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Replicating autobiographical memory research using social media: a case study

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ABSTRACT

The durability of memories for personally experienced events and the effectiveness of naturalistically generated cues of those events were investigated via a case study using Timehop to re-present information from Facebook, Twitter, and the iPhone photograph archive from the past six years to generate autobiographical memories. Replicating prior longitudinal self-studies of remembering, recency predicted successful recall of specific events. Prior research showing images to be more evocative of autobiographical remembering than text was also replicated here. Results also supported claims that direct retrieval is a common mode of remembering. Somewhat surprisingly, retrieval of autobiographical memories had little influence on ongoing affect, cognition, and behaviour. This is suggested as “proof of concept” that social media data allows for modern replication of diary-type studies and expansion beyond typical participant pools. The interrelated functions of social media for remembering and of autobiographical remembering to social media can also be explored with this method.

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From a distance of 40 years, Neisser (1978) reflected on the influence of Bartlett's (1932) landmark study of schemas and social influences on memory and lamented that cognitive psychologists were still yet to be studying “real uses of memory in humanly understandable situations” (p. 4). Here we are, another 40 years after Neisser's own challenge and I am happy to say that many of my colleagues have answered the call to study interesting and important questions of autobiographical memory. In the four decades since, much work has been done on a number of questions about “personal evocations” Neisser outlined:

Why do just [some] memories come [to mind] and not others? When are they trustworthy, and when fabricated? Why do I have so few from my very early childhood? Do some people have more of them than others, and if so why? What function do they serve? How does the nature and incidence of personal recollection vary with age, culture, sex, and situation? What happens when whole sections of the past become inaccessible, as in functional amnesia? (p. 13)

We now have a robust body of literature addressing spontaneous (e.g., Berntsen et al., 2013) and effortful (e.g., Rubin, 2006) retrieval, false memories (e.g., Scoboria et al., 2017), infantile amnesia (e.g., Bauer, 2015), individual (e.g., Palombo et al., 2018) and cross-cultural (e.g., Wang, 2013) differences, the functions (e.g., Harris et al., 2014) of remembering, the contexts of spontaneous autobiographical recollection (e.g., Demiray et al., 2019), and a variety

of amnesiac syndromes (e.g., Rubin & Greenberg, 1998; Palombo et al., 2015) as well as many other questions of direct and immediate consequence to everyday experience.

Yet, at this time, there is a parallel conversation occurring in the discipline that posits a critique not from the perspective of ecological validity but from that of construct validity and reproducibility (Open Science Collaboration, 2015). Thankfully, the advent of new technology can help us address all of these concerns simultaneously. For example, studies using SenseCam (a wearable camera that automatically captures images which can be reviewed later) have shown real promise in supporting autobiographical recollections in those with cognitive impairments (e.g., Berry et al., 2007; Brindley et al., 2011) and has been used to examine cue efficacy (St. Jacques et al., 2011) as well as event discriminability and durability (Finley et al., 2011) in healthy adults.

“Life-logging” technologies like SenseCam indiscriminately encode ongoing experience in a way that models naïve conceptions of human encoding. The resulting images require significant organization and editing to overcome the inherent signal-to-noise problem to result in a meaningful accounting of past experience. In this way, SenseCam is a powerful metaphor for human remembering and forgetting. Similarly, the data management demands and search parameters for these data mimic problems for the human cognitive system and present

significant challenges for investigators who intend to use this technology for research purposes (Doherty et al., 2012).

In contrast, social media systems encourage periodic and selective recording of ongoing experience. They combine long-standing habits of diary-keeping and social disclosure to create an emergent phenomenon. This cultivated record is an equally powerful metaphor for autobiographical memory. Moreover, the substance of this record can be used to directly query memory in a way that is less technologically and temporally demanding of both participants and researchers. Social media platforms in which individuals share personal experiences are now ubiquitous and can be readily adapted to expand our research beyond memories that participants generate (or record) at the request of experimenters to naturally occurring memories in real-world contexts. Furthermore, these relatively novel forms can be used to replicate past findings. I shall present here a case study in just such an approach as encouragement for my fellow investigators to further embrace both Neisser's challenge and contemporary concerns to conduct ethological and reproducible memory research.

The object of this investigation is autobiographical memory – the individual, conscious recollection of events experienced in the personal past. Although autobiographical memory includes representations of extended events (e.g., a weeklong vacation to the beach) and schematic representations of recurring events (e.g., a typical trip to the grocery store) as well as semantic knowledge about the self (e.g., what city is identified as one's "hometown"), its core components are specific, concrete recollections of episodes that occurred at a discrete time and place (e.g., that I had a bagel and coffee for breakfast this morning in the kitchen with my spouse). In addition to the details of the event, autobiographical memory also includes the phenomenological experience of remembering. The vividness with which one conjures those details, the subjective sense of reliving the past in the present, the degree to which one feels close to the past event, and the confidence one has that the recollection accurately reflects the occurrence of the event in the past are all separable constructs that cohere in a holistic experience of recall. Additionally, autobiographical memories serve multiple functions for the individual. Autobiographical memories support self-identity by providing evidence of who we are and what we have done. They direct action by allowing us to reflect on past performance in similar situations. They can help us to change (or sustain) our mood by providing emotional experiences upon which to reflect. Further, they help us to build and maintain social relationships in ways that mirror the personal functions described above. For example, sharing past experiences with others can be how we describe ourselves and/or how we come to understand them. Doing so can provide information that is relevant to an ongoing event. And, lastly, talking about the past can elicit a desired

emotional reaction. Therefore, understanding what personally experienced events are available in autobiographical memory, how they can be brought to mind, and what influence they exert on the present are important questions for those interested in memory as an individual and as a collaborative process.

The current study investigates a number of these fundamental questions of autobiographical remembering. First, what is the durability of individual autobiographical memories and is it influenced by the emotional aspects of the event? Second, what cues are effective reminders of past events? Third, how does successful retrieval of an autobiographical memory influence ongoing affect, cognition, and behaviour? Moreover, the current study addresses those questions by adapting new technologies to replicate and extend past findings.

Past research

At our earlier crossroads, pioneers in the study of autobiographical memory endeavoured to replicate canonical laboratory-based memory phenomena identified with artificial stimuli and captured under ideal conditions in more naturalistic scenarios. Examples of this were the work of Linton (1975, 1978), White (1982, 1989, 2002), and Wagenaar (1986) who all conducted longitudinal case studies of their own memories. The longitudinal nature of this work was particularly important as autobiographical memory encompasses nearly the entire lifespan and, as such, repeated observations of the same individual over (lengthy) intervals are necessary to fully capture the phenomenon. These prior investigators explicitly recorded personally experienced events, rated various characteristics of each event associated with durability, and tested their own recall of the events at various delay intervals.

Over a period of six years, Linton (1975, 1978) recorded two events per day and rated their novelty, emotional intensity, importance, and other features associated with her (predicted) ability to accurately date that event when tested later. She tested herself on half of all items within the first month of occurrence, then retested those events and the remaining events at intervals ranging from 2.5 to 6.5 months for a duration of six years. Her primary interest was in dating accuracy; Therefore, her retrieval assessment was whether she could recall the specific date on which a given event occurred as well as judging temporal order of two cued events.

