This is a transcript of The Conversation Weekly podcast 'As we dream, we can listen in on the waking world,' published on February 15, 2024.

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Gemma Ware: We humans spend about a third of our lives sleeping. Most of us dream regularly, though some people remember their dreams more than others. But it turns out that scientists know surprisingly little about why or how we experience these dreams. Now, new research from a sleep lab in France has unlocked a way to find out more. They've been communicating with people as they dream.

I'm Gemma Ware, and this is The Conversation Weekly, the world explained by experts.

Today I'm joined by Lionel Cavicchioli, the Health and Medicine editor at The Conversation in France. Salut Lionel, it's great to have you on the show.

Lionel Cavicchioli: Hello Gemma, thank you for having me.

Gemma Ware: So, Lionel, today we're looking at a really fascinating story you've been working on, about how neuroscientists actually study our dreams. Tell me what drew you to this story.

Lionel Cavicchioli: Actually, I've always been fascinated by dreams. What is their function? What shaped them? Why do some people remember their dreams and others do not? And a few months ago, I stumbled upon very surprising results published in the scientific journal, *Nature Neuroscience*, by a team of French researchers. And these researchers, they just discovered that under certain conditions, it was possible to exchange information with dreamers.

Gemma Ware: This is amazing to me that you could actually talk to somebody in their dream. And I know you've been working with one of the researchers, Başak Türker. Tell me a bit about her and her team.

Lionel Cavicchioli: Yeah, Başak Türker is a postdoctoral researcher at Institut du Cerveau in Paris (Paris Brain Institute). And her lab is based at a hospital that helps people with sleep disorders. For example, their patients have narcolepsy, which is a sleep disorder that is characterized by irresistible sleep attacks that can occur at any time of the day. And she's using state-of-the-art imagery techniques in order to watch what is occurring in the brain of dreamers.

Gemma Ware: And they're also looking at lucid dreamers, aren't they? Tell me why they're so important to understanding what we already know about dreams.

Lionel Cavicchioli: Yeah, these people are quite special because, maybe you've already experienced this strange feeling in the middle of a dream, you suddenly realize that you are dreaming, and then often you wake up at this point. Well, this sensation is common for lucid dreamers. Actually, while sleeping and starting to dream, these people are aware that they are dreaming, always. Even more fascinating is that they are able to control, at least to some extent, what happens in their dreams. They can fly, they can make people appear, disappear, and these kinds of dreamers, of course, are very rare, but it turns out that many of them are also suffering from narcolepsy, and so Başak Türker, she had a lot of potential lucid dreamers in her lab.

Gemma Ware: Well, it's a fascinating area of research and we wanted to find out more about it. So I called up Başak to speak with her about what she'd been doing. And she told me that she actually sometimes has lucid dreams herself, but it wasn't actually that that drove her curiosity into dream research. It was that she was dreaming a lot.

Başak Türker: As a child, I would sleep like 13-14 hours and that was something normal. My parents were like, "Okay, she sleeps, it's okay."

Gemma Ware: But some of Başak's parents' friends didn't see it like that.

Başak Türker: One day we were at a vacation together and I woke up after 14 hours of sleep and they told me, "But Başak, you just spent 14 hours sleeping,

you're missing life. You should just, you know, wake up early and live life, you're just gonna live half of your life and it's horrible." And at first, I was like, "oh, they're right, like I'm not living life, I have to wake up earlier." But then I started thinking, well, they're saying this because probably they're not dreaming. Like for them, sleep is just you lay down, nothing happens, it's all black. And of course, you feel like you're missing out because you're not doing anything. But for me, each night I dream of so many things. I experienced so many stuff, and I remember them. So, I don't consider it as a missing life, but I actually experience stuff so that also counts as living.

Gemma Ware: It was Başak's interest in dreams that led her to become a neuroscientist, and she soon found out that dream research is actually really tricky.

