

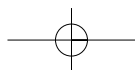
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Effects of Age on Involuntary Autobiographical Memories

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Research on autobiographical memory has primarily focused on memories which are retrieved by participants in response to a particular word or phrase, the so called cue-word technique (Conway & Bekerian, 1987; Haque & Conway, 2001). Alternatively, participants may be asked to recall memories from a particular life period or to recall their most vivid memories (Cohen & Faulkner, 1988; Rubin & Kozin, 1984). The common denominator of this research, however, is that retrieval of autobiographical memories is requested and the process of remembering is voluntary, deliberate, and purposeful. However, autobiographical memories can also come to mind spontaneously and without any conscious or deliberate effort to retrieve them. Despite their prevalence in everyday life, these involuntary autobiographical memories have received relatively little attention until recently. Initial findings in this area indicate, however, that there may be some important differences between involuntary and voluntary autobiographical memories. For example, involuntary memories have been found to be more specific, more positive, and less rehearsed compared to voluntary memories (Berntsen, 1998; Berntsen & Hall, 2004).

These findings suggest that different mechanisms may be involved in the retrieval of involuntary autobiographical memories. One way to investigate these differences further is to study the effects of age on involuntary autobiographical memory and compare the findings to those obtained in the domain of voluntary autobiographical memory. In this chapter we describe the first exploratory study on the effects of age on involuntary autobiographical memory. Before we describe the study and its results we will first briefly consider research on aging and voluntary autobiographical memory, followed by a brief review of the main findings from research on involuntary autobiographical memories.

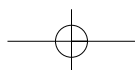
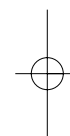


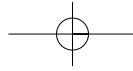
Using the cue-word technique, research on voluntary autobiographical memory has focused on issues concerning storage, organization, and retrieval of memories (Barsalou, 1988; Brewer, 1986; Linton, 1986); how autobiographical memory overlaps and relates to other types of memory (Larsen, 1992); what function it serves (Bluck, 2003; Cohen, 1996; Holland & Rabbit, 1990; Neisser, 1988; Wagenaar, 1992; Wilson & Ross, 2003); and how accurate reports of past episodes are (e.g., Barclay, 1988; Brewer, 1986).

The effects of age on autobiographical memory have received relatively little attention, with the majority of work concentrating on the distribution of memories across the life span. Two important findings have emerged from this research using the cue-word technique. First, regardless of age, people tend to recall recent memories more often than older memories. This decline in the probability of recalling a memory appears to follow a power function. Each further year of retention is reducing the likelihood of recalling by 50 percent (e.g., Rubin, 1999). Second, the so-called "reminiscence bump" is found in samples of older people (Rubin, 1999). In addition to a clear recency effect, there is another (albeit smaller) peak in the recall of memories of events that occurred when participants were approximately between 10 and 30 years old. Although the exact age frame of the bump varies (e.g., Chu & Downes, 2000), the phenomenon has been repeatedly reported in the literature and has been found with different retrieval methods, including the traditional cue-word technique, recall of most vivid memories, and recall of most important memories. However, the overall distribution may vary depending on the method used to invoke these voluntary autobiographical memories. For example, when older adults are asked to recall their most vivid (e.g., Cohen & Faulkner, 1988; Fitzgerald, 1988) or their most important memories (e.g., Rubin & Schulkind, 1997), the recency effect is reduced and a more prominent reminiscence bump is observed.

Another interesting finding in relation to aging and voluntary autobiographical memory refers to the specificity of memories. People often recall general events even when they are asked to recall only specific events (Conway & Rubin, 1993; Barsalou, 1988; Linton, 1986; Williams & Dritschel, 1992), and this preference for recalling general events is more pronounced in older adults (Levine et al., 2002; Piolino et al., 2002; Spencer & Raz, 1995). However, Cohen and Faulkner (1988) found that the specificity of older adults' voluntary memories was related to the amount of prior rehearsal. Hence, they argue that frequent rehearsal may be necessary to preserve specific and detailed memories in old age (Cohen, 1996; Cohen & Faulkner, 1988).

As pointed out earlier, there has been very little research on involuntary autobiographical memory. Thus far, this research has mostly used the naturalistic diary method, whereby participants record details of their involuntary memories and the situations in which they occur in a diary (Berntsen, 1996,



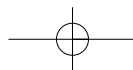
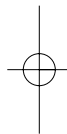
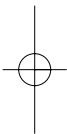


1998; Berntsen & Hall, 2004; Kvavilashvili & Mandler, 2004; Mace, 2004, 2005). Although the procedures vary somewhat, in all studies the information obtained from the diaries is very similar and concerns the characteristics of the involuntary memory (e.g., the memory content, specificity, emotional valence, prior rehearsal, etc.), the context in which the memory occurred, and information as to whether or not there was any identifiable cue that triggered the memory.

There is now converging evidence from these studies indicating that there are optimal conditions for the occurrence of involuntary autobiographical memories. First, involuntary autobiographical memories mostly occur when attention is diffused and not focused, for example, while carrying out automatic activities such as walking, driving, or making a cup of coffee (Berntsen, 1998; Kvavilashvili & Mandler, 2004). Second, the majority of involuntary autobiographical memories (approximately 80–93 percent) have identifiable triggers (Berntsen, 1996, 1998; Berntsen & Hall, 2004; Kvavilashvili & Mandler, 2004; Mace, 2004). Moreover, these triggers usually correspond to the central features of the memory content in that they form part of the remembered event (e.g., the sight of an old lady's open-toed sandals may trigger the memory: "I was remembering how embarrassed I was at 13 to wear open-toed sandals and dresses"; Roberts, McGinnis, & Bladt, 1994). In Berntsen and Hall's study (2004), the most frequently observed commonalities between the trigger and corresponding memory was a shared theme, object, or person and, to a lesser degree, a shared location and activity (see also Berntsen, 1996).

