

Study Finds That Sleep Selectively Preserves Emotional Memories

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As poets, songwriters and authors have described, our memories range from misty water-colored recollections to vividly detailed images of the times of our lives.

Now, a study led by researchers at Beth Israel Deaconess Medical Center (BIDMC) and Boston College offers new insights into the specific components of emotional memories, suggesting that sleep plays a key role in determining what we remember – and what we forget.

Reported in the August 2008 issue of the journal *Psychological Science*, the findings show that a period of slumber helps the brain to selectively preserve and enhance those aspects of a memory that are of greatest emotional resonance, while at the same time diminishing the memory's neutral background details.

“This tells us that sleep's role in emotional memory preservation is more than just mechanistic,” says the study's first author Jessica Payne, PhD, a Harvard University research fellow in the Division of Psychiatry at BIDMC. “In order to preserve what it deems most important, the brain makes a tradeoff, strengthening the memory's emotional core and obscuring its neutral background.”

Previous studies have established the key role that sleep plays in procedural memory, demonstrating that the consolidation of procedural skills (such as typing or playing the piano) is greatly enhanced following a period of sleep.

But sleep's importance in the development of episodic memories – in particular, those with emotional resonance– has been less clear.

“Emotional memories usually contain highly charged elements – for example, the car that sideswiped us on the ride home – along with other elements that are only tangentially related to the emotion, such as the name of the street we were traveling on or what store we'd just passed,” explains study author Elizabeth Kensinger, PhD, an Assistant Professor in the College of Arts and Sciences at Boston College. “We were interested in examining whether sleep would affect memory for all of these elements equally, or whether sleep might allow some of the event features to decay at a faster rate than others.”

The authors tested 88 college students. Study participants were shown scenes that depicted either neutral subjects on a neutral background (a car parked on a street in front of shops) or negatively arousing subjects on a neutral background (a badly crashed car parked on a similar street). The participants were then tested separately on their memories of both the central objects in the pictures and the backgrounds in the scenes. In this way, memory could be compared for the emotional aspects of a scene (the crashed car) versus the non-emotional aspects of the scene (the street on which the car had crashed.)

Subjects were divided into three groups. The first group underwent memory testing after 12 hours spent awake during the daytime; the second group was tested after 12 nighttime hours, including their normal period of nighttime sleep; and the third baseline group was tested 30 minutes after viewing the images, in either the morning or evening.

“Our results revealed that the study subjects who stayed awake all day largely forgot the entire negative scene [they had seen], with their memories of both the central objects and the backgrounds decaying at similar rates,” says Payne. But, she adds, among the individuals who were tested after a period of sleep, memory recall for the central negative objects (i.e. the smashed car) was preserved in detail.

“After an evening of sleep, the subjects remembered the emotional items [smashed car] as accurately as the subjects whose memories had been tested only 30 minutes after looking at the scenes,” explains Kensinger. “By contrast, sleep did little to preserve memory for the backgrounds [i.e. street scenes] and so memory for those elements reached a comparably low level after a night of sleep as it did after a day spent awake.”

“This is consistent with the possibility that the individual components of emotional scene memory become ‘unbound’ during sleep,” adds Payne, explaining that “unbinding” enables the sleeping brain to selectively preserve only that information which it calculates to be most salient and worthy of remembering. A real-world example of this tradeoff, she adds, is the “weapon focus effect” in which crime victims vividly remember an assailant’s weapon, but have little memory for other important aspects of the crime scene. Traumatic memories, such as the flashbacks experienced among individuals with post-traumatic stress disorder, can demonstrate similar disparities, with some aspects of an experience seemingly engraved in memory while other details are erased.

“Sleep is a smart, sophisticated process,” adds Payne. “You might say that sleep is actually working at night to decide what memories to hold on to and what to let go of.”