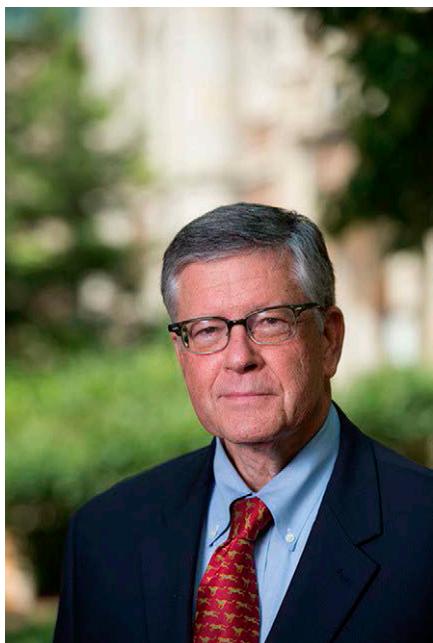




QnAs with Henry L. Roediger III

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Which is better for learning: Reading or taking a test? Surprisingly, cognitive psychologist Henry L. Roediger III says that for retaining information, testing yourself is often more effective than repeated studying. Roediger has spent nearly 50 years exploring how the human mind works, with a particular interest in learning and memory. Among the topics he investigates is false memory: When someone remembers an event differently from the way it occurred or, in the most extreme case, never happened. He also studies retrieval practice to aid learning, as well as collective memory, which describes how people in groups remember and identify with their shared past. A professor at Washington University in St. Louis, Roediger was elected to the National Academy of Sciences in 2017. He recently spoke with PNAS about his research inspirations, the imprecision of human memories, and collective memory, a phenomenon he explored in his Inaugural Article (1).



Henry L. Roediger III. Image courtesy of Joe Angeles (Washington University in St. Louis, St. Louis, MO).

older, I started marveling that I could do that, that I could keep memories fresh; you ask other people about things from when they were 5 years old or younger, and they don't remember much. I started wondering how memory works and why we remember some things and completely forget other things. And then, much to my surprise, when I began studying psychology, I found out that there's a whole field of people who study how memory works. So that piqued my interest in being a psychologist.

PNAS: For your Inaugural Article (1), why did you decide to examine collective memory?

Roediger: Collective memory is in the news every day. We talk about how we remember the past all the time. One example I like to use is the lead up to the Iraq War early this century. The people in the United States who wanted us to intervene said that stopping Saddam Hussein would be like stopping a new Hitler before he had the chance to conquer others, so they were invoking World War II. The people opposed to the war were saying that the invasion would create a new Vietnam; we would be going into a country where we have no pressing national interest. It would be an unnecessary war, just like Vietnam. In this case, both support and opposition of a policy caused policymakers to invoke the past. This happens repeatedly in history.

PNAS: What led to you to focus on World War II?

Roediger: I learned the American version of the story from my father, from the movies, from my textbooks, from everything in American culture. The story I always heard was how the United States won World War II. Yes, we had allies, but the way the story is told in the United States portrays our contributions as the deciding blows in both the European and Pacific theaters. And I believed that story up until maybe 10 years ago, when I had conversations with my colleague Jim Wertsch about how important the Russian contributions were in deciding the war. Wertsch, who was a coauthor on my Inaugural Article (1), had spent a lot of time in Russia and learned the country's point of view. In one study, he had asked

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high school students there to list the five most important events of the Great Patriotic War, what they call the period from 1941 to 1945, and when they did so, not one of them involved the United States (2). Basically, the students only listed events involving Soviet soldiers. We knew people from the United States would remember the war differently. This observation—that people of nations seem to remember the war in different ways—was the impetus for our study.

PNAS: What were the most interesting findings from your Inaugural Article (1)?