Although cues are obviously important for triggering involuntary autobiographical memories, there are some discrepancies concerning which type of trigger is most conducive to eliciting memories. Berntsen and Hall (2004; also see Berntsen, 1996) found that the majority of cues were external and perceptual (e.g., objects, people, or places), as opposed to internal thoughts or feelings. However, according to Mace (2004), this classification is too broad and does not take into account the linguistic cues in the form of words encountered either in one's environment (external) or in one's thoughts (internal). Hence, he suggested classifying cues as abstract (i.e., words either spoken, written, or thought), sensory/perceptual (i.e., raw sensory experiences such as sound, smell, taste; fundamental perceptions such as seeing an object, place, or person; any activity), or state-based (i.e., any mood, feeling, or physiological state). Thus, in this classification, abstract cues can be either external or internal, whereas sensory/perceptual cues are external and state cues internal. In a diary study of involuntary autobiographical memories, Mace (2004) found that the majority of memories (68 percent) were triggered by abstract cues (see also Mace, 2005).

The discrepant results obtained by Mace (2004) and Berntsen and Hall (2004) could be due to different methodology. Thus, Berntsen and Hall (2004)



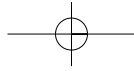
did not directly ask their participants whether a trigger was present; they had participants describe commonalities in the environment or their thoughts and the memory content. In contrast, Mace (2004) directly asked participants whether there was a cue that triggered the memory. It is obvious that more research needs to be conducted on involuntary autobiographical memories to find out whether they are predominantly triggered by abstract cues, as suggested by Mace (2004; see also Berntsen, chapter 2, and Ball, Mace, & Corona, chapter 6, both this volume). There are also no data concerning the type of triggers that elicit involuntary autobiographical memories in older adults.

Finally, there have been two preliminary studies, which have examined the distribution of involuntary autobiographical memories using young and old participants. Berntsen and Rubin (2002) asked their participants to recall *retrospectively* details of the last involuntary memory they had experienced. Older adults reported experiencing involuntary memories less frequently than young adults. Importantly, Berntsen and Rubin (2002) report that, in general, the distribution of involuntary memories is similar to that found with voluntarily retrieved memories, i.e., a strong recency effect with a clear but less pronounced reminiscence bump. However, in a recent diary study of involuntary autobiographical memories, Mace (2003) reported a somewhat different distribution of these memories for older participants. He found a clear reminiscence bump with a greatly reduced recency effect. Therefore, it is still unclear whether the robust findings concerning the distribution of voluntarily retrieved autobiographical memories will extend to involuntarily retrieved memories.

■ THE PRESENT STUDY

The aim of the present study was to replicate and expand existing research on involuntary autobiographical memory by comparing the involuntary memories of younger older adults (i.e., 64 years old and above) in a naturalistic diary study. The rationale was to explore any similarities and/or differences between young and older adults' experiences of involuntary autobiographical memories (particularly those that have been highlighted when memories are voluntarily recalled). Furthermore, by comparing our findings of involuntary autobiographical memories in older adults with the findings from research on voluntary autobiographical memories, questions concerning the similarities and differences between these two forms of autobiographical memory could be addressed.

The method used was based on Berntsen's (1996) naturalistic diary study of involuntary memory. However, in Berntsen's (1996) study participants were instructed to record a maximum of two involuntary autobiographical memories per day, whereas the present study required participants to record all involuntary



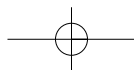
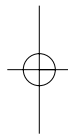
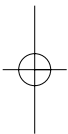
autobiographical memories they experienced during a one-week period. This was deemed necessary to examine exactly how often such memories occur in everyday life. Participants were provided with prestructured diaries and recorded information regarding the frequency of involuntary memories, the conditions in which they occur, and characteristics of the memories.

The main predictions regarding age effects and involuntary autobiographical memory are outlined below.

It was hypothesized that older adults may experience involuntary autobiographical memories less frequently than young adults (cf. Berntsen & Rubin, 2002). The basis for this prediction comes from two strands of research. First, older people appear to experience fewer involuntary processes in the form of daydreaming and task-unrelated thoughts. For example, Giambra (1989, 1993) carried out a series of experiments where participants were required to partake in a long, monotonous vigilance task. During the procedure participants noted each time they had unbidden (i.e., involuntary) thoughts unrelated to the vigilance task. Giambra (1989, 1993) found that older adults (60 years plus) reported up to 50 percent fewer involuntary task unrelated thoughts than young adults.

Second, previous research on involuntary autobiographical memory indicates that these memories are more likely to occur when people are engaged in relatively routine or automatic activities (e.g., walking, doing housework, bathing) that are cognitively undemanding and require low levels of concentration (Roberts et al., 1994; Berntsen, 1996). However, research indicates that as people grow older the availability of attentional resources declines, as there is an increased need to attend to automatic activities such as walking (Grady & Craik, 2000). For example, Lindenberger, Marsiske, and Baltes (2000) had young and old adults carry out a dual task. Namely, participants had to walk along two narrow tracks while memorizing a word list. They found that under these dual-task conditions performance for both tasks declined with age. Therefore, if automatic activities require increasingly more attention with increasing age it follows that they will have to concentrate more on these activities than younger people. Hence, older adults may experience involuntary autobiographical memories less frequently than young adults.

The remaining predictions are based on the assumption that different mechanisms are involved in voluntary and involuntary autobiographical memories. For example, in relation to memory specificity it was predicted that no age effects would be observed and that involuntary autobiographical memories of both young and older adults would be predominantly specific. Moreover, it was expected that a high percentage of specific involuntary memories in older adults would not be due to frequent rehearsal of these memories. Finally, in relation to the distribution of involuntary memories predictions were made separately for the young and older groups. It was expected



that a clear recency effect would be found in the young group. For the older group the distribution of involuntary memories was expected to have a clear reminiscence bump with a reduced or no recency effect.

Method

Participants

Participants were 21 volunteers. Of these, 11 were young (8 females and 3 males), with the mean age of 23.55 years (range 20–28 years). Ten participants were old (4 female and 6 men), with the mean age of 74.2 years (range 64–80 years). All older participants and one young participant were recruited from an existing subject pool of volunteers. The remaining young participants were recruited from psychology undergraduates and by word of mouth (i.e., friends of participants, etc.).

All older adults were healthy and resided in the community. They did not report any vision, hearing, or physical mobility problems, or any of the following: serious head injury, stroke, mental health and/or memory problems that had been diagnosed by the doctor. Furthermore, English was the first language of all participants.

