

Mind

How to take control of your dreams to boost learning and creativity

Dream engineers are developing technologies that can help you sleep more soundly and use your nighttime hours to your advantage - but there could also be a dark side

By [Emma Young](#)

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👤 DongQiu

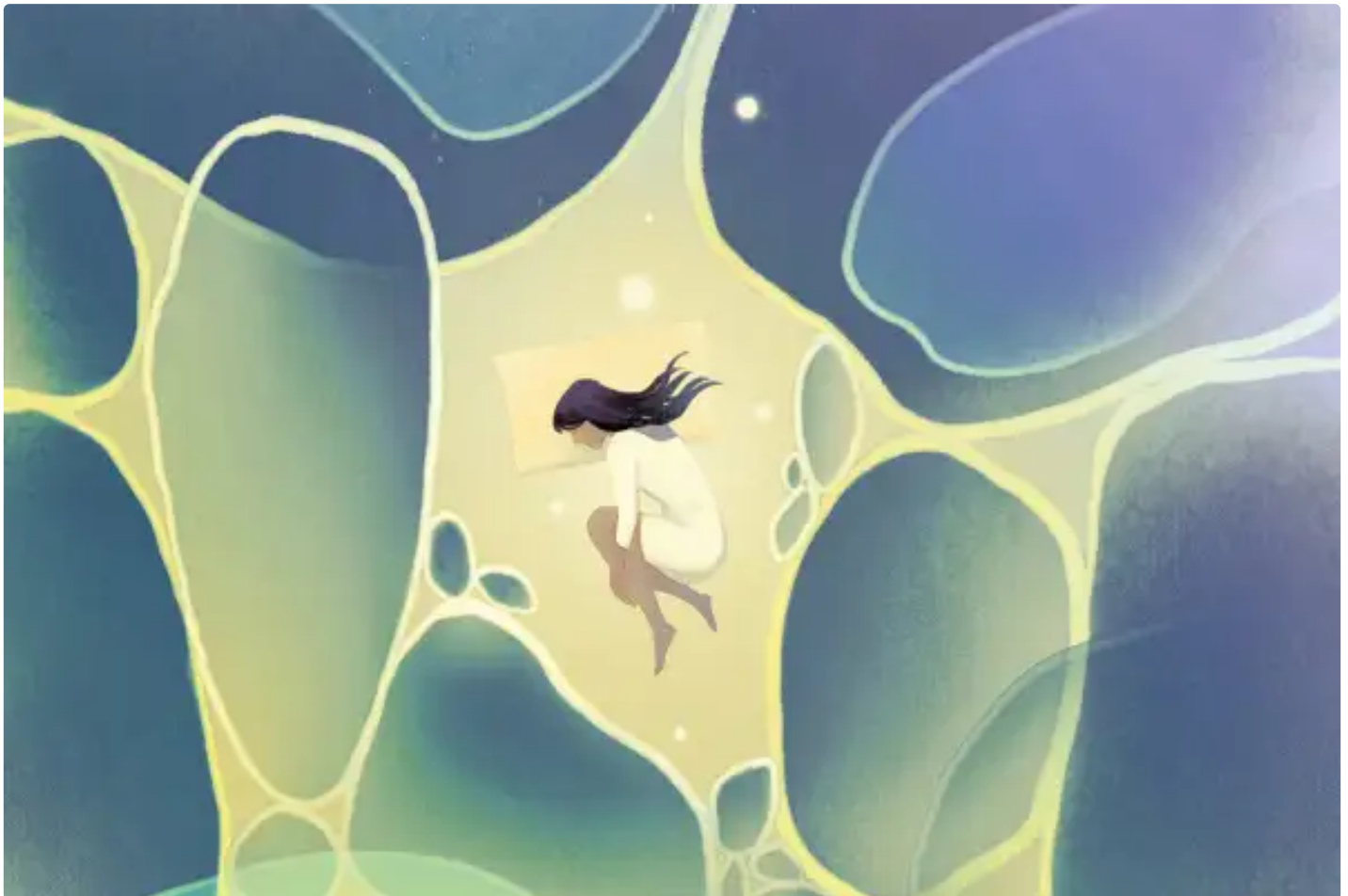
WHEN an ancient Egyptian sought an encounter with Bes, the god of fertility and childbirth, they would draw an image of the deity on their hand, wrap that hand and their neck with black cloth, and then settle down to sleep. This practice, described in a papyrus that dates to around 1350 BC, is the [earliest documented example](#) <http://www.dreamscience.ca/en/documents/New/content/incubation/Incubation/overview/for/website/updated.pdf> of the use of sensory stimulation to try to influence the content of a dream.

