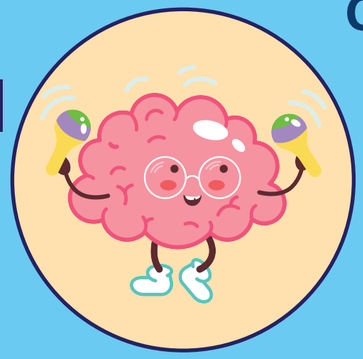
Music and Resting-state fMRI

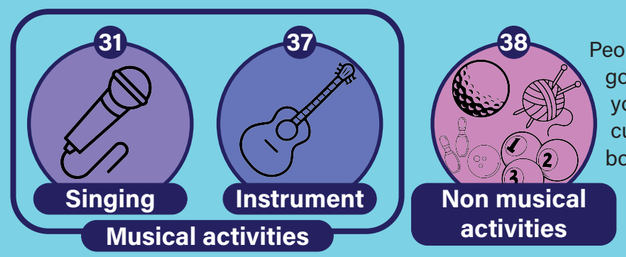
How Does Music Change Brain Function as We Age?



CONTEXT

As we age, the way our brain works at rest changes. Even when we are not doing anything, our brains are still active. This baseline activity is known as resting-state function connectivity (RSFC). RSFC describes how different regions of the brain "talk" to each other when we are not focused on a specific task. These connections form resting-state networks (RSNs), which include systems involved in functions like attention and memory.
Our previous study showed that amateur musicians outperformed non-musicians in specific cognitive tasks measuring inhibition and working memory, though these advantages were not global. Here we ask the following questions: does RSFC differ between musicians and non-musicians? How does RSFC relate to the cognitive advantages found in our previous work? Understanding how RSFC changes with age—and how activities like music might help preserve or enhance it—is an exciting research area that could tell us a lot about healthy brain aging.

Participants in Three Groups



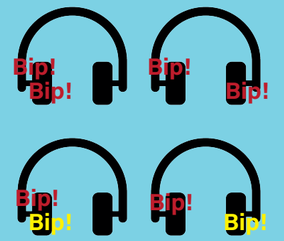
People practising:
golf, billiards, knitting, yoga, pétanque, curling, video games, bowling, tai chi, ...

What was Measured

Magnetic Resonance Imaging (MRI)

Resting-state fMRI was measured using a 3T MRI scanner. The participants were asked to lie quietly, stay still, without thinking of anything in particular. The scan lasted for 10 mins.

Selective attention



Participants listened to pairs of sounds and indicated whether:
1- The sounds are identical, regardless of their location;
2- The sounds are presented to the same ear, regardless of their pitch.

Inhibition

Red Blue Green

A list of color words is presented. The participant must
1- Name the color of the ink for each word (Test A);
2- Name the color of the ink for each word, but if the word is in a box, then read the word (Test B).

Working memory

7 9 3 6 2

Increasingly long series of numbers are presented to the participant who must:
1- Repeat the numbers in the same exact order (Test A)
2- Repeat the numbers in the reverse order (Test B)

What We Found

Aging and brain connectivity

Our results show that aging affects connectivity in a variety of ways. While many age-related changes in brain connectivity were negative (meaning reduced communication between brain regions), we also observed some positive changes. Interestingly, people with musical training—both singers and instrumentalists—showed different brain connectivity patterns compared to non-musicians, even in older age. These differences appeared in specific areas of the brain and hint at how music might influence brain aging.

Music and the Aging Brain

Musical activities seem to offer a protective effect on the resting-state networks, which could delay the onset of age-related decline in brain function. Music could act as a form of cognitive enrichment—giving the brain extra stimulation that helps it stay resilient over time.
Interestingly, we found that the *type* of musical activity matters:

—For singers, higher connectivity was associated with better cognitive performance. This suggests that singing helps preserve the brain's communication patterns, which could be described as "aging with stability".

—For instrumentalists, lower connectivity was linked to better performance. This may indicate a compensation mechanism, where the brain adapts and recruits additional neural resources to keep functioning well.

Summary

The relationship between brain aging and cognition is complex. Different parts of the brain and different networks are affected in different ways. Our findings suggest that music can make a difference. Singers may age well by preserving the brain's connections, whereas instrumentalists may rely on compensation, that is, by reorganizing how their brains work to maintain cognitive functions.

Source :
Zhang, X., & Tremblay, P. (2025).
Aging of resting-state functional connectivity in amateur singers, instrumentalists and controls.
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Xiyue Zhang & Pascale Tremblay, 2025

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