The Peaks of Life: The Differential Temporal Locations of the Reminiscence Bump Across Disparate Cueing Methods

Jonathan Koppel and Dorthe Berntsen

Center on Autobiographical Memory Research, Department of Psychology and Behavioural Sciences, Aarhus University, Bartholins Allé 9, Building 1340, 8000 Aarhus C, Denmark.

Email address for Jonathan Koppel: jkoppel@psy.au.dk; email address for Dorthe Berntsen: dorthe@psy.au.dk

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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

Abstract

The reminiscence bump has generally been assessed through either (1) the *cue word method*, or (2) several related methods which we refer to under the umbrella of the *important memories method*. Here we provide a review of the literature demonstrating that the temporal location of the bump varies systematically according to cueing method, with the mean range of the bump located from 8.7 to 22.5 years of age for word-cued memories, versus 15.1 to 27.9 for important memories. This finding has hitherto been under-acknowledged, as existing theoretical accounts of the bump generally hold its location to be stable across cueing methods. We therefore re-evaluate existing theoretical accounts of the bump in light of these varying locations, addressing each account's consistency with (1) the respective bumps found through each method taken individually, and (2) the sensitivity of the bump's location to cueing method.

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The *reminiscence bump* refers to the disproportionate number of autobiographical memories, in middle-aged and older adults, dating from adolescence and early adulthood (Rubin, Wetzler, & Nebes, 1986). Because this distribution breaks away from the standard forgetting function (e.g., Ebbinghaus, 1885/1964; Rubin & Wenzel, 1996), it has been considered a distinctive feature of autobiographical memory and one of its defining characteristics. Indeed, the bump is mentioned in most, if not all, introductory textbooks covering the field (e.g., Eysenck & Keane, 2010; Goldstein, 2008; Rathbone, Moulin, Conway, & Holmes, 2012).

The distribution of autobiographical memories across the lifespan has most often been assessed through one of two broad classes of cueing techniques. We will refer to the first technique, developed by Crovitz and Schiffman (1974) as a modification of a procedure used by Galton (1879), as the *cue word method*. Here, participants generate memories in response to cue words (for subsequent studies employing this technique, see, e.g., Janssen, Rubin, & St. Jacques, 2011; Rubin & Schulkind, 1997a; 1997b; Schuman & Corning, 2014). In the second technique, which we will refer to under the umbrella of the *important memories method,* participants are asked to report particularly notable memories. Examples of memory assessments focusing on important memories include, for instance, queries for important memories (or the most important memories) from participants' lives (e.g., Cuervo-Lombard et al., 2007; Glück & Bluck, 2007; Rubin & Schulkind, 1997b) and queries for especially vivid memories (e.g., Benson et al., 1992; Fitzgerald, 1988; Robinson

& Taylor, 1998). We also include in this category cases in which participants were asked to simply freely recall autobiographical memories, with no explicit instruction that these memories should be important (e.g., Conway & Holmes, 2004; Demiray, Gülgöz, & Bluck, 2009; Rabbit & Winthorpe, 1988), as we suspect that the search process triggered through such free-recall methods is far more similar to the search process triggered through the important memory method than the cue word method (see below).

The salient distinction between these two classes of cueing techniques concerns the retrieval strategies required by each. The cue word method is held to instigate an associative, bottom-up search process (Crovitz & Schiffman, 1974), while the important memories method involves a strategic, top-down search, structured around important memories in particular. This has implications for the nature of the autobiographical memories produced through each method, with the cue word method yielding a putatively unbiased sampling of autobiographical memories over the lifespan (Crovitz & Schiffman, 1974), while the important memories method yields a focus on the most significant memories of one's life. Memories elicited through the important memory method are, correspondingly, more closely related to meaning-making processes and personal identity (e.g., Glück & Bluck, 2007).

It is perhaps unsurprising, then, that neither the bump, nor the broader distribution of memories across the lifespan, is identical across these two cueing methods. First, the bump is larger in the important memories method. Second, word-cued memories, correspondingly, exhibit a sizable recency effect which is, at best, drastically attenuated in important memories (Fitzgerald, 1988; Fromholt et al., 2003; Rubin & Schulkind, 1997b). Here we draw attention to another difference between the bumps found through each method, one which has been little studied. This difference concerns the temporal location of the

bump. As we will document in the current review, the location of the bump varies across the cue word and important memories methods. These disparate locations of the bump hold implications for theoretical accounts of the effect. Therefore, we will go on to re-evaluate existing accounts in light of this under-acknowledged sensitivity of the location of the bump to cueing method.

The disparate locations of the bump across cueing methods has generally gone unrecognized or unacknowledged in the literature, as authors of textbooks in cognitive psychology (e.g., Eysenck & Keane, 2010; Goldstein, 2008; Rathbone et al., 2012) and academic articles (e.g., Bohn & Berntsen, 2011; Dickson, Pillemer, & Bruehl, 2011; Habermas, 2007; Koppel & Berntsen, 2014; Morrison & Conway, 2010; Schrauf & Hoffman, 2007; Shimizu, Anderson, & Takahashi, 2012; Thomsen, Pillemer, & Ivcevic, 2011; Webster & Gould, 2007) usually describe the bump as a unitary phenomenon, most often citing the ages of approximately 15 to 30 as representing the bump period.

To be sure, there has been some acknowledgement of the divergent locations of the bump. Most notably, Rubin and Schulkind (1997b) culled autobiographical memories through both cue words and by asking participants to report five of the most important events of their lives. They found that, while the bump for word-cued memories stretched from ages 10 to 29, the bump for most important memories was concentrated in the 20-29 range (for other references to this finding, see also Janssen, Gralak, & Murre, 2011; Janssen, Rubin, et al., 2011; Janssen & Murre, 2008; Kawasaki, Janssen, & Inoue, 2011; Maki, Janssen, Uemiya, & Naka, 2013).

However, to this point, no systematic reviews have followed up on these isolated findings and observations. The lack of a systematic review illustrating the sensitivity of the bump's location to cueing method may be why most researchers fail to note this effect.

Additionally, prior researchers have not precisely isolated the age ranges over which the bumps in both methods have been found across the literature, nor have they fully grappled with the theoretical implications of these divergent bumps. In light of these considerations, there is a need for: (1) A corrective to the widespread oversimplification of the bump's location as being unitary, including a systematic demonstration of the actual location of the bump as found through both the cue word and important memories methods, and (2) a thorough reckoning of the implications of the varying locations of the bump for existing theoretical accounts of the effect.

The Temporal Location of the Reminiscence Bump

As a means of identifying the temporal location of the reminiscence bump according to the two methods reviewed above, we have listed all the relevant papers which, to our knowledge, have probed for the bump thus far (Tables 1 and 2). Table 1 lists articles in which the cue word method was employed, and Table 2 lists articles employing the important memories method. Table 1 illustrates the type of cue word used in each study (with the most common being nouns; e.g., *bar*, *factory*, *chair*), the number of memories participants were asked to generate, the age range over which the bump was found in each case (e.g., from ages 15 to 30), and the midpoint of this range. Table 2 lists the analogous information for studies using the important memory method.

In reporting the age range of the bump in each study, we adhered as much as possible to the authors' own characterization of the location of the bump they attained. Given that the bump often takes the form of a continuous curve, there is often a subjective component to the precise age range at which authors place the bump, and our method of reporting the authors' characterization of the range of the bump with as much fidelity as

possible means we were constrained by the specific age bins and analyses used by the original authors. However, this method represented the most conservative way of reporting the range of the bump in each study, in that it minimized our reliance on our own judgement.

We are interested here in the location of the bump in the general population. Therefore, where articles report data from both clinical and non-clinical samples (Cuervo-Lombard et al., 2007; Fromholt et al., 2003; Fromholt & Larsen, 1991; Raffard et al., 2009; Raffard et al., 2010), we included only the data from the non-clinical sample. Similarly, there have been several investigations of the distribution of autobiographical memories in immigrant samples (Conway & Haque, 1999; Larsen, Schrauf, Fromholt, & Rubin, 2002; Schrauf & Rubin, 1998; 2001), in which researchers have examined how the experience of immigration affects this distribution. We excluded these papers as well, under the reasoning that the distribution of autobiographical memories in these samples is not necessarily indicative of that of the general population.

