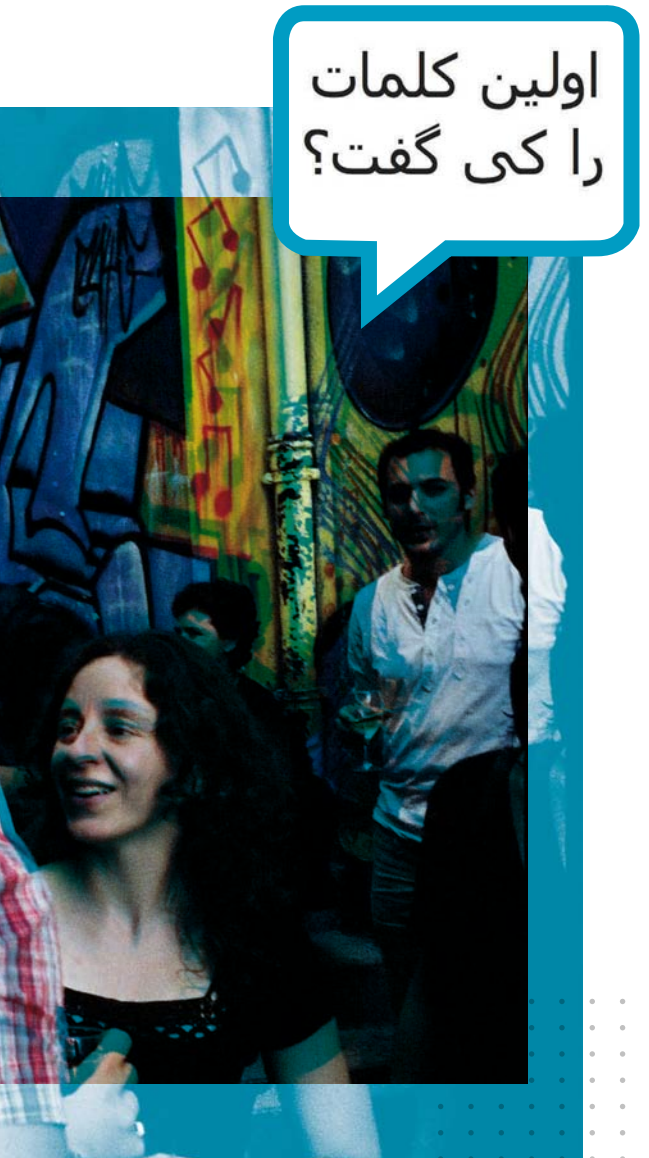



## CAN LEARNING A LANGUAGE REWIRE YOUR BRAIN?

As our species evolved parts of our brain expanded, resulting in more computing power for language. It's what makes us hard-wired for communication. What is perhaps more surprising is how language can shape our brains throughout our lives.

Most of the evidence for this comes from studies of people who are bilingual. Brain scan studies show that switching between two languages triggers different patterns of brain activity compared with speaking in one language, particularly in the prefrontal cortex. That part of the brain, at the very front of our skulls, is involved in organising and acting on information, including using working memory, reasoning and planning. Other studies show that bilinguals are faster at getting to grips with a new language.

Quadrilinguist Arturo Hernandez, director of the Laboratory for the Neural Bases of Bilingualism at the University of Houston in Texas, says these differences could reflect differences in the architecture of bilingual brains. In other words, learning another language could change how your brain is wired. "It would make sense, if you have had this very different linguistic experience, to see some sort of stable, long-lasting effect," Hernandez says.

It may also make the brain more resilient. Ellen Bialystok at York University in Toronto, Canada, has found that lifelong bilinguals tend to be diagnosed with dementia on average 4.5 years later than monolinguals, and have more white matter, including in their prefrontal cortex. White matter is made of nerve fibres that connect different brain regions, shuttling information back and forth between them. So boosting language skills appears to build more connected brains – although Bialystok cautions that this still needs to be confirmed.