Roediger: We replicated Wertsch's result with Russians and found that there are indeed two strongly competing narratives of the war's victory. One surprise to me was that people from nine other countries produced data similar to those from the United States. When asked to list 10 critical events in the war, they usually produced events that conformed to the American story. In fact, people from every country we included in our study, except Russia, produced events like the attack on Pearl Harbor, D-Day, the Holocaust, and the dropping of atomic bombs. They didn't mention the Battle of Stalingrad or the Battle of Kursk, two events that historians agree were decisive in the war. Nor the final Battle of Berlin, when the Russians overcame heavy German resistance and entered Berlin, causing the Germans to surrender. I was surprised how even Chinese people, the Soviet's frequent ally after the war, produced events that represented the American version of the story of the war. I think there are two big takeaways from this study. One is that even allies in the same war have what we called national narcissism: People from most countries see events from their point of view, or their group's point of view, and usually they don't even realize it. The second takeaway is that somehow, probably through American media, an American version of that war has spread to most other countries, both on the Axis side and the Allied side.

PNAS: A different aspect of memory you have researched extensively is memory retrieval. Why is that important?

Roediger: We divide the stages of memory into encoding or initial learning, storage in the brain over time, and retrieval—bringing the information into consciousness when you need it. You learn something new, which changes your brain, and you form memory traces. Later, you must be able to retrieve that information to use it. We encode and store hundreds of experiences each day, and we can recall those for a short while. After that, we often need strong cues for retrieval. Part of my research has been about the process and aftereffects of retrieval. That is, retrieving

information enhances the probability that we will be able to retrieve it again later. And retrieval boosts the probability of future recall much more than studying the information (3).

PNAS: How does memory retrieval connect to your research on false memories?

Roediger: I helped develop paradigms to study false memories, and they are now widely used. In one paradigm, which I developed with Kathleen McDermott, we adapted a technique that James Deese used in the 1950s for other purposes (4). The paradigm involved lists of words all associated with a word that generated each list. One example is from the word *sleep*. The associated words are *bed, rest, tired, awake, dream, nap, drowsy*, and others. After the list of associated words is presented, participants are asked to recall the list immediately, only reporting words that they are absolutely sure they heard on the list. Yet people make errors by including the word *sleep* that generated the list but was not presented in it. For example, over 50% of the people recall the word *sleep* even though it was not on the list. These lists create false memories even when people are trying hard to avoid them. This type of false memory is self-generated, meaning no misleading information is involved, and it occurs immediately after presentation (5).

PNAS: Why is that?

Roediger: Our theory is that the words on the list are associated with the word *sleep*, and either consciously or unconsciously, the associations from the words are triggering the representation of the word *sleep*. And we found that the more the words on the list that are associated with the missing word, the more likely it is this phenomenon will occur. We also tested recognition memory where people are asked, "Did this word occur on the list you heard?" If you give people *sleep* during the recognition test, they'll report that they recognize it with about the same probability as they recognize words that actually were on the list, and with high confidence. The illusion is quite powerful.

PNAS: And the million-dollar question: What is the secret to remembering where you put your keys?

Roediger: While you're putting them down, stop and tell yourself what you just did. Pay attention. Don't just throw them somewhere. Then, a couple of minutes later, say or think, "Okay, this is where I put my keys." In other words, practice retrieving the information so you have it. Another tip to avoid the problem of remembering where your keys are: Always put them in the same place when you come into your home. That's what I do.

1 H. L. Roediger, 3rd et al., Competing national memories of World War II. *Proc. Natl. Acad. Sci. U.S.A.* **116**, 16678–16686. (2019).

2 J. V. Wertsch, *Voices of Collective Remembering* (Cambridge University Press, Cambridge, UK, 2002).

3 J. D. Karpicke, H. L. Roediger, 3rd, The critical importance of retrieval for learning. *Science* **319**, 966–968 (2008).

4 J. Deese, On the prediction of occurrence of particular verbal intrusions in immediate recall. *J. Exp. Psychol.* **58**, 17–22 (1959).

5 H. L. Roediger, K. B. McDermott, Creating false memories: Remembering words that were not presented in lists. *J. Exp. Psychol. Learn. Mem. Cogn.* **21**, 803–814 (1995).