White (1982) recorded one event per day for one year and tested himself on these items at six months (1982), six years (1989), and 20 years (2002) later. During the initial recording period, he rated the frequency of the event, its vividness, its importance, its association with semantic knowledge, its physical intensity along five dimensions (sight, sound, feel, smell, taste), its emotional intensity, and he also chose from among 40 specific emotion terms to describe the event. At recall, like Linton, he provided date estimates for each event. In addition, he rated his own

recall on a 5-point scale ("5, total degree of recall; or 4, high degree of recall; or 3, some details recalled but aware of considerable loss; or 2, aware that some such event occurred, but hardly any detail recallable; or 1, no recollection of such an event" (1982, p. 175)).

Wagenaar (1986) recorded one event per day over a period of six years on a cued recall form identifying who the event included, what the primary activity was, where, and when the event occurred. Further, he recorded a "critical detail" about the event that would serve as a check for the completeness of his recall. He also rated the salience, emotional involvement and pleasantness of each event. He then tested his recall of each event once and only once, modifying the quality and quantity of information provided from the record to bring the remaining details of each event to mind.

In terms of durability, Linton (1978) found less than 1% of items were forgotten within the first year, 5–6% were forgotten per year in the intervening years, with 9.3% forgotten after five years. In all, just fewer than one-third of all events were forgotten by the end of the study at a relatively flat rate of forgetting. Similarly, Wagenaar (1986) and White (1982, 1989) found the forgetting function to be generally linear, although overall White found his memory to be poor and Wagenaar reported his to be quite good. After reading the full description of the event, White (1982) failed to generate a memory 40% of the time after six months, whereas Wagenaar (1986) reached a similar threshold under similar cueing circumstances only after six years. This finding was consistent with earlier work by Smith (1952) using a very different method. She had tested her own memory by attempting to recall all the events from her life during a few particularly eventful periods and assessing the accuracy of those recollections against her own diary and that of her mother (which included details about the daughter's life). Smith judged herself to have forgotten 20% of events at 15 months, 34% at 6 years, 38% at 8.5 years, 40% at 10 years, 41% at 22 years, and 47% at 46 years.

One event characteristic that was associated with durability was the novelty of the event. White (1982, 1989, 2002) found that less frequently occurring events were more recallable at all delay intervals (though less so after 20 years than after six months or six years). Linton (1975, p. 396), for example, described amending her recording habits "because in those first few months of the study [she had] a tendency to include events of too repetitive a nature" such as her habit of playing tennis multiple times per week with regular playing partners. Similarly, Smith (1952) noted that greater event frequency was not associated with a greater likelihood of recall and attributed that to the merging of similar events in memory. Instead, she noted, novelty (as in rarity or uniqueness) was more predictive of clear event recall and that unexpected events (as in surprising) were also well remembered.

For cue efficacy, Wagenaar found "when" cues to be particularly ineffective and "what" cues to be most

effective in generating memories. Further, both Wagenaar (1986) and White (1982) showed dramatic increases in accessibility of memories as the availability of information about the event increased.

One common feature of all three case studies is the intentional recording of events for the explicit purpose of later study. Wagenaar (1986, p. 233) warned "one methodological problem ... is that the act of recording, especially when it involves such processes as scaling and explicit structuring, makes the recorded events stand out against the background of other events." However, contemporaneous work by Thompson (1982) mitigated some of that concern. Thompson had participants' roommates record events from participants' lives and found no difference in recall between the roommates and the participants.

Other studies attempted to remedy the problem of "awareness of future testing" by recruiting diarists and then mining those materials for relevant autobiographical events to be assessed at various delays (Burt, 1992; Burt et al., 2001, p. 2004; Smith, 1952). Burt (1992) recruited eight regular diarists and then extracted event data from those diaries that could be described in the same *who*, *what*, *where*, and *when* features that Wagenaar (1986) used, selecting no more than one item per day. The delay interval between recording and recalling ranged from a bit less than a year to nearly nine years ago (with an average around three years). Again, emulating Wagenaar (1986), participants were presented with subsets of event features and asked to generate the rest. Ten years later, Burt et al. (2001) obtained retest data from a subset of these participants. Instead of generating descriptions of uncued event features, participants rated their memories on a 9-point scale at this interval ("1 = it never happened, 2 = the combination of cues does not prompt any recollection, 3 = it could be one of many similar events, 4 = I can just barely remember it, 5 = I remember it but not so well, 6 = I remember it fairly well, 7 = I remember it very well, 8 = I remember it almost perfectly, 9 = I remember it perfectly" (pp. 128–129)). Because Wagenaar had shown *when* to be such an ineffective cue, Burt (1992; Burt et al., 2001) avoided it entirely as a cue type and only included temporal information as a detail to be recalled by participants.

Like Wagenaar, Burt found the *what* cue was most effective in generating memories. Initially, Burt (1992) found few events were completely forgotten by his participants. In the later follow-up, Burt and colleagues (2001) found that participants were still able to recall over half (55%) of the specific events. Of those that were not recalled, the reasons given were that the event described was "too similar" to other events (41%) or that insufficient information was provided about the event (45%), again suggesting a failure of discriminability. Furthermore, in only 13% of cases did the participant believe the event to never have happened. In other words, for most events, participants knew that the event occurred but

could not recall specific distinguishing details. None of these past studies examined the influence of recollection on current thoughts, emotions, or actions.

Current research

Today, many individuals spontaneously record events from their lives via social media. Although these events are certainly intentionally recorded, there is not necessarily the expectation that they will be accessed later. Yet, many technology services have arisen precisely to remind people of past postings on social media as a means of facilitating nostalgia.¹ Routledge and colleagues (2011) have shown that nostalgia adds to one's perception of life as meaningful and that it reduces existential mortality threat. Many technological services are therefore premised on the fact that it is pleasant to be reminded of the past. Timehop is a freely-available application that re-presents previously-posted information from social media accounts and photograph storage accounts that aims to "reinventing reminiscing" (<https://timehop.com/about>, retrieved 28 June 2017). Functionally, services like Timehop present reminders of past postings which are temporally-generated by means of "on this day" selection. Otherwise, the content of the post is not curated. Information regarding *who*, *what*, or *where* the event occurred is only included to the extent that it was originally recorded. Therefore, the original source of the reminder has important implications as the function may differ across sources (e.g., Facebook for event recording, Twitter for news sharing) as well as within each source (e.g., photos as event markers or as notes/reminders). Continuing a long tradition in exploratory science (and specifically emulating Linton, White, and Wagenaar), I served as my own subject.

By adopting the case study approach, I can address confirmatory and exploratory questions concurrently. In other words, I can replicate and extend fundamental findings in autobiographical memory while examining novel technological and methodological issues. Similarly, a case study will provide an in-depth investigation of both subjective and objective data simultaneously. As a memory investigator, obviously, my motivation and compliance rate are high, but, I am also well-positioned to relate observations to questions of theory. Although the generalisability may, admittedly, be limited, there are still advantages to providing "proof of concept" that rigorous and highly ecologically valid work of this type can (and should) be conducted by other memory investigators with naïve participants. Indeed, given the privacy concerns at issue, it seemed prudent to not involve a large sample prior to establishing that the potential benefits would outweigh those risks. The seminal longitudinal case studies described above (Linton, 1975, 1978; Wagenaar, 1986; White 1982, 1989, 2002) have been cited, collectively, more than 600 times whereas the longitudinal diary studies (Burt, 1992; Burt, Kemp & Conway, 2001, 2004; Smith, 1952), collectively, have been cited nearly 100

times. Therefore, there is a clear utility of this work to the field.

