How Much Are Our Brains Still Listening After We've Fallen Asleep?

By Paige Towers • June 23, 2016 at 11:51am

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We use the phrase “out like a light” to describe falling asleep. But the idea that we doze off like a switch — on one moment, off the other — isn’t quite accurate. The sleeping brain cycles through lighter and deeper stages of nonREM and REM sleep and back again, exhibiting varied levels and types of activity. It quiets down, but it never fully turns off.

So, if we want to keep chasing the light metaphor, it might be more apt to liken the brainatrest to a light panel with several, fluctuating dimmer switches. One of those switches concerns the brain’s connection to the outside world, which slides up and down over the course of a night. A new study,

published in the Journal of Neuroscience

, deepens our knowledge of when and how much the brain “listens” during sleep.

For decades, we’ve known that the sleeping brain is sort of on airplane mode — it mostly

ceases processing sensory information (light, sound, smells) so it can focus on other

tasks, such as memory consolidation, which is the conversion of new information into longterm memories. But, the sleeping brain doesn't go offline entirely. It engages with the outside world selectively, picking up intel (e.g., our names) when doing so might protect us from danger.

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The specifics of the brain's selective listening have been unclear — how much does it listen during different sleep stages, and what happens in the brain to let it listen. In the current study, researchers from École Normale Supérieure explored these questions through an experiment (a riff on something they'd done in 2009).

Eighteen participants listened to recordings of spoken words (e.g.,"knife" or "sparrow") and pushed buttons to classify each word as an animal or object. Participants began the experiment while they were awake, and the recordings continued to play during their sleep.

While participants stopped pushing buttons once they actually dozed off, EEG recordings revealed that their their brains prepared to respond to the sounds during light

nonREM sleep (stages 1 and 2). During REM sleep, their brains still prepared to respond, but only when they'd heard the words before they fell asleep. And, during deep (nonREM) sleep, researchers saw no buttonpushingrelated brain activity whatsoever.

According to lead study author Thomas Andrillon, their findings show that "the more complex brain activity is, the more we're able to respond to the environment in a complex manner."

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Based on observed activity patterns, researchers proposed brain mechanisms corresponding to levels of responsiveness in different sleep stages. It shouldn't be surprising that the brain stops listening during deep sleep — we know it's busy doing other things (like making sure we remember critical facts and experiences).

It's a little surprising that the brain partially stops listening during REM. Andrillon says the brain may process limited information during REM as a result of a localglobal conflict. Basically, only part of the brain wakes up in response to the

sound of thunder in the night sky, or your roommate's key opening the front door.

"Always listening can prevent the brain from resting and restoring its resources or circuits," said Andrillon. "Being able to switch off could also be a huge advantage. Thus, the optimality could be a tradeoff between listening and switchingoff."

And we know the brain is already busy during dreams. The precise purpose of REM mentation (dreams!) is up for debate, but prevailing theories say we dream to strengthen emotional memories and help us make connections between events and objects that our spacey waking brains would otherwise gloss over.

Regardless, the dreaming brain is too busy inventing stories about flying or showing up to work naked or whatever to deal with any predators that might be lurking about.