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I can't imagine...

Brain damage that wipes out the past also takes out the future.

Kerri Smith

Imagine a day on the beach: the hot sand, warm sunshine and aquamarine waters. Easy for you and me. But near impossible for some amnesiacs, according to new research.

When Eleanor Maguire, a neuroscientist from University College London, UK, asked volunteers to imagine a fictional new experience, they had no trouble conjuring up detailed and enticing scenes of forests, castles or beaches. As a memory specialist, she wondered what would happen if she asked patients with amnesia, who have a well-established deficit in remembering their past experiences, to do the same thing.



It's just like being there... Some patients with brain damage find it hard to piece together an imagined scene.

They couldn't. For these patients, an imagined beach scene sounded like this: "As for seeing I can't really, apart from just sky... I can hear the sound of seagulls and of the sea... um.... the only thing I can see is blue."

Getty

"They really do live in the present — they can't richly imagine the past or future," Maguire says. She and her team report their results in *Proceedings of the Academy of Sciences*¹.

Mental time-travel

All the patients studied had damage to their hippocampus — a region of the brain that, in animals, has been shown to deal with space and navigation as well as memory. Damage here is the cause of most amnesia cases.

Why couldn't these patients imagine the future? The problem isn't that they can't imagine specific details, Maguire reports. Instead, they can't stick everything together into a coherent whole. They have the pieces of the puzzle, but can't put them together. This might be linked to the damaged brain area's spatial function, she says.

A handful of brain-imaging studies have addressed the hippocampal role in imagination over the past few years, says Dan Schacter, a psychologist at Harvard University in Cambridge, Massachusetts, who himself has been doing such work.

In a study soon to be published², Schacter found that the hippocampus was more active in normal volunteers when they were imagining future events, as opposed to remembering past ones. He argues that the hippocampus is playing an active role in pulling together bits and pieces of past experiences from throughout the brain, and stitching them together into an imagined future. With damage to the hippocampus, amnesic patients can no longer engage in vivid 'mental time-travel'.

Pieced together

Damage to the hippocampus shouldn't be classified as simple amnesia, argues Shayna Rosenbaum, a memory researcher from York University in Toronto, Canada. "It's not

amnesia we're talking about, but the integration of details from elsewhere in the brain," she says.

Rosenbaum's own research suggests that the inability to imagine the future isn't entirely due to the spatial problem of not being able to make a mental map.

Her investigations of an amnesic patient known as KC shows that he has more difficulty imagining future events that are plausible (such as a familiar event happening in a familiar location) than those that are implausible (such as a visit from a spaceship). This suggests that KC doesn't have trouble piecing together a mental picture, *per se*, but in gathering the fragments of memory with which to make the picture.

Maguire's team is now investigating ways of testing theories about the hippocampus, and looking into what other realms of thought and memory might need a spatial context to function properly.

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