

Address for Correspondence:

Jonathan Koppel

Center on Autobiographical Memory Research

Department of Psychology and Behavioural Sciences

Aarhus University

Bartholins Allé 9, Building 1340

8000 Aarhus C

Denmark

Telephone: +45 8716 5943

Fax: +45 8715 0201

Email: jkoppel@psy.au.dk

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Recent Advances in Understanding the Reminiscence Bump: The Importance of Cues in Guiding
Recall from Autobiographical Memory

Jonathan Koppel¹

Center on Autobiographical Memory Research, Aarhus University

David C. Rubin

Duke University; Center on Autobiographical Memory Research, Aarhus University

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Abstract

The reminiscence bump is the increased proportion of autobiographical memories from youth and early adulthood observed in adults over 40. It is one of the most robust findings in autobiographical memory research. Although described as a single period of increased memories, a recent meta-analysis which reported the beginning and ending ages of the bump from individual studies found that different classes of cues produce distinct bumps that vary in size and temporal location. The bump obtained in response to cue words is both smaller and located earlier in the lifespan than the bump obtained when important memories are requested. The bump obtained in response to odor cues is even earlier. This variation in the size and location of the reminiscence bump argues for theories based primarily on retrieval rather than encoding and retention, which most current theories stress. Furthermore, it points to the need to develop theories of autobiographical memory that account for this flexibility in the memories retrieved.

Keywords: autobiographical memory; cuing; important memories; olfaction; reminiscence bump; word-cued memories

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Recent Advances in Understanding the Reminiscence Bump:

The Importance of Cues in Guiding Recall from Autobiographical Memory

The reminiscence bump refers to the disproportionate number of autobiographical memories, in adults over 40, dating from youth and early adulthood. Since Rubin, Wetzler, and Nebes (1986) first demonstrated the bump, it has been considered a hallmark of autobiographical memory, and, as such, is typically featured in introductory cognitive textbooks (e.g., Eysenck & Keane, 2010; Goldstein, 2015; Rathbone, Moulin, Conway, & Holmes, 2012). Researchers generally cite a single age range as representing a single bump period from approximately 10 or 15 to 30 years of age (e.g., Dickson, Pillemer, & Bruehl, 2011; Habermas, 2007; Koppel & Berntsen, 2014a). The widespread interest in the bump stems in part from providing a quantitative description that allows reminiscence and nostalgia to be probed in more detail and in part because the bump does not conform to standard monotonically decreasing retention functions (e.g., Ebbinghaus, 1885/1964; Rubin & Wenzel, 1996).

However, recent evidence and some isolated early observations suggest that the bump has been widely misunderstood, in that it is often treated as a unitary phenomenon when, in fact, both the size and temporal location of the bump are sensitive to the cuing method used to elicit memories. We review this evidence before discussing its theoretical implications.

THE LIFESPAN DISTRIBUTION OF AUTOBIOGRAPHICAL MEMORIES

Three phenomena are observed when adults are asked to retrieve autobiographical memories to words not selected for special content. The first is retention, which can be described as a power function (i.e., a linear function of the logarithm of the number of memories per hour plotted as a function of the logarithm of the time since the event). It has an excellent fit to a precise quantitative function with identical slopes across participants of different ages

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(Rubin et al., 1986; Rubin & Schulkind 1997; Rubin & Wenzel, 1996). The second phenomenon is childhood amnesia, which can be described as a monotonically increasing function of age from 0 to about age 8 (Rubin, 2000). The third phenomenon is the bump. Empirically, the first two phenomenon can be described much more precisely than the third. None of the three has a single preferred theoretical mechanism. However, because both childhood amnesia and the bump depended on age at the time of the event rather than the age at retrieval or retention interval, explanations of the bump have emphasized heightened encoding during the ages in which the bump occurs rather than differences in cuing, which occurs much later at retrieval.

WORD-CUED MEMORIES VERSUS IMPORTANT MEMORIES

Two methods have been dominant in studying the bump (Koppel & Berntsen, 2015). The first method, with which the bump was first identified (Rubin et al., 1986), has participants retrieve autobiographical memories in association to cue words. It is intended to provide a neutral sample of the entire contents of memory (Crovitiz & Schiffman, 1974; Galton, 1879). The second method has participants report important autobiographical memories, such as the most important memories of their lives (e.g., Rubin & Schulkind, 1997) or memories they would include in a book about their life (Fitzgerald, 1996).