Turning to papers which we did include in Tables 1 and 2, we list several types of studies in which the authors report not one overall distribution, but two or more distributions. First, there are a number of studies, which we classified as employing a variant of the important memories method, in which the researchers had participants report specific types of memories (e.g., their happiest and/or saddest memory; Berntsen & Rubin, 2002; Berntsen, Rubin, & Siegler, 2011; Davison & Feeney, 2011; Dickson et al., 2011; Haque & Hasking, 2010; Rubin & Berntsen, 2003; Thomsen et al., 2011). In these cases, though we note each of these individual bumps in Table 2 (i.e., for each specific type of memory), we also calculated the mean range and midpoint of the bump across the different types of memories, as found in each paper.

Similarly, there are two studies in which the authors report the temporal distributions of memories of differing emotional valences separately (i.e., though the authors did not ask participants to separately report memories of different valences, they divided the memories by valence in analyzing the data), rather than the distributions of all memories taken together (Alea, Ali, & Marcano, 2014; Bohn, 2010). In these cases, we likewise report the individual bumps for memories of each valence, as well as the mean range and midpoint of the bump across the memories of each valence, as found in each paper.

Additionally, there are several studies in which the authors individually report the results of multiple samples or age groups (e.g., Benson et al., 1992; Davison & Feeney, 2008; Janssen, Chessa, & Murre, 2005). Here, in addition to reporting the individual age ranges and midpoints of the bump for each type of cue word or each group, we likewise also calculated the mean range and midpoint of the bump as found in each paper. However, where the authors present the data for individual samples or age groups, but nonetheless include these groups in the same analyses or refer to an aggregate bump across all groups (e.g., Berntsen & Rubin, 2002; Conway et al., 2005, regarding the free recall data; Rubin & Schulkind, 1997b), we follow the authors in simply reporting this aggregate bump. Lastly, Rubin et al. (1986) report the location of the bump as found through a combination of original data and through a reanalysis of previously published data. For this paper, we calculated one location of the bump, reflecting this aggregate bump.[1]

[1] We should also note that Janssen and colleagues often employ a mathematical model to remove the recency effect and present a clearer view of the retention of autobiographical memories across the lifespan (see Janssen, Gralak, et al., 2011, for an elaboration of the model). For three of their papers, then (Janssen, et al., 2005; Janssen & Murre, 2008; Maki et al., 2013), as well as for Alea et al., (2014), the location

With these considerations noted, we used the age ranges and midpoints reported in Tables 1 and 2 to calculate, separately for papers using the cue word method and those using the important memories method, the overall mean age range and midpoint of the bump. The advantage of this admittedly rough type of analysis is that it allows us to compare the location of the bump across studies employing culturally different samples and varying sample sizes, while weighing all studies equally. The latter point is a particular concern for cue word studies, as the sample sizes in five cue word studies in particular (Janssen et al., 2005; Janssen, Gralak, et al., 2011; Janssen, Rubin, et al., 2011; Janssen & Murre, 2008; Schuman & Corning, 2014) dwarf those of the rest of the literature, being at least four times larger than any of the other cue word studies in Table 1. We weighed all studies equally, then, rather than all participants, because the latter approach would have biased the findings in favor of a few studies with particularly large sample sizes.

As indicated in Tables 1 and 2, the mean range of the bump for word-cued memories is from 8.7 to 22.5 years of age, with the mean midpoint located at 15.5. Conversely, the mean range of the bump for important memories is from 15.1 to 27.9, with a mean midpoint of 21.5. To illustrate the temporal distributions for word-cued and important memories, we plotted idealized distributions for each type of memory (Figure 1).

To test the statistical significance of this difference in the location of the bump across both types of memory assessments, we compared the mean midpoints through an independent-samples *t*-test, yielding a significant difference, $t(51) = 4.84$, $p < .001$, $d = 1.37$.[2]

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of the bump we report in Table 1 is based on data that has been adjusted through this model. However, Janssen, Gralak, et al. (2011) demonstrated that applying this model does not alter the location of the bump.

[2] One might object to our inclusion, noted above, of studies in which participants were asked to report specific types of memories, such as their happiest and/or saddest memory (e.g., Berntsen & Rubin, 2002),

If anything, this independent-samples test understates the significance of the difference between the groups, insofar as the participants who supplied important memory data in Rubin and Schulkind (1997b) were, in part, the same participants who supplied word-cued memory data in Rubin and Schulkind (1997a).

The bump in important memories, therefore, corresponds fairly well to the bump period that is often cited in the literature. Conversely, the early bump in word-cued memories represents a stark contrast to the location of the bump typically reported in both textbooks (Eysenck & Keane, 2010; Goldstein, 2008; Rathbone et al., 2012) and academic articles (e.g., Dickson et al., 2011; Koppel & Berntsen, 2014; Schrauf & Hoffman, 2007). The bump in word-cued memories, in fact, may be more accurately characterized as a type of primacy effect, in that it represents a heightened number of autobiographical memories in the period soon after the full offset of childhood amnesia (Rubin, 2000). In the following section, we address the theoretical implications of these varying locations of the bump.

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on the grounds that these focused inquiries may not reflect the distribution of autobiographical memories more broadly. Similarly, one might likewise object to our inclusion of studies in which the authors report only the individual distributions for memories of differing valences taken separately (e.g., Bohn, 2010), in that we do not know the overall distribution of memories in these cases. Therefore, we also calculated the mean age ranges and midpoints of the bumps with these studies excluded. The results were similar, with the mean range of the bump in word-cued memories from 8.3 *(*SD = 3.4) to 22.5 (SD = 5.3) years of age, and the mean midpoint located at 15.4 (*SD* = 3.8); for important memories, the range was from 14.0 *(*SD = 5.9) to 27.7 *(*SD = 6.8), with a mean midpoint of 20.9 (*SD* = 5.3). The difference in the mean midpoint of the bump in word-cued versus important memories remained significant, $t(42) = 3.90$, $p < .001$, $d = 1.20$.

Implications for Theoretical Accounts of the Reminiscence Bump

The identification of the differential temporal locations of the bump across the cue word and important memory methods calls for a reconsideration of existing accounts of the reminiscence bump phenomenon. It particular, it suggests that two specific criteria need to be applied in weighing each account of the bump. First, as Janssen and colleagues have noted (Janssen et al., 2011; Kawasaki et al., 2011; Maki et al., 2013), not every account of the bump necessarily applies equally well in explaining the bump in each method. Therefore, researchers must consider each account's consistency with the respective bumps in word-cued memories and important memories taken individually, given their respective locations.

Second, it is incumbent upon an account of the bump to not only be consistent with the location of the bump in either or both of the cue word and important memories methods taken individually, but to also be consistent with the varying locations of the bump across different cueing methods. That is, a given theory should ideally predict, or at least leave room for, an interaction between retrieval strategy and underlying memory structures in relation to the bump's location.

We have been able to identify five main accounts of the bump in the literature. As we will illustrate, in several respects, these accounts can be viewed as complementary, rather than contradictory. These accounts are: (1) the *identity formation account* (e.g., Conway & Pleydell-Pearce, 2000; Fitzgerald, 1988; 1996; Homes & Conway, 1999), (2) the *life script account* (Berntsen & Rubin, 2004; see also Rubin & Berntsen, 2003), (3) the *cognitive account* (Pillemer, 2001; Robinson, 1992; Rubin, Rahhal, & Poon, 1998), (4) the *cognitive abilities account* (Janssen & Murre, 2008; Janssen, Kristo, Rouw, & Murre, 2015; Rubin et al., 1998), and (5) the *life story account* (Glück & Bluck, 2007; see also Bluck &

Habermas, 2000, for the initial theoretical formulation of the life story concept, and Demiray et al., 2009, for an elaboration of the life story account).

