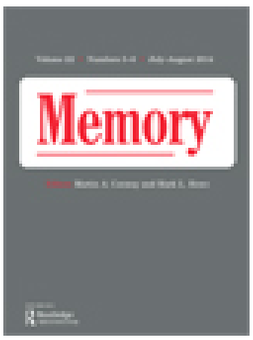

Memory

ISSN: 0965-8211 (Print) 1464-0686 (Online) Journal homepage: http://www.tandfonline.com/loi/pmem20

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To cite this article: Daniel L. Greenberg, Anthony J. Bishara & Marino A. Mugayar-Baldocchi (2017): Anchoring effects on early autobiographical memories, Memory

To link to this article: http://dx.doi.org/10.1080/09658211.2017.1297833

Published online: 28 Feb 2017.

MEMORY, 2017
http://dx.doi.org/10.1080/09658211.2017.1297833

Routledge
Taylor & Francis Group

Anchoring effects on early autobiographical memories

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ABSTRACT

Studies of childhood memory typically show that our earliest memories come from between three and four years of age. This finding is not universal, however. The age estimate varies across cultures and is affected by social influences. Research from the judgments and decision-making literature suggests that these estimates might also involve a judgment under uncertainty. Therefore, they might be susceptible to less social influences such as heuristics and biases. To investigate this possibility, we conducted two experiments that used anchoring paradigms to influence participants' estimates of their age during early autobiographical memories. In Experiment 1, participants answered either a high-anchor or a low-anchor question, and were warned that the anchor was uninformative; they went on to estimate their age during their earliest autobiographical memory. In Experiment 2, we replicated Experiment 1 and extended the design to examine additional early autobiographical memories. In both experiments, participants in the low-anchor condition gave earlier age estimates than those in the high-anchor condition. These results provide new insights into the methods used to investigate autobiographical memory. Moreover, they show that reports of early autobiographical memories can be influenced by a relatively light touch – a change to a single digit in a single question.

ARTICLE HISTORY
Received 28 November 2016
Accepted 16 February 2017

KEYWORDS
Autobiographical memory; anchoring effect; childhood amnesia; episodic memory

Take a moment to think back to the earliest event you can remember. How old were you at the time? If your answer falls somewhere around three and a half, you are in good company. Over the last 120 years, dozens of studies have posed this question, and the results have shown "remarkable consistency" (Nelson & Fivush, 2004, p. 486): On average, adults will report that they were somewhere between three and four years of age. The years before that seem lost to memory, an apparent mnemonic void known as childhood amnesia (see Bauer, 2007; Nelson & Fivush, 2004, for reviews and theoretical discussion).

This finding is one of the most reliable in the autobiographical memory literature, but there are exceptions. For instance, some cultures tend to report earlier autobiographical memories than others. Western participants typically report earlier memories than Asian participants (Mullen, 1994; Wang, 2001), and participants of Maori descent report earlier memories still (MacDonald, Uesiliana, & Hayne, 2000). These differences might arise from cultural variations in the ways in which parents reminisce with their children (see Bauer, 2007). Thus, the culture in which one is raised can affect the extent of childhood amnesia.

Experimental manipulations can have a similar effect. One study used social influences and visualisation techniques to encourage people to report earlier memories (Malinoski & Lynn, 1999). Initially, participants reported events from just over 3.5 years of age, which is in accordance with the literature described earlier. After a good deal of coaxing, however, the majority of participants claimed to remember their second birthday, and a sizable minority stated that they remembered events from their first year of life (see also Marmelstein & Lynn, 1999). In a related study, age estimates were affected by social pressure and conformity (Peterson, Kaasa, & Loftus, 2009). One group of participants listened to an experimenter and two confederates describe memories from age 2 or before. In contrast, the control group was simply asked to think about their earliest memory and then estimate the age at which it had occurred. On average, participants exposed to the social influences reported earlier memories than the control group did.

Kingo, Bohn, and Krøjgaard (2013) examined this topic from a different perspective. They noted that many studies of early autobiographical memory incorporate "warm-up" questions about other memories; these questions are intended to orient participants to the task and perhaps provide them with some additional contextual cues. Kingo and colleagues (2013) wondered whether these questions might induce the same social pressure and expectancy effects that previous studies had examined. They compared the effects of two different warm-up questions – one asking about memories from age 6, and the other asking about memories from age 3 – then asked about participants' earliest memories. They found

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that participants who received the age-3 warm-up question reported earlier memories.