Koppel and Berntsen (2015) argued that the key distinction between these two cuing methods concerns the contrasting retrieval strategies triggered in each. The word-cue method allows any association between the cue and the memory, whereas the request for an important memory requires an event with a specific role in the participant's life story and so tends to produce a narrative-based search. Initial empirical observations indicated that neither the bump nor the broader distribution of autobiographical memories are identical across these two methods. Specifically, compared to important memories, the bump for word-cued memories

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contains a smaller proportion of the memories and is located earlier in the lifespan (Rubin & Schulkind, 1997). Word-cued memories also produce many more recent memories (Rubin et al., 1986; Rubin & Schulkind, 1997). In a meta-analysis examining more than 50 studies that used either word-cued or important memories to study the bump, Koppel and Berntsen (2015) found that the beginning and ending ages reported for the bump for word-cued memories had means of 9 and 23 years of age compared to 15 and 28 years for important memories, a difference of about five years. Thus, there are effectively at least two different bumps. Figure 1 presents a temporal distribution for both word-cued and important memories taken from the same study and for odor-cued memories estimated from three published studies.

The bump in word-cued memories may begin even earlier than is indicated by Koppel and Berntsen's (2015) estimate. Researchers have most often used either five-year intervals (e.g., 0-5 years, 6-10 years, etc; Koppel & Berntsen, 2014b) or 10-year intervals (e.g., 0-10 years, 11-20 years, etc; Rubin & Schulkind, 1997) in plotting the distribution of word-cued memories. However, both Rubin and Schulkind (1997) and Janssen, Rubin and St. Jacques (2011) demonstrated that the location of the bump in word-cued memories can shift depending on which age bin researchers employ. For instance, Janssen et al. (2011) found that plotting their word-cued memory data in 5-year bins produced a peak from 6 to 10 years of age, while 10-year bins produced a peak from 11 to 20. This suggests that using 10-year bins for word-cued memories may obscure the beginning of the bump in the 6 to 10 year age range. Therefore, the bump in word-cued memories may peak soon after childhood amnesia, which generally ends around the age of 8 (Rubin, 2000).

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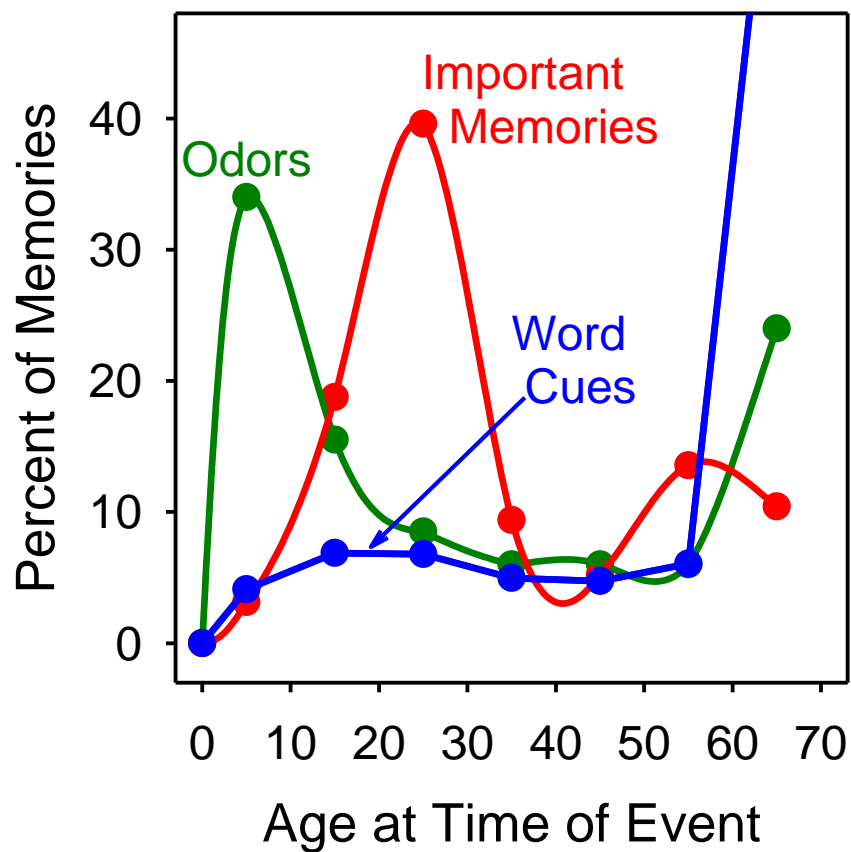


Figure 1. The data for the word-cued and important memories is from Rubin and Schulkind (1997), and is used to illustrate the Koppel and Berntsen (2015) review. The last decade of the word-cued memories has a value of 57%. The olfactory plot is an approximation based on papers by Chu and Downes (2000) and Willander and Larsson (2006, 2007), with the last decade approximated from information in Chu and Downes (2000).

