Bilingualism and the brain

By Dr Christos Pliatsikas
Lecturer in Psycholinguistics in Bi-Multilinguals,
University of Reading

Learning a new skill might change the shape of the parts of the brain that are responsible for that particular skill.

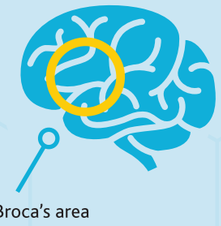
Your plastic brain

Any new knowledge, memory or skill that we learn needs to be stored somewhere in the brain, so you can access and use it in the future. Studies have shown that learning a new skill might change the shape of the parts of the brain that are responsible for that particular skill.

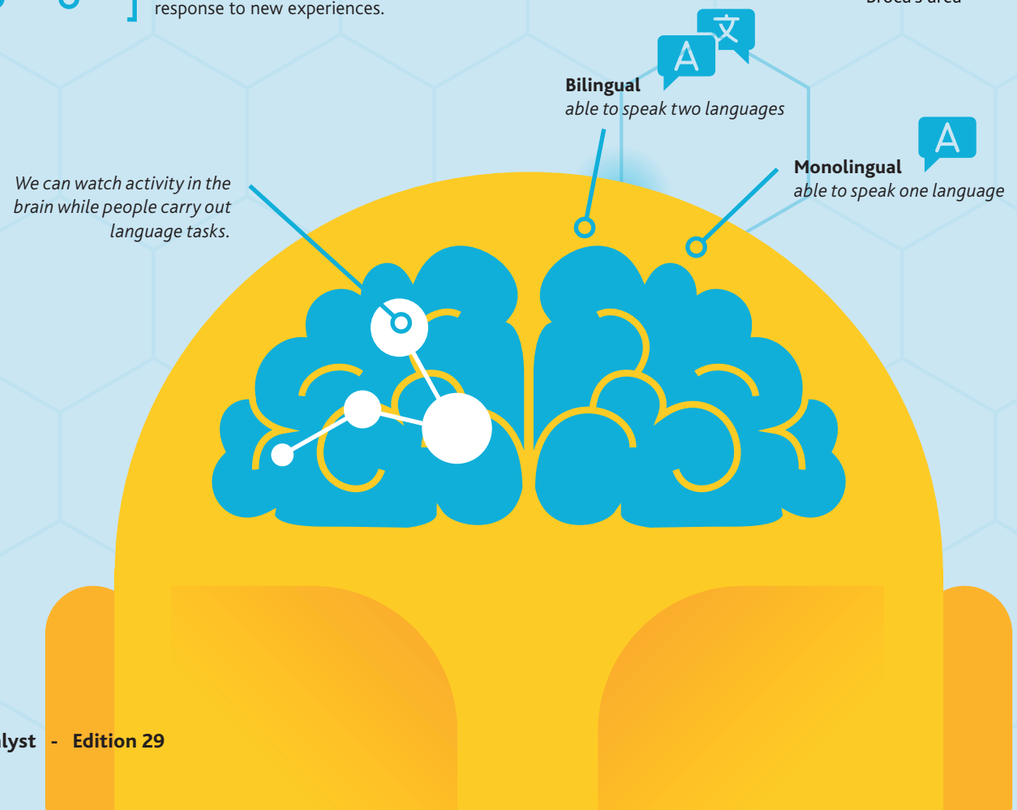
Elite athletes, such as basketball players, have been shown to have enlarged brain regions related to the control of movement. Taxi drivers in London have an enlarged hippocampus compared to the general population. The hippocampus is responsible for forming new memories and is very important for navigating around the world. These examples show that our brain is plastic. This means that its structure does not remain the same throughout our life and can change in response to new experiences.

Language and the brain

We have known that particular areas of the brain are involved in speech since the 19th century. Back then, most of the information about the brain was gleaned using post-mortems carried out on people with language problems, like Louis Victor Leborgne, a French man who suffered from paralysis and had lost the ability to speak – but could still understand language. During an autopsy a lesion, or wound, was found in his brain – in the frontal lobe of his left hemisphere. This area is now known as 'Broca's area', after Pierre Paul Broca who discovered what this area did. Carl Wernicke also studied patients with brain injuries that affected language and he discovered a region which was involved in the comprehension of language.



