Sleeping your way to an “A” using smell

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It is commonly known that sleep is an important biological process. It’s required for basic brain processing, maintaining good health, and preventing a range of disorders and diseases (US Dept of Health 2022). Sleep is also very important for facilitating memory consolidation. When we first create new memories, they are in a fragile state and susceptible to interference and deterioration. During memory consolidation, the fragile memory is strengthened via short- and long-term processes in which the memory is integrated with previous knowledge pathways in the brain, therefore making memory reactivation – the ability to remember or recall information – possible in the future. Since very little new information is taken in while we are sleeping, the time we spend asleep is when most of our memory consolidation occurs (Rasch and Born, 2013).

Even though our brains work very hard while we are sleeping to consolidate our memories, we often cannot consolidate all the information we received during the day, thus some is left to decay. The memories that are most likely to be consolidated are ones that hold personal or emotional importance, are connected to a reward, or ones that hold information we know we will need in the future (Jönsson and Pace-Schott, 2021).

Considering this restriction, is there a way to increase a memory’s chance of being consolidated so that we are more likely to remember the information in the future? A study by Vidal et al. (2022) explores the use of odor cues to increase memory reactivation in an academic setting. To examine if odor cues could be used to target memory reactivation and consolidation during sleep, the researchers tested if the presence of a specific odor during a school lesson and again during sleep led students to successfully consolidate their memories and remember more information.

In the experiment (Fig. 1a), high school students were given a history lesson by their teacher in the presence of a coconut odor and subsequently given a short-term exam about the information they just learned. Then, later that night, students were presented with the same coconut odor for the first 1.5 hours they were asleep, only on the first night. Finally, 8 days later, the students were given a long-term exam, different from the previous one but based on the same lesson, without the presence of the coconut odor.

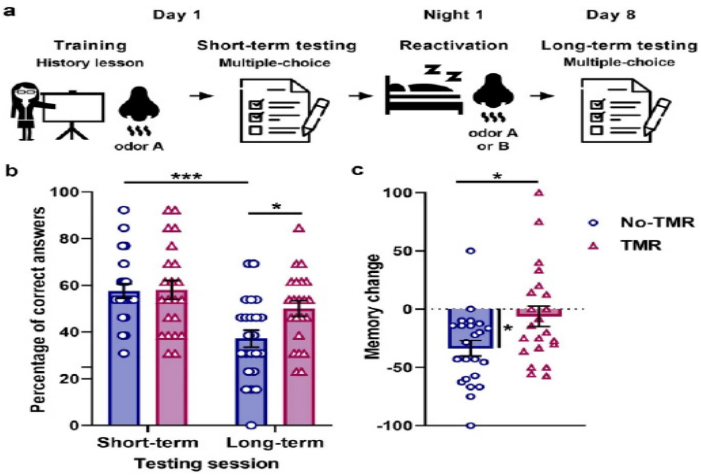

Figure 1. Experimental design, students presented with coconut odor cue during sleep (TMR group) answered significantly more questions correctly on long-term exam and had significantly less memory change than control (No-TMR) (Figure taken from Vidal et al. 2022).

The results from the Vidal et al. study show that the use of the odor cue significantly increases memory reactivation (Fig. 1b). Students who were presented with the same coconut odor during sleep as when they were given the history lesson scored significantly higher on the long-term exam than those in the control group (controls were presented with a different odor during sleep). Additionally, students who received the coconut odor during sleep had significantly lower memory change between their short-term exam on day 1 to their long-term exam a week later. Considering these results, this study suggests that odor cues can increase memory reactivation and therefore could increase the chance of a memory being consolidated.

Ultimately, the study by Vidal et al. (2022) shows that association between a specific odor and information presented during a school lesson is sufficient enough to increase the memory’s ability to be consolidated and later reactivated without the need for additional studying at home, provided that the odor presented during sleep is the same. Naturally, there are limitations to this method, such as ensuring the odor is the same during both presentations, and most importantly, ensuring the odor successfully dissipates after the lesson so that it is not reassociated with a following lesson.

Regardless, the findings of Vidal et al. (2022) suggest that there is a strong relationship between odor cues and memory reactivation and further solidify the importance of sleep for memory consolidation. These findings could help innovate the way we teach and relay information, while also highlighting the importance of a good night sleep for students.

References

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