Why are these age estimates susceptible to influence? As Friedman (1993) has noted, providing a date for an autobiographical memory is a challenging task. Dates are rarely encoded directly, and there is rarely a "time code" stamped on our memories; rather, participants must construct a time estimate by assessing a variety of other factors, including memory strength, overlapping memories, and contextual cues. Consequently, dating errors are common, and there are a number of famous examples. For instance, Freud's idea of the Oedipus complex was grounded in a memory of a train journey, but he was wrong about when it had happened; he remembered it as having occurred when he was about 2 years old, but it actually took place nearly a year and a half later (Breger, 2000). Overall, the dating of an autobiographical memory requires a judgment under uncertainty, and therefore might be affected by the heuristics and biases such as those examined in research on judgments and decision-making.

In particular, the anchoring effect (Tversky & Kahneman, 1974) occurs when participants are asked to estimate a number about which they are uncertain, such as the length of the Mississippi River. In the standard paradigm, participants are first asked whether the Mississippi River is longer or shorter than 3500 miles (with the number 3500 serving as the anchor) and then are asked to estimate the actual length. When experimenters vary the anchor across groups of participants, the mean estimate varies as well: Higher anchors tend to lead to higher estimates of the river's length (Simmons, LeBoeuf, & Nelson, 2010; also see Epley & Gilovich, 2005; Jacowitz & Kahneman, 1995; Mussweiler & Strack, 2000). Furthermore, the anchoring effect still occurs when participants are told that the anchor is uninformative (Simmons et al., 2010), suggesting that social influences and expectancy are not likely to be the underlying causes.

Numerous studies have demonstrated anchoring effects on semantic memories (e.g., judgments about trivial facts). However, we are aware of no study that has examined anchoring effects on autobiographical memories. Furthermore, it is hard to find examples of anchoring effects even for the broader category of episodic memories in general. To the best of our knowledge, there is only one existing report that comes close. In that report (Cheek, Coe-Odess, & Schwartz, 2015), participants showed anchoring effects on the number of puzzles or mazes that they had just seen, or the number of stairs that they had just climbed up. In each case, the numeric judgment was made moments after the event had occurred, and so it is unclear whether such judgments involved episodic or working memory representations (or both). Thus, if anchoring effects could be demonstrated on early autobiographical memories, it would suggest that anchoring effects generalise to a broader class of phenomena than previously considered.

In two experiments, we used an anchoring paradigm to try to influence participants' estimates of their own age during early autobiographical memories. In the first experiment, we asked about participants' *earliest* autobiographical memories, since these memories have been the focus of substantial previous research. In the second experiment, we replicated the first experiment and extended it to investigate other early autobiographical memories. Furthermore, we used the Linguistic Inquiry and Word Count (LIWC) programme to explore the possibility that the anchoring manipulation would have a detectable effect on the content of the memories. Critically, the anchoring manipulation is quite small relative to the other manipulations that have been used; it involves changing only a single digit in the anchoring question.

Experiment 1

Method

Participants

All testing was conducted using amazon.com's Mechanical Turk (MTurk; see Crump, McDonnell, & Gureckis, 2013, for discussion of its use in psychological research). In accordance with MTurk's policies at the time, participants had to be 18 or older and residents of the United States. Participants who completed the experiment received small financial compensation ($1 or less). Based on a pilot experiment, we determined that approximately 166 participants per group would be needed to be able to detect the difference between high- and low-anchor conditions with power of .90. When preliminary analyses (blind to condition) indicated that some participants were failing to complete the experiment, we increased the recruitment limit to the highest number possible with available project funds (206 per group). Note that the stopping rule was determined prior to unblinding of the anchor condition. Overall, 412 participants initially enrolled in the experiment. Eleven were excluded because they had participated in a previous version of the experiment. Thirteen were excluded because an examination of their IP addresses revealed that they appeared to be located somewhere outside the United States, and 69 were excluded because they failed to finish the experiment. An additional 2 were excluded for reporting that their earliest memory was from after the age of 10 (see Multhaup, Johnson, & Tetrick, 2005, for a similar cut-off). To prevent bias, all exclusion criteria were established while the researchers were blind to the anchor condition. Ultimately, 317 participants were included in the analyses. One hundred and thirty-two participants identified as female, 177 identified as male, 1 person identified as transgender, and 7 people did not report a gender. The mean age was 32.7 (SD = 10.5). All participants provided informed consent.

