



### Keep active in middle-age!

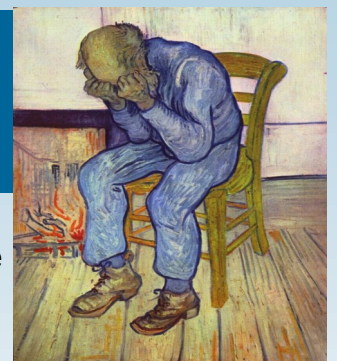
*Rik Henson*

You all told us about your past and present education, occupation and everyday activities, which we divided according to three stages of life: youth, middle-age and later years. Some of you also completed tests of cognitive abilities and had a brain scan. For those of you over 65 years of age, we tested which of these lifestyle variables predicted your current cognitive ability. Level of education during your youth was a key predictor. More surprising however was that your mid-life activities (such as sport, music, games, social engagements) made an additional unique contribution to your current cognitive ability, above and beyond education and other factors like your mid-life occupation, current age and even current activities. This is important because middle-aged people can potentially modify their lifestyles to increase their cognitive health in later years, reducing or delaying cognitive problems such as those occurring in dementia. Furthermore, when we examined the relationship between current cognitive health and brain structure, we found that the cognitive health of people who had engaged in more mid-life activity was less dependent on the current structural state of their brain. In other words, their past experiences offered a form of protection (or what we call “cognitive reserve”) against the changes in the brain that occur with advancing age. The next step is to tease apart the physical, mental and social aspects of mid-life activities to see which are critical, and to identify other aspects of the brain (such as functional rather than structural integrity) that are affected by these activities. Armed with this knowledge, we can advise people on how best to ensure rich lifestyles during their middle-age years in order to stave off problems later in life.

### Memory and depressive symptoms in the general population

*Susanne Schweizer*

Decades of research have investigated the impact of clinical depression on memory, and revealed specific biases (for example, depressed individuals are better at remembering negative information than healthy individuals). However, we know very little about the effects of non-clinical levels of depressive symptoms on memory performance in the general population. Symptoms of depression are very common. Indeed 87% of our 2544 participants reported at least one symptom of depression. With these data, we showed that higher levels of depressive symptoms were associated with subjective report of problems with memory. However, higher levels of depressive symptoms were not associated with the objective ability to recall verbal information (a spoken story). Rather, they were associated with worse objective memory for objects that were presented together with distracting negative images, but not distracting images that were neutral or positive. This suggests that, when people are feeling low, they may find it particularly difficult to remember information when they are distracted by content that matches their mood state. This study therefore provides important data for understanding how everyday mood affects our memory.

