FUKUDA LAB
UNIVERSITY OF TORONTO
JULY 2019

YOU CAN DO IT, YES YOU CAN

Boosting memory performance with healthy aging

THE FUKUDA LAB PRESENTS RESULTS FROM OUR FIRST SENIOR STUDY

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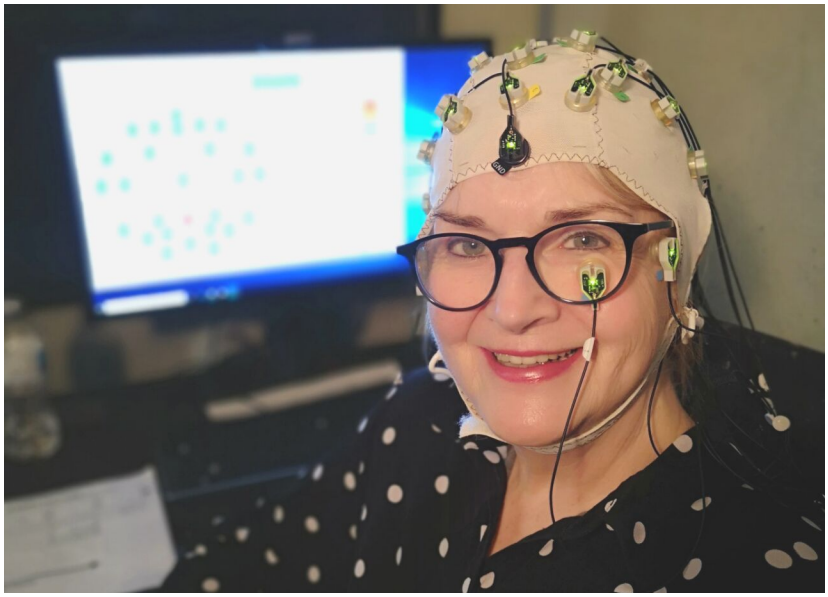


Dear Seniors,

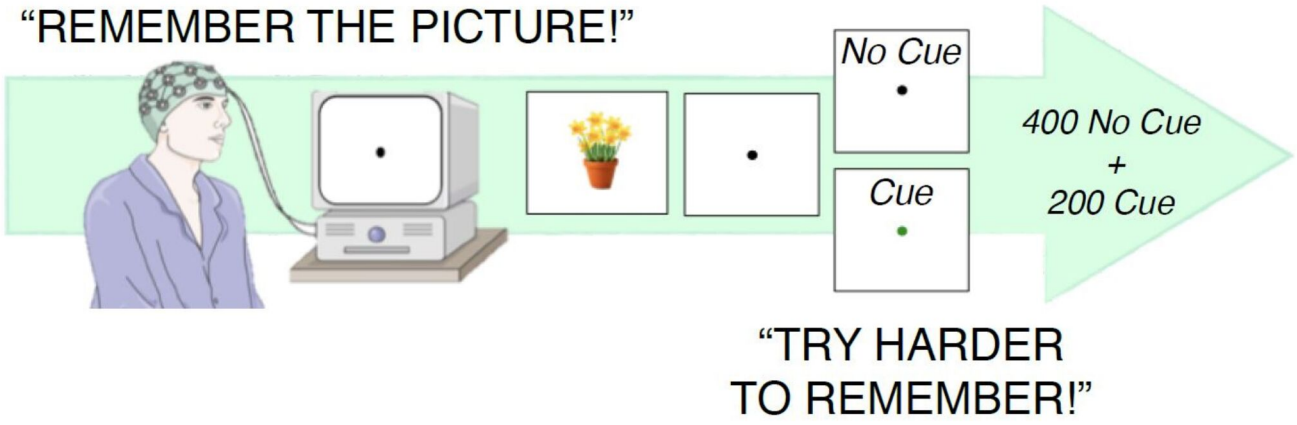
We are pleased to present you with this newsletter regarding the completion of a study that you participated in at the University of Toronto Mississauga's Fukuda Lab in the Department of Psychology! As always, we are very grateful for your participation in this research to help us learn more about the healthy aging of the brain and memory. This study began in late December 2017 and is now complete; we will present a little summary of the data we collected here in this letter.

TASK DESCRIPTION

This study was motivated by the idea that it is possible to have some control over our memory. Many of us, regardless of age, would love to be able to better manipulate our memories (mostly to prevent loss of important information!) and so we set out to determine if it was possible to 'up-regulate' our memories.

Up-regulation refers to the ability to remember some information better than others by 'trying really hard' to remember them. This idea is similar to a situation like if you were in a class and the professor mentioned that some material was important for you to remember and that it might be on the exam. You ideally want to remember everything the teacher says, but would likely try extra hard to make sure you don't forget what they say is *especially* important for the test!

However, something that is hard to see in real life is what mental processes are going on in your mind when you are trying extra hard to remember something. This is why we used **electroencephalography (EEG)** to look into people's brains and see what part of the brain is helping with this ability.



Task outline: Participants wearing an EEG cap viewed pictures on the computer. Pictures to be up-regulated in memory were followed by a green dot cue.