Procedure

The listing on MTurk stated that the task was to "answer a memory questionnaire" and "Remember certain events and answer several questions about them". Participants

who selected the study were taken to a welcome screen, which provided a similar description of the study but did not disclose the hypotheses. There were two anchoring conditions (one with the high anchor of 6 and the other with a low anchor of 1). We chose these anchors because they were equidistant from 3.5, which is the typical mean age of the earliest memory. Participants were pseudorandomly assigned to condition. After passing the welcome screen, participants were instructed that "numbers shown on the screen are not meant to be informative, and are not meant to be hints. The true numbers for you may be close to OR far from the numbers that you see on the screen". This warning about the uninformativeness of the anchor was adapted from Simmons and colleagues (2010).

These instructions were immediately followed by a screen with the anchoring question so that they would be unlikely to be forgotten. In the high-anchor condition, participants were asked "Think about your earliest memory. Was your earliest memory before or after age 6?" In the low-anchor condition, the question was the same, but the digit "6" was replaced with "1". Next, participants were asked to provide an exact numeric estimate of their age during their earliest autobiographical memory. After that, they were asked to type out a detailed description of that memory; they were encouraged to "try to be as specific as possible in regards to dates, times, etc.". Participants then answered a single 7-point Likert-type question from the Autobiographical Memory Questionnaire (Rubin, Schrauf, & Greenberg, 2003) that asked them whether they saw their memory from a third-person perspective or a first-person perspective, since previous research had suggested that earlier memories are more likely to be retrieved from a third-person point of view (see Rice & Rubin, 2009, for a review, but see West & Bauer, 1999, for an exception). The last section of the survey required answering demographic questions on gender and age. There was no time limit for the participants to answer any question.

Results

Table 1 provides the means and 95% confidence intervals for the data from both experiments. The left side shows the data from Experiment 1. Preliminary analyses revealed no significant effect of participant age or gender on the age estimates. An independent-samples *t*-test provided evidence for a significant difference between the high-anchor condition and the low-anchor condition, $t(315) = 3.52$, $p = .0005$, $\eta^2 = 0.04$. The ratings of first- versus third-person perspective did not differ between conditions, $t(315) = 0.79$, $p = .43$.

Table 1. Means [and 95% confidence intervals] for the age estimates of memories in Experiments 1 and 2.

	Exp. 1	Exp. 2		
	Earliest	Earliest	Vacation	Bicycle
Low anchor	3.6 [3.3, 3.8]	3.6 [3.3, 3.9]	6.3 [6.0, 6.5]	6.2 [5.7, 6.6]
High anchor	4.2 [3.9, 4.4]	4.3 [4.0, 4.7]	7.4 [7.0, 7.7]	7.8 [7.2, 8.3]

Discussion

In this experiment, participants were given either a high anchor or a low anchor, and were then asked to recall and date their earliest autobiographical memory. Participants in the high-anchor condition gave later estimates than those in the low-anchor condition. The difference was about 6 months – comparable to the effects of growing up in an Asian culture instead of a Western culture (Wang, 2001).

Thus, Experiment 1 showed that the anchoring manipulation could affect the age at which participants estimated their earliest autobiographical memory to have occurred. The very earliest memory is of particular interest because it has been the focus of substantial theorising and investigation. Yet, by definition, each participant can have only one such memory. Moreover, as Pillemer and White (1989) and Kingo and colleagues (2013) have noted, asking for participants' very earliest memory is a bit peculiar because it requires the participant to engage in an unusual sort of search. Therefore, in Experiment 2, we extended the design by including other early autobiographical memories: earliest memories of riding a bike without training wheels and of going on vacation, in addition to the very earliest memory, as in Experiment 1. We hypothesised that anchors would affect age estimates for all three of these memories given that each involves a judgment under uncertainty. Additionally, we explored the content of the retrieved memories by using the LIWC programme (Pennebaker, Booth, & Francis, 2007).

Experiment 2

Method

Only methodological differences relative to Experiment 1 are reported here.

Participants

Initially, 1141 people enrolled in the experiment. Of these, 28 participants were excluded because an examination of their IP address revealed that they appeared to be located somewhere outside the United States, and 319 were excluded because they failed to finish the experiment. An additional 2 participants were excluded for reporting a memory from after the age of 18, and 4 were excluded for failing to report an age. Ultimately, data from 788 participants were included in the experiment. Three hundred and forty-three participants identified as female, 413 identified as male, 1 identified as genderqueer, and 31 participants did not report a gender. The mean age was 36.2 (SD = 11.0).