Below, we summarize each account and evaluate it in relation to the two criteria noted above. We should stress that our evaluation of each account of the bump focuses on its ability to account for these two hitherto largely ignored questions. We do not engage in a different or more comprehensive evaluation of each account in relation to other issues (for evaluations of theoretical accounts of the bump in relation to other questions, see, e.g., Bohn & Berntsen, 2011; Glück & Bluck, 2007; Janssen & Murre, 2008; Rubin et al., 1998). Lastly, we note that our summaries of the cognitive and cognitive abilities accounts are partially based on Rubin et al.'s (1998) overview of the classic theoretical accounts of the bump; the life script and life story accounts, however, were developed subsequent to Rubin et al., as was the iteration of the identity formation account which we describe in greatest detail.

The Identity Formation Account

The identify formation account (which has also been termed the *self-narrative account*) is probably the most frequently cited account of the bump. Currently, the most prominent version of the identity formation account is the one offered by Conway and colleagues, in conjunction with their influential model of autobiographical memory, known as the *self-memory system* (for theoretical papers in which Conway and colleagues elaborate their model, including their corresponding account of the bump, see Conway, 1992; 2005; Conway & Pleydell-Pearce, 2000; Conway, Singer, & Tagini, 2004; for Conway and colleagues' empirical demonstrations of the bump, which are informed by and serve to provide support for their account of the effect, see Conway & Haque, 1999; Conway &

Holmes, 2004; Holmes & Conway, 1999; Rathbone, Moulin, & Conway, 2008). Therefore, we will focus on their version of the account.

The identity formation account has historically drawn from theories of lifespan development (Fitzgerald, 1988; 1996), and Conway and colleagues' account is constructed in particular around Erikson's (1950) theory of psychosocial development (Conway & Pleydell-Pearce, 2000; Holmes & Conway, 1999). In Erikson's theory, an individual's personality (or ego identity) develops across the entire lifespan according to eight stages, each characterized by a specific developmental conflict that has to be resolved adequately in order to attain the relevant psychosocial skills and personal growth. The two stages of Erikson's model which proponents of the identity formation account hold as comprising the bump period are adolescence (particularly the later years of the adolescent stage) and young adulthood (Conway & Pleydell-Pearce, 2000; Holmes & Conway. 1999). The specific developmental conflict of adolescence is the establishment of a sense of identity (rather than role confusion), while the developmental conflict of young adulthood is to establish a sense of intimacy (rather than isolation). Thus, during these periods, the individual has to discover his or her social and ideological values and vocational interests, and develop long-lasting goals and significant relationships.

For this reason, according to the identity formation account, the period of late adolescence and early adulthood has a privileged role in autobiographical memory. That is, this account holds that the importance of late adolescence and early adulthood to the formation of one's identity results in a clustering of identity-salient events occurring during this period (Conway & Pleydell-Pearce, 2000; Holmes & Conway, 1999). These events receive privileged encoding, and also come to play a key role in the individual's self-narrative.

This account of the bump is part of the broader framework of the self-memory system, whereby autobiographical memories are the product of the interplay between the self, the events one experiences, and one's subsequent autobiographical knowledge base (e.g., Conway & Pleydell-Pearce 2000). By this framework, memories are both encoded and retrieved through the goal structure of the *working self*, referring to a set of control processes operative at a given point in time; at the time of encoding, events that are relevant to the goals of the current working self are preferentially encoded, with all encoded events becoming part of one's autobiographical knowledge base. Likewise, at retrieval, when drawing upon this knowledge base, memories are selectively constructed out of events from the knowledge base that are relevant to the goals of the working self at the time of retrieval.

According to Conway and colleagues, then, the processes operative in the self-memory system produce the bump because the self typically becomes consolidated during the bump period of late adolescence and early adulthood, as one's long-term goals and plans are formulated (Conway & Pleydell-Pearce, 2000). This lends a high degree of goal-relevance to many events from the bump period, and this clustering of goal-relevant events is responsible for the preferential recall for events from this time. This account is also related to Singer and Salovey's (1993) concept of *self-defining memories*, in that Conway and colleagues contend that the bump may be produced by a preponderance of such memories in late adolescence and early adulthood (Rathbone et al., 2008) .

The identity formation account: Consistency with the bumps in word-cued and important memories. As to the application of the identity formation account to the respective bumps in word-cued and important memories, this account seems more consistent with the later bump found in important memories than the earlier bump found in word-cued

memories. That is, the events that this account holds as typically serving to establish one's personal and professional adult identities are skewed towards the bump period as found in the important memories method. One indication of this, for instance, is that Erikson's (1950) stages of development which the account holds as comprising the bump period (i.e., late adolescence and young adulthood) map better onto the age range of this later bump.

An empirical demonstration of this point is found in Holmes and Conway (1999), who attained a bump in autobiographical memory from ages 20 to 29, along with an earlier bump from 10 to 19 in recall for public events, in asking participants to free-recall important autobiographical and public events over a 10-minute period each. Holmes and Conway take these two different bumps as supporting their identity formation account of the bump, inasmuch as, following Erikson's (1950) model, they had predicted that the bump for public events should correspond to the period of adolescence and its developmental challenge of establishing a sense of identity (including, crucially, generational identity), while the bump for autobiographical events should correspond to the period of young adulthood and its developmental challenge of establishing intimacy. Content-coding further revealed that, consistent with the predictions Holmes and Conway pulled from Erikson's model, the bump in autobiographical memory was largely driven by memories of formative adult relationships (for related findings, see Conway & Holmes, 2004).

The identity formation account: Consistency with the differential locations of the bump. In evaluating the theoretical accounts of the bump according to the second criterion, namely, whether they are consistent with the differential locations of the bump across disparate cueing methods, the main consideration is to what extent each account stresses processes at retrieval as underlying the bump; the more that a given account posits

that the bump is driven by factors at retrieval, the more consistent it is with the finding that disparate retrieval strategies produce bumps at different locations. Conversely, the more an account stresses that the bump is due to a clustering of encoded autobiographical memories in the bump period, the less consistent it is with the differential locations of the bump, as such an explanation would predict a relatively stable location of the bump, corresponding to this peak in the number of encoded memories.

With these considerations in mind, proponents of the identity formation account generally seem to stress processes at encoding as underlying the bump. Specifically, as we noted above, Conway and colleagues emphasize that the goal-relevance of many events of the bump period leads to the privileged encoding or retention of events from this period. For instance, Conway and Pleydell-Pearce (2000) state that "On the basis of the above evidence, we conclude that the reminiscence bump reflects preferential retention of events from a period of consolidation of the self." (pp. 280; for a similar emphasis on processes at encoding or retention, see also Conway & Haque, 1999; Holmes & Conway, 1999)

However, as the above description of the self-memory system suggests, this framework also allows for a role for factors at retrieval: As Conway and Holmes (2004) note, though many events from the bump period may be preferentially encoded due to their relevance to one's goals at the time of encoding, their eventual retrieval is also contingent upon their relevance to one's goals at the time of retrieval, that is, to a congruence between goals at encoding and goals at retrieval. By this framework, the bump is therefore due to both the encoding of a disproportionate number of events during the bump period, as well as the high accessibility of these events at the time of retrieval.

This account suggests, then, that there may be some variation in the memories recalled across the cue word versus important memory methods. That is, if we allow that the

important memory method may activate one's most significant long-term goals in a manner that the cue word method may not, it is plausible that one's active goal structure at the time of retrieval may vary across the two methods. Indeed, Conway and colleagues have argued that, in retrieving autobiographical memories, the point of entry into the autobiographical knowledge base is contingent on the cues available at retrieval, with some cues producing a top-down search starting at the level of lifetime periods or general events, and other cues invoking specific memories in particular (e.g., Conway, 1992; Conway & Pleydell-Pearce, 2000).