All older participants had previously taken part in a study conducted by Kvavilashvili et al. (2006). All scored above the cutoff point of 24 on the Mini Mental State Examination ($M = 27.80$). Additionally, the older sample in the study of Kvavilashvili et al. (2006) obtained significantly higher scores than the young group on the vocabulary sub-test (i.e., Spot-the-Word Test) of the Speed and Capacity of Language Processing Test (SCOLP; Baddeley, Emslie, & Nimmo-Smith, 1993).

Materials and procedure

The materials used were adapted from Berntsen's (1996) diary study. During an initial interview participants were provided with a diary in the form of a notebook, which contained 20 questionnaires. Twenty questionnaires were provided because, in an earlier pilot study, none of the participants who were supplied with 50 questionnaires recorded more than 20 memories in a one-week period. One questionnaire had to be completed for each involuntary memory experienced. Detailed instructions of how to complete the diary were given. Detailed verbal and written explanations of the phenomenon were also provided. Thus, involuntary autobiographical memories were described as memories from the past that come to mind spontaneously, without any deliberate attempt to retrieve them (i.e., past memories that simply "pop" into

one's mind). It was explained that involuntary memories may vary in detail, with some memories referring to a single episode/event (e.g., the day you moved into a new house; when a member of your family was born), and others being more general, referring to either *extended* events that lasted for a longer period of time (e.g., a holiday in Italy) or *repeated* events (e.g., traveling to work on the subway; going to the beach every summer during childhood). It was also explained that involuntary memories could be many years old or only a few days old. Owing to the personal nature of the data provided, confidentiality was explicitly assured, and when the researcher was confident the participant fully understood all the instructions, written consent was obtained.

Each questionnaire elicited information regarding the content of the involuntary autobiographical memory, and the conditions under which it occurred. Questions were either structured (i.e., multiple-choice or on a 5-point rating scale) or open (i.e., participants had to describe an aspect of their experience in their own words, including a description of the memory content).

Participants provided a brief description of the memory content and indicated the following: specificity of the memory (specific or general), how old they were in the remembered event, how unusual this event was (on a 5-point scale ranging from 1 = very unusual to 5 = very usual), and frequency of rehearsal (on a 5-point scale ranging from 1 = never to 5 = very often). Regarding the conditions of occurrence, participants reported in their own words where they were at the time, what activity they were involved in and how much they were concentrating on this activity (on a 5-point scale ranging from 1 = not at all to 5 = fully). They also reported the presence/absence of a trigger. If a trigger was present they indicated whether it was internal or external, and described what is in their own words. Finally, participants recorded details of their current mood when each memory occurred and the emotional valence of each memory. However, the results concerning these two variables are reported in a separate paper (see Schlagman, Schulz, & Kvavilashvili, 2006).

Participants carried the diaries with them at all convenient times for a period of seven days commencing the day after their initial interview. Each questionnaire was completed immediately, or as soon as possible, after the occurrence of an autobiographical memory. If participants were unable to complete the questionnaire or felt the content was too personal a space was provided for them to record this in the form of a tick. There were no restrictions on how many memories were recorded each day.

Results

All participants completed a diary and a total of 231 involuntary autobiographical memories were recorded by participants throughout the one-week

period (128 by young and 103 by older participants). Before conducting any analysis each memory description was read to ensure that all records were “autobiographical.” This resulted in seven memories being discarded, as they were clearly not autobiographical but were examples of either remembering future intentions (i.e., prospective memory), the tip-of-the-tongue phenomenon, or daydreams/current thoughts (e.g., “I was thinking that she (my dog) will be nipping out on a walk about this time with my dad”).

Frequency of involuntary memories

Participants recorded details of each memory in a diary. If they were unable to record a memory in full (i.e., using a questionnaire) then this was recorded in the form of a tally (tick) in the appropriate section of the diary. The young group recorded a total of 125 autobiographical memories in full (Range = 4–17, Mean = 11.45, $SD = 3.70$) and a total of 45 tallied memories (Range = 0–12, Mean = 4.09, $SD = 3.53$).

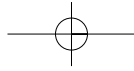
In the older group a total of 99 autobiographical memories were recorded in full (Range = 2–18, Mean = 10.00, $SD = 6.22$) and with the exception of one male participant, zero memories were tallied. It was clear that this elderly man (74 years old) who tallied 25 memories was a very unusual case. He informed the investigator that he had many more memories that he did not attend to and enjoyed the experience so much that he was going to begin writing his memoirs. Therefore, when analyzing the frequency of involuntary memories his data were excluded.

The overall mean number of memories (i.e., recorded plus tallied memories) experienced by the young group was 15.55 ($SD = 5.11$), whereas the old group recorded a mean of 9.11 ($SD = 5.88$), and this difference was statistically significant $t(19) = 2.62$, $p = .02$, with a large effect size (*Cohen's d* = 1.12).

Conditions in which involuntary memories occur

Ongoing activities

Participants had to record what activities they were involved in at the time of experiencing an involuntary autobiographical memory. The descriptions of these activities were analysed by two independent raters (the first and the second authors) to determine whether they were controlled or automatic. A controlled activity was defined as one that requires attentional resources to be deployed for successful execution, for example, attending a meeting, reading and writing, studying, and working. An automatic activity was defined as an activity that is fairly routine and does not require a great deal of attention in order to be successfully executed, e.g., walking, eating, having a shower, etc. In the



former, there is no discrepancy between one's current actions and thoughts (i.e., one needs to think about what one is doing), whereas in the latter there is usually a discrepancy between one's actions and concurrent thoughts, for example, washing one's hands and, at the same time, daydreaming about a holiday (cf. Berntsen, 1998; Norman & Shallice, 1986; Reason, 1984). Those activities that may require attentional resources to be deployed only occasionally and requiring little attention for most of the time (e.g., driving or photocopying papers) were also classified as automatic. Agreement between the two raters was excellent both for the young ($Kappa = .82$, $SE = .08$) and for the older group ($Kappa = .76$, $SE = .10$). All disagreements were resolved through discussion.

The frequencies of involuntary autobiographical memories as a function of automatic versus controlled activities can be seen in Table 5.1. Overall, the majority of involuntary autobiographical memories were reported to have occurred while participants were involved in automatic activities (61 percent). This was true for both age groups (63 percent and 59 percent for old and young, respectively), and the groups did not differ in these percentages, $\chi^2 = .33$, $df = 1$, $p = .57$.