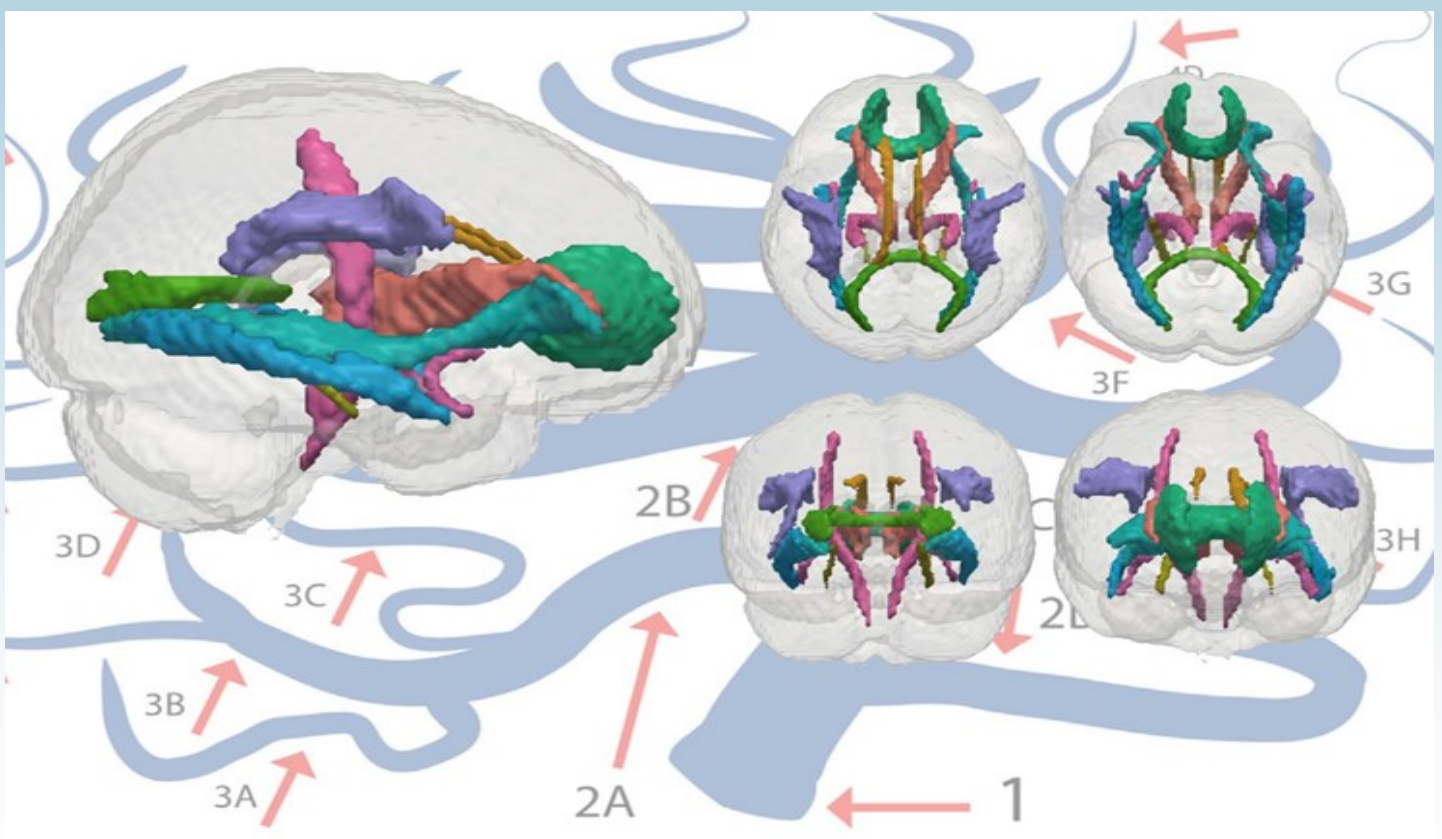
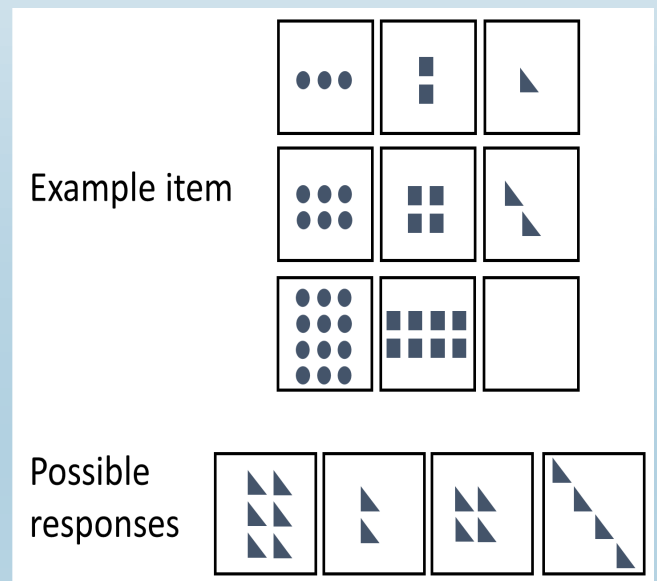


# Mapping the brain's superhighways

Rogier Kievit

The ability to solve abstract problems, sometimes known as 'fluid intelligence', plays a central role in many day-to-day activities across the lifespan. Scientists measure this ability using puzzles like the one shown below. The surprising thing is that, as useless as these puzzles seem in and of themselves, they are a great predictor of a range of other outcomes, including healthy aging. One key ability to solve these problems is mental speed: How quickly you can perform simple tasks like press a button, or recognize a specific letter (like 'p') among a large set of other similar letters (like 'q'). The idea behind the connection between mental speed and problem solving is that the quicker you can mentally juggle potential solutions to the problem, the easier you'll find it to select the right one. This is indeed what we found: The quicker and the more reliably people responded to very simple tasks ('press this button as quickly as you can when you see a flash'), the better they did at the puzzle task.