Başak Türker: It's very hard to have objective measures of dreams. If you want to do research on dreams, you would need to wake people up and ask them, "Oh, what happened during the night?" But first of all, well, you have to trust the subjective report. They may forget some stuff, for example, and you will never access that information. And we don't have good neural markers that tells us when someone is dreaming. Even if they tell you, "Oh, I was just dreaming about this," you can never know when that dream occurred. It can be two seconds ago, two minutes ago, two hours ago because night is so long and you remember dreams but it's very hard to pinpoint it during the night.

Gemma Ware: This inability to determine when somebody was dreaming stymied sleep researchers for decades. Until the early 1980s, when two scientists, a psychologist called Keith Hearn and a psychophysiologist called Stephen LaBerge, hatched a brilliant plan.

Başak Türker: So sleep is not homogenous. We go through different sleep stages every night. And some sleep stages like REM sleep, so rapid eye movement sleep, is characterized by this paralysis or muscle atonia. So basically you cannot move your body. So, Keith Hearn and Stephen LaBerge thought, 'okay, so we're paralyzed in REM sleep that we know, but we also know that people tend to move their eyes.' So they thought, okay, so it looks like eyes are not paralyzed.' So what they did was to invite some lucid dreamers and told them, okay, if you realize that

you're lucid dreaming, try to remain in the dream and just look left, right, left, right, left, right. So do this eye movement, and we will put some electrodes next to your eye to follow your eye movement so we can get the signal. And this was the first time they showed that actually lucid dreaming was a real phenomenon because before we didn't have any objective proof, but this time we had people sleeping in the lab, having these lucid dreams and telling in real time that they were dreaming with these eye movements. So that was of course revolutionary for dream research, because suddenly now we can know when someone is dreaming.

Gemma Ware: So Başak and her colleagues knew that it is possible for lucid dreamers to send out information, while they're dreaming, using these eye movements. It's a window of communication with the outside world. But they wondered whether these lucid dreamers could actually also receive information while they were dreaming.

Başak Türker: We thought okay, so these lucid dreamers, they're conscious of their dreams. So their consciousness is, kind of, elevated compared to regular dreamers. So we thought maybe they would be also conscious of the environment in which they're sleeping, and maybe they would be able to get this information at the same time. So we recruited a lucid dreamer. Actually, this participant was a patient with narcolepsy, because it turns out patients with narcolepsy have a very great superpower which is having a lot of lucid dreams. So this is what we do actually in our lab, we recruit patients with narcolepsy because they're very good lucid dreamers.

Gemma Ware: They began their study with this one volunteer, a lucid dreamer who happened to be both a patient and an intern in the sleep clinic.

Başak Türker: So he gave us the idea. and he said I feel like I can maybe, like, contract some muscles on my face and I can record it and see it in real life. So we said okay let's try it on you, because you're a great lucid dreamer and if it works, it would work on you, definitely.

Gemma Ware: They connected their volunteer to electrodes to monitor his brain activity and ensure that he was actually asleep. Then, using the eye movement

technique from Hearn and LaBerge's research, that we heard about earlier, they asked him to inform them when he was lucid dreaming. That's when the fun began.

Başak Türker: We tried many stuff. First of all, we asked him some questions while he was sleeping. Yes-No questions. And we asked him to contract his facial muscles, so either corrugator or zygomatic muscles. So, when you smile and when you frown, these are the muscles that you would use. So we asked him to contract his muscles to say yes or no. And it was incredible because when we started the experiment it was a bit, you know, adventurous, but we didn't think that that would actually work. And while we were recording him, we were like, do you like chocolate? And we were looking at his muscle recording, and we started seeing these contractions.

Gemma Ware: So when you asked him, do you like chocolate, he, his muscles made to smile?