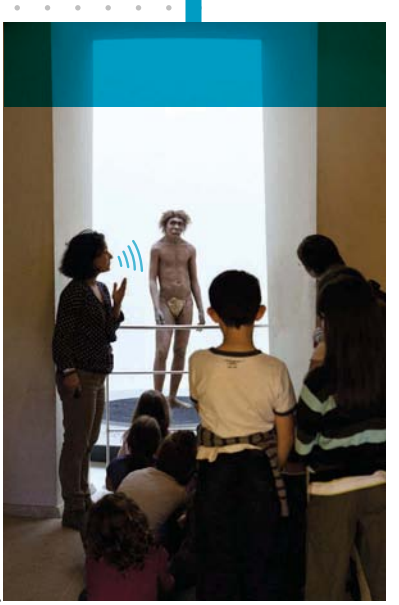
More evidence for the benefits of second languages came last year from a study of 608 people who had had a stroke. Thomas Bak of the University of Edinburgh, UK, found that of the bilinguals among them, 40 per cent recovered full function, compared with only 20 per cent of monolinguals. Bak speculates that the mental gymnastics involved in speaking several languages could build extra connections that improve function and help cope with damage. "The idea is that if you have a lot of mental exercise, your brain is trained and can compensate better," says Bak. **Megan Scudellari** is a science writer in Boston

words they say are globally shared because they sound almost the same also includes *who, what, two* and *water*.

Another approach is to look at words that change very slowly over long periods of time. My own team has used such statistical studies to show that words for the numbers 1 to 5 are some of the slowest evolving. Also on this list are words involved in social communication, like *who, what, where, why, when, I, you, she, he* and *it*. This list fits with the expectation that language evolved because of its social role (see "Why did we evolve language?", page 28). It also has some overlap with Ruhlen's list.

More broadly, we can say with some confidence that the first words probably fitted into just a few categories. The first ones may have been simple names, like those used by some of our primate relatives.

**Some sounds could be relics of an ancestral mother tongue**



JUAN MANUEL CASTRO PRIETO/AGENCE VU/CAMERA PRESS

Vervet monkeys give distinct alarm calls for leopards, martial eagles and pythons, and young vervets must learn these. In humans, *mama* is a strong candidate for a very early noun, given how naturally the sound appears in babbling and how dependent babies are on their mothers. The sound "*m*" is also present in nearly all the world's languages.

Imperatives like *look* or *listen* are also likely to have appeared early on, perhaps alongside verbs like *stab* or *trade* that would have helped coordinate hunting or exchanges. Even this simple lexicon allows sentences like "look, wildebeest" or "trade arrows". Finally, simple social words like *you, me* and *I, yes* and *no*, were probably part of our early vocab. Amusingly, a recent study suggested that *huh* is universal, prompting headlines that it was among the first human words. Perhaps it was the second.

Mark Pagel


# CAN LANGUAGE INFLUENCE HOW YOU SEE THE WORLD?

Time flows from back to front for English-speakers: we "cast our minds back" to the 1990s, and "hope for good times ahead". It's an example of a cultural concept encoded in language, but can language in turn influence how we think?

Maria Sera is a native Spanish-speaker who grew up believing all squirrels were female. The Spanish word for squirrel, *ardilla*, is feminine. As a linguist at the University of Minnesota, she has found some substance for her childhood belief. Studies of French and Spanish speakers, whose languages attribute genders to objects, suggest they associate those objects with masculine or feminine properties.

The idea that the language you speak could influence how you think dates back to 1940, when linguist Benjamin Lee Whorf proposed that people whose languages lack words for a concept would not understand it. It was relegated to fringe science until the early 2000s, when a few people began probing a related but more nuanced idea: that language can influence perception.

Greek, for instance, has two words for blue – *ghalazio* for light blue and *ble* for a darker shade. A study found that Greek speakers could discriminate shades of blue faster and better than native English speakers.

Language even seems to affect our sense of space and time. Some peoples, like the Guugu Yimithirr in Australia, don't have words for relative space, like left and right, but do have terms for north, south, east and west. Studies have shown that they tend to be unusually skilled at keeping track of where they are in unfamiliar places. There is also some evidence that the direction in which your first language is written can influence your sense of time, with speakers of Mandarin more likely to think of time running from top to bottom than English speakers. And the language you speak may affect how you perceive others (see "Does your language shape your personality?", right).