Next, we examined participants' rating of how much they were concentrating on the activity they were involved in at the time of reported memory. This was rated on a 5-point scale (ranging from 1 = not at all to 5 = fully concentrating). Mean concentration ratings were calculated for each participant, and from these individual means overall means for each age group were calculated. The mean concentration rating of the older group was significantly higher ($M = 3.40$, $SD = .78$) than that of the young group ($M = 2.51$, $SD = .83$), $t(19) = 2.50$, $p = .02$, and the magnitude of this difference amounted to a large effect (*Cohen's d* = 1.10).

Additional information on concentration ratings is provided in Table 5.2, which shows the percentage of memories recorded by young and old participants during low levels of concentration (points 1 and 2 of the 5-point scale),

Table 5.1 Frequencies (%) of Recorded Memories as a Function of Activity (Controlled vs. Automatic) and Age (Young vs. Old).

Age Group	Activity		Total
	Controlled	Automatic	
Young	51 (41%)	74 (59%)	125 (100%)
Old	36 (37%)	62 (63%)	98 (100%) ^a
Total	87 (39%)	136 (61%)	223 (100%)

^a The reduced number of memories is due to missing data.

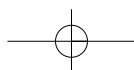


Table 5.2 Frequencies (%) of Recorded Memories as a Function of Concentration Ratings (Low vs. Medium vs. High) and Age (Young vs. Old).

<i>Age group</i>	<i>Concentration rating</i>			<i>Total</i>
	<i>Low</i>	<i>Medium</i>	<i>High</i>	
Young	75 (60%)	18 (14%)	32 (26%)	125 (100%)
Old	31 (31%)	13 (13%)	55 (56%)	99 (100%)
Total	106 (47%)	31 (14%)	87 (39%)	224 (100%)

Note. Concentration was rated on a 5-point scale (1 = not at all, 5 = fully concentrating). Ratings 1 and 2 were classed as low, 3 as medium, and 4 and 5 as high levels of concentration.

medium level of concentration (point 3), and high levels of concentration (points 4 and 5). In the young group, the majority of memories (60 percent) were experienced during low levels of concentration, whereas in the old group the majority of memories (56 percent) were experienced during high levels of concentration, $\chi^2 = 22.11$, $df = 2$, $p < .001$. This pattern of results provides support for the idea that with increased age even fairly habitual and automatic everyday activities become attentionally demanding and more difficult to carry out.

Triggers

For each recorded memory participants indicated whether or not a trigger was present and, if so, whether the trigger was in their thoughts (i.e., internal) or in the environment (i.e., external). Table 5.3 presents the overall frequencies of involuntary memories as a function of the type of trigger for both age groups. Overall, the majority of memories (78 percent) in both age groups did have

Table 5.3 Frequencies (%) of Recorded Memories as a Function of Type of Trigger (Internal vs. External vs. None) and Age (Young vs. Old).

<i>Age group</i>	<i>Type of trigger</i>			<i>Total</i>
	<i>External</i>	<i>Internal</i>	<i>None</i>	
Young	68 (54%)	33 (27%)	24 (19%)	125 (100%)
Old	55 (56%)	16 (16%)	28 (28%)	99 (100%)
Total	123 (55%)	49 (22%)	52 (23%)	224 (100%)

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identifiable triggers compared to no trigger (23 percent). Furthermore, out of the 172 involuntary memories that were triggered, the majority were reported to have been triggered by external cues (72 percent) as opposed to internal cues (28 percent). Although older adults had a tendency to report a greater number of memories with no triggers (28 percent versus 19 percent) and less number of memories with internal triggers (16 percent versus 27 percent) than younger adults, this difference did not reach statistical significance $\chi^2 = 5.41$, $df = 2$, $p = .07$.

Abstract versus sensory/perceptual versus state triggers

Participants recorded what the trigger was in their own words. On the basis of participants' descriptions the triggers were coded according to Mace's (2004) classification. Thus, cues were categorized either as abstract, sensory/perceptual, or state based. We added a further category of undecided for those triggers that could not be placed into a category due to insufficient information. The agreement between the two independent raters was excellent for both age groups; for the young group *Kappa* was .76 ($SE = .08$) and for the older group .83 ($SE = .09$). All disagreements were resolved through discussion.

The overall results of this classification can be seen in Table 5.4. The frequencies presented in this table show that both in young and older adults the cues were equally likely to be classed as abstract and sensory/perceptual (47 percent and 44 percent, respectively), with very few cues falling into the state and undecided categories, $\chi^2 = .30$, $df = 2$, $p = .86$ (for this analysis, the data in the state and undecided categories were collapsed due to small number of cases in these categories).

Triggers in relation to memory content

Finally, the relationship between the reported triggers and their corresponding memories was examined to ascertain if they formed an integral part of

Table 5.4 Frequencies (%) of Memories as a Function of Trigger (Abstract vs. Sensory/Perceptual vs. State vs. Undecided) and Age (Young vs. Old).

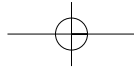
Age Group	Type of trigger				Total
	Abstract	Sensory/Perceptual	State	Undecided	
Young	47 (46%)	46 (46%)	6 (6%)	2 (2%)	101 (100%)
Old	34 (48%)	30 (42%)	0 (0%)	7 (10%)	71 (100%)
Total	81 (47%)	76 (44%)	6 (4%)	9 (5%)	172 (100%)

remembered event as suggested by the results of Berntsen and Hall (2004). Two raters independently coded the trigger-memory relationship into four possible categories: intrinsically related (when trigger formed part of what was remembered), associatively related, no obvious relationship (i.e., unrelated), and undecided (when there was insufficient information to classify the trigger). For example, the memory, "I got a hole in one on the sixth hole of a golf course . . . we saw the ball spiral down the flag into the hole! Very exciting!" was reported as being triggered by a "remark made about a hole in one," which was intrinsically related to the memory content. Whereas the memory, "When I was a little girl we were given a double dose of antibiotics" was triggered by "my daughter saying she felt ill," which was associated to the memory content. The memory "my father in hospital" was triggered by "house valuation," which appears to be completely unrelated to the memory content. Finally, the memory "Grandmother's house in Barnet, I remember her collecting her washing from the clothesline in the garden," which was triggered by "an article in the paper I was reading," was classified as undecided as there is clearly not sufficient information about the article to make a decision about the relation between the trigger and the memory content. Additionally, if a participant reported that a trigger was present but did not record what it was in their own words then this would be classed as undecided. The agreement between the raters was acceptable; *Kappa* was .61 (*SE* = .08) for the older group, and .55 (*SE* = .06) for the young group. All disagreements were resolved through discussion.