Three thousand years on, neuroscientists and psychologists are turning this ancient idea into something more scientific. Overturning long-held preconceptions about the disconnect between our brains and bodies during sleep, these “dream engineers” are using sounds, smells, touch and even bodily movements to influence the content of people’s dreams. In doing so, they have achieved striking benefits, from improving sleep quality and mood to boosting learning and creativity.

Better yet, the dream engineers are now developing dream-induction devices that can be used by anyone in their own home. This raises the prospect that we could all soon be harnessing our sleeping hours to our advantage. However, the power of these techniques on a resting mind is leading some, not least the researchers themselves, to worry about the potential for misuse. “I have no doubt that dream engineering could open many minds, heal others and help us to understand one another more clearly,” says [Adam Haar Horowitz](#) <https://www.media.mit.edu/people/adamjhh/overview/> at Massachusetts Institute of Technology. “It could also become an advertising gimmick. We have to proceed with caring and watchful eyes.”

Dream engineering isn't the same as lucid dreaming, where some people can become aware of their dream world and learn to direct the action. Psychologists have been interested in this [method of hacking dreams for over a century](#) </article/mg22029480-700-sleeping-daredevil-the-first-dream-hacker/>. But lucid dreaming is tough to master. What's more, it entails a level of conscious control by the dreamer, whereas manipulation through dream engineering doesn't. “It involves dialogue with a self we cannot access while awake,” says Haar Horowitz.

A desire to find a way to “talk” to this inner voice has inspired him and others to try to influence dreams without the dreamer's conscious awareness. Until recently, this seemed impossible because neuroscientists and psychologists thought that the brain was somehow disassociated from the rest of the body during sleep to prevent us from acting out our dreams. Now though, it is clear [this isn't the case](#) <https://philpapers.org/rec/WINPBD> – and that's where dream engineers come in. As they put it in one study, the body is a “[permeable barrier](#)” <https://www.sciencedirect.com/science/article/pii/S1053810020300325> that can be used to interface with the virtual world of dreams”.