Design and procedure

Participants were pseudorandomly assigned to one of three memory conditions. In one memory condition, they were asked about their earliest autobiographical memory, just as in Experiment 1. In the other two conditions, they were asked about other early memories – their earliest memory of riding a bicycle without training wheels, and their earliest memory of a vacation. Within each memory condition, participants were pseudorandomly assigned to the high-anchor or the low-anchor condition. In this experiment, the high anchor was 10 and the low anchor was 1 for all three memories. These anchors were chosen based on pilot testing, which showed that the earliest memories of bike riding and vacation typically came from before age 10. Thus, the experiment had a 3 × 2 design (Memory [earliest, bicycle, vacation] × (Anchor Height [1, 10]).

After participants answered the anchoring question, they provided an exact numeric estimate of their age during the memory. Next, participants were asked to provide a description of the memory. This portion of the instructions was the same across all memories. Participants were asked to try to be as specific as possible and to provide a specific time and place. They were instructed that they had to write for three and a half minutes and enter at least 250 words. The survey would not proceed until at least 250 words were entered. Participants were again asked about the perspective from which they saw their memories and then moved on to answer demographic questions.

Once data collection was complete, we used the LIWC program (Pennebaker et al., 2007) to analyse the content of the memories. First, in accordance with the LIWC manual, we examined the memories to correct misspellings, replace misused words (such as "there" for "their"), expand abbreviations and contractions, etc. (see Pennebaker et al., 2007). Second, to avoid problems with multiple comparisons, we focused on a handful of features that have been the subject of previous research on early memories. For instance, some evidence indicates that early memories have a greater number of negative terms than positive terms, so we tested for differences in the frequencies of positive and negative emotional terms. Other research has suggested that early and later memories differ in the amount of perceptual and visual information they contain (see Bauer, 2007, for a review), so we tested for differences in perceptual and visual terms (note that the latter is a subset of the former). In this way, we explored the possibility that the anchoring manipulation might affect the content of the memories.

Results

Table 1 presents the means and confidence intervals for each memory condition and anchor height. Again, preliminary analyses revealed no significant effect of participant age or gender on the age estimates. An overall 3 × 2 (Memory [earliest, bicycle, vacation] × (Anchor Height [1, 10]) analysis of variance (ANOVA) revealed a significant main effect of anchor height ($F(1, 782) = 45.86$, $p < .0001$, $\eta^2 = 0.04$) as well as a significant main effect of memory condition ($F(2, 782) = 141.74$, $p < .0001$). The Memory × Anchor Height interaction did not reach significance ($F(2, 787) = 2.41$, $p < .0909$, $\eta^{2\,=} 0.004$).

Next, we conducted a set of planned comparisons that examined each memory separately. For the earliest memory, participants in the low-anchor condition reported earlier memories than those in the high-anchor condition ($F(1, 248) = 9.14$, $p = .0028$, $\eta^2 = 0.04$). Similarly, for the memory of riding a bicycle without training wheels, participants in the low-anchor condition again reported earlier memories on average ($F(1, 270) = 22.22$, $p < .0001$, $\eta^2 = 0.08$). Finally, for the memory of a family vacation, the mean reported age in the high-anchor condition was once again higher than the age reported in the low-anchor condition ($F(1, 264) = 19.80$, $p < .0001$, $\eta^2 = 0.07$).

For the exploratory analyses, the distributions of the LIWC variables were highly non-normal, so they were dichotomised and used as dependent variables in a logistic regression analysis. There was no evidence that the anchoring manipulation had any effect on the frequency of positive words (Wald $\chi^2 = 0.005$, $p = .94$) or the frequency of negative words (Wald $\chi^2 = 1.418$, $p = .23$). There were trends towards more perceptual and visual words in the high-anchor condition, but neither trend reached significance (for perceptual words, Wald $\chi^2 = 3.318$, $p = .069$; for visual words, Wald $\chi^2 = 3.168$, $p = .075$).

General discussion

We conducted two experiments that used an anchoring paradigm to influence participants' estimates of their age during early autobiographical memories. In the first experiment, participants were given a high or low anchor, and were then asked to estimate their age during their earliest autobiographical memory. Participants in the low-anchor condition reported earlier age estimates than those in the high-anchor condition. In the second experiment, we replicated the first experiment and examined other early autobiographical memories as well. Once again, participants in the low-anchor conditions reported earlier age estimates. In both experiments, participants were warned that the anchor was uninformative, so the anchoring effect was not likely attributable to explicit social influences.