First, I downloaded the Timehop application to my iPhone (26 March 2015). I then allowed the app to access my existing Facebook and Twitter accounts and gave it access to my iPhone photograph library. The information available to Timehop was dependent upon my prior use of each of these services; My Facebook account has been active since January, 2006, my iPhone photos archive includes images dating to October, 2012, and I have been on Twitter since April, 2015. My activities with each technology are typically mundane. As of this writing, my most recent Facebook posts included a link to a fundraiser that a friend was sponsoring, a photo from a group outing with friends, a text description of my reaction to a sporting event, and a photo of my house showing the change of seasons. My most recent iPhone photographs include a screenshot of a colour matrix to aid in the selection of a paint colour, a snapshot of my dinner plate, a photograph of a recipe from a cookbook, a photograph of a newly received gift, and a photograph of a speaker at an on-campus event. My most recent tweets include retweeting a survey link for a colleague, a reminder of upcoming conference registration, a comment on and link to a Chronicle for Higher Education article, a comment and link to a thread on diversifying institutions, and a retweet of a job posting.

These representative examples underscore one limitation of using social media postings as the corpus for autobiographical events: their cultivated nature. There is some evidence to suggest that social media postings are accurate but selective (Back et al., 2010; Utz, 2012). In other words, people tend to post content that authentically represents primarily positive experiences. The fact that posts are initially intended for communication with others rather than as reminders to oneself may also limit their effectiveness and generalisability as mnemonic cues. There is also differentiation of content across platforms. For me, Facebook includes more personal content aimed at an audience of friends and family; Twitter includes more professional content and its audience includes more colleagues and acquaintances. On a given date, Timehop presented information that had been posted to those accounts and/or acquired by the camera on that same calendar date in previous years. See Figure 1 for representative Timehop screenshots. The term "reminder" will be used to refer to any Facebook post, Tweet, or iPhone photograph that was presented to me via the Timehop app. Reminders included photographs and comments I composed myself, but also links to news stories and/or websites, images from elsewhere on the internet, and other content.

Next, I created an online Qualtrics questionnaire to record information about the reminders, the events those reminders brought to mind, and the effect those reminders had on my current state. A flowchart outlining the questionnaire logic and including the full text of



Figure 1. Left panel shows a full screen capture including Timehop logo, date prompt, and an image-type reminder (note the source icon shows that it was a photograph taken on my iPhone). The right panel shows text-only reminders (of Facebook postings) from the same date, one year apart.

each questions is presented in Figure 2. After being asked to identify how many reminders were presented, I was asked a series of questions regarding each individual reminder: when (number of years) and where (Facebook, Twitter, or iPhone photos) it was from as well as the type of reminder it was (text only, an image only, both image and text, or other). The “other” category included groupings of multiple images (with or without text) as well as links to other media (with or without commentary). Then, I asked whether the reminder was of “a specific event”. If so, I was asked whether I remembered the event. If so, I was asked further questions about the valence (“completely pleasant”, “mostly pleasant”, “neither pleasant nor unpleasant”, “mostly unpleasant”, or “completely unpleasant”) and emotional intensity (“extremely intense”, “somewhat intense”, or “not at all intense”) of the event. Lastly, I was asked whether recalling the event changed my mood or behaviour. If the answer to the former was “yes”, then I was asked for more detail (“very happy”, “somewhat happy”, “somewhat sad”, “very sad” or “other” with room to describe what emotions were felt). If the answer to the latter was “yes”, then I was provided with an open text field to describe how my behaviour changed.

There were 150 days of possible data collection (16 December 2015 through 14 May 2016²) and I completed

the survey every day that a Timehop notification appeared. A total of 94 days included at least one reminder (45 of those days included one and only one reminder). Across all days, there were a total of 170 reminders presented with the most reminders presented on any one day being 7 (New Year’s Eve). Somewhat coincidentally, the duration of recall was six years, paralleling Linton (1978), White (1989), and Wagenaar (1986). Of the 170 reminders, 117 were reminders of specific events, that is, descriptions of ongoing activities, thoughts and/or emotions that occurred at a particular time and place (e.g., viewing live and recorded entertainment, get-togethers with friends, meals, and travels). Non-event reminders included photographs of objects (e.g., recipes in magazines), links to media (e.g., news stories from nytimes.com), and other, similar miscellany. Most event reminders were from Facebook (77.8%) and the remainder were iPhone photos (including those not previously shared via social media). The available data included events that transpired over a period of nearly ten years (though, as stated above, the earliest post that was actually presented as a cue during data collection was from six years ago) and the period of observing autobiographical recollections extended for nearly five months. This nested longitudinal aspect allowed for consideration of a rich body of data.

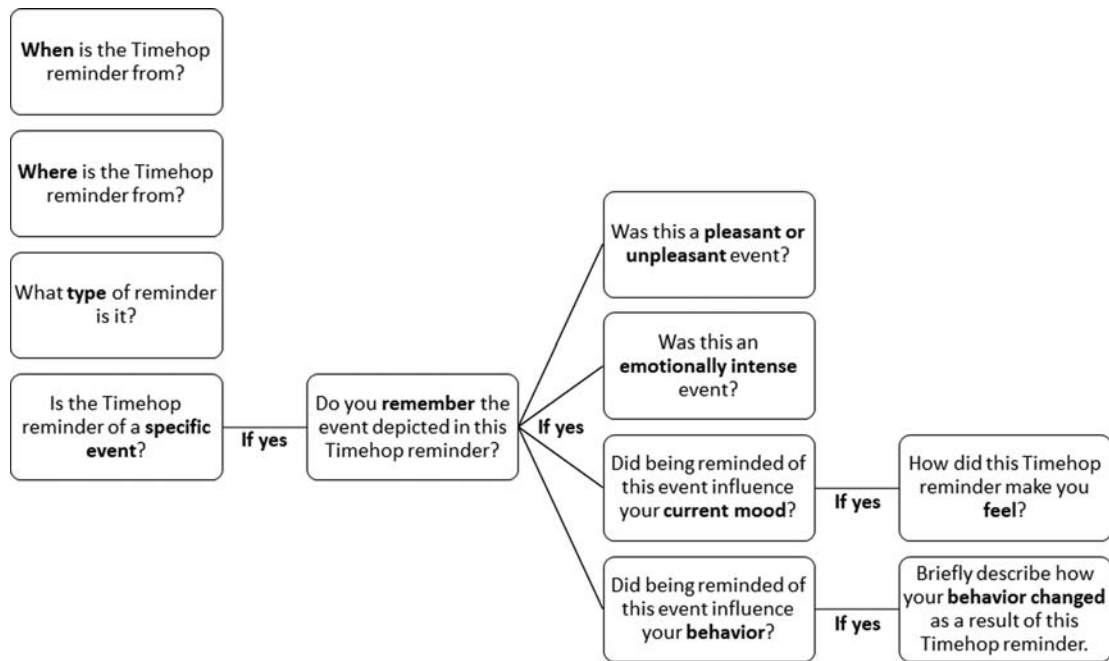


Figure 2. A flowchart of the specific questions asked about each Timehop prompt.