Table 5.5 shows that the majority of triggers were intrinsically related to the memory content (55 percent), and this was true for both age groups (48 percent in old and 59 percent in young, respectively), as shown by the results of a chi-square test, $\chi^2 = 2.58$, *df* = 2, *p* = .28 (for this analysis, the data in the unrelated and undecided categories were collapsed due to small number of cases in these categories).

Table 5.5 Frequencies (%) of Recorded Memories as a Function of Trigger–Memory Relationship (Related vs. Associated vs. Unrelated vs. Undecided) and Age (Young vs. Old).

<i>Age group</i>	<i>Trigger–memory relationship</i>				<i>Total</i>
	<i>Related</i>	<i>Associated</i>	<i>Unrelated</i>	<i>Undecided</i>	
Young	60 (59%)	27 (27%)	5 (5%)	9 (9%)	101 (100%)
Old	34 (48%)	22 (31%)	0 (0%)	15 (21%)	71 (100%)
Total	94 (55%)	49 (28%)	5 (3%)	24 (14%)	172 (100%)



Characteristics of involuntary memories

Specificity of memories

Participants recorded whether the memory was of a specific or general event. The frequencies of memories as a function of specificity and age are presented in Table 5.6. There was an overall predominance of specific memories (77 percent) compared to general ones (23 percent), and the old group (75 percent) did not differ from the young (78 percent) in these percentages $\chi^2 = .40$, $df = 1$, $p = .53$.

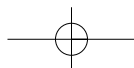
Rehearsal frequency

For each memory participants recorded how often they had recalled the remembered event before (rehearsal) on a 5-point scale (ranging from 1 = never to 5 = very often). To examine the relationship between rehearsal and specificity of involuntary autobiographical memories, mean rehearsal ratings for general and specific memories were calculated for each participant and, from these individual means, overall means for each age group were calculated. In the young group, the mean rehearsal ratings for specific and general memories were 1.82 ($SD = .52$) and 2.41 ($SD = .80$), and in the old group, these means were 2.59 ($SD = .57$) and 2.25 ($SD = .49$), respectively. The mean ratings are fairly low, indicating that often participants recalled involuntary memories that they had not thought of or rehearsed before.

These means were entered into a 2 age (young versus old) \times 2 memory (specific versus general) mixed ANOVA with the repeated measures on the last factor. This analysis revealed no main effects of memory type ($F < 1$) or age group $F(1, 19) = 2.03$, $p = .17$. However, there was a significant age by memory interaction $F(1, 19) = 7.90$, $p = .01$ (see Figure 5.1). A test of simple main effects showed that in the old group the rehearsal ratings for specific memories were

Table 5.6 Frequencies (%) of Recorded Memories as a Function of Specificity of Memory (Specific vs. General) and Age (Young vs. Old).

Age group	Specificity		Total
	Specific	General	
Young	98 (78%)	27 (22%)	125 (100%)
Old	74 (75%)	25 (25%)	99 (100%)
Total	172 (77%)	52 (23%)	224 (100%)



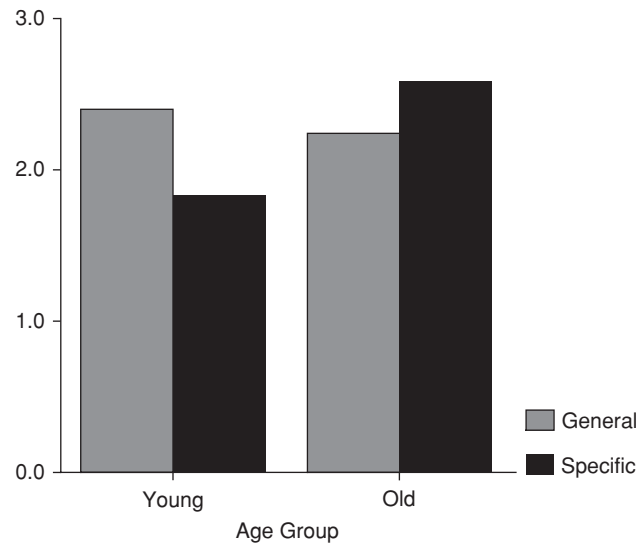


Figure 5.1 Mean Rehearsal Ratings Made on a 5-Point Scale (1 = Never, 5 = Very Often) as a Function of Memory Type (Specific vs. General) and Age Group (Young vs. Old).

not reliably higher than for general memories ($p = .17$). In the young group, however, specific memories were rehearsed less frequently than general memories ($p = .02$).

The frequency distribution of the retention time of the memories

The frequency distribution of memories across the life span was examined separately for the two age groups. To examine the distribution of memories, the age of each memory was calculated by subtracting the age of the participant in the memory from their current age. This would provide the retention time in years for each memory. If the memory was from the current year retention time would be zero. The overall mean retention time in years, calculated from the mean retention time for each participant, was 3.66 for the young ($SD = 5.10$, range = 0–21), and 37.42 for the old group ($SD = 23.41$, range = 0–75).

