

Why being bilingual helps keep your brain fit

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Credit: Wikimedia Commons

In a café in south London, two construction workers are engaged in cheerful banter, tossing words back and forth. Their cutlery dances during more emphatic gesticulations and they occasionally break off into loud guffaws. They are discussing a woman, that much is clear, but the details are lost on me. It's a shame, because their conversation looks fun and interesting, especially to a nosy person like me. But I don't speak

their language.

Out of curiosity, I interrupt them to ask what they are speaking. With friendly smiles, they both switch easily to English, explaining that they are South Africans and had been speaking Xhosa. In Johannesburg, where they are from, most people speak at least five languages, says one of them, Theo Morris. For example, Theo's mother's language is Sotho, his father's is Zulu, he learned Xhosa and Ndebele from his friends and neighbours, and English and Afrikaans at school. "I went to Germany before I came here, so I also speak German," he adds.

Was it easy to learn so many languages?

"Yes, it's normal," he laughs.

He's right. Around the world, more than half of people – estimates vary from 60 to 75 per cent – speak at least two languages. Many countries have more than one official national language – South Africa has 11. People are increasingly expected to speak, read and write at least one of a handful of "super" languages, such as English, Chinese, Hindi, Spanish or Arabic, as well. So to be monolingual, as many native English speakers are, is to be in the minority, and perhaps to be missing out.

Multilingualism has been shown to have many social, psychological and lifestyle advantages. Moreover, researchers are finding a swathe of health benefits from speaking more than one language, including faster stroke recovery and delayed onset of dementia.

Could it be that the human brain evolved to be multilingual – that those who speak only one language are not exploiting their full potential? And in a world that is losing languages faster than ever – at the current rate of one a fortnight, half our languages will be extinct by the end of the century – what will happen if the current rich diversity of languages

disappears and most of us end up speaking only one?

Bilinguals perform these tasks much better than monolinguals – they are faster and more accurate.

I am sitting in a laboratory, headphones on, looking at pictures of snowflakes on a computer. As each pair of snowflakes appears, I hear a description of one of them through the headphones. All I have to do is decide which snowflake is being described. The only catch is that the descriptions are in a completely invented language called Syntaflake.

It's part of an experiment by Panos Athanasopoulos, an ebullient Greek with a passion for languages. Professor of psycholinguistics and bilingual cognition at Lancaster University, he's at the forefront of a new wave of research into the bilingual mind. As you might expect, his lab is a Babel of different nationalities and languages – but no one here grew up speaking Syntaflake.

The task is profoundly strange and incredibly difficult. Usually, when interacting in a foreign language, there are clues to help you decipher the meaning. The speaker might point to the snowflake as they speak, use their hands to demonstrate shapes or their fingers to count out numbers, for example. Here I have no such clues and, it being a made-up language, I can't even rely on picking up similarities to languages I already know.

After a time, though, I begin to feel a pattern might be emerging with the syntax and sounds. I decide to be mathematical about it and get out pen and paper to plot any rules that emerge, determined not to "fail" the test.

The experience reminds me of a time I arrived in a rural town a few hours outside Beijing and was forced to make myself understood in a language I could neither speak nor read, among people for whom English

was similarly alien. But even then, there had been clues... Now, without any accompanying human interaction, the rules governing the sounds I'm hearing remain elusive, and at the end of the session I have to admit defeat.

I join Athanasopoulos for a chat while my performance is being analysed by his team.

Glumly, I recount my difficulties at learning the language, despite my best efforts. But it appears that was where I went wrong: "The people who perform best on this task are the ones who don't care at all about the task and just want to get it over as soon as possible. Students and teaching staff who try to work it out and find a pattern always do worst," he says.

"It's impossible in the time given to decipher the rules of the language and make sense of what's being said to you. But your brain is primed to work it out subconsciously. That's why, if you don't think about it, you'll do okay in the test – children do the best."

The first words ever uttered may have been as far back as 250,000 years ago, once our ancestors stood up on two legs and freed the ribcage from weight-bearing tasks, allowing fine nerve control of breathing and pitch to develop. And when humans had got one language, it wouldn't have been long before we had many.

Language evolution can be compared to biological evolution, but whereas genetic change is driven by environmental pressures, languages change and develop through social pressures. Over time, different groups of early humans would have found themselves speaking different languages. Then, in order to communicate with other groups – for trade, travel and so on – it would have been necessary for some members of a family or band to speak other tongues.

We can get some sense of how prevalent multilingualism may have been from the few hunter-gatherer peoples who survive today. "If you look at modern hunter-gatherers, they are almost all multilingual," says Thomas Bak, a cognitive neurologist who studies the science of languages at the University of Edinburgh. "The rule is that one mustn't marry anyone in the same tribe or clan to have a child – it's taboo. So every single child's mum and dad speak a different language."