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OLFACTORY CUES

In terms of the location of the bump, odors provide the most striking comparison to word and important cues. Three studies testing older adults compared odor and word cues with the same referent (Chu & Downes, 2000; Willander & Larsson, 2006, 2007). Koppel and Berntsen (2015) included the word-cued data from these studies, which, using 10-year bins, produced bumps with most memories in the 11 to 20 decade, consistent with other word-cued studies. There were not enough studies using odor cues to report for the criteria of Koppel and Berntsen's (2015) meta-analysis, but when they were examined qualitatively by Rubin (2015), a consistent and much earlier bump was found in the 0 to 10 age bin, as is shown in Figure 1. The agreement among the three studies was striking and was replicated even when older adults were asked to imagine the odor given the corresponding word cue (Willander & Larsson, 2008).

OTHER CHANGES IN CUING

As reviewed, changing the cues from odors to words to requests for important events produces dramatic changes in the location and proportion of memories in the bump. But even within these kinds of cuing, large changes are possible. For instance, the mean age for three word cues given to 212 undergraduates were: paper, 10 days ago; hospital, 61 days ago; and fire, 334 days ago (Rubin, 1982). In another word-cued study (Rubin & Schulkind, 1997), 20 adults aged 73 were given instructions that included the words in the first of each pair in parentheses; 20 other adults received the words in the second. "The (memory) / (event) you think of . . . can come from any point in time in your life, (even from as far back as you can remember) / (even as recently as this morning). The (memory) / (event) does need to be very specific . . . For example, if I were to use the word *store*, you might / (remember having gone to a little country store with your grandfather when you were five) / (think of having gone to the hardware store yesterday)."

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The instructions using the words in the first of each pair in parentheses produced a bump that peaked in the 10 to 20 age bin and contained 35% of the memories; the second peaked in the 20 to 30 age bin and contained 23% of the memories. Even within word-cued memories there are large effects that involve retrieval as well as encoding.

Within the realm of important and retrospectively reported involuntary memories, memories that participants considered positive produced a bump and those they considered negative did not (Berntsen & Rubin, 2002; Rubin & Berntsen, 2003). Memories cued by specific positive emotions, such as *extremely happy*, produced a bump, but those cued by negative emotions, such as *extremely sad*, did not. One exception was *extremely jealous*, a negative emotion that often requires the positive emotion of in love. The two other exceptions in this Danish sample were *extremely afraid* and *most traumatic*, but only in the oldest participants whose bump period coincided with the occupation of Denmark in WWII, an exception that proves the rule. Moreover, there were differences in when the bump occurred to positive emotions; the cue, *extremely in love*, produced a bump that peaked in the teens; *extremely proud* peaked in the 20s.

THEORETICAL IMPLICATIONS

Theoretical accounts of the bump were developed to account for a single increase in memories occurring between the ages of 10 or 15 to 30, and thus most were based on encoding differences during that period (see Koppel & Berntsen, 2015, for a review). For instance, the *identity-formation account* (Conway & Holmes, 2004; Conway & Pleydell-Pearce, 2000; Fitzgerald, 1988, 1996; Rubin, Rahhal, & Poon, 1998), postulates that this period contains a clustering of events that are related to identity formation. Such events receive increased encoding and retention because they are involved in solving basic life issues, are more central to

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related networks of events, and have their availability maintained through increased rehearsal.

The *cognitive-account* postulates that the increased availability in later adulthood is caused by the increased effort at encoding needed by the many novel events in the bump period (including many first-time experiences; Robinson, 1992) and the increased and continued rehearsal of those events, because they are more relevant to later life than childhood events (Rubin, et al., 1998).

The *cognitive-abilities account* postulates that the optimal encoding efficiency of many cognitive and neural functions during the bump period causes the bump (Janssen, Kristo, Rouw, & Murre, 2015; Rubin et al., 1998).