For the young group the relation between the frequencies of the memories and their retention time was analysed by applying a curve-fitting approach. Figure 5.2 depicts the frequencies of memories depending on retention time. As can be seen, the number of memories decreases rapidly with an increase in retention time, resulting in a clear recency effect. A curve-fitting regression

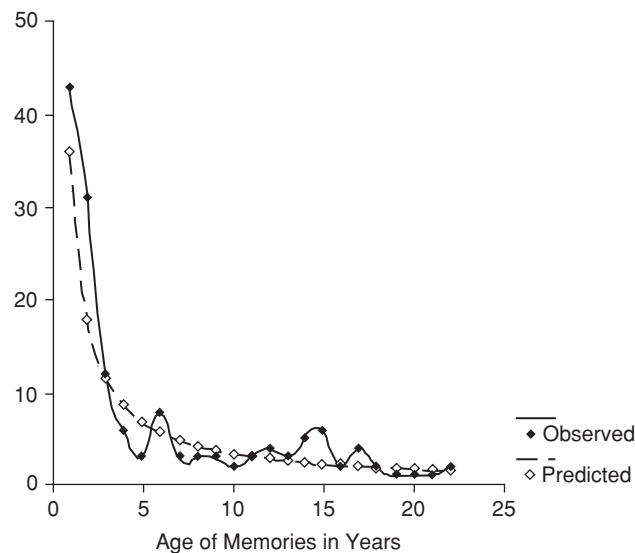
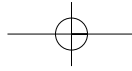


Figure 5.2 Memory frequency as a function of retention time (expressed in years) for the young group.

analysis confirmed that the shape of this frequency distribution resembled a decay function, as a hyperbolic regression model accounted for 91 percent of the variance of the observed counts.

For the older group the possible age range of memories was very large and, therefore, the data was examined in decades. The frequency distribution of retention times of memories in this age group is shown in Figure 5.3. The frequency distribution is very different from that of the young participants. While the recency effect appears to be reduced, there is a clear reminiscence bump with 24 percent of memories being 50–59 years old. Given the age range of our participants, this would mean that the reminiscence bump should cover a period when participants were in their early to late twenties.

A log-linear analysis was conducted to further examine the frequency distribution of memories in the old group in terms of their retention times (see Figure 5.3). The first model tested for equal probabilities, i.e., equal number of memories, would fall into each of the nine retention time classes. This model was rejected ($LR(7) = 15.82, p = .03$). Inspection of the residuals revealed an adjusted residual of 3.48 for the class of memories reaching back between 50 to 59 years, representing the reminiscence bump. After setting free the parameter for this class of memories, the goodness of fit test for the resulting log-linear model was acceptable ($LR(6) = 5.92, p = .43$). However, there was another high adjusted residual of 2.01 for the class of memories from the most

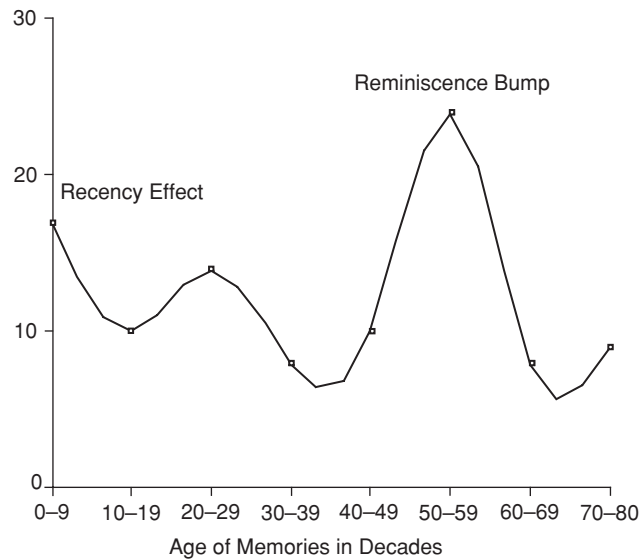


Figure 5.3 Memory Frequency as a Function of Retention Time (Expressed in Decades) for the Old Group.

recent period. When this parameter was added to the log-linear model, its fit became excellent ($LR(5) = 2.37, p = .80$). This model therefore provided evidence for both a recency effect as well as the reminiscence bump. A final model then tested for a difference between the frequencies of recent memories and those memories falling into the reminiscence bump.¹ This model still had an excellent fit ($LR(6) = 3.6, p = .74$), with the largest residual being smaller than 1.46. Thus, no difference in the frequencies of recent memories and memories falling into the reminiscence bump were found. This model was, therefore, accepted as the final model of the frequency distribution of involuntary autobiographical memories in the old age group.

The 24 memories falling into the reminiscence bump were compared against 27 memories from the most recent two decades (i.e., 0–9 and 10–19). Independent t-tests indicated no differences between these two groups of memories in the reported rehearsal frequency (bump memories $M = 2.71, SD = 1.60$, recent memories $M = 2.56, SD = 1.88, t(49) = .46, p = .65$), and average ratings of unusualness of remembered event (bump memories $M = 1.79, SD = 1.25$, recent memories $M = 2.41, SD = 1.37, t(49) = 1.67, p = .10$). Furthermore, the two groups of memories did not differ in the percentage of specific memories (87 percent and 74 percent for the bump and recent memories, respectively), $\chi^2 = 1.45, df = 1, p = .23$.

Discussion

The aim of the study described in this chapter was to compare the involuntary autobiographical memories of young and older adults. The results will be discussed in two parts. Initially, we will examine those results that replicate previous findings and further inform us about the conditions in which involuntary autobiographical memories are most likely to occur in everyday life. We will then discuss some novel results concerning age effects on involuntary autobiographical memory, including the specificity of memories and the distribution of these memories across the life span.

For both young and older adults involuntary autobiographical memories predominantly occurred while being engaged in such automatic activities as walking, eating, and driving. Moreover, the majority of involuntary autobiographical memories were reported to have identifiable triggers. These findings are in line with previous studies of involuntary autobiographical memory (e.g., Berntsen, 1996, 1998; Berntsen & Hall, 2004; Kvavilashvili & Mandler, 2004; Mace, 2004), and support the idea that, irrespective of age, involuntary autobiographical memories are most likely to occur during undemanding ongoing activities and in the presence of triggers. Our analysis of the trigger-memory relationship showed that the vast majority of recorded triggers were directly or associatively linked to the central features of elicited memories, which explains why triggers are so easy to identify (for similar findings see Berntsen, chapter 2 and Ball, Mace, & Corona, chapter 6, both this volume).

Furthermore, in line with an earlier study of Berntsen and Hall (2004), the triggers of involuntary autobiographical memories were found to be dominantly external stimuli as opposed to internal, and this was true for both young and older adults (see also Berntsen, 1998; chapter 2, this volume). In addition, following Mace (2004), we also classified the triggers of involuntary memories as being abstract, sensory/perceptual, or state based. The results showed that triggers were equally likely to be abstract (i.e., linguistic-based) or sensory/perceptual, with very few triggers classed as state based. Although we did not find the predominance of abstract triggers, the percentage of abstract triggers was large enough in both young and old participants to warrant further investigation and to discard the Proustian view of triggers being primarily sensory/perceptual (cf. Mace, 2004; Ball, Mace, & Corona, chapter 6, this volume).