In Aboriginal Australia, where more than 130 indigenous languages are still spoken, multilingualism is part of the landscape. "You will be walking and talking with someone, and then you might cross a small river and suddenly your companion will switch to another language," says Bak. "People speak the language of the earth." This is true elsewhere, too. "Consider in Belgium: you take a train in Liège, the announcements are in French first. Then, pass through Loewen, where the announcements will be in Dutch first, and then in Brussels it reverts back to French first."

The connection with culture and geography is why Athanasopoulos invented a new language for the snowflake test. Part of his research lies in trying to tease out the language from the culture it is threaded within, he explains.

Being so bound up with identity, language is also deeply political. The emergence of European nation states and the growth of imperialism during the 19th century meant it was regarded as disloyal to speak anything other than the one national language. This perhaps contributed to the widely held opinion – particularly in Britain and the US – that bringing up children to be bilingual was harmful to their health and to society more generally.

There were warnings that bilingual children would be confused by two languages, have lower intelligence, low self-esteem, behave in deviant

ways, develop a split personality and even become schizophrenic. It is a view that persisted until very recently, discouraging many immigrant parents from using their own mother tongue to speak to their children, for instance. This is in spite of a 1962 experiment, ignored for decades, which showed that bilingual children did better than monolinguals in both verbal and non-verbal intelligence tests.

However, research in the last decade by neurologists, psychologists and linguists, using the latest brain-imaging tools, is revealing a swathe of cognitive benefits for [bilinguals](#). It's all to do with how our ever-flexible minds learn to multitask.

Ask me in English what my favourite food is, and I will picture myself in London choosing from the options I enjoy there. But ask me in French, and I transport myself to Paris, where the options I'll choose from are different. So the same deeply personal question gets a different answer depending on the language in which you're asking me. This idea that you gain a new personality with every language you speak, that you act differently when speaking different languages, is a profound one.

Athanasopoulos and his colleagues have been studying the capacity for language to change people's perspectives. In one experiment, English and German speakers were shown videos of people moving, such as a woman walking towards her car or a man cycling to the supermarket. English speakers focus on the action and typically describe the scene as "a woman is walking" or "a man is cycling". German speakers, on the other hand, have a more holistic worldview and will include the goal of the action: they might say (in German) "a woman walks towards her car" or "a man cycles towards the supermarket".

Part of this is due to the grammatical toolkit available, Athanasopoulos explains. Unlike German, English has the -ing ending to describe actions that are ongoing. This makes English speakers much less likely than

German speakers to assign a goal to an action when describing an ambiguous scene. When he tested English–German bilinguals, however, whether they were action- or goal-focused depended on which country they were tested in. If the bilinguals were tested in Germany, they were goal-focused; in England, they were action-focused, no matter which language was used, showing how intertwined culture and language can be in determining a person's worldview.

In the 1960s, one of the pioneers of psycholinguistics, Susan Ervin-Tripp, tested Japanese–English bilingual women, asking them to finish sentences in each language. She found that the women ended the sentences very differently depending on which language was used. For example, "When my wishes conflict with my family..." was completed in Japanese as "it is a time of great unhappiness"; in English, as "I do what I want". Another example was "Real friends should...", which was completed as "help each other" in Japanese and "be frank" in English.

From this, Ervin-Tripp concluded that human thought takes place within language mindsets, and that bilinguals have different mindsets for each language – an extraordinary idea but one that has been borne out in subsequent studies, and many bilinguals say they feel like a different person when they speak their other language.

These different mindsets are continually in conflict, however, as bilingual brains sort out which language to use.

In a revealing experiment with his English–German bilingual group, Athanasopoulos got them to recite strings of numbers out loud in either German or English. This effectively "blocked" the other language altogether, and when they were shown the videos of movement, the bilinguals' descriptions were more action- or goal-focused depending on which language had been blocked. So, if they recited numbers in German, their responses to the videos were more typically German and

goal-focused. When the number recitation was switched to the other language midway, their video responses also switched.

So what's going on? Are there really two separate minds in a bilingual brain? That's what the snowflake experiment was designed to find out. I'm a little nervous of what my fumbling performance will reveal about me, but Athanasopoulos assures me I'm similar to others who have been tested – and so far, we seem to be validating his theory.