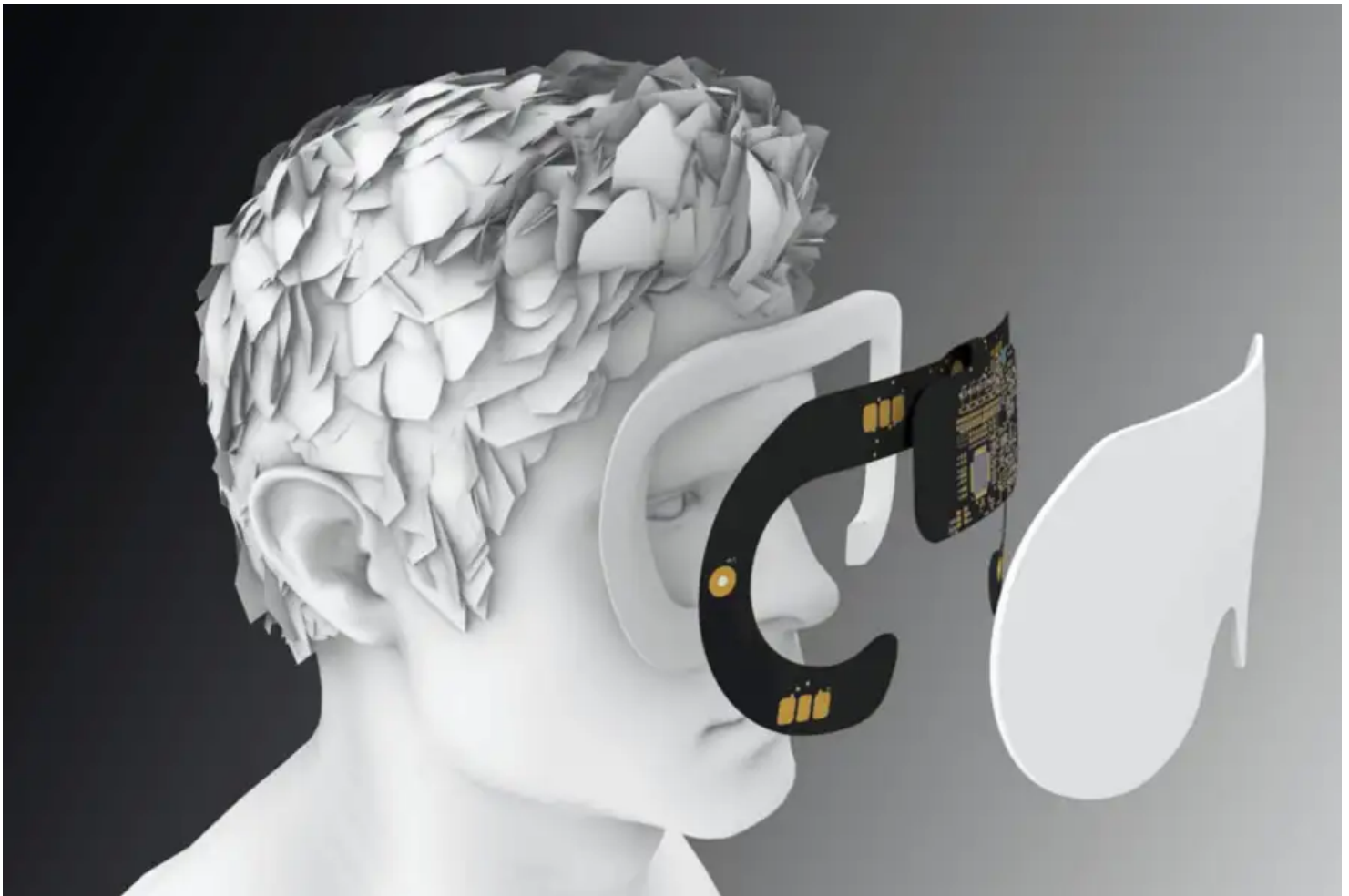


We are finally waking up to the causes of insomnia and how to treat it

Millions of people struggle with insomnia, but the sleep disorder is now a solvable problem – and the most effective therapy might involve your smartphone rather than sleeping pills

[/article/2339328-we-are-finally-waking-up-to-the-causes-of-insomnia-and-how-to-treat-it/](#)

Key to their ability to interface accurately is an improvement in knowledge about the patterns and functions of dreaming. This includes the recent realisation that dreams occur in all four stages of sleep, and that the style and typical content of them vary consistently between these stages. In the first, light stage, which represents the transition from wakefulness to sleep, we experience a state of mind called hypnagogia that Haar Horowitz describes as “trippy, loose, flexible and divergent”. The “microdreams” that happen during this stage are very brief and often integrate real events, such as the sound of a window slamming, with recent experiences and associated memories – so the sleeper might dream of a book falling, say, or of someone knocking on the door. Stage two, which plays a role in assimilating facts and learning from experiences, and stage three, or slow-wave sleep, in which memories are reorganised, were once believed to be devoid of dreams. Now, [studies of the sleeping brain have overturned this idea](#) <https://www.nature.com/articles/srep30932>. These dreams are, however, more prosaic and shorter than those in stage four, or rapid eye movement (REM) sleep. In stage three, for example, you might dream that you are eating a biscuit, whereas in stage four, a biscuit might be a vital part of a complex action plot in which you are leading an army against alien invaders.