Furthermore, later iterations of Conway and colleagues' model have made room for a higher-order construct that governs such a top-down search, in the form of Bluck and Habermas' (2000) *life story schema* (Conway, 2005; Conway et al., 2004), referring to one's own narrative about his or her life to that point. Although Conway and colleagues have not explicitly made this point, we consider it a fair reading of their account to infer that individuals would be expected to draw heavily upon the life story schema in retrieving important autobiographical memories, while they would be expected to do so to a considerably lesser degree, if at all, in retrieving memories in association to cue words.

Given that the identity formation account therefore suggests that the content of the recalled memories may vary across the cue word and important memory methods, it leaves room for the variation researchers have found in the *size* of the bump across the methods (e.g., Rubin & Schulkind, 1997b). That is, the top-down search triggered by the important memories method might be expected to selectively over-sample memories from the bump period, whereas the associative retrieval strategy triggered by the ostensibly unbiased cue word method (Crovitz & Schiffman, 1974) would be expected to produce a more representative sampling of autobiographical memories. However, the identity formation

account's premise that more memories are encoded at a certain part of the lifespan leads to the prediction that the *location* of the bump should be relatively stable, in that, again, one would expect the bump to correspond to this peak in the number of encoded memories. Moreover, Conway and colleagues have never suggested that their account would predict, or be consistent with, varying locations of the bump across cueing methods. Therefore, they appear to regard their account as consistent with a relatively unitary location of the bump.

The Life Script Account

Whereas the identity formation account posits that the bump is due to a preponderance of identity-salient events occurring in the bump period, the central contention of the life script account is that the bump is produced, rather, by the occurrence of a preponderance of culturally normative and important events in the bump period (Berntsen & Rubin, 2004; see also Rubin & Berntsen, 2003). The life script account represents, therefore, a cultural and schema-based account of the bump, rather than an individualistic and experienced-based account. In particular, it builds upon the premise that all cultures have their own unique cultural life scripts, referring to culturally shared representations of the order and timing of major transitional life events. Berntsen and Rubin (2004) first empirically demonstrated the existence of such life scripts, by asking a Danish sample to list the seven most important events that would most likely occur over the lifespan of a typical Danish infant of their own gender. There was considerable overlap in many of the events participants cited. For instance, having children, marriage, and college received the most citations. Life scripts have subsequently been collected from a number of other cultures, including Turkey (Erdoğan, Baran, Avlar, Cağlar Taş, & Tekcan, 2008), the United States

(Rubin, Berntsen, & Hutson, 2009), and Qatar (Ottsen & Berntsen, 2014). For a review of the life script literature, see Zaragoza Scherman (2013).

Berntsen and Rubin (2004) contend that the life script structures recall from autobiographical memory, in that it serves to heighten the mnemonic accessibility of events that are incorporated into it. By their account, the life script influences retrieval of important autobiographical events by providing search descriptions for events that are included in the script. The life script, then, serves a similar function in this account as the life story schema does in later iterations of the identity formation account (e.g., Conway et al., 2004), as they each represent cognitive structures that are held to govern the retrieval of important autobiographical memories. The salient difference between the life script and the life story schema, though, is that whereas the life script represents a culturally shared conception of the important events in the life of a typical individual within that culture, the life story schema is an individualized construct concerning one's own life story.

The life script is held to produce the bump because it is biased in favor of positive events happening during adolescence and early adulthood. Therefore, a request to retrieve important (or positive) memories from the personal past produces a bump in this period. Part of the evidence supporting this assertion is that the bump in autobiographical memory appears to track with the bump in the life script, at least when memories are culled through methods that are related to the important memories method. For instance, Rubin and Berntsen (2003) found a bump in both cultural scripts and autobiographical memory for positive events (e.g., being most proud), but generally not, in either case, for negative events (e.g., being most angry; for related findings, see also Berntsen & Rubin, 2002; Berntsen, Rubin, & Siegler, 2011; Collins, Pillemer, Ivcevic, & Gooze, 2007; Dickson et al., 2011; Haque & Hasking, 2010).

Relatedly, Bohn and Berntsen (2011) further demonstrated the role of the life script in producing the bump by looking at children's projections of the future: When children were asked to write their future life stories, these life stories evinced a bump paralleling that found in important autobiographical memories, with the bump largely driven by life script events (no bump was found, however, in imagined future events in response to cue words). This finding illustrates the role of the life script at retrieval in particular, as the act of projecting oneself into the future effectively draws exclusively on retrieval processes (for other findings on the use of the life script in future projections, see Berntsen & Bohn, 2010; Berntsen & Jacobsen, 2008; Bohn, & Berntsen, 2013; Grysman, Prabhaker, Anglin, & Hudson, 2013; 2014 Rasmussen & Berntsen, 2013).

The life script account: Consistency with the bumps in word-cued and important memories. Just as the identity formation account seems inconsistent with the early bump in word-cued memories, the same could be said of the life script account. That is, the timing of many of the most prominent life script events – such as, among those cited above, having children and marriage – typically corresponds better to the bump period found in important memories (United Nations, 2000). Indeed, in practice, the identity formation and life script accounts seem to largely agree on which specific events produce the bump; where the two accounts primarily differ is in their hypothesized reasons why these events are especially memorable: According to the identity formation account, these events are memorable due to their importance to identity, while, by the life script account, it is the scripted nature of these events which renders them particularly accessible in recall. As Berntsen and Rubin (2004) acknowledge, then, though the life script may explain the bump in

important memories, it likely plays, at best, a substantially smaller role in producing the bump in word-cued memories.

The life script account: Consistency with the differential locations of the bump. In contrast to the identity formation account, the life script account is explicitly and primarily concerned with processes operative at the time of retrieval. One implication of this emphasis on processes at retrieval is that, just as the identity formation account allows that the retrieval of important memories is more likely to draw upon the life story schema than is the retrieval of word-cued memories (Conway et al., 2004), Berntsen and Rubin (2004) suggest the same thing of the life script in their theoretical formulation of the life script account. And, indeed, this has been borne out in subsequent studies wherein the researchers coded for the percentage of word-cued and/or important events that represented life script events, as, typically, a far greater percentage of important memories represent life script events than do word-cued memories (Alea et al., 2014; Berntsen & Bohn, 2010; Berntsen & Jacobsen, 2008; Bohn, 2010; Glück and Bluck, 2007; Thomsen & Berntsen, 2008). One point the life script and identity formation accounts have in common, then, is that they both allow for some variation in the memories recalled across the cue word versus important memory methods.

However, where the life script account diverges from the identity formation account is that its emphasis on retrieval means it does not suggest that there is a peak in the number of encoded autobiographical memories at any particular part of the lifespan. That is, though the life script account posits that there is a clustering of life script events at a particular point in the lifespan, it does not suggest that there is a general increase in encoded

memories during this period. The life script account, therefore, would not predict that the location of the bump should necessarily be stable across disparate cueing methods.

At the same time, though, the life script account does not provide a direct explanation of these differential locations of the bump. Though the early location of the bump in word-cued memories does not contradict any of the claims or premises of this account, it appears that, whatever processes are involved in producing the bump in word-cued memories, they have little to do with the life script.

The Cognitive Account

The cognitive account represents an attempt to bring standard principles of experimental psychology to account for the bump in autobiographical memory (for delineations of the cognitive account, see Pillemer, 2001; Robinson, 1992; Rubin et al., 1998). By this account, the disproportionate number of autobiographical memories from adolescence and early adulthood is due to this period typically representing a time of rapid change. That is, many novel events tend to occur during this portion of the lifespan, which leads to enhanced recall for this period inasmuch as, in experimental settings, novelty has consistently been shown to aid memory.