In order to assess the effect that trying to understand the Syntaflake language had on my brain, I took another test before and after the snowflake task. In these so-called flanker tasks, patterns of arrows appeared on the screen and I had to press the left or right button according to the direction of the arrow in the centre. Sometimes the surrounding pattern of arrows was confusing, so by the end of the first session my shoulders had been hunched somewhere near my ears and I was exhausted from concentrating. It's not a task in which practice improves performance (most people actually do worse second time round), but when I did the same test again after completing the snowflake task, I was significantly better at it, just as Athanasopoulos has predicted.

"Learning the new language improved your performance second time around," he explains. Relieved as I am to fit into the normal range, it's a curious result. How can that be?

The flanker tasks were exercises in cognitive conflict resolution – if most of the arrows were pointing to the left, my immediate impulse was to push the left button, but this wasn't the correct response if the central arrow was pointing right. I had to block out my impulse and heed the rule instead. Another example of cognitive conflict is a test in which the names of colours are written in different colours ("blue" written in red, for example). The aim is to say which colour each word is written in, but

this is tricky, because we read the word much quicker than we process the colour of the letters. It requires considerable mental effort to ignore the impulse just to say the word we can't help but read.

The part of the brain that manages this supreme effort is known as the [anterior cingulate cortex](#) (ACC), part of the "executive system". Located on the frontal lobe, it is a toolbox of mental attention skills that enables us to concentrate on one task while blocking out competing information, and allows us to switch focus between different tasks without becoming confused. It is the executive system that tells us to go when we see a green light and stop for a red, and it is the same system that tells us to ignore the meaning of the word we read but concentrate on the colour of the letters.

The snowflake test prepared my ACC for the second flanker task, just as speaking more than one language seems to train the executive system more generally. A steady stream of studies over the past decade has shown that bilinguals outperform monolinguals in a range of cognitive and social tasks from verbal and nonverbal tests to how well they can read other people. Greater empathy is thought to be because bilinguals are better at blocking out their own feelings and beliefs in order to concentrate on the other person's.

"Bilinguals perform these tasks much better than monolinguals – they are faster and more accurate," says Athanasopoulos. And that suggests their executive systems are different from monolinguals'.

In fact, says cognitive neuropsychologist Jubin Abutalebi, at the University of San Raffaele in Milan, it is possible to distinguish bilingual people from monolinguals simply by looking at scans of their brains.

"Bilingual people have significantly more grey matter than monolinguals in their anterior cingulate cortex, and that is because they are using it so much more often," he says. The ACC is like a cognitive muscle, he adds:

the more you use it, the stronger, bigger and more flexible it gets.

Bilinguals, it turns out, exercise their executive control all the time because their two languages are constantly competing for attention. Brain-imaging studies show that when a bilingual person is speaking in one language, their ACC is continually suppressing the urge to use words and grammar from their other language. Not only that, but their mind is always making a judgement about when and how to use the target language. For example, bilinguals rarely get confused between languages, but they may introduce the odd word or sentence of the other language if the person they are talking to also knows it.

"My mother tongue is Polish but my wife is Spanish so I also speak Spanish, and we live in Edinburgh so we also speak English," says Thomas Bak. "When I am talking to my wife in English, I will sometimes use Spanish words, but I never accidentally use Polish. And when I am speaking to my wife's mother in Spanish, I never accidentally introduce English words because she doesn't understand them. It's not something I have to think about, it's automatic, but my executive system is working very hard to inhibit the other languages."

For bilinguals, with their exceptionally buff executive control, the flanker test is just a conscious version of what their brains do subconsciously all day long – it's no wonder they are good at it.

A superior ability to concentrate, solve problems and focus, better mental flexibility and multitasking skills are, of course, valuable in everyday life. But perhaps the most exciting benefit of bilingualism occurs in ageing, when executive function typically declines: bilingualism seems to protect against dementia.

Psycholinguist Ellen Bialystok made the surprising discovery at York University in Toronto while she was comparing an ageing population of

monolinguals and bilinguals.

"The bilinguals showed symptoms of Alzheimer's some four to five years after monolinguals with the same disease pathology," she says.

Being bilingual didn't prevent people from getting dementia, but it delayed its effects, so in two people whose brains showed similar amounts of disease progression, the bilingual would show symptoms an average of five years after the monolingual. Bialystok thinks this is because bilingualism rewires the brain and improves the executive system, boosting people's "cognitive reserve". It means that as parts of the brain succumb to damage, bilinguals can compensate more because they have extra grey matter and alternative neural pathways.

"Bilinguals use their frontal processors for tasks that monolinguals don't and so these processors become reinforced and better in the frontal lobe. And this is used to compensate during degeneration of the middle parts of the brain," Bialystok explains. However, it is no good simply to have learned a little French at school. The effect depends on how often you use your bilingual skill. "The more you use it, the better," she says, "but there's no breaking point, it's a continuum."