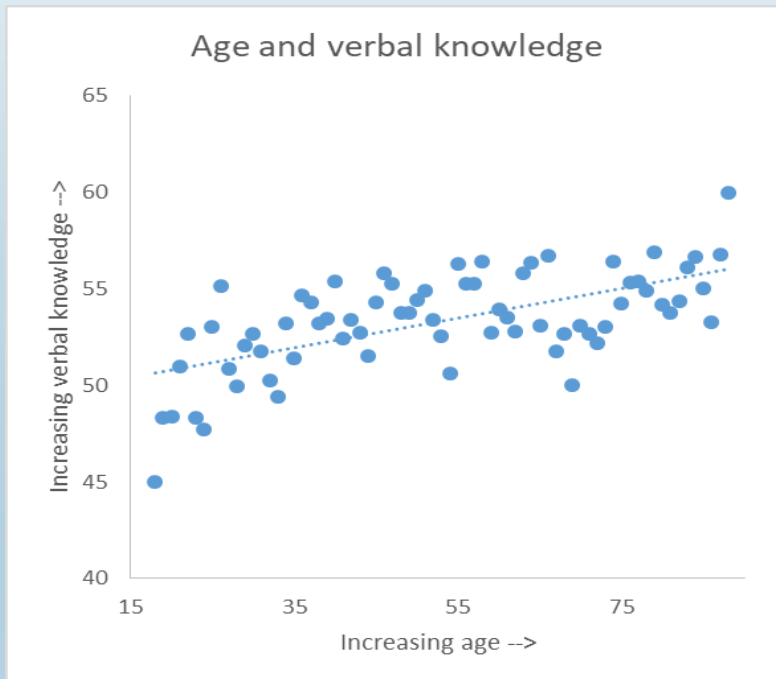
Although not new, establishing this relation was an important finding. Next, the unique nature of the Cam-CAN study allowed us to go one step further: We thought that the strength of connections between brain regions, in turn, plays an important role in supporting mental speed. In other words: The health of white matter (the brain's 'superhighways') is important for mental speed, which in turn is important for problem solving. Using mathematical models we indeed showed that this was the case: The stronger the brain connections, the quicker people were to respond and the better able they were to solve abstract problems. By mapping the relations between problem solving, mental speed and the connections in our brain simultaneously, Cam-CAN has brought us a step closer to understand healthy cognitive aging.



# Do we forget names because our brains are full? Don't worry, what you know won't hurt you...

Meredith Shafto

One of the most commonly-reported complaints of old age is the increase in temporary word finding failures known as tip-of-the-tongue states (TOTs). If you participated in Cam-CAN research, you may well have found yourself having a name or two on the tip of your tongue during a task that required naming famous faces. Although TOTs occur at any age, they tend to increase with age and a persistent belief is that this is caused by our brains “filling up” with information as we age, and that having too much knowledge in old age can cause confusion and lead to more TOTs.



A recent Cam-CAN study challenged this intuition, demonstrating that to the contrary, participants with larger vocabularies had fewer TOTs. Verbal knowledge continues to increase across our lifespans, which is shown for the Cam-CAN cohort in Figure 1. This knowledge may be a resource we use to help combat the rise of TOTs as we get older. Figure 2 shows that for all age groups, participants with higher verbal knowledge had fewer TOTs.

Why does the feeling persist that increased knowledge can lead to increased confusion when we are trying to remember a name? The answer has to do both with how knowledge is structured in our brains, and the difference between TOTs and other types of “memory” problems. When retrieving memories, we can muddle two people or

Figure 1: Verbal knowledge increases across the lifespan

concepts that are closely related in meaning, but during a TOT the correct meaning is known but the name is missing – indeed knowing who someone is but not knowing their name is often what is so frustrating about a TOT.

That is, although TOTs are increasingly frustrating as we age, this study reminds us that the difficulty is very specific – we might forget someone's name, but it is far less common to forget who the person is. More importantly, these results demonstrate that lifelong learning occurs in a number of areas including vocabulary, and that this learning helps rather than hurts cognitive function. So go out and read those books: what you know won't hurt you!