In contrast, the *life-script account* was devised specifically to explain the bump observed when important events were requested or were reported retrospectively as occurring involuntarily (Berntsen & Rubin, 2004). The life script includes culture-based general knowledge about categories of important events in a typical life and when they are expected to occur, such as marriage at age 27. Based on empirical observations used to formulate the life script, such categories of events are predominantly emotionally positive and are dated as occurring during the bump period in important memories. As an explanation of the bump, the life-script account differs from the other theories in that it stresses processes at retrieval rather than encoding, cultural semantic knowledge common to a group rather than episodic information from an individual life, and autobiographical memories that are important rather than autobiographical memories in general. Nonetheless, the importance of past and future life-script events in an individual's life should lead to them being especially well encoded and rehearsed, adding to the effectiveness of later searches. The finding of three different bumps suggests different explanations for each; the life-script account is a beginning for such differentiated accounts as it is intended for only the bump for important events.

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Accounts of the retrieval processes for word and odor cues make less specific predictions about the location of the bump, in part because the search is not as constrained by cognitive structures as well specified as the life script. It is likely that word cues trigger a search which involves looking for an event with a language-based and thus often a narrative-based context, through a cyclical process of refining the search by providing more specific cues until a memory is obtained (Conway & Rubin, 1993). For instance, the word cue, apple, may lead to an image of apples on a recent shopping trip or a time in your life when you ate a lot of apples. Odor cues can bypass the neural structures supporting language that word cues require and possess a direct, preconscious link with one's emotions (Rubin, 2006). Odor cues are therefore more likely to invoke isolated events lacking a linguistic and thus a narrative context and may therefore avoid interference from memories that are more verbally accessible, which could account for their earlier bump (e.g., Lawless & Engen, 1977). Similar effects could hold for linguistic instructions to imagine odor cues, though they would not bypass the initial processes using language-based neural structures.

The bump is a robust phenomenon, an observation that was not a prediction or test of psychological theories. As such, it tests existing theories of autobiographical memory and memory more generally. Theories devised and tested in the laboratory provide much of our scientific understanding of memory, but those theories are based and tested on a restricted range of events that does not span trivial to extremely relevant events, or encoding, retention, and retrieval times from minutes to decades, or processes that change with development over the course of a person's lifespan. The bump therefore provides a test case for using our existing theories to understand human memory as it functions in the wild, so that we can begin to find the aspects of our theories that will be most useful in this endeavor.

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Although the bump has been investigated for thirty years, recent work has forced a reconceptualization of its underlying processes. In particular, although factors that can affect the bump cannot be easily manipulated while holding all other factors constant, the demonstration of three distinct bumps allows the well-studied cognitive manipulation of changing retrieval cues to provide a way to distinguish among theories and suggest further tests. If autobiographical memory is to be adaptive over the lifespan, it must be flexible and able to produce relevant information as it is needed or desired, something a focus on encoding does not allow. The existence of changes in the word-cued reminiscence bump with changes in the word cues and instructions used and the existence of different reminiscence bumps for odor cues, word cues, and important events illustrates this flexibility and points to existing methods that can study it.

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Notes

¹ Address correspondence to: Jonathan Koppel, Center on Autobiographical Memory Research, Department of Psychology and Behavioural Sciences, Aarhus University, Bartholins Allé 9, Building 1340, 8000 Aarhus C, Denmark. Tel: +45 8716 5943. Fax: +45 8715 0201. Email: jkoppel@psy.au.dk.

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Recommended Readings

Berntsen, D., & Rubin, D. C. (See References). Represents the initial elaboration of the cultural life script account of the bump.

Conway, M. A., & Pleydell-Pearce, C. W. (See References). In the context of detailing an overarching model of autobiographical memory, the authors present the most elaborated description of what is currently the most influential iteration of the identity formation account of the bump.

Koppel, J., & Berntsen, D. (See References). This theoretical article provides a systematic illustration of the differential locations of the bump across word-cued versus important memories, and discusses the theoretical implications thereof in greater detail than we have been able to provide here.

Rubin, D. C., & Schulkind, M. D. (See References). Represents the first within-subjects demonstration of the differences in the bump across word-cued versus important memories.

Rubin, D. C., Wetzler, S. E., & Nebes, R. D. (See References). Through a combination of a re-analysis of prior work and the presentation of new data, the authors provide the first empirical demonstration of the bump.

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Figure Captions

Figure 1. The data for the word-cued and important memories is from Rubin and Schulkind (1997), and is used to illustrate the Koppel and Berntsen (2015) review. The last decade of the word-cued memories has a value of 57%. The olfactory plot is an approximation based on papers by Chu and Downes (2000) and Willander and Larsson (2006, 2007), with the last decade approximated from information in Chu and Downes (2000).