The first thing that participants did in this study (after getting the EEG cap put on) is to view a set of 600 pictures one at a time on the computer. These were pictures of real world objects that participants were asked to remember. Of the 600 pictures, 400 were followed by 'No Cue', or a black dot, and this meant to remember the pictures as usual.

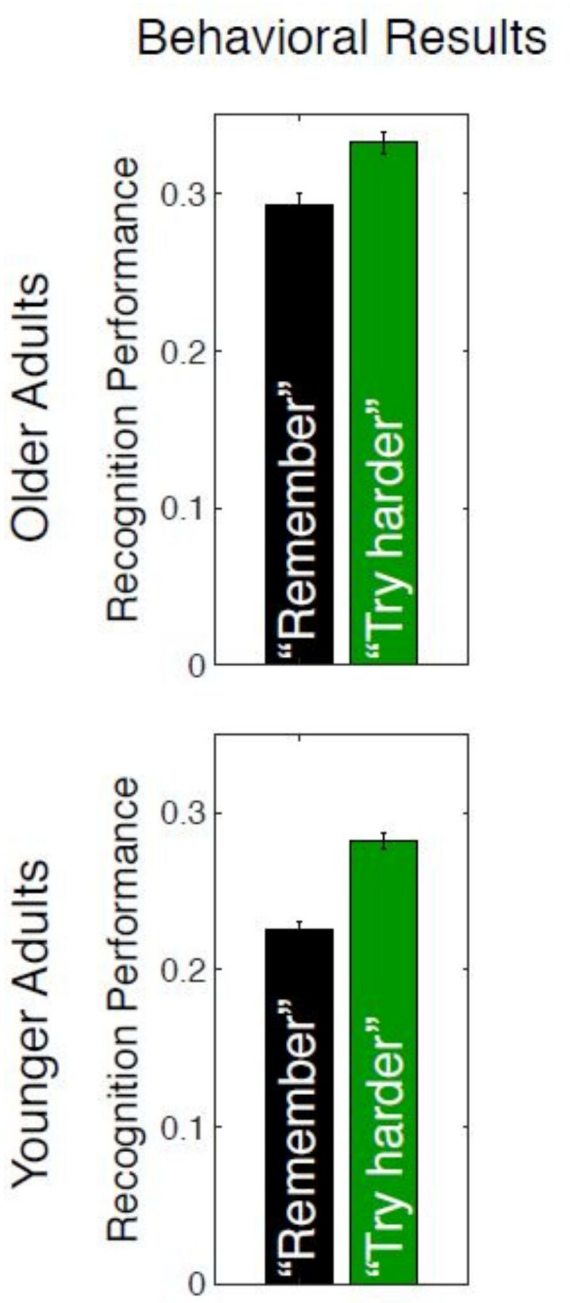
Importantly, there were 200 pictures which were followed by a green dot cue meaning ‘try extra hard' to remember the picture. After everyone finished viewing all the pictures, we showed one picture at a time and asked if participants recognized the pictures in a memory test.

RESULTS

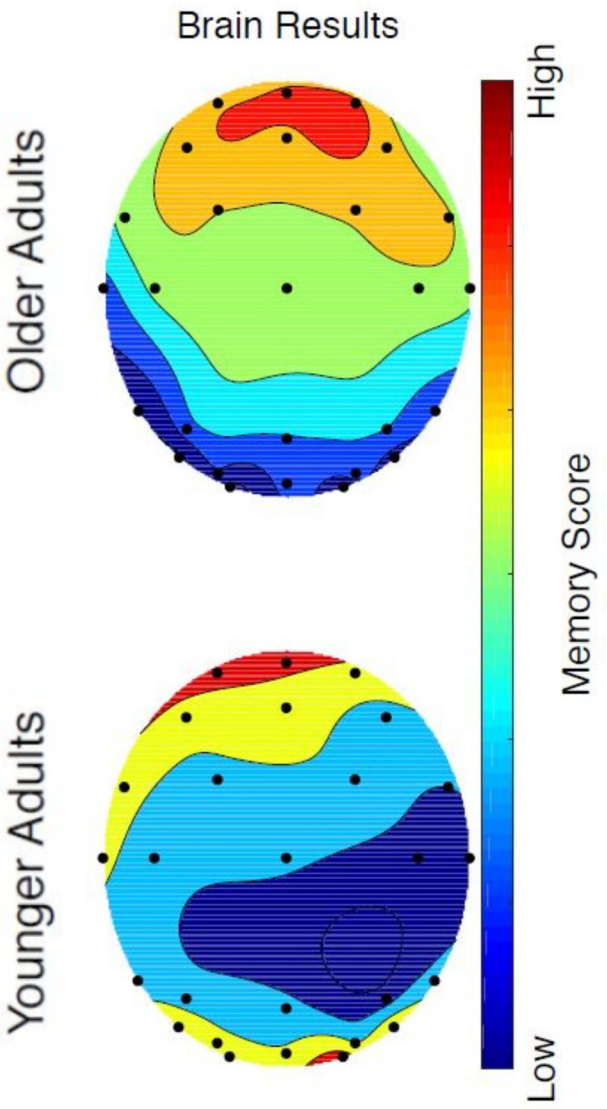
The results of this study were quite surprising to us! Firstly, the behavioural results show the recognition performance, in other words, how well everyone performed on the memory test.