As Rubin et al. (1998) note, the mnemonic benefits of novelty are threefold. First, novel events tend to engender a greater effort after meaning (Bartlett, 1932). Second, there is a reduction in proactive interference for novel events, because such events are different from the events that preceded them (for a review of experimental work demonstrating that a shift in the nature of the stimulus material results in a release from proactive interference, see Wickens, 1970). Third, novel events are generally distinctive, and thereby gain the advantages afforded to distinctive items and events in human memory (see

Hunt, 2006, for a review of the effects of distinctiveness on memory). According to the cognitive account, this combination of factors serves to produce the bump in autobiographical memory.

The cognitive account: Consistency with the bumps in word-cued and important memories. Given that the respective lifetime periods comprising the bump periods in both word-cued and important memories likely represent periods of rapid change, there is little reason to presume that the bump period of either method typically contains a greater number of novel events. Therefore, in this respect, the cognitive account seems equally consistent with the bump found through either method.

The cognitive account: Consistency with the differential locations of the bump. As to whether the cognitive account allows for the differential locations of the bump across cueing methods, we note that this account focuses on processes operative at encoding and/or retention as underlying the bump. Therefore, given that the cognitive account stipulates little role for retrieval processes, it is inconsistent with the finding that the disparate retrieval strategies engendered by different cueing methods lead to different locations of the bump; to an even greater extent than the identity formation account, the cognitive account holds that the bump is simply due to a peak in the number of encoded autobiographical memories at a certain part of the lifespan, and would therefore predict a relatively stable location of the bump, corresponding to this peak. In order to account for these two different bumps, it would have to be combined with other accounts.

The Cognitive Abilities Account

According to the cognitive abilities account, events of the bump period are encoded more effectively than events of other life periods because cognitive abilities are generally at their peak during this time, with a particular inflection point around the age of 20. This pattern in the trajectory of cognitive abilities across the lifespan is seen across a number of different types of tasks, including reaction time tasks (Cerella & Hale, 1994), standardized tests such as the Wechsler Memory Scale (Wechsler, 1987), and tests of general intelligence, such as the Woodcock-Johnson Revised Tests of Cognitive Abilities (Woodcock & Johnson, 1991). As Rubin et al. (1998) note, however, one limitation in attempting to trace the bump to an inflection point in cognitive abilities is that, though cognitive abilities do peak around 20 years of age, the decline thereafter is more gradual and slow than the drop-off in autobiographical memories after the bump period. The trajectory of cognitive abilities over the lifespan is, therefore, far from a perfect parallel of the distribution of autobiographical memories.

As to the evidence in favor of the cognitive abilities account, historically, support for this account has primarily been indirect, stemming from a lack of support for alternative accounts (Janssen & Murre, 2008). Recently, however, Janssen et al. (2015) attained more direct support for this account, in finding that performance on a series of verbal memory tests was related to retention of a personal event, over retention intervals ranging, across participants, from two days to 46 days. This result is limited, however, in that it reflects a relation between autobiographical memory and another type of memory ability, rather than an altogether discrete cognitive ability. Additionally, as the authors note, the relation they found between cognitive abilities and autobiographical memory performance over relatively short retention intervals does not necessarily indicate that this relation would

hold over a period of years or decades, as the cognitive abilities account suggests. Lastly, as the authors also note, whereas the cognitive abilities account specifies that heighted cognitive abilities confer a mnemonic advantage specifically at encoding, they could not disentangle whether, in their study, heightened cognitive capacities led to better encoding or retrieval of the personal event.

The cognitive abilities account: Consistency with the bumps in word-cued and important memories. Given that the inflection point in cognitive abilities is generally around the age of 20 (e.g., Cerella & Hale, 1994), this account may be more consistent with the bump in important memories than in word-cued memories. That said, there is enough flexibility in the location of this inflection point, and enough overlap between the peak in cognitive functioning and the period of the word-cued bump, that the more conservative conclusion to draw is that the cognitive abilities account could be considered broadly consistent with the individual bumps in both word-cued and important memories.

The cognitive abilities account: Consistency with the differential locations of the bump. The cognitive abilities account suffers from much the same limitation as the cognitive account, in that its exclusive focus on processes operative at encoding leaves scant room for disparate retrieval processes to result in bumps at different parts of the lifespan. That is, to the extent that an inflection point in cognitive abilities at a certain point in the lifespan produces the bump, one would expect the bump's location to remain constant across cueing methods. Thus, the cognitive abilities account likewise cannot be reconciled, by itself, with our demonstration of two systematically disparate bumps according to cueing method; in order to explain this, it too would have to be combined with other accounts.

The Life Story Account

The life story account builds on the complementary nature of prior accounts by integrating the four accounts described above into one unifying framework (Glück and Bluck, 2007; see also Demiray et al., 2009; Habermas & Bluck, 2000). As described in Demiray et al. (2009), the life story account combines two discrete theoretical prongs, that is, life story theory and lifespan developmental theory. The life story refers to the "constructed and remembered story of the life lived thus far" (pp. 711), and is represented in the life story account by the life story schema. According to the life story account, and similar to later iterations of the identity formation account (Conway et al., 2004), the life story schema serves as an organizational structure in recalling the important events of one's life (Glück and Bluck, 2007).

While life story theory represents the novel component of the life story account's explanation of the bump, the addition of lifespan developmental theory represents the account's attempt to integrate prior accounts (Demiray et al., 2009). The component of the life story account reflecting lifespan developmental theory draws in part, as in the identity formation account, from Erikson's (1950) theory of psychosocial development. For the purposes of the life story account, the most important tenet of lifespan developmental theory is that the period of adolescence and early adulthood is one of continuing growth. This growth takes several forms, reflecting the individual types of growth posited in each of the other accounts of the bump. First, as delineated in the cognitive abilities account, adolescence and early adulthood represents a time of cognitive growth and the time of peak cognitive functioning. Second, in line with the cognitive account, one of the major developmental tasks of this period is to learn novel things and acquire new skills and abilities, which leads to the occurrence of many novel and distinctive events in this period. Third, as

put forth in the identity formation account, this is the period of the formation of one's adult identity, leading to a clustering of identity-salient events, as well as events that are central to the development of one's self-narrative.

The final area of growth in adolescence and early adulthood is that, partially consistent with the life script account, there is a clustering of transitional events in this period. Specifically, this is when individuals first take control of their life by making important life decisions (e.g., choices about one's career, life partner, or childbearing). However, whereas the life script account suggests that such transitional events will be highly memorable simply by virtue of being part of the life script, Glück and Bluck (2007) and Demiray et al. (2009) contend that this cultural significance is not sufficient for such an event to be preferentially recalled. As an individualistic account rather than a cultural account, the life story account holds that a transitional event needs to be personally considered a transition point in one's own life story to become highly memorable, rather than just being normatively considered a transition point in one's culture.

By the life story account, then, the bump cannot simply be attributed exclusively to the factors relevant to any individual account. Rather, the bump is produced through a confluence of the use of the life story schema as an organizational structure in recalling one's life on the one hand, and factors representing all prior accounts on the other.

The life story account: Consistency with the bumps in word-cued and important memories. To the extent that the life story account draws from the cognitive and cognitive abilities accounts, it may be reasonably consistent with the bump found through either method. However, to the extent that it draws from the identity formation and life script accounts, it too is more consistent with the bump in important memories. On balance,

though, we would argue that, in practice, the life story account primarily stresses the same type of identity-relevant and transitional events as underlying the bump as the identity formation and life script accounts. Therefore, it is likewise true here that the timing of the relevant events more typically corresponds to the bump period in important memories than in word-cued memories. Indeed, in Glück and Bluck's (2007) initial empirical test of the life story account, the two events that appeared to play the largest roles in producing the bump were having children and marriage; again, the timing of these events is more typically within the bump period of important memories (United Nations, 2000).

