Why we remember, and forget. And what we can do about it

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Andrew Budson and Elizabeth Kensinger tell us forgetting is a necessary part of the process and there's nothing wrong with using memory aids. Credit: Kris Snibbe/Harvard Staff Photographer

Neurologist Andrew Budson and neuroscientist Elizabeth Kensinger not

only explain how memory works, but also share science-based tips on how to keep it sharp as we age in their new book, "Why We Forget and How to Remember Better: The Science Behind Memory." The book came out Wednesday.

The Gazette interviewed Budson, M.D. '93, and Kensinger '98 about the neuroscience of memory and tips for improving our recall. This interview has been condensed and edited for length and clarity.

GAZETTE: What are the most common misconceptions about memory?

KENSINGER: One of the most common errors is in the metaphors that we use to talk about memory that imply that there is a memory that sits somewhere in the brain, like a file that we can retrieve without effort. Memory is an active and effortful process. Every time that we're bringing a past event to mind, we have to use effort to rebuild that memory. A second, related misconception is that there is such a thing as photographic memory, which is this ability to effortlessly remember everything that you just saw. It might be that it feels to us that we remember random things that we weren't trying to remember, but there are reasons why we remember them; we were enjoying a song that we were listening to, or we were thinking about how bizarre something was, and those feelings or thoughts allowed that content to get into memory.

The third thing is that many people think that forgetting is bad and that an optimal memory system is one where forgetting doesn't occur. Forgetting is important because if every time that we were trying to make a prediction about the future or understand what is going on right now, we had to sift through everything that's ever happened to us, it would be inefficient. There's tremendous utility in pruning because it allows us to use the pieces of our past that are most likely to be relevant

for understanding what's going on right now or what might happen tomorrow or next year.

GAZETTE: Why do we forget things?

KENSINGER: At the most basic level, we want to think about memory as having three different phases that must happen for us to have access to past content. The first is to get the information into memory, a process that is referred to as encoding. Then, you must keep that information around, and this is called storage or consolidation. It's akin to pressing the save button on the document that you've just created on your computer, but unlike that analogy with a computer, you must continually re-store that content in the brain. And then finally, you must be able to bring that information to mind in the moment that you need it. Memory failures can reflect errors at any of those different stages. One of the most common times when errors arise is in that initial encoding phase, where often what happens is that we're just not devoting enough effort or paying enough attention.

GAZETTE: How can we make sure we remember things we need to remember?

KENSINGER: Throughout the book we use the mnemonic device of FOUR, which stands for four critical things that we must do to get information encoded into memory. First, you must Focus attention; second, you must Organize the information, then you must Understand the information, and lastly, you need to Relate it to something else that your brain already knows. It's much easier said than done. Often, when someone says, "I went to a party, and I met all these people, and I don't remember any of their names," the breakdown was at that first stage, not paying enough attention. At the moment of retrieval, we can also have failures. Any student has experienced this, where they know the content,

but during an exam, they're not able to come up with it. Or you're looking at someone's face, you know this person's name, but right there in that moment, you're not able to retrieve it. In those moments, you want to avoid the urge to generate possible answers and instead use general retrieval cues such as thinking about the last time you saw that person, the context, and the possible connections.

GAZETTE: How can sleep, or lack thereof, affect our memory?

KENSINGER: When we're talking about storing the information so that we have longer-term access to it, getting enough sleep is one of the most important things that we can do. Sleep helps information to move from being briefly accessible to being stored in long-term ways, and it guides the transition from something we remember from a specific event, like remembering when the teacher said the boiling point of water was 212 degrees Fahrenheit, to a fact we just know.

BUDSON: Sleep is important to consolidate memories so that they can be retrieved later, but sleep is also at least theorized to help us flush away the amyloid beta protein, at night. This protein is thought to trigger Alzheimer's disease dementia. It is still an active area of research, but there is some good evidence that when we sleep, our brain cells and the synapses shrink a little bit, and it allows us to flush away this protein that accumulates during the day. No one knows exactly what the normal function of the amyloid protein is, but some people believe, and I'm one of them, that it is an important part of the brain's immune system that defends it against foreign invaders like bacteria, viruses, parasites, and fungi. Now, in addition to sleep, we know that to keep our brains healthy—and for good health in general—we need to eat right, engage in regular aerobic exercise, keep a healthy body weight, and be socially active.