Başak Türker: Yeah, he smiled three times as we asked it. And when he's, when we asked, do you watch football, he frowned his eyes three times to say, no, I don't, I don't like it. And it was very funny because we woke him up after, and we asked him what happened during your sleep, tell us? So, he told us a bunch of stuff, his dreams, na na na, but he didn't tell us directly 'oh, also you asked me some questions and I answered. So, we were like, did he forget? So, we asked him "but do you remember some questions? We asked you some questions." And the moment we said it, he was like, "oh yeah, true, you asked me about the chocolate, the football," and I answered like this and the answer that he was giving actually matched the recording. So he was telling the truth.

Gemma Ware: It just didn't seem important like the dream was more important to him…

Başak Türker: Yeah of course.

Gemma Ware: …than the question.

Başak Türker: Yeah.

Gemma Ware: Bolstered by their early success, they tried seeing if their lucid dreamer would respond to touch as he slept.

Başak Türker: We also tried, for example, touching his hand different amount of times, one time, two times or three times, and we asked him, "well, if you feel some taps on your hand, contract your muscles as many times as you feel the taps," and he was also able to feel these taps and respond accurately to the tactile stimulation.

Gemma Ware: Başak and her colleagues were excited by their results, but the study only involved one person.

Başak Türker: So we were like, "Okay, one subject, it's nice, but clearly it can be an outlier you know it's just one person, doesn't mean anything."

Gemma Ware: Soon after, they attended a sleep research conference and it was there that they discovered that their study wasn't unique. Three other research groups, around the world, were conducting similar experiments also with one participant and finding similar results.

Başak Türker: Then we were like, okay if you found something, if we found something maybe this means something. So, this paper that we published in 2019 was a collaboration with these other research teams and also showed that, well, this might happen more often than we think, maybe our unique subject is not that unique.

Gemma Ware: Next, Başak and her colleagues in Paris decided to expand their research to include non-lucid dreamers. They also wanted to see if they could communicate with the lucid dreamers in stages of the sleep cycle other than REM sleep. So, they began a new study with two sets of participants, 27 with narcolepsy who had lucid dreams, and 22 healthy sleepers who weren't lucid dreamers.

Başak Türker: Participants would come in the morning, and we start by putting some electrodes on the surface of the skull to measure the brain activity. We call

this electroencephalography, so EEG. And this is the information that we use to decide if someone is sleeping or not. We also put some other captures on the eye and on the chin to see the muscle atonia if they're paralyzed or not, if they're moving their eyes. So after this installation, which takes almost one hour and a half, two hours, we bring them to the room, and we explain the experiment, what type of stimulus that we're going to use, what we're expecting from them, doing a little bit of training so that they're familiar with the task. And then we tell them, "okay, now we're gonna leave for 20 minutes. If you fall asleep, that's amazing. And during this period, we will present you some words that exist and some fake words that don't exist". For example, 'pizza' would be a real word and 'ditza' would be a non-existent word.

Gemma Ware: Participants were told that if they believed the sound they were hearing was a real word, they should contract their muscles to smile, and if it was fake, they should contract their muscles to frown.

Başak Türker: So, then we leave the room and they're lying down and falling asleep and we told them, like, start contracting while you're awake and if you continue hearing some voices while you're sleeping please keep responding by contracting your muscles.

Voice: Pizza, ditza, pizza, pizza, ditza!

Gemma Ware: They repeated this procedure five times with each patient and they were thrilled to see that it worked for the non-lucid dreamers.

Başak Türker: For healthy participants, we observed responses in most sleep stages. Only in deep sleep, we didn't see any responses, but in all the other sleep stages they were also able to respond. So we show that actually not only lucid participants, but non-lucid people, healthy people in most of the sleep stages can have this kind of response during sleep, and we can initiate communication with them.

Gemma Ware: They also found that the narcoleptic participants in the study, remember these were all lucid dreamers, were able to respond to stimuli during all

stages of sleep, not just REM sleep. Knowing that all sleepers can communicate during dreams, I had to ask…

So, this is something that someone could potentially test on themselves, I guess, could we?