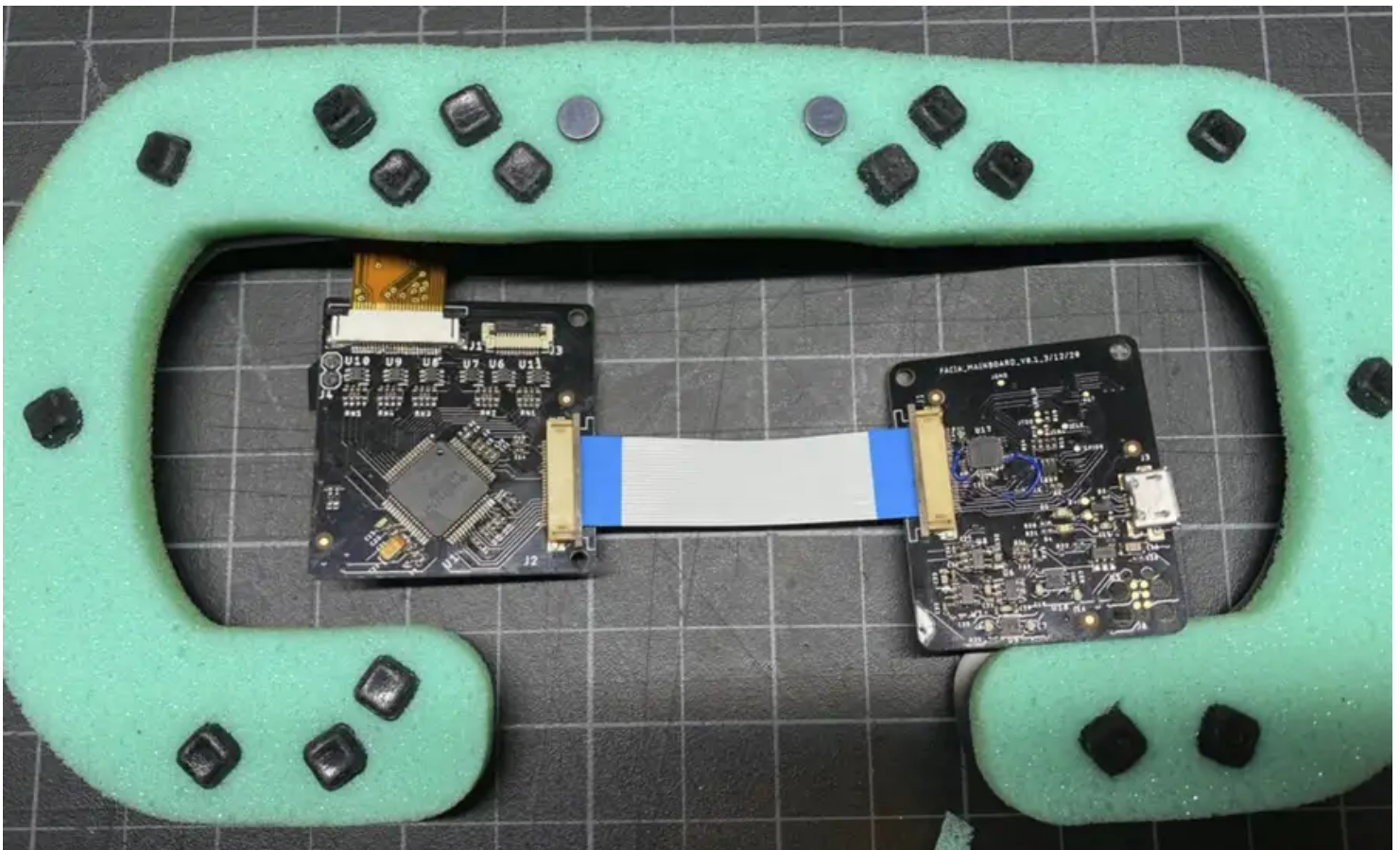
▲ **Fascia, which uses a face mask to detect your sleep stage, aims to improve sleep quality and enhance memory**

Guillermo Bernal, Walaa Alkhanaizi B.S. M.I.T., 2019

Early work on influencing dreams targeted experiences and interventions right before sleep. Conceptually, this wasn't far removed from the ancient Egyptian practice of focusing on Bes to conjure up a dream encounter with

him. Still, some of the results were impressive. In one study, when students were asked to think about a personal problem for 15 minutes before sleep, about [half reported having a dream that was related to their problem](https://psycnet.apa.org/record/1993-44179-001) <https://psycnet.apa.org/record/1993-44179-001> – and a majority of these believed that their dream contained a solution. A modern treatment for nightmares called imagery rehearsal therapy has a twist on this approach: people are advised to spend 5 to 10 minutes each night visualising a positive finale to a recurring nightmare before going to sleep – and studies show that this can [subsequently rewrite the ending](https://psycnet.apa.org/record/2010-06925-015) <https://psycnet.apa.org/record/2010-06925-015>.


Other dream engineers are targeting dreams during specific stages of sleep. One approach uses scent, inspired by research showing that when pleasant odours are wafted over people in REM sleep, on waking they report having had happier dreams. In the same way, unpleasant odours can foster unpleasant dreams. This is thought to happen as a result of the positive or negative emotions that are provoked by certain odours. One study exposed a group of smokers who wanted to quit to the smell of rotten eggs plus the smell of cigarettes during stage-two sleep. They went on to smoke [around 30 per cent fewer cigarettes](https://www.jneurosci.org/content/34/46/15382) <https://www.jneurosci.org/content/34/46/15382> on average the following week. A separate group exposed to the same odour combination while awake smoked just as many cigarettes as before.






