring a sense of identity and continuity.

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Appendix

Examples of Memories

The following are examples of memories from the last 12 months period, from the theme “a specific event last summer,” and from a phenomenal experience accompanying those memories, that is, self-perspective (field and observer responses) and state of consciousness (remember [R], know [K], and guess responses). Questions (Q) asked of the participant are in parentheses in the body of each response. Each event was scored on a 4-point episodic scale. What, where, and when refer to the content of the response.

Young adult:

“It was in Strasbourg, in a cellar. A beautiful vaulted cellar, splendid, but not church-like, no chandeliers, there were electric lights, but hidden by wrought iron. It was really cool. I drank a huge beer waiting for my friend ‘Ludo.’ It wasn’t long ago. It was 8 weeks ago, an evening around 7:30 P.M. There were windows which let the daylight in. The waiter was very effeminate, very courteous. The room was huge, about 40 meters long. There were some small individual lamps/candles on each table. To get to that room, there were some stairs, like a mezzanine, I could see people coming. I could see them going down. What stunned me was that you couldn’t hear the noise from the outside . . .”

The memory was scored 4. The phenomenal experience was as follows: field, what R, where R, when R, and each R justified in term of specific details.

Old adult:

“I heard my druggist got married again this summer. It doesn’t concern me personally, but it made me happy, we are the same age.

I got her a small gift, I brought her a pair of dish towels at her house at teatime. I like offering dish towels. (Q: Does this remind you of any specific detail?). We had tea and we chattered about the grandchildren as usual. So, that’s all. It was a nice day (Q: Does this remind you of any specific detail?) She is a very nice person and she take over an old drugstore that she had enlarged . . . (Q: When did that event happen?) It happened in July at Paris.”

The memory was scored 3. The phenomenal experience was as follows: field/observer, what R, where R, when R, and each R justified in term of specific details except for the what R.

Very old adult:

“It was when we had a party for my birthday in the house. We bought a house my second wife and I, in 1995, in the Yvelines. So, each year we invite family, we invite friends, neighbors and we make a barbecue in the garden. People arrive, we settle down outside, we bring a big table, we grill some meat and bake potatoes on the live coals. (Q: Does this remind you of any specific detail from your last birthday?), yes, we had a lot to drink, we were joyful. (Q: Does this remind you of any specific detail?), no, it’s always nice.”

The memory was scored 2. The phenomenal experience was as follows: observer, what R, where R, both Rs not justified in term of specific details, and when K.

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