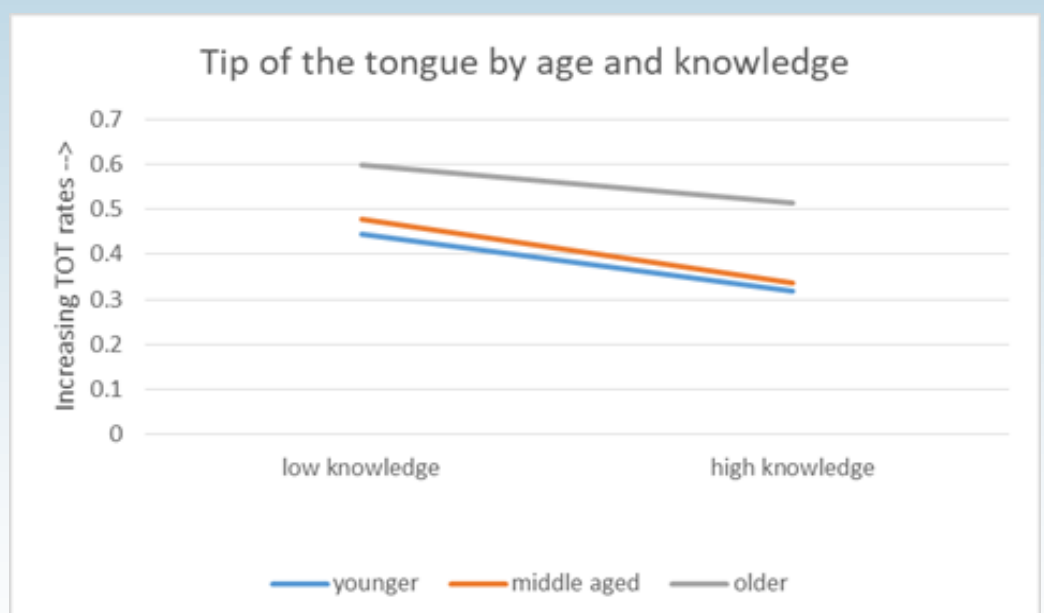
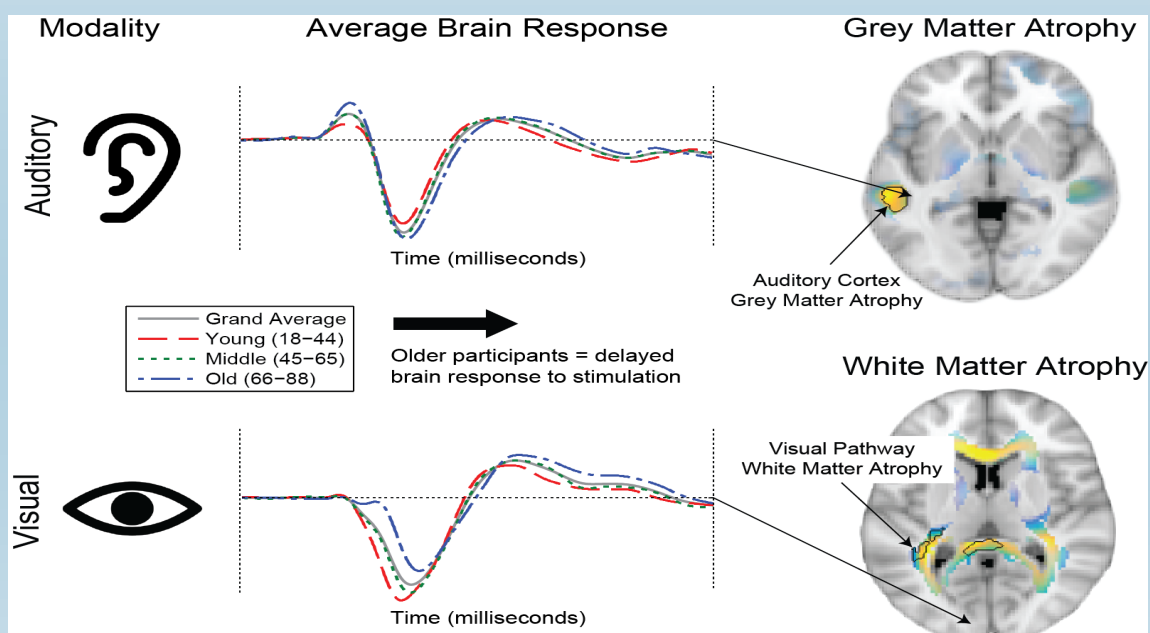


Figure 2: The figure shows that while TOT rates are higher for older adults, in each age group participants with higher verbal knowledge had fewer TOTs.

# Age-related slowing of the brain is caused by changes in brain structure over the lifespan

Darren Price

Many aspects of human behaviour slow down with age, which is thought to reflect a reduction of information processing speed in the brain. To measure the speed of simple visual and auditory processing, we presented participants with a flash of light and an auditory beep. The brain's electrical responses to these stimuli revealed a small but measurable age-related delay in the signal. While this delay has long been assumed to arise from age-related structural changes in the brain, this link has not previously been shown. Furthermore, age-related changes in brain structure come in many forms, and it is unclear which parts of the brain might be the cause. We have shown for the first time that age-related delay of visual information processing is mediated by deterioration of white matter fibres that carry information from the retina to the brain, while delays in auditory signals are mediated by deterioration of the grey matter (cell bodies) in the brain regions responsible for processing auditory information. This work demonstrates that there are multiple brain changes associated with age that influence even early sensory processing. This will help us understand the consequences for age-related changes in our vision and hearing.



**More information about the stories here, and other information about the Cam-CAN project, can be found here:**  
[www.cam-can.org](http://www.cam-can.org)

**Thank you for taking part and please do keep in touch...**

We are very grateful for your participation in the Cam-CAN project and for the time you have generously given us. Your contribution to our research is invaluable - we really couldn't do it without you!

We will be in contact again next year with some more news and some simple questions, so please let us know if you have recently changed your contact details or if you have any questions about the research. You can contact us on:

Tel: 01223 273723

E-mail: [admin@cam-can.com](mailto:admin@cam-can.com)

Cam-CAN, MRC-CBU, 15 Chaucer Road, Cambridge CB2 7EF.

*Thank you!*