▲ **An early prototype of Fascia, showing the main parts**




Guillermo Bernal, Walaa Alkhanaizi B.S. M.I.T., 2019



A slightly different method involves teaching people's brains to pair a particular sensory stimulus, such as an odour, with a learning task while they are awake, and then uses that same sensory cue to activate memories of the task during stage-three sleep. This technique, called targeted memory reactivation (TMR), seems to work by tricking the hippocampus, a region of the brain that is important for memory. By evoking what looks like a spontaneous reactivation of a memory in the cortex, it influences what the hippocampus replays during sleep – and so enhances learning of that material. Studies have found that TMR can [boost the learning of foreign vocabulary](https://pubmed.ncbi.nlm.nih.gov/27036946/) <https://pubmed.ncbi.nlm.nih.gov/27036946/> and [improve performance at a visuospatial task](https://pubmed.ncbi.nlm.nih.gov/27036946/) <https://pubmed.ncbi.nlm.nih.gov/27036946/>

<https://pubmed.ncbi.nlm.nih.gov/24456392/>. It can even help to [tackle implicit social biases](#) 
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4467959/>, as researchers at Northwestern University in Illinois found when they paired unusual sounds with specific aspects of training on race or gender bias, and then replayed these sounds during slow-wave sleep.

TMR can also help to [boost the effectiveness of imagery rehearsal therapy for treating nightmares](#) 
[https://www.cell.com/current-biology/fulltext/S0960-9822\(22\)01477-4?](https://www.cell.com/current-biology/fulltext/S0960-9822(22)01477-4?_returnURL=https://linkinghub.elsevier.com/retrieve/pii/S0960982222014774?showall=true)
[_returnURL=https://linkinghub.elsevier.com/retrieve/pii/S0960982222014774?showall=true](https://linkinghub.elsevier.com/retrieve/pii/S0960982222014774?showall=true). [Sophie Schwartz](#) 
<https://neurocenter-unige.ch/research-groups/sophie-schwartz/> at the University of Geneva in Switzerland and her colleagues recently [studied 36 people who regularly experience nightmares](#) 
<https://doi.org/10.1016/j.cub.2022.09.032>. All spent time envisaging a better end to their bad dreams before sleep, but half were also exposed to the sound of a piano chord every 10 seconds while they did this. At night, each person wore a headband containing electrodes to monitor their brain activity. When it registered that they had entered REM sleep, the same piano chord was played every 10 seconds until the REM period had finished. After two weeks, both groups had fewer nightmares, but the piano chord group had significantly fewer than the other group. Three months on, this benefit was still there. The researchers want to try the technique on nightmares linked to post-traumatic stress disorder.

“A large corpus of studies now demonstrates that TMR is both reliable and effective,” write Penelope Lewis at Cardiff University, UK, and [Daniel Bendor](#)  <https://www.ucl.ac.uk/pals/people/daniel-bendor> at University College London in [a recent paper on the technique](#) 
<https://www.sciencedirect.com/science/article/pii/S0960982219310358>.

Although the equipment used in many studies isn’t suitable for home use, new devices for a range of dream interventions are now emerging. A leading centre for such research is [Pattie Maes’s](#) 
<https://www.media.mit.edu/people/pattie/overview/> lab at MIT. There, [Guillermo Bernal](#) 
<https://www.media.mit.edu/people/gbernal/overview/> is developing a system called [Fascia](#) 
http://arinex.com.au/EMBC/pdf/full-paper_936.pdf, which comprises a sleep mask that collects sleep-stage data, plus a linked hub fitted with speakers, lights and an atomiser capable of releasing a variety of scents. A third element of the system collates and analyses signals from the sleeper in real time. The team hopes that Fascia will help people fall asleep faster, as well as improve overall sleep quality and boost memory consolidation.

Also at MIT, [Abhinandan Jain](#)  <https://www.media.mit.edu/people/abyjain/overview/> is working on a system called Somnia. It electrically stimulates the vestibular system in the inner ear, which tells the brain about the head’s position in space. In theory, vestibular stimulation could give dreamers sensations of movement, a bit like the way gamers use virtual reality to get an illusion of motion. It could therefore be used to “rock” someone to sleep without moving them, [improving sleep quality and enhancing memory](#)  [https://www.cell.com/current-biology/pdfExtended/S0960-9822\(18\)31662-2](https://www.cell.com/current-biology/pdfExtended/S0960-9822(18)31662-2). This is the current focus for Somnia.



▲ **Dormio, a wearable device that manipulates dreams through sound, has been shown to boost creativity**

Fluid Interfaces group, MIT Media Lab

Are you feeling sleepy?