The life story account: Consistency with the differential locations of the bump. The life story account has similar advantages and limitations regarding its consistency with the differential locations of the bump as the identity formation account. For instance, similar to the identity formation account, the life story account's invocation of the life story schema as an organizational structure in recalling one's life creates the likelihood that the disparate retrieval strategies triggered through the cue word and important memory methods will result in the retrieval of different memories. Indeed, proponents of the life story account contend, more explicitly than those of the identity formation account, that the life story schema plays a stronger role in structuring the retrieval of important memories than word-cued memories (Bluck & Habermas, 2000; Glück and Bluck, 2007). For instance, just as the identity formation account is consistent with the difference in the size of the bump across the word-cued versus important memory methods (Rubin & Schulkind, 1997b), Bluck and Habermas (2000) likewise argue that this difference in the size of the bump likely reflects the greater use of the life story schema in the retrieval of important memories, which leads to more memories being recalled from the bump period.

At the same time, the life story account's integration of the cognitive abilities, cognitive, and identity formation accounts – and, in the case of the identity formation account, the encoding-related factors posited within it in particular – suggests a large role for factors at encoding as well: Just as those accounts posit that the bump is at least partially attributable to a peak in the number of encoded autobiographical memories in the bump period, the same is therefore correspondingly true of the life story account As we noted regarding these other accounts, then, it is unclear how the proposition of such a peak in the number of autobiographical memories can be reconciled with the differential locations of the bump. Another limitation the life story account shares with the identity formation account is that proponents of the life story account likewise have never suggested that their account would predict, or that it is consistent with, varying locations of the bump.

Discussion

In this review, we have attempted to evaluate each of the existing accounts of the reminiscence bump in terms of (1) its consistency with the respective bumps in word-cued memories and important memories taken individually, in light of each bump's temporal location, and (2) its consistency with the disparate temporal locations of the bump across these two methods. The latter criterion effectively refers to the extent to which a given theory stresses processes at retrieval as underlying the bump, and therefore predicts or leaves room for an interaction between retrieval strategy and underlying memory structures in relation to the location of the bump. As we have argued, that is, the differential temporal locations of the bump across the cue word and important memories methods likely stems from the different retrieval strategies triggered through each cueing method

Through the framework of these two criteria, we can draw several conclusions at this point. First, by the former criterion, of the five most influential accounts of the bump, three of them – the identity formation, life script, and life story accounts – appear to be consistent with the bump in important memories, but not with the earlier bump in word-cued memories; this is by virtue of the fact that the timing of the formative personal and professional experiences these accounts stress as underlying the bump generally correspond more closely to the bump period in the important memories method. In contrast, the two remaining accounts – the cognitive and cognitive abilities accounts – appear to be at least broadly consistent with both the word-cued and important memory bumps taken individually, in that the processes each account stresses as underlying the bump seem to be operative at both bump periods.

Second, only the life script account meets our second criterion, as it is the only account that is consistent with the differential locations of the bump across different cueing methods. For instance, the cognitive and cognitive abilities accounts both specify only processes operative at encoding and/or retention as responsible for the bump. Therefore, they each suggest that the bump simply reflects a peak in encoded autobiographical memories at a certain part of the lifespan. Neither account allows, then, for the location of the bump to vary across the disparate retrieval strategies engendered by the cue word and important memory methods.

As for the identity formation and life story accounts, although the retrieval processes outlined in each account as contributing to the bump do allow for the differences researchers have found in the *size* of the bump across the word-cued versus important memory methods (Rubin & Schulkind, 1997b), the substantial role each account posits for factors at encoding and/or retention would work against the consistent and stark differences

in the location of the bump across these methods: Similar to the cognitive and cognitive abilities accounts, it follows from this prominence given to encoding and retention that the bump is partially due to a peak in the number of encoded autobiographical memories at a certain part of the lifespan. Therefore, these accounts would likewise predict a relatively stable location of the bump, corresponding to this peak. Moreover, it is noteworthy that proponents of these accounts have not contended that their accounts should lead to, or are consistent with, such differences in the location of the bump (e.g., Conway & Pleydell-Pearce, 2000; Glück and Bluck, 2007).

Conversely, as the life script account explicitly places primary responsibility for the bump on factors operative at retrieval, it correspondingly allows more room for the location of the bump to vary across different cueing methods. That is, the life script account's de-emphasis on factors at encoding and retention means it does not suggest that there is a clustering in the number of encoded autobiographical memories at a certain part of the lifespan. The life script account is in this respect consistent with the differential locations of the bump across different cueing methods. Still, it does not provide a direct explanation of these differential locations of the bump.

In sum, in accounting for the bump in word-cued memories, none of the existing accounts meet both criteria of not only (1) being consistent with the bump found through this method taken in and of itself, while also (2) being consistent with the varying locations of the bump across different cueing methods. Conversely, in accounting for the bump in important memories, the life script account best meets both of these criteria. In particular, the retrieval-based life script account is more consistent with the differential locations of the bump than the most closely competing accounts, that is, the identity formation and life script accounts. We would regard this as a point in favor of the processes

outlined in the life script account as underlying the bump in important memories, and as suggesting that the life script account possesses the greatest explanatory power in accounting for the bump in this domain.

Another strength of the life script account (which may also apply to the identity formation and life story accounts) is that it is consistent with the other differences between the distributions of word-cued versus important memories. Namely, as we have noted, the bump in important memories is larger than the bump in word-cued memories, with word-cued memories, correspondingly, also exhibiting a sizable recency effect which is reduced or lacking entirely in important memories (Rubin & Schulkind, 1997b). One can see how, by the life script account, the heavy clustering of life script events in adolescence and early adulthood would produce a fairly dramatic bump in important memories (Zaragoza Scherman 2013). Similarly, the life script account is also consistent with the reduced or non-existent recency effect in important memories, since the life script would not be expected to produce a mnemonic focus on the most recent events of one's life.

That said, these considerations do not necessarily suggest that the life script account is solely responsible for producing the bump in important memories. Again, the accounts of the bump are not mutually exclusive, and it is unlikely that any one account is solely responsible for the bump found in either word-cued or important memories.

Accounting for the Bump in Word-Cued Memories

One point we would like to emphasize is that the mechanisms underlying the bump in word-cued memories appear to remain largely unsettled. To be sure, the encoding- and retention-based processes outlined in the cognitive and cognitive abilities accounts may contribute towards the large number of encoded memories during the period of the word-cued

bump, in that these are the accounts that are most consistent with the location of the bump in this domain. However, given that these accounts are solely concerned with processes at encoding and/or retention, and that the accounts that do allow for processes at retrieval do not map well onto the location of the word-cued bump, the nature of the retrieval strategy triggered through the cue word method appears to be unknown. And, as we have argued, the operative retrieval strategy plays a large role in determining the location of the bump in a given cueing method.

Though we decline to speculate as to the precise nature of the retrieval strategy engendered through the cue word method, we would like to establish a few of the criteria that we believe any future attempts to identity or characterize this retrieval strategy should meet. First, any theory of the retrieval strategy employed in generating word-cued memories should reflect that, as we have noted, it appears to represent a type of associative, nonstrategic search process (Crovitz & Schiffman, 1974). Second, any such theory should naturally be able to account for the particularly early bump found in word-cued memories.

Beyond that, just as the life script account is consistent with the other differences between the distributions of word-cued versus important memories, any proposed theory of the retrieval strategy used in generating word-cued memories should also be consistent with these differences. In particular, given that the bump in word-cued memories is smaller than that in important memories (Rubin & Schulkind, 1997b), any such account should leave ample room for the generation of memories outside of the bump period. Similarly, given the sizable recency effect in word-cued memories (Rubin & Schulkind, 1997b), any proposed account should be able to explain this recency effect as well.

Final Thoughts

In conclusion, we would note that the sensitivity of the temporal distribution of autobiographical memories over the lifespan to cueing method indicates that the retrieval of autobiographical memories shows the same sensitivity to cueing methodology as other types of memories, such as laboratory-based episodic memories. That is, it is well-established that the information retrieved in many memory tasks is largely dependent on the type of retrieval strategy that is activated and recruited by the search process. For instance, the activation of a given cognitive schema influences what is recalled at retrieval (for the seminal illustration of the influence of schemata on memory, see Bartlett, 1932; for studies illustrating the role of schemata at retrieval in particular, see Anderson & Pichert, 1978; Brewer & Treyens, 1981; Smith & Graesser, 1981). Similarly, the content of autobiographical memories and their distribution across the lifespan are contingent upon the specific search process activated by the cues given at retrieval. Future accounts of the bumps should take these findings into consideration.