These experiments expand our understanding of the malleability of autobiographical memory. Previous studies used various forms of social influence, including peer pressure and the presence of an authority figure, to alter participants' age estimates (Malinoski & Lynn, 1999; Peterson et al., 2009). Another line of research has shown that cultural influences can have a similar effect (Wang, 2001). Here, we show that a subtler cognitive manipulation can influence these age estimates as well.

Anchoring effects have been most commonly demonstrated in studies of semantic memory (e.g., judgments about trivial facts). We are aware of only one study that examined anything along these lines (that is, memory for events that occurred at a specific time and place; Tulving, 1972). The study was designed to examine the effects of anchoring on participants' own recent behaviour (Cheek et al., 2015). In a series of experiments, participants were asked to solve some puzzles or climb some stairs. After completing the tasks, participants were asked a question about the number of puzzles they had completed or the number of stairs they had ascended. Participants' estimates were influenced by anchoring questions, with higher anchors leading to higher estimates. In that study, however, the interval between task and test was either very short or non-existent; in some experiments, only three filler questions separated the task from the test; in others, there was no intervening stimulus at all. While those experiments clearly demonstrated the effects of anchoring on self-relevant material, they did not clearly test episodic memory, and the memories they were probing were fairly trivial. Here, we advance upon this research by showing that consideration of an arbitrary number influenced one of the defining features of episodic memories – the temporal context. Thus, anchoring can influence participants' estimates of their age during remote, personally relevant autobiographical memories.

These findings also have methodological implications: They show that researchers need to pay careful attention to the way in which they ask for early memories. To be more specific, they suggest an alternative interpretation for the effects of "warm-up" questions on autobiographical memory (e.g., Kingo et al., 2013). As Pillemer and White (1989) noted, the typical earliest memory task might be a bit odd: Participants are simply asked to provide the desired memory without context, forewarning, or much else in the way of effective retrieval support. Researchers can avoid this problem by using a warm-up paradigm, in which participants are asked about memories from successively earlier periods, and then are finally asked about the earliest event they can remember. Kingo and colleagues (2013), however, suggested that this method might induce the expectancy effects or social pressures to which we referred earlier. To investigate this possibility, they compared the effects of two different warm-up questions. For one group, the warm-up question asked for a memory from before the age of 6; for the other, it asked for a memory from before the age of 3. Both groups were then asked to report their earliest memory and estimate the age at which the remembered event had occurred. On average, the age-3 group provided lower age estimates than the age-6 group did.

Kingo and colleagues (2013) suggested two possible explanations for these results. First, they proposed that retrieving one autobiographical memory might facilitate the retrieval of other autobiographical memories. Thus, participants who retrieved one early memory – say, from age 3 – might find it easier to recall other early memories from that period. Second, social expectation might play a role (as it did in the studies described earlier): The mention of a particular age (3 or 6) might lead the participant to believe that the experimenter expects more memories from that period.

Note the similarity to our anchoring paradigm. In both Kingo and colleagues' (2013) experiments and our own, seeing a number altered the age estimates that participants gave later on. Yet in our experiments, facilitated retrieval seems unlikely because each participant was asked to retrieve just one memory. The social expectation explanation also seems unlikely here given that we explicitly warned participants that the anchor was meaningless. (We cannot completely rule out the possibility that the anchor had an *unconscious* effect on social expectancies; however, even if it did, it would still have been a more subtle influence than the manipulations used in previous work.) Rather, we suggest that, in our experiments, simply *asking* the question could have affected the age estimates through the well-established anchoring effect. Direct comparisons of these conditions would help clarify the mechanisms at work, particularly in situations with warm-up questions, where multiple mechanisms may contribute to age estimates.

On the whole, then, our experiments provide new insights into several aspects of human cognition. They show that anchoring effects extend to a previously unstudied kind of judgment under uncertainty – namely, an individual's estimate of age during a particular episodic memory. Furthermore, these results expand our understanding of the malleability of autobiographical memory by showing that social manipulation is not necessary to alter these age reports. Rather, these estimates can be influenced by a relatively light touch – a change to a single digit in a single question.

Acknowledgements

The authors acknowledge Andrew N. Salvatore's work on the Qualtrics survey that was used in Experiment 2.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

D. L. Greenberg, A. J. Bishara, and M. A. Mugayar-Baldocchi acknowledge the generous support from the College of Charleston Office of Undergraduate Research and Creative Activities (SURF Grant SU2014-015 and AYRA Grant AY2015-005). The authors also acknowledge support from the Dean's Discretionary Fund in the School of Humanities and Social Sciences at the College of Charleston.

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