Başak Türker: Yeah, like if you wanted to test it, you could maybe film your face with a camera during the night so that you can see the contractions. You can prepare maybe a sound that beeps, time to time, during the night and you can tell yourself, "Okay, if I hear the beep, I will contract one of my muscles," for example, and try to train, and maybe it wouldn't happen in the first time, but maybe one day you might actually manage to do it. The only problem is that normally we do this in the sleep lab because we want to make sure that people are sleeping. It can also happen that you feel maybe that you're asleep but actually you're not so much asleep. So, the only way to make sure that it is actually happening would be still track your brain activity in a sleep lab.

Gemma Ware: Why is this important? What are the advantages of being able to do this other than it's quite cool?

Başak Türker: First of all, scientifically, I think this can open an important line of research because now, if we can communicate with dreamers, not only we know when they're dreaming, but we can also ask them questions. So we can ask, "What are you seeing? Are you seeing faces? Are you outside? Are there any people?" and try to get Yes-No answers. Or maybe we can even develop a more complicated language actually, with different muscle contractions and combinations. And if we can have this dialogue, we can access, in real time, the dreams, which is very cool. And then, it would really facilitate research in dreams. So that's the scientific part. But I also see a lot of clinical implications. For example, there are a lot of people suffering from nightmares, recurrent nightmares. And if we could communicate with them, this is only a dream, this is only a nightmare, that would be a big relief for them. So, we can imagine different strategies for coping. These people during the night they can have a recording saying, "you're sleeping, you're sleeping." And if they could hear it while dreaming, that would be a huge relief.

Gemma Ware: Başak says her research could also help further our understanding of conditions like sleep misperception, in which people believe they've got insomnia when they have in fact slept.

Başak Türker: So these people, although they sleep, they feel like they're not sleeping, which is a very weird phenomenon. And maybe they have these moments of opening to world more often than other people. So they keep perceiving what's going on in the world. And maybe that's why they're convinced that they're not sleeping, but actually they're sleeping.

Gemma Ware: And more fundamentally, why do you think we have this ability to listen, receive, and communicate while we're dreaming?

Başak Türker: I can tell you one of my intuitions, which might be false, it's pure speculation, but for me, it would make sense that we have this ability to still process information coming from the world while sleeping and maybe respond to it, because, well, now we're sleeping in bed and everything is okay, but actually our ancestors were not in a nice bed. They were actually sleeping in a very dangerous environment and there were animals that could attack. They were in a very uncertain place when they were sleeping. So, for a brain that evolved in that context that would actually make sense to track what's going on in the environment while they're sleeping so that if something happens you can react to it very quickly. So that might be one of the reasons why we have this ability. It can be a remainings of that evolution.

Gemma Ware: What would you want to know? What would you want to find out to finally understand what people are dreaming?

Başak Türker: I would like to know if we can, if we can really develop a language and communicate in real time. Not a complex language like we're having right now, but a simpler one. And ask about what they're dreaming and then we can, at the same time, scan their brains and see what kind of brain activity occurs at the same time, which would enable us to tell what's going on in the brain when we're dreaming. Because once again, that's a mystery. We don't know how the brain produces dreams, and that would be amazing to understand how come, that

we have our eyes closed but we can still perceive stuff and we're disconnected from the world and still experience all these very complicated stuff in the night, and that would be amazing to understand how that occurs in the brain. I would like to know how it occurs, why it occurs, why it's useful, why we're having this every night and what it brings us actually?

Gemma Ware: That's it for this week's episode. Thanks to Başak Türker for speaking with us and to our colleague, Lionel Cavicchioli who worked with her on the original story for The Conversation in French. It's also been translated into English and we'll pop a link to that in our show notes.

This episode was written and produced by Katie Flood with production assistance from Mend Mariwany. I'm Gemma Ware, the show's executive producer. Sound design was by Eloise Stevens, and our theme music is by Neeta Sarl. Stephen Kahn is our global executive editor, Alice Mason runs our social media and Soraya Nandy does our transcripts.

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