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Conflict of Interest Statement

The authors report no conflict of interest.

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Table 1

Studies Using the Cue Word Method – Articles Presented in Chronological Order

Article	Type of Cue Word/Other Notes	Range of the Bump	Midpoint of the Bump
Alea, Ali, & Marcano (2014; reflecting analyses on both adjusted and unadjusted data)*[34]	10 Nouns (e.g., *bar*)	Positive Memories: 6-15; 26-30 Negative Memories: 6-15; 26-30 Mean Range: 16-22.5	Positive Memories: 10.5; 28 Negative Memories: 10.5; 28 Mean Midpoint: 19.3
Schuman & Corning (2014; results from main study, rather than replication study manipulating question wording)	Eight Nouns	5-20	12.5
Maki, Janssen, Uemiya, & Naka (2013; adjusted data, and aggregate bump across all three types of cue words)	Nine Nouns, seven Emotional Words (e.g., *anger*), and six Emotion-Provoking Words (e.g., *doctor*)	7-25	16
Janssen, Gralak, & Murre (2011; raw, unadjusted data from the experimental data set)	10 Nouns	6-20	13

[3] Where we refer to data as being *adjusted*, this indicates that the authors employed the mathematical model described in Footnote #1 to remove the recency effect from the temporal distribution of participants' memories (see Janssen, Gralak et al., 2011). However, as we noted in the earlier footnote, it appears that the model does not alter the location of the bump.

[4] In papers marked with an asterisk, the authors either asked participants to report specific types of memories (e.g., their happiest and/or saddest memory) or report the results of memories of differing emotional valences separately. In these cases, as described in the text, we report the individual range of the bump for each type of memory (or for memories of each valence), as well as the mean range of the bump found in the paper. For these papers, we only report the range of the bump for the types of memories (or valences of memories) which in fact evinced a bump.

Janssen, Rubin, & St. Jacques (2011)	10 Nouns	6-15	13
Kawasaki, Janssen, & Inoue (2011; raw, unadjusted data, from the middle-aged adults)	10 Nouns	6-15	10.5
Schlagman, Kliegel, Schultz, & Kvavilashvili (2009; voluntary memory data, from the older adults)	30 total phrases, with a combination of Nouns (e.g., *warm fire)*, Verbs (e.g., *giving directions*), and Feeling States (e.g., *feeling safe*)	10-30	20
Janssen & Murre (2008; adjusted data)	10 Nouns	6-20	13
Willander & Larsson (2008; cue word condition)	20 Odor-Related Words (e.g., *tobacco*)	11-20	15.5
Willander & Larsson (2007; name only condition)	20 Odor-Related Words	0-20	10
Willander & Larsson (2006; cue word condition)	20 Odor-Related Words	11-20	15.5
Conway, Wang, Hanyu, & Haque (2005; Bangladeshi sample)	20 unspecified words	15-25	20
Grenier et al. (2005; autobiographical memory data, from the older group)	25 Nouns	10-19	14.5
Janssen, Chessa, & Murre (2005; adjusted data, and collapsed across the Dutch and US samples)	10 Nouns/The authors report a specific age for the bump, rather than a range. We report this age as the midpoint.	N/A	Males: 15 Females: 13 Mean Midpoint: 14
Fromholt et al. (2003; Exp. 2, data from centenerians)	15 Nouns	10-30	20
Chu & Downes (2000; verbal label condition)	27 Odor-Related Words	11-25	18

Rybash & Monaghan (1999)	18 total words, with an unspecified combination of Nouns, Activity Verbs (e.g., *break*), and Affect Terms (e.g., *surprised*)/The authors collected remember/know ratings for each memory, and plot the distributions separately for memories that received *remember* judgements and those that received *know* judgements. However, the location of the bump was identical in each case.	6-15	10.5
Rubin & Schulkind (1997a; Exp. 1, data from 70-year-olds)	124 Nouns	10-29	19.5
Jansari & Parkin (1996; Exp. 1, data from 46-50 and 56-60 year-olds, and overall bump generally common to both the *recency* and *no-recency* conditions)	16 Nouns, 16 Activity Verbs, and 16 Affect Words	6-15	10.5
Howes & Katz (1992; cue word data for autobiographical memory)	50 Nouns/For each word, participants were instructed to recall a memory from a specific 15-year interval (e.g., up to age 15), with 10 words per time period.	Middle-Aged Group: No Bump Older-Aged Group: No Bump	
Hyland &Ackerman (1988; old group)	Six Nouns, six Activity Verbs, and six Affect Words	11-30	20.5

Rabbit & Winthorpe (1988; cue word data)	Varying number of Nouns/For each cue word, participants were instructed to retrieve a memory from a given third of their life (e.g., the first third). For each time period, they were given ten minutes to retrieve as many memories as they could.	Unclear[5]	
Holding, Noonan, Pfau, & Holding (1986; older group)	Four Adjectives (e.g., *alone*), 14 Unmistakable Nouns (e,g, *company*), One Plain Verb (*read*), and 31 words which could be construed as Nouns or Verbs (e.g., *dress*)	Unclear (See Footnote #5)	
Rubin, Wetzler, & Nebes (1986; data from 50- and 70-year olds)	20 Nouns/Also includes a reanalysis of Fitzgerald and Lawrence (1984), Franklin and Holding (1977), and Zola-Morgan, Cohen, and Squire (1983; control groups).	11-30	20.5
Fitzgerald & Lawrence (1984)	20 Nouns and 20 Affect Words	See Rubin, Wetzler, & Nebes (1986)	
Zola-Morgan, Cohen, & Squire (1983)	10 Nouns	See Rubin, Wetzler, & Nebes (1986)	
McCormack (1979)	15-24 Nouns, across the three experiments reported.	Unclear (See Footnote #5)	

[5] Rabbit and Winthorpe (1988), as well as Holding, Noonan, Pfau, and Holding (1986) and McCormack (1979), report the distribution of memories not according to the participant's age at the time of each event, but according to a given fraction of the participant's life in which each event occurred (i.e., which third or which fourth). It is therefore unclear in these studies whether the authors attained a conventional bump, and, if so, the age range at which it was located.

Franklin & Holding (1977)	Four Adjectives, 14 Unmistakable Nouns, One Plain Verb, and 31 words which could be construed as Nouns or Verbs	See Rubin, Wetzler, & Nebes (1986)	
		Overall Mean Range: 8.7 (*SD* = 3.7) – 22.5 (*SD* = 5.2)	Overall Mean Midpoint: 15.5 (*SD* = 3.8)

Table 2

Studies Using the Important Memories Method – Articles Presented in Chronological Order

Article	Type of Memory/Other Notes	Range of the Bump	Midpoint of the Bump
Berntsen, Rubin, & Siegler (2011)*	Participants recalled the most positive event of their lives, as well as the traumatic or negative event that currently troubles them the most.	Most Positive Event: 20-29	Most Positive Event: 24.5
Dickson, Pillemer, & Bruehl (2011; Studies 2 and 4)*	In Study 2, participants recalled an especially positive event and an especially negative event, or a surprising positive event and a surprising negative event; in Study 4, participants recalled a highly expected event and a highly unexpected event./In the latter study, participants also rated the emotional valence of both the highly expected and highly unexpected event they mentioned. Though the authors subsequently report the individual distributions for both the positive and negative expected and unexpected events, they also report the overall distributions, collapsed across positive and negative events; we report the bump in these overall distributions.	Especially Positive Event: 16-30 Surprising Positive Event: 16-30 Highly Expected Event: 16-30 Highly Unexpected Event: 16-30 Mean Range: 16-30	Especially Positive Event: 23 Surprising Positive Event: 23 Highly Expected Event: 23 Highly Unexpected Event: 23 Mean Midpoint: 23
Thomsen, Pillemer, & Ivcevic, (2011)*	After dividing their life story into chapters, participants recalled an important specific memory from their most positive and most negative chapter, respectively.	Memory from Most Positive Chapter: 21-30	Memory from Most Positive Chapter: 25.5