More generally, language helps us understand the world by allowing us to categorise things. Children are better at grouping objects if they have already learned the names of the categories they belong to. Conversely, after a stroke, people who have lost language skills can have trouble grouping objects. "It's not that language just affects some high-level reasoning part of the brain," says Gary Lupyan of the University of Wisconsin-Madison. "It's changing our basic perceptual representations." **Megan Scudellari**

**"GREEKS HAVE TWO WORDS FOR BLUE AND ARE FASTER AT TELLING SHADES OF BLUE APART"**


KIKE CALVO/NATIONAL GEOGRAPHIC CREATIVE

**What's in a word? It depends who you're talking to**

## DOES YOUR LANGUAGE SHAPE YOUR PERSONALITY?

**"To have another language is to possess a second soul," Charlemagne is rumoured to have said. He may have been on to something. In the 1960s, sociolinguist Susan Ervin-Tripp of the University of California at Berkeley asked English-Japanese bilinguals to describe what was going on in ambiguous pictures. One person, for example, told a different tale depending on their storytelling language. A picture of a woman leaning against a couch elicited a story in Japanese about a woman contemplating suicide after the loss of her fiancé. The same person, asked to respond at a separate session in English, said the woman was completing a sewing project for a class. "In general, there was more emotion in the Japanese stories," Ervin-Tripp wrote in a description of the experiment. "The switch in language draws with it the cultural baggage associated with that language."**

**Nairán Ramírez-Esparza at the University of Connecticut asked bilingual Mexicans to rate their personalities using both English and Spanish questionnaires. English responses emphasised openness and extroversion, while Spanish responses were more humble and reserved. "Language is such a powerful thing. It obviously makes you see yourself differently," Ramírez-Esparza says.**

**According to Shai Danziger of Ben-Gurion University in Israel and Robert Ward of Bangor University in the UK, it can also influence how you think of others. They asked Arabic-Hebrew bilinguals to match Arab and Jewish names with positive or negative trait words by pressing a key. They say participants showed more involuntary positive attitudes towards Jews when tested in Hebrew than when tested in Arabic. Paula Rubio-Fernandez of the University of Oslo, meanwhile, has found that bilingual children perform better on tests that require them to understand a situation from someone else's perspective.**

**Evidence is mounting that the words we speak and think shape our brains, perceptions, and personalities. Who knows what else? Perhaps our tastes, habits, or values. The door is wide open.**
Megan Scudellari

MARTIN PARR/MAGNUM PHOTOS

**English will move outside of native speakers' control**

## WILL WE ALL ONE DAY SPEAK THE SAME LANGUAGE?

With over a billion native speakers, Mandarin Chinese is the language spoken by the greatest number of people. English comes third, after Spanish. But unlike Mandarin and Spanish – both spoken in more than 30 countries – English is found in at least 100. In addition to the 335 million people for whom it is their first language, 550 million cite it as their second. It dominates international relations, business and science.

All this suggests English is on course to be the planet's lingua franca. It just probably won't be the English that native speakers are used to.

Millions of second-language English speakers around the world have created dialects that incorporate elements of their native languages and cultures. Anna Mauranen of the University of Helsinki in Finland calls these varieties similects: Chinese-English, Brazilian-English, Nigerian-English. Taken together they – not American or British English – will chart the language's future path, she says.

"We used to think there were two possible futures," says Jennifer Jenkins at the University of Southampton, UK. "In one we'd all end up speaking American English. In the other, English would separate like Latin did, and we'd end up with [new] languages. I don't think either of those is happening."

Instead, English similects are probably here to stay. Even in a future where China, India and Nigeria are global superpowers, English is likely to be the language of choice for international discourse, simply because it is already installed. Weirdly, this puts native speakers at risk. "We're getting to the stage where all the educated people of the world have English," says Jenkins. "Once it's no longer a special thing, native speakers lose their advantage."

They could even be at a disadvantage. Non-native speakers are all tuned to each-other's linguistic quirks. "If you put a Chilean, a Japanese and a Polish person in a discussion in English, they understand each other perfectly," says Jenkins. "Put one with two native English speakers and there might be problems."

Mauranen envisions a future in which English similects begin to blend over national borders. New dialects are likely to form around trades or regions. She says these common goals will drive the evolution of the lingua franca, regardless of whether we call it English or not.

That is not to say that all other languages will vanish. German will remain the language of choice within German borders. Even Estonian, spoken by just 1 million people, is safe. "It's a fully fledged language, used for everything [in Estonia]," says Mauranen.

Likewise, the language directly descended from Shakespeare's English has staying power with Brits and Americans. But English, like football, will soon move outside their control, pulled into something new by the rest of the planet. **Hal Hodson** is a technology editor at *New Scientist* ›