Results

Durability of autobiographical memories

Recency

First, I examined how recency influenced which events were more likely to be recalled (see Figure 3). However, as the events were drawn from naturally occurring social media and photography behaviours, specific event reminders were not evenly distributed across all time periods. There were far fewer reminders from two, three, and four years ago ($n = 6, 9, \text{ and } 11$, respectively) than from one, five, and six years ago ($n = 26, 22, \text{ and } 43$, respectively). When comparing only event reminders from last year and from five years ago (which had a roughly equal number of reminders), recency was significantly associated with successful recall, Pearson $\chi^2(1, N = 48) = 26.87$,

$p < .001$. Only three events from the most recent year were forgotten whereas 19 of the reminders from five years ago failed to generate memories. This pattern is consistent with past research, both from self-testing and from diary-based methods. Although the finding that longer delays are correlated with forgetting is certainly not novel, the conceptual replication of this finding in methods with quite variable encoding and retrieval demands remains important.

Novelty

If I were to rerun the study, I would have also included a question as to the novelty of the event depicted. As shown in the right panel of Figure 1, many events are frequently repeated activities. Earlier investigators made similar observations (Linton, 1975, 1978; Smith, 1952;

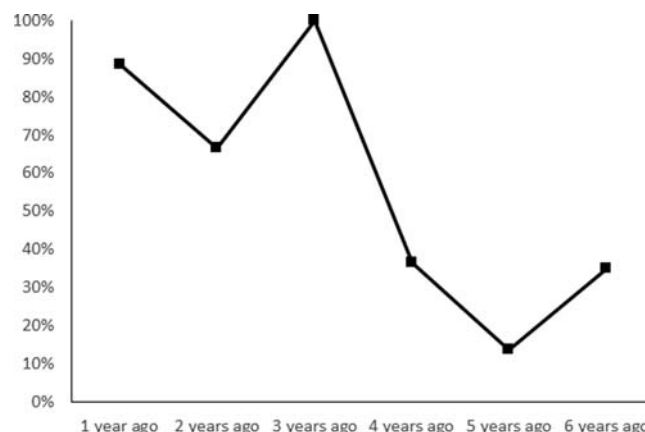


Figure 3. Percent of specific event reminders that effectively cued memories of past events as a function of how long ago that event occurred.

Wagenaar, 1986; White, 1982, 1989, 2002). My own forgotten events were frequently weather-related (e.g., major snowstorms) that, while noteworthy and disruptive at the time, became indiscriminable from other, similar events later. Sporting events were also commonly forgotten and are similarly repetitive; Individual games are highly emotional at the time, but that affect fades quickly as new games and new seasons unfold. When examining his own retest consistency, White (1989) found recall ratings at six months to be strongly correlated with ratings at six years. Furthermore, memories were much more likely to lose detail than to gain it, providing some indication that loss is due to interference with subsequent events.

Emotion

Next, I examined the influence of emotion in recalled events. The vast majority of remembered events ($n = 54$) were positive ($n = 46$). Of the few negatively valenced event memories, one was “extremely intense”, two were “somewhat intense” and five were “not at all intense.” The pattern was similar for positive memories ($n = 2, 15$, and 29 for each intensity category, respectively). Previous research has consistently found that emotional events are recalled better than neutral events (Smith, 1952; White, 1982, 1989, 2002; 1986), but data on valence effects are more variable. Wagenaar (1986) and White (1982) found positive memories to be remembered better than negative events, but Smith (1952) found the reverse. Both Wagenaar (1986) and Smith (1952) describe evidence consistent with the fading affect bias (Walker et al., 1997), though they obviously did not identify it by that name. In all cases, the valence effects were much smaller than the intensity effects, as is generally true of autobiographical memories (Talarico et al., 2004).

Cue efficacy

Secondly, I examined which types of reminders were most likely to cue memories of past events. Although Timehop expressly generates reminders on the basis of temporal information, the least effective cue according to prior case studies, that is never the sole aspect of the event presented. In the current data, activity information, along with location information, were frequently included in photographs and social media postings.

Reminders with images (image(s) only: 22 remembered vs. 2 not remembered; image(s) and text: 13 remembered vs. 9 not remembered) were significantly more likely to be effective cues than were text-only posts (21 remembered vs. 48 not remembered), Pearson χ^2 (2, $N = 115$) = 27.90, $p < .001$. A recent study of another reminiscence-based technology, Pensieve, also found that photographs were better triggers than were text-only cues (Peesapati et al., 2010).

Because the events here were not recorded for the purpose of later study, no additional data about event attributes were collected at encoding. Looking to past

research, White (2002) found initial vividness of the event to be the strongest predictor of long-term recall. Frequency was strongly inversely related to recall. None of the physical attributes were associated with later recall with the notable exception of *sight*. He suggested that these physical details could be aspects of vividness, a view consistent with how vividness is conceptualised in the broader autobiographical memory literature. These latter two correlations were stronger at earlier intervals but remained significant (only less so) at the longest interval. Smith (1952) reported that the childhood memories of herself and the seven other diarists studied were primarily visual. These findings are in agreement with other evidence of the primary role visual imagery plays in autobiographical remembering (Greenberg & Rubin, 2003) and with the greater effectiveness of imageable cues (Rasmussen & Berntsen, 2014; Williams et al., 1999). Notably, pictures are not generally more effective in generating autobiographical memories than are their verbal labels (Goddard et al., 2005).

These cue efficacy results are relevant to discussions of autobiographical memory retrieval more broadly. All of the Timehop cues used here, because they are personally relevant, self-generated, and highly associated with specific events are likely to lead to direct retrieval of autobiographical memories (Uzer et al., 2012; Uzer & Brown, 2017). The generative retrieval process of autobiographical memory that is more commonly observed in word-cue paradigms (Crovitz & Schiffman, 1974) is less common here because the particular event is either recalled or not. In more typical cueing paradigms, an individual responding to a generic cue (e.g., “tree” or “book”) engages in an iterative process of self-generating more precise cues until they are able to successfully retrieve a valid autobiographical memory (e.g., an event that occurred, to the participant, lasting less than one day, that occurred more than 24 h ago, that is associated with the cue). This generative process typically takes more than 15 s to retrieve an autobiographical memory whereas direct retrieval typically takes less than 5 s (Uzer, 2016). Obviously, I did not record reaction time data in the current study, but my subjective experience was one of immediate recognition of the event (or, in the case of forgotten events, a relatively immediate confusion and lack of recognition). Because influential models of autobiographical memory organisation and structure (e.g., the self-memory system of Conway & Pleydell-Pearce, 2000) were primarily based on abstract cue-driven recall, and therefore, generative autobiographical memory processes, findings such as those discussed here are relevant to theoretical considerations of the relative frequency of direct retrieval. For example, Haque and Conway’s (2001) claim that effortful, generative retrieval is more common than more automatic direct retrieval is likely due to overreliance on laboratory-based autobiographical memory retrieval. In contrast, others who have examined a broader range of retrieval procedures have shown that

direct retrieval is quite common (Harris et al., 2015; Uzer et al., 2012). Overall, more naturalistic autobiographical memory retrieval contexts are necessary to ensure our theoretical models are accurate representations of psychological phenomenon.

Event by cue interactions

Again, because these events were not recorded for the purpose of future study, it was not possible to examine many encoding-retrieval interactions. However, one such effect was seen. There was a slight interaction between emotional valence and reminder type (See Table 1) in that the vast majority of successfully remembered negative events were cued by text-only posts ($n = 7$). Each type of reminder was equally likely to generate memories of each intensity (roughly proportional to their total representation in remembered events).