Broca's area



Learning a language

Since the 19th century, our knowledge of the brain in relation to language has shown that many parts of the brain are involved. The ability to scan the living brain has been an enormous benefit to research, as we can watch activity in the brain while people carry out language tasks.

We no longer have to wait for people to die to examine their brains and, importantly, we can see the changes in the brain as language skills develop. This has been particularly useful in studying people as they learn and use additional languages, in other words becoming 'bilingual' (able to speak two languages), rather than 'monolingual' (able to speak one language). It might not seem obvious, but learning additional languages is a demanding task.

First, you have to learn new names for items and actions that you already know, ie the lexicon of the new language. You then have to learn a whole new set of rules about the structure of the new language, or its grammar, which sometimes are very different to the ones you are used to.

Last, but not least, you have to learn the sounds of the new language, which can be very different to the sounds you already know, and also extremely difficult to learn (this is why many non-native speakers of English have a foreign accent).

However, the biggest challenge is to control which of the languages you want to use at a particular time. Studies have shown that both languages are active and compete against each other each and every moment we try to speak. This means that the bilingual brain faces an ongoing challenge, which does not apply to the monolingual brain: constant controlling of competing languages. The brain tackles this task successfully almost all of the time, however, sometimes this control fails, and that's when bilinguals might produce words in the 'wrong' language.

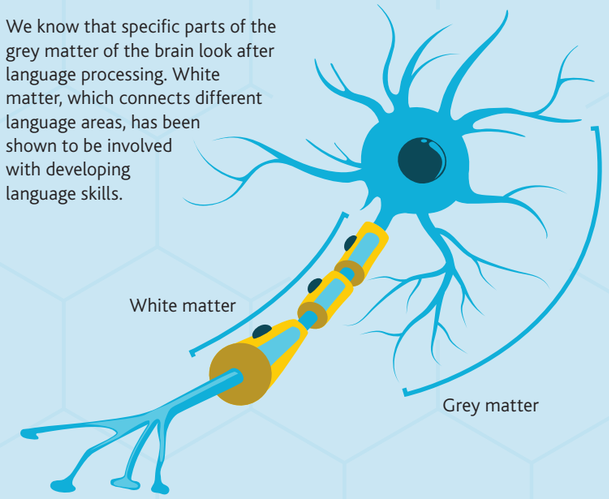
Bilinguals do get better with practise and experience, as they gradually acquire a better command of their additional language, as well as better control of which language is active each time. This improvement shows in the structure of their brain; like the brains of well-trained elite athletes, which get restructured to accommodate fine movement and balance, the brains of bilinguals show significant restructuring of those regions that serve language learning and language control.

The brains of bilinguals show significant restructuring of those regions that serve language learning and language control.

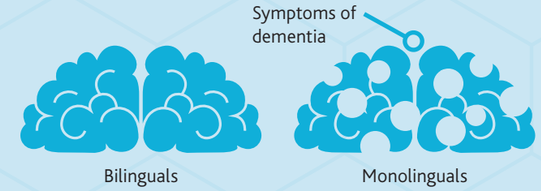
Restructuring the brain

But which areas of the brain do this, and how does the brain change shape? Our brains consist of billions of neurons, which can be divided into two parts: the soma or somata, known as 'grey matter'; and the axon, which is often called 'white matter'.

We know that specific parts of the grey matter of the brain look after language processing. White matter, which connects different language areas, has been shown to be involved with developing language skills.



There are also parts of the brain that help to control competition in cognition, or thought, including from languages. This helps your brain choose which language to use. Interestingly, work using scanning techniques from my lab and others has demonstrated increases in size of these regions for bilinguals, compared to monolinguals. It seems that the brain responds to the demanding skill of learning and controlling additional languages by growing the areas that help with these tasks.



Many studies have shown that, in old age, bilinguals have better preserved brains than monolinguals. Some researchers have even suggested that the first symptoms of dementia might appear later in life in bilinguals versus in monolinguals. In other words, learning another language makes the brain more resilient to ageing, and keeps it healthy for longer!

The lesson is:
we should all be learning languages, and using them.