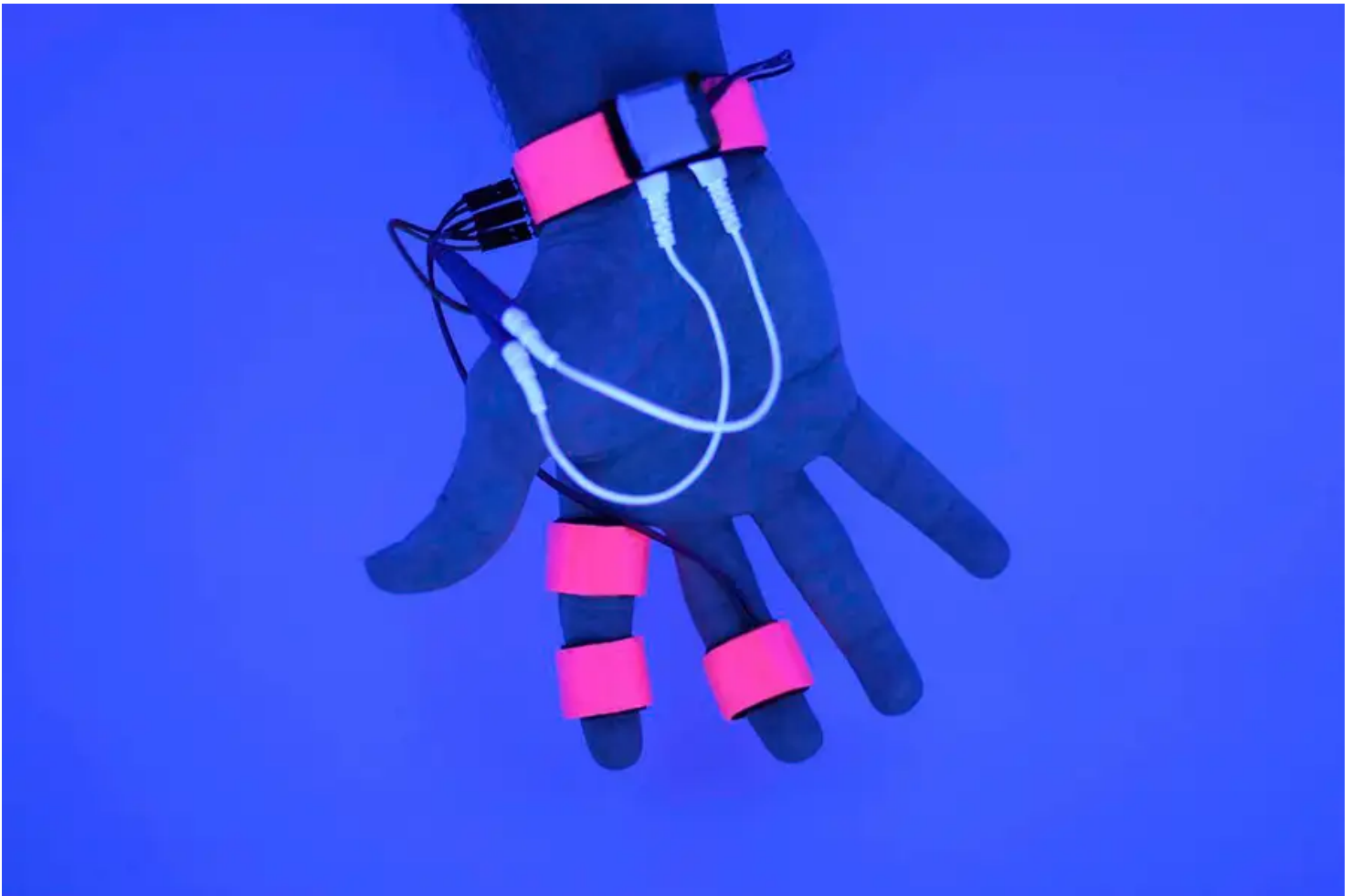
Technology that changes a person's body temperature may also soon find its way into dream engineering devices. Some VR headsets already contain tiny thermoelectric elements that trigger temperature sensations. These might be used to warm a person, helping them to fall asleep, and then cool them to enhance deep sleep. VR also sometimes employs haptic devices to give touch sensations, which the researchers at MIT have used to influence dreams. For instance, a pilot test found that activating an electrical, muscle-stimulating device on the calf during REM sleep led people to report limb-based sensations in their dreams, such as running.