Influence of past on present

Finally, I examined the influence of reminders on my current state. When asked specifically if the reminder influenced my current mood, I responded “yes” on 21 occasions. Of these, the vast majority lead me to feel “somewhat happy” ($n = 15$). On the other occasions, I was “very happy” twice and once each I indicated that I was “somewhat sad”, “excited”, “relieved”, and “bittersweet & jealous”. Prior research on reminiscence has shown that life review gives significance to life experiences and increases self-esteem and satisfaction (Thomas & Briggs, 2016). Similarly, nostalgia has been shown to boost mood and increase positive self-regard (Wildschut et al., 2006). Wildschut and colleagues (2006) have found that this type of deliberate nostalgia is most frequently triggered by negative affect in the present with remembering the past being used as a means of emotion regulation to feel more positively. The second-most frequent trigger they reported was social interaction (e.g., jointly reminiscing with people about shared past events). However, this research was done in the context of self-directed reminiscence where the individual both chooses to engage in reminiscence behaviour and selects which memories to recollect. This is slightly different from Timehop where an externally-generated cue is presented. In this context, the individual chooses to participate in the reminiscence activity abstractly by downloading the app (and perhaps in choosing when to respond to a notification) but the

event that is presented and/or the associated memories that are brought to mind are outside the individuals’ control. It is also different from Pensieve and other reminiscence-based technologies which more directly cue nostalgia-based recollection.

In other words, the memories discussed here present an interesting middle case between voluntary and involuntary memories. Berntsen (2012) has argued that involuntary retrieval is a basic, perhaps dominant, form of autobiographical remembering. Involuntary memories are not accompanied by deliberate attempts to retrieve but are instead brought to mind seemingly spontaneously. The phenomenon typically occurs when attention is diffuse and when environmental features serve to cue central aspects of the involuntarily retrieved event (Berntsen, 1998). The memories generated here are cued by external stimuli (like involuntary memories) but opening the app to view those cues is a voluntary act. The retrieval of the memories is not strategic, per se, but nor is it altogether unexpected.

In general, individuals report enjoying reminiscence-based technology, finding that it enhances their mood (Peesapati et al., 2010). Perhaps surprisingly, this extends even to a review of negative experiences. Thomas and Briggs’s (2016) participants appreciated seeing past Facebook posts of negative events as it gave them an opportunity to reframe or reflect on an experience that might otherwise have been avoided. Relatedly, even though strategic recall of positive past autobiographical experiences is a common emotion-regulation technique, involuntary memories tend to influence mood more so than do voluntary memories (Johannessen & Berntsen, 2010). Therefore, the influence of these “middle case” memories on mood provides an interesting context for disentangling these effects. Another advantage of memory studies which use social media postings as stimuli is that these rather trivial events are otherwise unlikely to be spontaneously rehearsed nor brought to mind by experimenter-generated prompts. Yet, when those mundane memories are available, they tend to be appreciated by participants and may be quite informative to investigators.

My experience is certainly compatible with this. Although there is little in the mood-change data to suggest that using Timehop is a pleasant experience, it was and is. I continue to use the app (though no longer in conjunction with the Qualtrics survey) and find being reminded of past experiences to be a positive addition to my digital habits. Obviously, this is influenced both by the relative positivity of my life experiences and the further selectivity in sharing mostly positive experiences via social media and/or documenting via photographs more positive events than negative events. The positivity bias in social media is relatively robust (Reinecke & Trepte, 2014), but there are differences among platforms (e.g., Kim and Lee (2016) discuss how symmetrical and asymmetrical networks can differentially serve social relationship vs. information-seeking functions), among

Table 1. Emotional intensity of memories brought to mind by each type of reminder.

	Extremely intense	Somewhat intense	Not at all intense
Image(s) only	1	9 ^a	12
Text only	2 ^a	6 ^a	13 ^b
Image(s) and text	0	2	11

^aIncludes 1 negative memory.

^bIncludes 5 negative memories.

All other memories were positive in valence.

individuals (e.g., Forest and Wood (2012) found that users with high self-esteem post content with less negativity and more positivity than users with low self-esteem), and among cultural contexts (e.g., Lee-Won et al. (2014) found that U.S.-based Facebook users included more positive content than did South Korean-based users) that ought to be accounted for in future studies using stimuli of this type.

The benefits of using an app like Timehop are similar to the benefits of social media use generally. These sites are reinforcing because of their continually changing, primarily positive content and how interacting with that content facilitates connection with others. Here, being presented with one's own (prior) posts similarly elicits positive affect and bolsters a connection with one's (past) self. Plus, the costs associated with social comparison when viewing others' posts are mitigated by the fuller contextual knowledge one has of one's own life. The understanding that social media posts may comprise a "highlight reel" is more obvious when reviewing one's own timeline than when viewing the intermixture of postings from many others' timelines. An added benefit of Timehop that I appreciate is the reminder of cyclic patterns (e.g., seasonally dependent activities, holidays) and recurring themes (common frustrations or pleasantries) in one's life. The loss of specific details from particular events (as was shown by the novelty findings above), can provide reassurance that current difficulties shall soon pass or that what has brought joy in the past could do so again.

Technologies like Timehop deliberately facilitate the emotion regulation and social functions of reminiscence. Timehop describes itself as a digital nostalgia app meant to "help people find new ways to connect with each other around the past." (www.timehop.com/about, retrieved 5 March 2019) They contrast themselves with dominant digital technologies that focus on new, and fleeting, content. As others turn their attention to deliberately designing spaces and objects meant to facilitate remembering (van den Hoven & Eggen, 2014), a greater understanding of the mechanisms and consequences of autobiographical memory will be necessary. Ideally, creators and/or designers will partner with academics and/or practitioners to construct effective memory products and places. One example of such a productive collaboration is development is the Reminiscence in Open Air Museums project (Hansen, 2017) developing fully immersive environments for individuals with dementia to support autobiographical remembering.

Only eight reminders in the current study lead to behaviour change. The most common reaction was to share the reminder with someone else who shared the original event ($n=7$). On all of those occasions, we jointly reminisced about the past event. (In current use, I continue to share reminders with others who shared the original event.) In one case, the reminder caused my spouse and me to discuss a related, future event. In only one case did the reminder lead me to take specific

action and that was in anticipation of a related, future event. Specifically, seeing a reminder of a past gathering to watch the Academy Awards prompted me to print mock ballots for the current year's gathering. The directive function of memory is best served by a strategic recall of task-relevant experiences and therefore less likely to be prompted by retrieval of temporally cued memories.