The remaining findings concern the effects of age on involuntary autobiographical memory. For example, in line with our prediction, older adults reported experiencing involuntary autobiographical memories considerably less frequently than younger adults. This replicates previous findings about reduced daydreaming and task-unrelated thoughts in old age, and indicates that with increased age there may be a general tendency to experience less spontaneous

mental processes, irrespective of their content. Importantly, the results of our study also shed some light on possible reasons behind this phenomenon. Thus, both age groups mostly reported being involved in fairly routine automatic activities at the time when involuntary memories occurred (see Ball, chapter 7, this volume, for further discussion). However, in comparison to younger adults, older adults were more likely to report higher levels of concentration on these tasks. Since older adults may need to pay more attention to the execution of automatic activities, they will have fewer attentional resources available to experience task-unrelated thoughts and memories (for similar results obtained in a study of prospective memory and aging, see Kvavilashvili & Fisher, 2006).

An interesting set of findings was also obtained in relation to aging and the specificity of involuntary autobiographical memories that are in sharp contrast with previous studies on voluntary autobiographical memory. These studies have shown that *voluntary autobiographical memories* of older adults are more likely to be general than those of younger adults (e.g., Levine et al., 2002; Piolino et al., 2002). This reduction in memory specificity in old age has been explained by the fact that voluntary retrieval of autobiographical memories is a slow, effortful, and top-down process (e.g., Conway, 1990; Conway & Pleydell-Pearce, 2000) that can be problematic to older adults owing to general decline with age in attentional resources and working-memory capacity. For example, a recent fMRI study has shown that different brain areas were activated in young and older adults during voluntary retrieval of autobiographical memories (Maguire & Frith, 2003; for a review of relevant research see Piefke & Fink, 2005). The results also show that older adults can maintain a small pool of specific memories by frequent rehearsal. If these memories are not deliberately retrieved on regular basis the connections deteriorate and the details are lost (Cohen, 1996; Cohen & Faulkner, 1988).

In contrast, our findings show that the majority of involuntary autobiographical memories were specific for both young and older adults. Moreover, older adults did not report rehearsing their specific memories more frequently than their general memories. Thus, unlike voluntarily recalled autobiographical memories, older adults appear to have direct access to specific involuntary memories that have not been maintained by frequent prior rehearsal. Interestingly, in young participants, specific involuntary memories were reliably less rehearsed than general memories. These findings indicate that the specificity of involuntary memories may not be mediated by the amount of prior rehearsal neither in old nor young participants.

Another important finding concerns the distribution of memories across the life span. In the young group the distribution of involuntary memories looked very similar to that found when memories are voluntarily retrieved. The majority of involuntary memories were from the most recent years and

the number of memories declined by about half for each year of retention, i.e., a recency effect was found. Berntsen (1996) and Mace (2003) also found this recency effect for young adults' involuntary autobiographical memories. However, for the older group this recency effect was greatly diminished: the number of involuntary memories falling in the most recent decade did not differ from the number of involuntary memories recalled from when participants were approximately 20–29 years old (see Mace, 2003, for similar results). This finding is in contrast to previous work with *voluntary memories* retrieved to cue-words as the classic distribution includes a strong recency effect along with a less prominent reminiscence bump.

The finding is even more striking when the method of calculating the distribution is considered. In previous studies of voluntarily retrieved memories the distribution of memories is calculated by excluding memories from the most recent year. To include these memories would result in the reminiscence bump being totally overshadowed by the recency effect (e.g., see Conway, 2005; Rubin, 1999). In the present study, involuntary memories from the most recent year were included in the calculation of the distribution of memories. However, the number of memories falling into the most recent decade still did not exceed the number of memories falling into the reminiscence bump period. Therefore, the occurrence of involuntary autobiographical memories in older adults is not only affected by the recent past, but seems to also reveal a bias toward the retrieval of older memories. Hence, the shape of the distribution of involuntary autobiographical memories appears to be clearly different from that of voluntary autobiographical memories where the recent memories outnumber those falling into the reminiscence bump.

Several explanations have been put forward to account for the reminiscence bump in voluntary autobiographical memories as studied by the cue-word method. Most of these explanations converge on the idea that a period of late adolescence to early adulthood, covered in the reminiscence bump, is a transitional period full of such self- and identity-defining life events as finishing one's education, one's first job, marriage, starting a new family, etc. (see Berntsen & Rubin, 2004 for a review of evidence in support of this idea). However, the accounts differ in terms of proposed underlying mechanisms that keep the memories of events from this life period more activated than events from adjacent periods. The review of these accounts is outside the scope of this chapter and has been done elsewhere (see, e.g., Berntsen & Rubin, 2002; Rubin, 2002; Rubin, Rahhal, & Poon, 1998). Instead, we will briefly examine possible reasons for obtaining the pronounced bump and reduced recency for involuntary memories in older adults.

It is interesting to note that a similar distribution has been obtained when older adults are asked to deliberately recall their most important or vivid memories. For example, in a study by Rubin and Schulkind (1997), 57 percent

of important memories fell into the bump period in contrast to 17 percent of memories recalled by the same participants in response to cue words. Could it be, then, that involuntary memories are of more important events than voluntary memories retrieved to cue-words? We did not obtain ratings of importance in the present study. Although memories were rated as fairly unusual this applied to both bump and more recent memories. Moreover, unusualness does not necessarily entail importance. For example, cutting one's toe may be a fairly unusual event (in that it does not happen to one frequently), but it would hardly be an important event (unless one lost one's toe). In addition, the examination of bump memories in our study did not support the idea that they were predominantly of important life events listed above.

An alternative explanation of the distribution of older adults' involuntary autobiographical memories is to suggest that older adults "live in the past" by frequently thinking about their past, and especially about the events from the period of reminiscence bump. This excessive reminiscing would activate not only the memories of important life events from the bump period but also many other related memories of less important and mundane events. Therefore, when certain triggers are encountered in one's environment or thoughts that match central features of already (subconsciously) activated memories, this will result in the sudden and involuntary recollection of these memories (cf. Kvavilashvili & Mandler, 2004; see also Berntsen, chapter 2, this volume).

