Memory links to 40 winks

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Sleep enhances our ability to remember to do something in the future, according to new research from Washington University in St. Louis.

(PhysOrg.com) -- When it comes to executing items on tomorrow's to-do list, it's best to think it over, then "sleep on it," say psychologists at Washington University in St. Louis.

People who sleep after processing and storing a memory carry out their intentions much better than people who try to execute their plan before getting to sleep. The researchers have shown that sleep enhances our ability to remember to do something in the future, a skill known as prospective memory.

Moreover, researchers studying the relationship between memory and sleep say that our ability to carry out our intentions is not so much a function of how firmly that intention has been embedded in our memories. Rather, the trigger that helps carry out our intentions is

usually a place, situation or circumstance — some context encountered the next day - that sparks the recall of an intended action.

These are the key findings from a study published online this month in Psychological Science of the relationship between memory and sleep. Researchers Michael Scullin, doctoral candidate in psychology, and his adviser, Mark McDaniel, PhD, professor of psychology in Arts & Sciences, are focusing on "prospective memory" — things we intend to do — as opposed to "retrospective memory" — things that have happened in the past.

Prospective memory includes such things as remembering to take a medication, buying a Mother's Day card or bringing home the ice cream for a birthday party. While the vast majority of sleep literature in psychology is devoted to retrospective memory, this study is the first foray into the relationship between sleep and prospective memory, the kind of memory we put to work every day. The findings, researchers say, offer important contributions to the understanding of the role sleep plays in cognition as well as memory.

Let's say that you intend to give a colleague a message tomorrow, McDaniel explains. Seeing the colleague the next day will be a strong cue for remembering to give the message. But, during the time your brain encoded the intention, you're also vaguely thinking of a meeting the two of you will attend the next afternoon. The context of the conference room is weakly associated with your intention to give the message even though you haven't really thought explicitly about associating the room with the message.

The Scullin/McDaniel study shows that sleep strengthens the weak association between the conference room (the context) and the delivery of the message (the intention). But sleep does little or nothing with the stronger association between the person and the message.

“We found that sleep benefits prospective memory by strengthening the weak associations in the brain, and that hasn’t been shown before,” Scullin says.

“One of the more provocative findings we have is that sleep didn’t strengthen the link between the explicit cue, which is the person, and the intention, rather it strengthened the weak association and the intention,” McDaniel says.

Here’s how they showed it:

The researchers tested four different groups each of 24 Washington University students. Two were control groups — one tested in the morning, the other in the evening — to eliminate the notion that the biological clock might play any role in memory function. Another group was prepped for tests in the morning then tested twelve hours later in the evening before getting to sleep. The fourth group learned the test routine in the evening, went home and slept, then were tested 12 hours later in the morning.

Participants were given instructions for three tests in this order and the tests later were given in blocks of 150 items in the same order: a living/non-living test, in which they decided if a word (cat, for instance, or skate) indicated a living or non-living entity; a lexical decision test, in which participants decided if a string of letters was a word or nonsense; and a semantic category test, in which a word was classified by participants into a category, baseball, for instance, in the category of sport.

After learning the last test, participants were told that in the midst of these ongoing tests — given to represent such everyday activities as driving, watching TV, listening to a teacher — the words table or horse would pop up on a screen, and when they saw them, they were to press

the “Q” button. This represented the prospective memory intention.

The researchers found that participants who tested in the morning following sleep overwhelmingly performed the prospective memory task better in the semantic category test, or context, than in the other two, and they found no such correlation in the group who tested sleepless.

The crux of the finding rests on the fact that the prospective memory instruction was given right after the semantic category practice. In this context, those who slept remembered the prospective memory intention better than in the other categories.

“Sleep promoted the remembering to do the prospective memory task when that one context was present, but not when some other context was present,” McDaniel says. “That’s because of temporal contiguity — the fact that the participants were told to hit that ‘Q’ button right after they were exposed to the semantic category context.

“The idea is that the semantic category test is weakly associated with the prospective memory intention — it’s weakly floating around in the mind and becomes weakly associated with the prospective memory test,” McDaniel says.

To return to the colleague and message analogy, because before sleeping you remembered you had a message to deliver to your colleague and you would see him in the conference room tomorrow, sleep enhances the likelihood that you will tell him in the conference room, but not in some other context, the office, elevator, the mail room, for example.

The researchers believe that the prospective memory process occurs during slow wave sleep — an early pattern in the sleep cycle — involving communication between the hippocampus and cortical regions. The hippocampus is very important in memory formation and

reactivation and the cortical regions are keys to storing memories.

“We think that during slow wave sleep the hippocampus is reactivating these recently learned memories, taking them up and placing them in long-term storage regions in the brain,” Scullin says. “The physiology of slow wave sleep seems very conducive to this kind of memory strengthening.”

More information: Paper: pss.sagepub.com/content/early/ … 956797610373373.full

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