User comments in the Peesapati and colleagues (2010) study similarly suggest a greater influence of reminiscence technology on thoughts and emotions than on behaviour. Of the behaviours that were generated in response to their cues, social-oriented actions dominated (e.g., contacting a person with whom they shared a past event). This is consistent with the social function of reminiscence described by Westerhof and Bohlmeijer (2014) and of autobiographical memory more generally (Bluck et al., 2005). Wildschut and colleagues (2006) found that the second-most frequently cited benefit of nostalgia is to strengthen social bonds. Social interaction, in turn, can enhance remembering – Wagenaar (1986) describes retrieving a subset of "forgotten" events by soliciting additional information about the event from a shared participant. Voluntary retrieval of autobiographical memories in everyday life is highly associative, with memories strategically recalled to serve ongoing needs. Those needs are often social (e.g., continuing conversation) and directive (e.g., solving an immediate problem by drawing on past experience), resulting in higher ratings of those functions for voluntary memories than for involuntary memories (Rasmussen et al., 2014). Because retrieval of autobiographical memories as a result of Timehop cues is not immediately related to ongoing goals, those memories may only indirectly serve the functions of self-reflection, social sharing, mood improvement, and/or behavioural inducement. From the current data at least, it seems that they rarely do so immediately and concretely. Perhaps the measures used here were inappropriate or insufficiently sensitive. In addition to novelty, I regret not asking about the specificity of each retrieved memory. The interaction of specificity and emotionality seems to influence how memories shape behaviour (Selimbegović et al., 2016) and that could not, unfortunately, be captured in the current study. It is the case that I continue to use the app and therefore must derive some pleasure from it; Perhaps the cumulative effect is more influential than the momentary effect assessed with this instrument.

Suggestions for future research

Smith (1952, p. 182) presciently stated that "the method used in this study is too time consuming for repetition in more than an occasional case." Wagenaar (1986) and White (1982) similarly call for replication. Yet, longitudinal studies of autobiographical memory have proven to be onerous and rare. The ubiquity of social media sites in everyday life therefore presents a truly innovative

methodological opportunity for the study of autobiographical memory.

This new technique, however, is not without its own limitations. Most salient are privacy considerations inherent in the use of social media generally and how those ethical concerns may be compounded by inclusion in social science research. Although there are obvious generalisability limitations with a single-participant design, reproducing this method at a large scale does introduce technical challenges for maintaining the privacy and security of participant data. Similarly, my motivation and therefore compliance with daily participation requirements were quite high; whether larger samples will be equally reliable or if the reporting demands will need to be revised ought also to be considered.

Provided these concerns can be adequately addressed, one area that may particularly benefit is the study of false memories. Linton (1975, 1978) eloquently outlined the difficulties of creating appropriate lures for autobiographical events, including the interplay between generating plausible events from recurrent people, places, and activities while remaining relatively certain that a created event did not, in fact, occur. Burt and colleagues (2004) created false events by altering the activity and/or location and/or other participants included in diary entries. Although their participants were generally accurate in rejecting these events (approximately 40% vs. 6% for true events), they did false alarm to some events, even when it was the activity that was changed. In contrast, creating foils from the social media postings of peers may be a fruitful way of generating lures with higher confidence that the events did not occur to the participants. Therefore, testing autobiographical memory discriminability may be more amenable to systematic investigation with this technique.

All of the activities required of participants in the current method can be done on a smartphone which most potential participants will already own and use quite naturally and frequently for similar activities. Approximately 80% of U.S. adults currently own a smartphone and the median ownership rate for advanced economic nations is 76% (Taylor & Silver, 2019). According to the same report, the majority of young adults (aged 18–34) in many emerging economies also own smartphones. Further, the reach of social media services continues to expand across all age groups. Nearly 70% of all U.S. adults use Facebook, 35% Instagram, and nearly 25% Twitter, with rates of Instagram and Twitter use even higher in young adult samples (71% and 45%, respectively, Smith & Anderson, 2018). The same Pew Research Study found that a typical American uses multiple social media sites and the majority of Facebook and Instagram users access those sites at least once a day (with 46% of Twitter users doing so). The global ubiquity of smartphones and social media sites implies that an added benefit of studies like that presented here is possible expansion beyond typical populations studied in memory research.

There is little extra obligation required of participants in a study such as the current one. Quite deliberately, participants are not asked to take special notice of ongoing events or to record them in a daily diary or other technique. This point could be expanded even further by taking advantage of the passive data collection capabilities of the smartphone itself, like by using geolocation recording to cue memories by physical location. The effort required at retrieval is minimal – responding to questions on a smartphone (or similar device) and those demands can be modulated by the experimenter. Here, in the interests of keeping the instrument as brief and unobtrusive as possible, I did not ask about the phenomenological experience of remembering. However, there is no reason that rating-scale questions about vividness, reliving, psychological distance, confidence, and innumerable other features of autobiographical recollection could not be incorporated in a study like this. Recent work has differentiated belief in the occurrence of events, the detailed recollection of those events, and belief in the accuracy of the recollections (Scoboria et al., 2015). Examining these constructs in more ecologically valid settings would be an important contribution to applied memory research.

Similarly, I recorded only brief descriptions of changes to ongoing mood and behaviour, but lengthier qualitative data could be captured, if desirable. There are some potential privacy concerns, but none exceed those of using social media sites generally. Participants would need to grant the app access to their online data, but the privacy policies of apps like Timehop are publicly available and any other concerns would be addressed via typical informed consent procedures. My subjective impression is that compliance and persistence rates will be high as long as frequency and length demands are reasonable. Further, my subjective experience of recollection in response to Timehop cues was similar to that of ordinarily recalling autobiographical memories in daily life by incidental reminders via photographs, conversations, or other cues and was, therefore, generally pleasant. Whether or not social media per se is of interest to the investigator, the functional use of social media for sharing personally experienced events makes them a fertile testing ground for autobiographical memory hypotheses. Wang and colleagues (2017) found that self-reported posting of the event to social media increased the likelihood of recalling personal events as recorded in a daily diary after delays of one and two weeks. Reminiscence technologies like Timehop can confirm prior posting, increase the delay interval, and, potentially, examine recall at the level of which event components were shared vs. unshared. Social media sites generally allow for the modern replication of diary-type studies with large numbers of participants with lengthier delays. These publicly available, temporally-coded “diaries” are still selective (as were the events recorded by previous diarists) but they are not recorded with the intent to recall nor with any expectation of subsequent rehearsal. I

hope that my more ambitious colleagues will go beyond self-experimentation to include large-scale studies of public remembering. Similarly, I hope to inspire more creative, novel questions about the functions of social media to remembering and of autobiographical remembering to social media.

Notes

1. To clarify, these features are a relatively late addition to the social media landscape and, although rather ubiquitous now, at the time this study was undertaken they were relatively novel. Therefore, any postings made to social media prior to the advent of these services could not have been posted with the intention of their use for future reminders; that may no longer be true.
2. Since Timehop presents reminders from at least one year ago, Twitter reminders were only available during the last two months of data collection.