Initial evidence in support of this priming hypothesis comes from a recent study of Mace (2005) on young adults, showing that involuntary autobiographical memories can indeed be primed by thinking about the past. In this study, participants completed a diary of their involuntary autobiographical memories for a period of two weeks. At the end of the first week, participants came into the laboratory and were asked to voluntarily recall memories from a specific lifetime period, e.g., high school or when they were when they were between 13 and 16 years old. After the voluntary recall session, participants continued to record their involuntary memories in a diary for a further week. The results showed that participants who had been primed for a particular lifetime period in the laboratory involuntarily recalled a larger proportion of memories from this period during the following week than the controls. Interestingly, these memories were not identical to memories deliberately recalled in the laboratory; they were of different events but from the same time period.

Although the explanation of the pronounced bump in older adults' involuntary memories via a priming mechanism is compelling, it rests on the assumption that with increased age people are more likely to reminisce about their past and especially about the events from the period of reminiscence bump. However, current research indicates that there is no difference in the frequency with which younger and healthy community-dwelling older adults

engage in reminiscing about their past (e.g., Holland & Rabbit, 1991; Webster, 1994; Webster & McCall, 1999). Nevertheless, the results of some studies show that older adults do report thinking and talking about more remote memories than younger adults (e.g., Webster, 1994; Pasupathi & Carstensen, 2003). Moreover, there is evidence that reminiscence serves different functions in older and younger adults (Cohen & Taylor 1998; Pasupathi & Carstensen, 2003; Webster, 1994; Webster & McCall, 1999). For example, Webster & McCall (1999) found that younger adults tended to engage more in reminiscence for the purposes of reducing boredom, solving current problems, and maintaining a sense of self-identity. In contrast, older adults tended to engage more in reminiscence as a way of preparing for death and teaching and informing others about life and moral issues.

These findings are in line with the socioemotional theory of aging developed by Carstensen and her colleagues (Carstensen, Isaacowitz, & Charles, 1999; Carstensen, Funk, & Charles, 2003). According to this theory, with the approach of old age, time becomes perceived as limited, and consequently peoples' goals shift from expanding their knowledge to finding emotional meaning and satisfaction in life. This important shift in values and goals has powerful effects on a variety of emotional and cognitive processes that are vital in maintaining psychological well-being in old age. It is therefore quite likely that older adults will engage in reminiscing about important life events from the bump period in order to see their life as being positive, successful, and well lived, and when informing and teaching others about life and moral issues (cf. Erikson, 1982/1997).

On the basis of the ideas discussed above, the future research on reminiscence bump and involuntary autobiographical memory will need to concentrate on two issues. First, to find whether older people do indeed reminisce about events of the bump period more frequently than events from other periods. As pointed out above, currently there is only indirect evidence in support of this idea. Secondly, it is necessary to directly compare the content of involuntary memories of the bump period with the content of voluntary memories from the same period to examine the hypothesis that the former will be mainly of relatively unimportant mundane events, whereas the latter would more often comprise important or significant events. Ideally, this comparison should be within subjects and not between different samples.

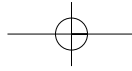
A final point that we want to make in relation to the reminiscence bump are some recent findings on *voluntary autobiographical memory* showing that reminiscence bump may be present or is much more pronounced for positive events and not for negative events. For example, in a study by Berntsen and Rubin (2002), when old participants were asked to recall their most important, happiest, and saddest memories, the reminiscence bump was present for the most important and happiest but not for the saddest memories (see also

Rubin & Berntsen, 2003). It is interesting that the results from the present study extend the findings of Berntsen and Rubin (2002) to the reminiscence bump of involuntary autobiographical memories.

As pointed out earlier (see "Method"), the results from the present study concerning the emotional valence are reported in Schlagman et al. (2006). In this study, the content analyses of memories recorded by our participants showed that in the young group 29 percent of the memories were of such typically negative events as "accidents/illness," "stressful events," and "deaths/funerals," whereas in the old group only 7 percent of memories fell into these categories (see Schlagman et al., 2006, Table 1). The absence of negative memories in the old group was also confirmed by the analyses of participants' own ratings of emotional valence of their memories. In the young group, 24 percent and 10 percent of memories were rated as "very negative" and "negative," respectively (points 1 and 2 on a 5-point scale) while in the old group, only 1 percent and 4 percent of memories were rated as "very negative" and "negative" (see Schlagman et al., 2006, Table 2). Given that reminiscence bump may mainly consist of positive memories, as shown by Berntsen and Rubin (2002), and that older people displayed a remarkable tendency to record very few involuntary negative memories, it is perhaps unsurprising that we obtained a pronounced reminiscence bump in the present study.

To summarize, older adults experienced involuntary memories that were up to 70 years old but were highly specific, and had not been maintained by frequent rehearsal as their prior rehearsal rate did not differ from that of general involuntary memories. In addition, while there was a pronounced reminiscence bump, the recall of memories of the most recent decade (including those from the current year) was greatly diminished. These findings are in contrast to those obtained in studies of *voluntary autobiographical memories* and provide further support for the idea that different mechanisms may be involved in voluntary and involuntary autobiographical memory. Since involuntary memories, by their very nature, are spontaneous and non-deliberate, their retrieval is likely to bypass the processes required when autobiographical memories are voluntarily retrieved and, as a result, novel but detailed and specific memories come to mind without any effort (cf. Conway & Pleydell-Pearce, 2000).

Although the results of this study are both novel and encouraging they are based on relatively small samples. It will be necessary to replicate and further extend current findings on larger samples of young and old participants. Most importantly, future research should study voluntary and involuntary autobiographical memories within one sample of older adults in order to directly compare these two forms of memory. We are currently in the process of conducting such studies with a variety of methods both in and outside the laboratory.



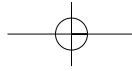
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- 1 This can be done by testing an equality constraint relating to these two parameters in the log-linear equation.

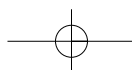
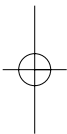
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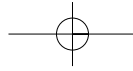
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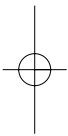


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