Meanwhile, Haar Horowitz is developing his own sleep engineering wearable, [Dormio](#) 🔗

<https://www.media.mit.edu/projects/sleep-creativity/overview/>, along with a method of intervention called targeted dream incubation. Dormio is a glove-like device fitted with sensors that monitor the wearer's heart rate and muscle tone to detect when they have moved into the first stage of sleep. At this point, via a connection to a smartphone or computer, it triggers an audio recording to be played. Five minutes later, a second audio cue wakes the sleeper, who is asked to say what is on their mind, then allowed to fall back into stage-one sleep. This process can be repeated over and over.

[Initial research with the device](#) 🔗 <https://www.sciencedirect.com/science/article/abs/pii/S1053810020300416>, published in 2020, revealed that audio prompts of the word "tree" reliably led to stage-one, hypnagogic dreams that were related to trees. In 2023, Haar Horowitz, [Bob Stickgold](#) 🔗 <https://brain.harvard.edu/?people=robert-stickgold> at Harvard University and their colleagues reported a randomised controlled study that went further. As well as triggering tree-themed dreams (one participant remembered having arms made of old wood, for example),

the technique also enhanced creative thinking. After 45 minutes of targeted dream incubation, people did better on creativity tests relating to the topic of trees compared with others who had slept without any specific prompt or those who had stayed awake either thinking about trees or simply paying attention to their own thoughts. Psychologists have long sought reliable methods of boosting everyday creativity, and the researchers are excited about the potential of Dormio to do this. “It’s a game changer,” says Stickgold.



▲ **Dormio includes sensors worn on the hand that monitor your heart rate and muscle tone**