In the bar graphs to the right, we can see a black bar which shows how much was remembered when we asked participants to remember pictures as usual (followed by a black dot) and a green bar that shows how much was remembered for pictures people were told to 'try extra hard' to remember (followed by a green dot). For **both younger and older adults**, we can see in the bar graphs that participants remember more pictures when asked to 'try extra hard' to remember (green bar) than pictures they were asked to remember as usual (black bar). This shows us that older adults performed the same, if not better, than younger adults on the memory test, especially for the pictures we asked them to up-regulate! This is amazing, given that participants were asked to remember 600 pictures!

Next, when we looked into the brain activity we can see some different results. We created some maps of the brain (shown from a birds-eye-view), with the front part of the head pointing up and back of the head pointing down on the diagram.



Behavioural results: older and younger adults memory test performance. Both age groups demonstrated better memory for pictures they were told to 'try harder' to remember than pictures they were told to remember as usual.



EEG results: older adults show less distributed (more frontal) areas of the brain contributing to successful up-regulation memory performance as compared to younger adults

The schematic shows which region of the brain contributes more to higher memory scores. The higher the score and the more that brain area helps with memory, the more red the brain map appears. If the area is blue, this means that area of the brain didn't contribute much to memory, leading to a lower memory score.

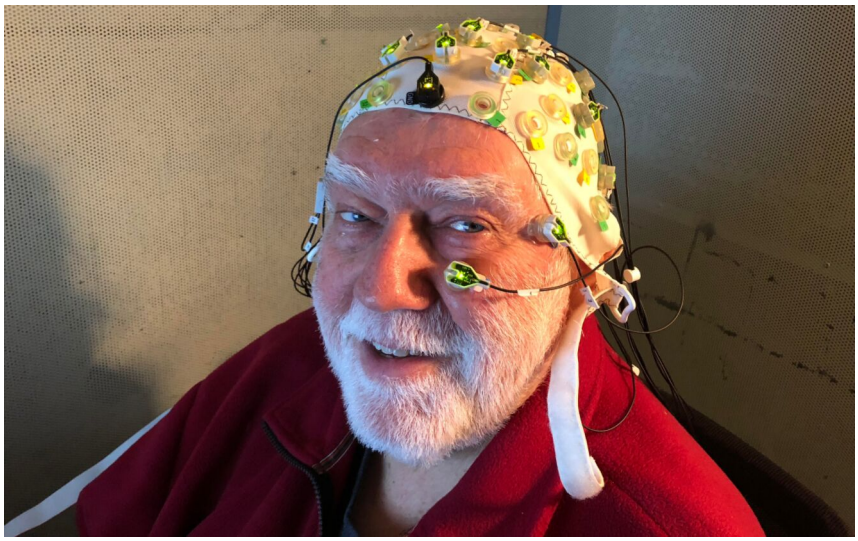
We see that for older adults, the frontal area of the brain was the most red, showing that this area helped with successful memory encoding. This means that this area helped participants to have a better performance on the memory test (higher memory score). The frontal area of the brain is mostly involved in so called 'higher' cognitive functions termed **executive functions** which include memory, problem solving, and motivation among many others. Perhaps older adults are calling upon these functions to perform the memory task.

In comparison, when we look at the brain maps of the younger adults, we see a different pattern of results. While there is some red in the frontal part of the brain, we also see that the back of brain contributes to improved memory performance as well. Younger adults seem to have a more distributed contribution of brain activity to achieve their successful memory scores.

CONCLUSIONS

So, overall we can see that older adults performed the same (and maybe even better!) than the younger adults when it came to the memory test, but that they used different parts of the brain to do so. This is quite interesting and definitively warrants further investigation! How can our brain behave differently when we age but can still maintain optimal memory performance? Are there ways we can tap into this unique brain power to further enhance or stop the degradation of our memory? This is very exciting, but most importantly very encouraging.

In our lab, we study healthy aging, and it is heartening to see such great performance and enthusiastic participation from our older friends. This should be reassuring to those of you who thought you did poorly or were not confident in your memory! Humans seem to have an extraordinary power to remember visual information, and this persists even into older age.



Again, this research rests on the continual support and love you show to our lab and department, and even more grandly, to the psychological community as a whole. Aging may be inevitable, but strong memory and subsequently a rich quality of life can still flourish. We love to learn more and are always inspired by your amusing life stories. We hope that you will come back to visit us again when we have more research opportunities in the future, and that you will work together with us to make the human experience that much more fulfilling, one brain at a time!

Sincerely,

Caitlin Tozios & April Pereira
Graduate students, Fukuda Lab
Department of Psychology
University of Toronto

Looking to get involved in more experiments? We have other exciting studies available (including those without the EEG cap). We also now have online access where you can view and schedule available times for different studies.

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Thank you as well to our funding agencies