Disclosure statement

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References

- Back, M. D., Stopfer, J. M., Vazire, S., Gaddis, S., Schmukle, S. C., Egloff, B., & Gosling, S. D. (2010). Facebook profiles reflect actual personality, not self-idealization. *Psychological Science*, 21(3), 372–374. <https://doi.org/10.1177/0956797609360756>
- Bartlett, F. C. (1932). *Remembering: An experimental and social study*. Cambridge University Press.
- Bauer, P. J. (2015). A complementary processes account of the development of childhood amnesia and a personal past. *Psychological Review*, 122(2), 204–231. <https://doi.org/10.1037/a0038939>
- Berntsen, D. (1998). Voluntary and involuntary access to autobiographical memory. *Memory*, 6(2), 113–141. <https://doi.org/10.1080/741942071>
- Berntsen, D. (2012). Spontaneous recollections: Involuntary autobiographical memories are a basic mode of remembering. In D. Berntsen, & D. C. Rubin (Eds.), *Understanding autobiographical remembering: Theories and approaches* (pp. 290–330). Cambridge University Press.
- Berntsen, D., Staugaard, S. R., & Sørensen, L. M. (2013). Why am I remembering this now? Predicting the occurrence of involuntary (spontaneous) episodic memories. *Journal of Experimental Psychology: General*, 142, 426–444. <https://doi.org/10.1037/a0029128>
- Berry, E., Kapur, N., Williams, L., Hodges, S., Watson, P., Smyth, G., Srinivasan, J., Smith, R., Wilson, B., & Wood, K. (2007). The use of a wearable camera, SenseCam, as a pictorial diary to improve autobiographical memory in a patient with limbic encephalitis: A preliminary report. *Neuropsychological Rehabilitation*, 17(4–5), 582–601. <https://doi.org/10.1080/09602010601029780>
- Bluck, S., Alea, N., Haberman, T., & Rubin, D. C. (2005). A tale of three functions: The self-reported uses of autobiographical memory. *Social Cognition*, 23(1), 91–117. <https://doi.org/10.1521/soco.23.1.91.59198>
- Brindley, R., Bateman, A., & Gracey, F. (2011). Exploration of use of SenseCam to support autobiographical memory retrieval within a cognitive-behavioural therapeutic intervention following acquired brain injury. *Memory*, 19(7), 745–757. <https://doi.org/10.1080/09658211.2010.493893>
- Burt, C. D. B. (1992). Retrieval characteristics of autobiographical memories: Event and date information. *Applied Cognitive Psychology*, 6(5), 389–404. <https://doi.org/10.1002/acp.2350060504>
- Burt, C., Kemp, S., & Conway, M. (2004). Memory for true and false autobiographical event descriptions. *Memory*, 12(5), 545–552. <https://doi.org/10.1080/09658210344000071>
- Burt, C. D. B., Kemp, S., & Conway, M. (2001). What happens if you retest autobiographical memory 10 years on? *Memory & Cognition*, 29(1), 127–136. <https://doi.org/10.3758/BF03195747>
- Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autobiographical memories in the self-memory system. *Psychological Review*, 107(2), 261–288. <https://doi.org/10.1037/0033-295X.107.2.261>
- Crovitz, H. F., & Schiffman, H. (1974). Frequency of episodic memories as a function of their age. *Bulletin of the Psychonomic Society*, 4(5), 517–518. <https://doi.org/10.3758/BF03334277>
- Demiray, B., Mischler, M., & Martin, M. (2019). Reminiscence in everyday conversations: A naturalistic observation study of older adults. *Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, 74(5), 745–755. <https://doi.org/10.1093/geronb/gbx141>
- Doherty, A. R., Pauly-Takacs, K., Caprani, N., Gurrin, C., Moulin, C. J. A., O'Connor, N. E., & Smeaton, A. F. (2012). Experiences of aiding autobiographical memory using the SenseCam. *Human-Computer Interaction*, 27, 151–174. <https://doi.org/10.1080/07370024.2012.656050>
- Finley, J. R., Brewer, W. F., & Benjamin, A. S. (2011). The effects of end-of-day picture review and a sensor-based picture capture procedure on autobiographical memory using SenseCam. *Memory*, 19(7), 796–807. <https://doi.org/10.1080/09658211.2010.532807>
- Forest, A. L., & Wood, J. V. (2012). When social networking is not working: Individuals with low self-esteem recognize but do not reap the benefits of self-disclosure on facebook. *Psychological Science*, 23(3), 295–302. <https://doi.org/10.1177/0956797611429709>
- Goddard, L., Pring, L., & Felmingham, N. (2005). The effects of cue modality on the quality of personal memories retrieved. *Memory*, 13(1), 79–86. <https://doi.org/10.1080/09658210344000594>
- Greenberg, D. L., & Rubin, D. C. (2003). The neuropsychology of autobiographical memory. *Cortex*, 39(4–5), 687–728. [https://doi.org/10.1016/S0010-9452\(08\)70860-8](https://doi.org/10.1016/S0010-9452(08)70860-8)
- Hansen, A. (2017). *Reminiscence in open air museums: Results from the erasmus+ project active ageing and heritage in adult learning*. Jamtli Förlag.
- Haque, S., & Conway, M. A. (2001). Sampling the process of autobiographical memory construction. *European Journal of Cognitive Psychology*, 13(4), 529–547. <https://doi.org/10.1080/09541440125757>
- Harris, C. B., O'Connor, A. R., & Sutton, J. (2015). Cue generation and memory construction in direct and generative autobiographical memory retrieval. *Consciousness and Cognition*, 33, 204–216. <https://doi.org/10.1016/j.concog.2014.12.012>
- Harris, C. B., Rasmussen, A. S., & Berntsen, D. (2014). The functions of autobiographical memory: An integrative approach. *Memory*, 22(5), 559–581. <https://doi.org/10.1080/09658211.2013.806555>
- Johannessen, K. B., & Berntsen, D. (2010). Current concerns in involuntary and voluntary autobiographical memory. *Consciousness and Cognition*, 19(4), 847–860. <https://doi.org/10.1016/j.concog.2010.01.009>
- Kim, C., & Lee, J. K. (2016). Social media type matters: Investigating the relationship between motivation and online social network heterogeneity. *Journal of Broadcasting & Electronic Media*, 60(4), 676–693. <https://doi.org/10.1080/08838151.2016.1234481>
- Lee-Won, R. J., Shim, M., Joo, Y. K., & Park, S. G. (2014). Who puts the best “face” forward on facebook?: Positive self-presentation in online social networking and the role of self-consciousness, actual-to-total friends ratio, and culture. *Computers in Human Behavior*, 39, 413–423. <https://doi.org/10.1016/j.chb.2014.08.007>