Bilingualism can also offer protection after brain injury. In a recent study of 600 stroke survivors in India, Bak discovered that cognitive recovery was twice as likely for bilinguals as for monolinguals.

Such results suggest bilingualism helps keep us mentally fit. It may even be an advantage that evolution has positively selected for in our brains – an idea supported by the ease with which we learn new languages and flip between them, and by the pervasiveness of bilingualism throughout world history. Just as we need to do physical exercise to maintain the health of bodies that evolved for a physically active hunter-gatherer lifestyle, perhaps we ought to start doing more cognitive exercises to

maintain our mental health, especially if we only speak one language.

In recent years, there has been a backlash against the studies showing benefits from bilingualism. Some researchers tried and failed to replicate some of the results; others questioned the benefits of improved executive function in everyday life. Bak wrote a rejoinder to the published criticisms, and says there is now overwhelming evidence from psychological experiments backed by imaging studies that bilingual and monolingual brains function differently. He says the detractors have made errors in their experimental methods.

Bialystok agrees, adding that it is impossible to examine whether bilingualism improves a child's school exam results because there are so many confounding factors. But, she says, "given that at the very least it makes no difference – and no study has ever shown it harms performance – considering the very many social and cultural benefits to knowing another language, bilingualism should be encouraged". As for the financial benefits, one estimate puts the value of knowing a second language at up to \$128,000 over 40 years.

The result of my test in Athanasopoulos's lab suggests that just 45 minutes of trying to understand another language can improve cognitive function. His study is not yet complete, but other research has shown that these benefits of learning a language can be achieved quickly. The problem is, they disappear again unless they are used – and I am unlikely to use the made-up snowflake language ever again! Learning a new language is not the only way to improve executive function – playing video games, learning a musical instrument, even certain card games can help – but because we use language all the time, it's probably the best executive-function exerciser there is. So how can this knowledge be applied in practice?

One option is to teach children in [different languages](#). In many parts of

the world, this is already being done: many Indian children, for example, will use a different language in school from their mother or village tongue. But in English-speaking nations, it is rare. Nevertheless, there is a growing movement towards so-called immersion schooling, in which children are taught in another language half the time. The state of Utah has been pioneering the idea, with many of its schools now offering immersion in Mandarin Chinese or Spanish.

"We use a half-day model, so the target language is used to teach in the morning, and then English is used in the afternoon – then this is swapped on other days as some learn better in the morning and some in the afternoon," explains Gregg Roberts, who works with the Utah Office of State Education and has championed immersion language teaching in the state. "We have found that the kids do as well and generally better than monolingual counterparts in all subjects. They are better at concentrating, focusing and have a lot more self-esteem. Anytime you understand another language, you understand your language and culture better. It is economically and socially beneficial. We need to get over our affliction with monolingualism."

The immersion approach is being trialled in the UK now, too. At Bohunt secondary school in Liphook, Hampshire, head teacher Neil Strowger has introduced Chinese-language immersion for a few lessons.

I sit in on an art class with 12-year-olds being taught by two teachers: one speaking English, the other Chinese. The children are engaged but quiet, concentrating on the task of learning multiple ideas. When they speak it is often in Chinese – and there is something rather surreal about watching young people in the UK discussing British graffiti artist Banksy in Mandarin. The children say they chose to learn in Chinese because they thought it would be "fun" and "interesting" and "useful" – a far cry from the dreary French lessons I endured at school.

The majority of the art class will take their Chinese GCSE exams several years early but Strowger tells me the programme has had many benefits in addition to their grades, including improving students' engagement and enjoyment, increasing their awareness of other cultures so that they are equipped as global citizens, widening their horizons, and improving their job prospects.

What about those of us who have left school? In order to maintain the benefits of bilingualism, you need to use your languages and that can be tricky, especially for older people who may not have many opportunities to practise. Perhaps we need language clubs, where people can meet to speak other languages. Bak has done a small pilot study with elderly people learning Gaelic in Scotland and seen significant benefits after just one week. Now he aims to carry out a much larger trial.

It is never too late to learn another tongue, and it can be very rewarding. Alex Rawlings is a British professional polyglot who speaks 15 languages: "Each language gives you a whole new lifestyle, a whole new shade of meaning," he says. "It's addictive!"

"People say it's too hard as an adult. But I would say it's much easier after the age of eight. It takes three years for a baby to learn a [language](#), but just months for an adult."

As the recent research shows, that's a worthwhile investment of time. Being bilingual could keep our minds working longer and better into old age, which could have a massive impact on how we school our children and treat older [people](#). In the meantime, it makes sense to talk, hablar, parler, sprechen, beszél, berbicara in as many languages as you can.

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