Bohn (2010; memory data, from the older group)*	Participants recalled the seven events that they considered most central to their life story.	Positive Events: 16-30	Positive Events: 23
Haque & Hasking (2010; Study 1, memory data)*	Participants recalled the happiest event, saddest event, most important event, most traumatic event, most angry event, most in love event, most jealous event, most proud event, most fearful event, the event indicating the highest success, and the most surprising event of their lives.	Happiest Event: 20-29 Most Important Event: 20-29 Most in Love Event: 20-29	Happiest Event: 24.5 Most Important Event: 24.5 Most in Love Event: 24.5 Mean Midpoint: 24.5
Raffard et al. (2010; control group)	Participants recalled three self-defining memories.	20-24	22
Demiray, Gülgöz, & Bluck (2009)	Participants free-recalled autobiographical memories, being given seven minutes to retrieve as many memories as they could for each five-year interval in their life (e.g., from 20-25).	10-30	20
Raffard et al. (2009; control group)	Participants recalled three self-defining memories.	20-24	22
Davison & Feeney (2008; collapsed across general and specific regrets)*	Participants recalled up to five regrettable experiences.	Study 1: 10-19 Study 2, Participants in Their 40's: 20-29 Study 2, Participants in Their 60's: 20-29 Mean Range: 16.7-25.7	Study 1: 14.5 Study 2, Participants in Their 40's: 24.5 Study 2, Participants in Their 60's: 24.5 Mean Midpoint: 21.2

Rathbone, Moulin, & Conway (2008)	All memories participants generated in association to *I am* statements (10 memories to each of three statements in Study 1, and eight memories to each of four statements in Study 2), as well as the first three memories (Study 2).	All Memories: No Bump First Three Memories: 21-40 Mean Range: 21-40	Mean Midpoint: 30.5
Thomsen & Berntsen (2008; data for individual memories)	Participants recalled the five events that they considered most central to their life story.	6-30	18
Cuervo-Lombard et al. (2007; all recalled events, and data from the control group)	Participants recalled 20 important autobiographical events.	21-25	23
Glück & Bluck (2007)	Participants completed the Life Story Questionnaire, in which individuals list up to 15 events or experiences that they consider most personally important in their life.	16-30	23
Webster & Gould (2007; age groups in their 40's and older)	Participants recalled one memory that "was important in your life, or that changed how you think about yourself." (pp. 155)	20-29	24.5
Conway, Wang, Hanyu, & Haque (2005; Japanese, English Chinese, and US samples)	Participants free-recalled 20 autobiographical memories.	15-25	20
Conway & Holmes (2004; Exp. 1)	Participants free-recalled autobiographical memories, being given five minutes to recall up to three memories from each decade of their life	10-29	19.5

	(e.g., from 10-19).		
Schroots, van Dijkum, & Assink (2004; late adulthood group)	Participants completed the Life-Line Interview, in which they were asked to draw a life-line for both past and future events, and to date and label each event.	10-40	25
Fromholt et al. (2003; Exp. 1, data from centenarians)	Participants gave a 15-minute free narrative of their life, in response to the instruction, "Tell about the events that have been important in your life."	10-30	20
Rubin & Berntsen (2003; Study 1, overall bump common to all age groups in their 40's and over, except where noted)*	Participants reported how old they were when they felt most afraid, most proud, most jealous, most in love, most angry, and when they experienced the most important event of their lives./ Subsequently, participants also rated the most important event as positive, negative, or mixed, and the authors report the distributions separately for positive memories and for negative/mixed memories, respectively.	Most Proud: 20-29 Most in Love: 10-19 Most Jealous: 20-29 (averaged across the four age groups in their 40's and over) Most Important Event/Positive: 20-29 Mean Range: 17.5-26.5	Most Proud: 24.5 Most in Love: 14.5 Most Jealous: 24.5 Most Important Event/Positive: 24.5 Mean Midpoint: 22
Berntsen & Rubin (2002; involuntary memory data excluded, and overall bump common to all age groups in their 40's and over)*	Participants reported their age at the time of the happiest, saddest, most traumatic, and most important event of their lives.	Happiest Event: 20-29 Most Important Event: 20-29 Mean Range: 20-29	Happiest Event: 24.5 Most Important Event: 24.5 Mean Midpoint: 24.5
Elnick, Margrett, Fitzgerald, & Labouvie-Vief (1999; data from the Life History Timeline, and overall bump common to all age groups)	Participants completed the Life History Timeline, in which they were asked to fill in a timeline, divided in five-year increments, with events from their life that stood out as most significant.	20-29	24.5
Holmes & Conway (1999; Exp. 1,	Participants free-recalled, over 10	20-29	24.5

private event data)	minutes, autobiographical events which they considered to be important.		
Robinson & Taylor (1998; vivid memory data)	Participants reported four vivid memories.	5-11	8
Rubin & Schulkind (1997b; important memory data, from the 70- and 73-year-olds)	Participants recalled five of the most important events of their lives.	20-29	24.5
de Vries & Watt (1996; late adulthood group)	In an adaptation of the Rappaport Time Line, participants were presented with a blank line which represented their entire lifespan, and were asked to mark, label, and date significant life events of their past and future.	11-30	20.5
Fitzgerald (1996; overall bump for both age groups)	Participants recalled four events that they would include in a book about their life.	16-25	20.5
Benson et al. (1992)	Participants reported 10 vivid memories.	Japanese Sample: 21-30 US Sample: 11-20 Mean Range: 16-25	Japanese Sample: 25.5 US Sample: 15.5 Mean Midpoint: 20.5
Fitzgerald (1992)	Participants recalled five events that they would include in a book about their life.	11-30	20.5
Howes & Katz (1992; free recall data for	Participants free-recalled	Middle-Aged Group: Unclear[6]	

[6] The middle-aged group in Howes and Katz (1992) demonstrates an increase in memories in the 16-30 and 31-45 age bins, then a decrease in the 46-60 interval. Although this superficially looks like a bump, the age bins do not allow for a clear demarcation between the bump and recency periods, given that this group had a

autobiographical memory)	autobiographical events, being given five minutes to recall as many events as they could for each 15-year interval in their life (e.g., up to age 15).	Older-Aged Group: No Bump	
Fromholt & Larsen (1991; control group)	Participants gave a 15-minute free narrative of their life, in response to the instruction, "Tell about the events that have been important in your life."	10-30	20
Mackavey, Malley, & Stewart (1991)	The authors performed a content analysis on the autobiographies of 49 psychologists, identifying the *autobiographically consequential experiences* reported therein.	18-35	26.5
Cohen & Faulkner (1988; middle-aged and elderly groups)	Participants reported six of their most vivid memories.	0-10	5
Fitzgerald (1988; Study 2)	Participants reported their three clearest autobiographical memories.	11-25	18
Rabbitt & Winthorpe (1988; free recall data)	Participants free-recalled autobiographical memories, being given 10 minutes to recall as many memories as they could from each third of their life (e.g., the first third).	Unclear (See Footnote #5)	
		Overall Mean Range: 15.1 (*SD* = 5.5) – 27.9 (*SD* = 5.9)	Overall Mean Midpoint: 21.5 (*SD* = 4.8)

mean age of 48 years (ranging from 40 to 55). Additionally, the decrease in the 46-60 bin may merely reflect the drop-off in years lived within that interval, rather than the true decrease that would indicate a bump.

Figure 1. Idealized temporal distributions of word-cued and important autobiographical memories over the lifespan. The top panel contains the distribution of word-cued memories, and the bottom panel contains the distribution of important memories.