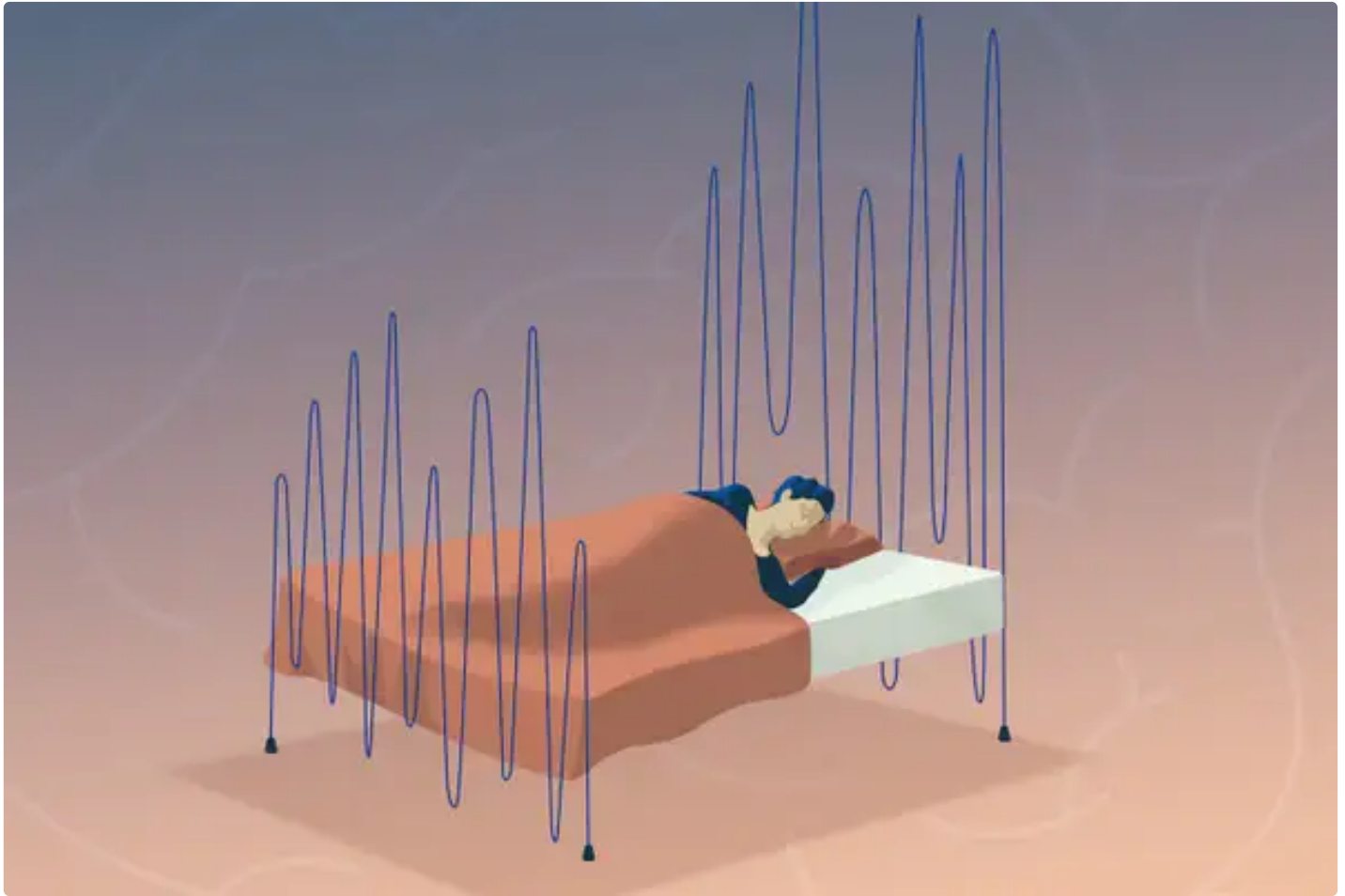
Oscar Rosello

Nevertheless, the idea that we can interact with a sleeping person’s brain to influence what they dream about and what they learn has some in the field feeling jittery. In 2018, a team of researchers in China reported that when participants were repeatedly played the name of a familiar snack, such as M&M’s, during the stage-two phase of a daytime nap, they [awoke feeling more positively about this snack](https://elifesciences.org/articles/40583) <https://elifesciences.org/articles/40583> than they did about others that hadn’t been named. This effect didn’t happen for people who were played the snack names while they were awake.

A few years later, an online advertising campaign by the Molson Coors Beverage Company said it had found that [viewers of a specially designed video](https://www.forbes.com/sites/robpegoraro/2021/01/27/this-beer-company-didnt-buy-a-super-bowl-ad-it-wants-into-your-dreams-instead/) <https://www.forbes.com/sites/robpegoraro/2021/01/27/this-beer-company-didnt-buy-a-super-bowl-ad-it-wants-into-your-dreams-instead/> could be induced to dream about Coors beer. This led to a group of 40 dream researchers, including Stickgold and Haar Horowitz, publishing an online letter in 2021 calling for the regulation of commercial applications of dream manipulation.

Despite the letter, Haar Horowitz has been approached by numerous businesses curious about how they might use dream incubation for commercial gain. In the meantime, other researchers have more closely examined that route. In 2023, Moran Cerf at Northwestern University published a paper titled [“Dream Marketing”](#) [https://www.newscientist.com/article/mg26134780-100-how-to-take-control-of-your-dreams-to-boost-learning-and-creativity/](#)

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4353051: A method for marketing communication during sleep and dreams". In it he wrote: "The method allows marketing researchers and practitioners to penetrate the sleeping brain and access the dreamer's thoughts with the goal of impacting subsequent awake behavior." It is this type of potential use that worries many in the field.



How to get a better night's sleep by hacking your brainwaves

Wearable technology that stimulates the brain to make you sleep more deeply promises to revolutionise your slumber – can it really lead to a better night's rest?

[/article/mg26034663-000-how-to-get-a-better-nights-sleep-by-hacking-your-brainwaves/](#)

The public letter urging caution also mentioned the possibility of nefarious agents targeting another person's dreams to generate feelings of sexual attraction, for example, or to influence political leanings. Asked how exactly it might influence attraction, Stickgold points to the possibility of an app installed on an unwitting owner's phone that might be set to say "sexy Bob" over and over once it has ascertained that the owner has fallen asleep. "Scarier still is [if] it says 'vote Trump'," he adds.

Another concern raised by some is that interfering with our dreams could disrupt the normal beneficial processes that accompany sleep, such as learning and removing detritus from the brain. Maes believes this is one reason why many people aren't already playing foreign vocabulary while they sleep, for example. When it comes to using our sleeping hours, "there are many promising methods out there, but these have not spread because both scientists and the public aren't willing to put their sleep at risk", she says.

Stickgold doesn't share these particular fears. He believes that the degree of control we are currently able to exert over the dreaming state is too small for us to worry about disrupting normal processes. Indeed, despite his other concerns, the future of dream engineering excites him. "I think the potential is real, and it's great," he says. "But the potential for abuse is real too."

Emma Young is a freelance journalist and author based in Sheffield, UK