

Singing from memory unlocks a surprisingly common musical superpower

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Psychologists from UC Santa Cruz wanted to study "earworms," the types of songs that get stuck in your head and play automatically on a loop. So they asked people to sing out any earworms they were experiencing and record them on their phones when prompted at random times throughout the day.

When researchers analyzed the recordings, they found that a remarkable proportion of them perfectly matched the [pitch](#) of the original songs they were based upon.

More specifically, 44.7% of recordings had a pitch error of 0 semitones, and 68.9% were accurate within 1 semitone of the original [song](#). These findings were published in the journal [*Attention, Perception, & Psychophysics*](#).

"What this shows is that a surprisingly large portion of the population has a type of automatic, hidden 'perfect pitch' ability," said Cognitive Psychology Ph.D. candidate Matt Evans, who led the study with support from Psychology Professor Nicolas Davidenko and undergraduate research assistant Pablo Gaeta.

"Interestingly, if you were to ask people how they thought they did in this task, they would probably be pretty confident that they had the melody right, but they would be much less certain that they were singing in the right key," Evans said.

"As it turns out, many people with very strong pitch memory may not have very good judgment of their own accuracy, and that may be because they don't have the labeling ability that comes with true perfect pitch."

Evans explained that true perfect pitch is the ability to accurately produce or identify a given note on the first try and without a reference pitch. Less than one in 10,000 people possess that ability, with the list including famed musicians like Ludwig van Beethoven, Ella Fitzgerald, and Mariah Carey. But, scientists are increasingly finding that accurate pitch memory is much more common.

Prior research has shown that participants in laboratory settings who are

asked to recall a well-known song and sing it from memory end up singing it in the right key at least 15% of the time, which is much more often than could be expected by chance. But there are still a lot of unknowns about how this memory process works, and that included questions about whether it took deliberate effort for people to recall songs in the right key, or if it happened automatically.

That's where earworms came in handy. Because earworms are a type of musical memory experience that happens involuntarily, the UC Santa Cruz team decided to use them to test whether pitch memory was still relatively accurate when music wasn't being recalled purposefully.

The team's findings that earworms did in fact very strongly follow the key of the original song suggests that there may be something unique about musical memories and the ways they are encoded and maintained inside our brains.

"People who study memory often think about long-term memories as capturing the gist of something, where the brain takes shortcuts to represent information, and one way our brains could try to represent the gist of music would be to forget what the original key was," explained Professor Davidenko.

"Music sounds very similar in different keys, so it would be a good shortcut for the brain to just ignore that information, but it turns out that it's not ignored. These musical memories are actually highly accurate representations that defy the typical gist formation that happens in some other domains of long-term memory."

As researchers continue working to unpack the mechanisms behind musical [memory](#), Evans says he hopes the current findings will also help more people have the confidence to participate in music.

He noted that the pitch accuracy of participants in the study was not predicted by any objective measures of singing ability, and none of the participants were musicians or reported having perfect pitch. In other words, you don't have to have special abilities to demonstrate this foundational musical skill.

"Music and singing are uniquely human experiences that so many people don't allow themselves to engage with because they don't think they can, or they've been told they can't," Evans said.

"But in reality, you don't have to be Beyonce to have what it takes to make [music](#). Your brain is already doing some of it automatically and accurately, despite that part of you that thinks you can't."

More information: Matthew G. Evans et al, Absolute pitch in involuntary musical imagery, *Attention, Perception, & Psychophysics* (2024). [DOI: 10.3758/s13414-024-02936-0](https://doi.org/10.3758/s13414-024-02936-0)

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