GAZETTE: Sudoku or crossword puzzles? Which one helps keep our brain healthy and memory strong?

BUDSON: The short answer to that is that when you do computerized brain games or Sudoku, you get better at brain games and Sudoku, but that doesn't generally translate into overall brain function. Having said that, we know that when one engages in novel cognitively stimulating activities, there have been shown to be benefits. One study that came out recently looked at crossword puzzles compared to computerized brain training games, and they found that the people who did crossword puzzles did better. Crosswords may be something that's beneficial because they are always a bit different, and they require you to think about words and your knowledge in different and novel ways. But having healthy social interactions has been shown to be important. Our brains did not evolve to do crossword puzzles or computer games; they evolved in large part for social interactions. This is one of the reasons why staying socially active is so important. In summary, you must eat right, exercise, keep yourself cognitively stimulated, stay socially active, and sleep.

GAZETTE: How does memory change with aging?

KENSINGER: With aging that is not Alzheimer's disease or other pathological aging, memory annoyances are very common. We forget things like proper nouns; we can't think of someone's name; we can't think of the title of the book that we read last week. We also are more prone to forgetting some of the specifics, because with aging, there's a transition toward the brain prioritizing the gist of what happened. The brain embraces the similarities across events rather than trying to hold on to each individualized event. That can lead to a lot of memory frustrations, and it also can make us prone to some types of memory distortions or false memories where we think something happened, but it

was something slightly different. It's also important to point out that there are some upsides to this transition. It is thought that this tendency for the brain to recognize the similarities across events may be one of the contributors to what we think of as wisdom that comes with old age.

GAZETTE: Of the many tips to improve memory you share in your book, which has been the most helpful to you?

BUDSON: The first thing I would say is that there's nothing wrong with outsourcing your memory or using memory aids. Anybody who wants to remember a shopping list or an appointment that's coming up, write it down, put it in your phone or a planner; use reminders and calendars.

I offload my memory as much as possible. I have all my passwords written down in a secure digital place. I use calendars, planners, and lists. In terms of trying to remember things better, day to day, I work at trying to be present and pay attention to what I'm doing and trying to multitask less. When I park my car in a parking garage, I'm trying to be conscious of exactly what I'm doing. If I'm going for a run in an unfamiliar location, I'm really going to pay attention. I also work very hard to turn things into habits and routines as much as possible so that it'll just become automatic, a habit.

KENSINGER: I really like the FOUR mnemonic we came up with. That has helped me to think about all those different steps I need to take each time something is important for me to remember. I think the small mnemonics that we create in the moment are also helpful. For example, for passwords, I create a sentence so an alphanumeric code makes sense to me, and I can remember it over long periods of time. Those sorts of mnemonics that we're generating ourselves are powerful because they demand that you do those four things, and especially that you invest

effort in creating the memory. We've all had that frustrating moment where we don't know where we left our phones. For me, that is often an encoding failure because I set my phone down somewhere when I wasn't paying any attention. Now when I'm putting my phone down, I say it out loud: I'm putting my phone on the counter. It's a very simple strategy, but because it's simple, I remember to do it. You must focus your attention on those early actions to save yourself from those annoyances of forgetting later.

And lastly, one of the most important pieces of advice for students who are studying for a test is this: Do not cram. When you're staying up to study before the exam, you don't sleep. As we already talked about, sleep is important for consolidating memories. And, if you realize you don't understand something as you're pulling an all-nighter, there's often not enough time to build that understanding. Also, you want to be studying information in lots of different ways and in lots of different contexts. You don't just want to be studying in your dorm room or always at the same seat at the library; you want to study in lots of different places at lots of different times of day because all of that is going to help you remember the information. It is because of that variability, that need for sleep, and the time that it can take to reach understanding that it is important that students start their preparation early and keep it going ideally throughout the semester rather than cramming right before a big test.