- Linton, M. (1975). Memory for real-world events. In D. A. Norman, & D. E. Rumelhart (Eds.), *Explorations in cognition* (pp. 376–404). Freeman.
- Linton, M. (1978). Real world memory after six years: An in vivo study of very long term memory. In M. M. Gruneberg, P. E. Morris, & R. N. Sykes (Eds.), *Practical Aspects of memory* (pp. 69–76). Academic Press.
- Neisser, U. (1978). Memory: What are the important questions? In M. M. Gruneberg, P. E. Morris, & R. N. Sykes (Eds.), *Practical Aspects of memory* (pp. 3–24). Academic Press.
- Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, 349, 943. <https://doi.org/10.1126/science.aac4716>
- Palombo, D. J., Alain, C., Söderlund, H., Khuu, W., & Levine, B. (2015). Severely deficient autobiographical memory (SDAM) in healthy adults: A new mnemonic syndrome. *Neuropsychologia*, 72, 105–118. <https://doi.org/10.1016/j.neuropsychologia.2015.04.012>
- Palombo, D. J., Sheldon, S., & Levine, B. (2018). Individual differences in autobiographical memory. *Trends in Cognitive Sciences*, 22(7), 583–597. <https://doi.org/10.1016/j.tics.2018.04.007>
- Peasapati, S. T., Schwanda, V., Schultz, J., Lepage, M., Jeong, S., & Cosley, D. (2010). *Pensieve: Supporting everyday reminiscence* (p. 2027). ACM Press.
- Rasmussen, K. W., & Berntsen, D. (2014). “I can see clearly now”: The effect of cue imageability on mental time travel. *Memory & Cognition*, 42(7), 1063–1075. <https://doi.org/10.3758/s13421-014-0414-1>
- Rasmussen, A. S., Johannessen, K. B., & Berntsen, D. (2014). Ways of sampling voluntary and involuntary autobiographical memories in daily life. *Consciousness and Cognition*, 30, 156–168. <https://doi.org/10.1016/j.concog.2014.09.008>
- Reinecke, L., & Trepte, S. (2014). Authenticity and well-being on social network sites: A two-wave longitudinal study on the effects of online authenticity and the positivity bias in SNS communication. *Computers in Human Behavior*, 30, 95–102. <https://doi.org/10.1016/j.chb.2013.07.030>
- Routledge, C., Arndt, J., Wildschut, T., Sedikides, C., Hart, C. M., Juhl, J., Vingerhoets Ad J. J. M., & Schlotz, W. (2011). The past makes the present meaningful: Nostalgia as an existential resource. *Journal of Personality and Social Psychology*, 101(3), 638–652. <https://doi.org/10.1037/a0024292>
- Rubin, D. C. (2006). The basic-systems model of episodic memory. *Perspectives on Psychological Science*, 1(4), 277–311. <https://doi.org/10.1111/j.1745-6916.2006.00017.x>
- Rubin, D. C., & Greenberg, D. L. (1998). Visual memory-deficit amnesia: A distinct amnesic presentation and etiology. *Proceedings of the National Academy of Sciences*, 95(9), 5413–5416. <https://doi.org/10.1073/pnas.95.9.5413>
- Scoboria, A., Talarico, J. M., & Pascal, L. (2015). Metamemory appraisals in autobiographical event recall. *Cognition*, 136, 337–349. <https://doi.org/10.1016/j.cognition.2014.11.028>
- Scoboria, A., Wade, K. A., Lindsay, D. S., Azad, T., Strange, D., Ost, J., & Hyman, I. E. (2017). A mega-analysis of memory reports from eight peer-reviewed false memory implantation studies. *Memory*, 25(2), 146–163. <https://doi.org/10.1080/09658211.2016.1260747>
- Selimbegović, L., Régner, I., Huguet, P., & Chatard, A. (2016). On the power of autobiographical memories: From threat and challenge appraisals to actual behaviour. *Memory*, 24(10), 1382–1389. <https://doi.org/10.1080/09658211.2015.1111908>
- Smith, M. E. (1952). Childhood memories compared with those of adult life. *The Pedagogical Seminary and Journal of Genetic Psychology*, 80(2), 151–182. <https://doi.org/10.1080/08856559.1952.10533620>
- Smith, A., & Anderson, M. (2018). Social media use in 2018. Pew Research Center. <http://www.pewinternet.org/2018/03/01/social-media-use-in-2018/>.
- St. Jacques, P. L., Conway, M. A., & Cabeza, R. (2011). Gender differences in autobiographical memory for everyday events: Retrieval elicited by SenseCam images versus verbal cues. *Memory*, 19(7), 723–732. <https://doi.org/10.1080/09658211.2010.516266>
- Talarico, J. M., LaBar, K. S., & Rubin, D. C. (2004). Emotional intensity predicts autobiographical memory experience. *Memory & Cognition*, 32(7), 1118–1132. <https://doi.org/10.3758/BF03196886>
- Taylor, K., & Silver, L. (2019). Smartphone ownership is growing rapidly around the world, but not always equally. Pew Research Center. <http://www.pewglobal.org/2019/02/05/smartphone-ownership-is-growing-rapidly-around-the-world-but-not-always-equally/>.
- Thomas, L., & Briggs, P. (2016). Reminiscence through the lens of social media. *Frontiers in Psychology*, 7, article 870. doi: 10.3389/fpsyg.2016.00870.
- Thompson, C. P. (1982). Memory for unique personal events: The roommate study. *Memory & Cognition*, 10(4), 324–332. <https://doi.org/10.3758/BF03202424>
- Utz, S. (2012). Social network site use among Dutch students: Effects of time and platform. In F. Comunello (Ed.), *Networked sociability and individualism: Technology for personal and professional relationships* (pp. 104–126). IGI Global. doi: 10.4018/978-1-61350-338-6.
- Uzer, T. (2016). Retrieving autobiographical memories: How different retrieval strategies associated with different cues explain reaction time differences. *Acta Psychologica*, 164, 144–150. <https://doi.org/10.1016/j.actpsy.2016.01.004>
- Uzer, T., & Brown, N. R. (2017). The effect of cue content on retrieval from autobiographical memory. *Acta Psychologica*, 172, 84–91. <https://doi.org/10.1016/j.actpsy.2016.11.012>
- Uzer, T., Lee, P. J., & Brown, N. R. (2012). On the prevalence of directly retrieved autobiographical memories. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 38(5), 1296–1308. <https://doi.org/10.1037/a0028142>
- van den Hoven, E., & Eggen, B. (2014). The cue is key: Design for real-life remembering. *Zeitschrift Für Psychologie*, 222(2), 110–117. <https://doi.org/10.1027/2151-2604/a000172>
- Wagenaar, W. A. (1986). My memory: A study of autobiographical memory over six years. *Cognitive Psychology*, 18(2), 225–252. [https://doi.org/10.1016/0010-0285\(86\)90013-7](https://doi.org/10.1016/0010-0285(86)90013-7)
- Walker, W. R., Vogl, R. J., & Thompson, C. P. (1997). Autobiographical memory: Unpleasantness fades faster than pleasantness over time. *Applied Cognitive Psychology*, 11(5), 399–413. [https://doi.org/10.1002/\(SICI\)1099-0720\(199710\)11:5<399::AID-ACP462>3.0.CO;2-E](https://doi.org/10.1002/(SICI)1099-0720(199710)11:5<399::AID-ACP462>3.0.CO;2-E)
- Wang, Q. (2013). *The autobiographical self in time and culture*. Oxford University Press.
- Wang, Q., Lee, D., & Hou, Y. (2017). Externalising the autobiographical self: Sharing personal memories online facilitated memory retention. *Memory*, 25(6), 772–776. <https://doi.org/10.1080/09658211.2016.1221115>
- Westerhof, G. J., & Bohlmeijer, E. T. (2014). Celebrating fifty years of research and applications in reminiscence and life review: State of the art and new directions. *Journal of Aging Studies*, 29, 107–114. <https://doi.org/10.1016/j.jaging.2014.02.003>
- White, R. (2002). Memory for events after twenty years. *Applied Cognitive Psychology*, 16(5), 603–612. <https://doi.org/10.1002/acp.819>
- White, R. T. (1982). Memory for personal events. *Human Learning*, 1(3), 171–183.
- White, R. T. (1989). Recall of autobiographical events. *Applied Cognitive Psychology*, 3(2), 127–135. <https://doi.org/10.1002/acp.2350030204>
- Wildschut, T., Sedikides, C., Arndt, J., & Routledge, C. (2006). Nostalgia: Content, triggers, functions. *Journal of Personality and Social Psychology*, 91(5), 975–993. <https://doi.org/10.1037/0022-3514.91.5.975>
- Williams, J. M. G., Healy, H. G., & Ellis, N. C. (1999). The effect of imageability and predicability of cues in autobiographical memory. *The Quarterly Journal of Experimental Psychology Section A*, 52(3), 555–579. doi:10.1080/713755828