

How humans evolved language, and who said what first

Mark Pagel

We are the only living ape with complex language, but why? What were the first words, and who spoke them? And did Neanderthals converse too?

Who spoke the first words?

Language is a powerful piece of social technology. It conveys your thoughts as coded puffs of air or dozens of drawn symbols, to be decoded by someone else. It can move information about the past, present and future, formalise ideas, trigger action, persuade, cajole and deceive.

Today, [there are 7102 such codes spoken around the world](#). All human societies have language, and no language is “better” than any other: all can communicate the full range of human experience. To those of us who study human evolution, this incredible universality suggests that our species has had language right from when *Homo sapiens* arose in Africa between 200,000 and 160,000 years ago. A more recent origin could not explain how groups that stayed in Africa after *H. sapiens* migrated to the rest of the world 60,000 years ago also have language.

If *H. sapiens* has always had language, could other extinct human species have had it too? Some believe that Neanderthals did – which would imply we both inherited it from our common ancestor some 500,000 or more years ago. This theory is consistent with the discovery that *FOXP2*, a gene that is essential to speech, is identical at two key positions in humans and Neanderthals but different in chimpanzees. But a single gene is not enough to explain language. And recent genetic evidence shows that the Neanderthal brain regulated its version of *FOXP2* differently.

What’s more, language is inherently symbolic – sounds stand for words that stand for real objects and actions. But there is scant evidence that Neanderthals had art or other symbolic behaviour – a few pieces of pigment and some disputed etchings. By comparison, the humans who lived alongside them in Western Europe painted beautiful murals, made musical instruments and had a wide variety of tools and weapons. Suggestions that language evolved even earlier – for example in *Homo erectus*, an upright ape that walked on the African savannah two million years ago – are little more than idle speculation. It seems more likely, from the existing evidence at least, that our ability to bend each other’s ears is indeed unique.

Why did we evolve language?

Our language skills didn’t come for free. Humans had to evolve complex brain circuits and sophisticated machinery in order to speak, and spend precious years teaching their children. Why pay that price?

Many people attribute our linguistic skills to our large brains, ability to make complex hand gestures, distinctive vocal tracts and to the gene *FOXP2*, which gives us the fine-tuned control of our facial muscles. But on their own, these traits do not explain why we evolved language. There are animals with larger brains, gesturing is widespread among primates and some bird species can imitate human speech without our descended larynx or our particular version of *FOXP2*.

Instead, the feature that most clearly separates us from other animals is the sophistication of our symbolic and cooperative social behaviour. Humans are the only species that routinely exchanges favours, goods and services with others outside their immediate family. We have an elaborate division of labour, we specialise at tasks and then trade our products with others. And we have learned to act in coordinated ways outside the family unit, such as when a nation goes to war or people combine their efforts to build a bridge.

We take the complexity of our social behaviour for granted, but all these actions rest on the ability to negotiate, bargain, reach agreements and hold people to them. This requires a conduit – like a modern USB cable – to carry complex information back and forth between individuals. Language is that conduit.

Some social insects – ants, bees and wasps – have a level of cooperation without language. But they tend to belong to highly related family groups, genetically programmed to act largely for the good of the group.

Human societies must police anyone who tries to take advantage. With words and symbols, we can expose them as cheats and tarnish their reputations. We can lavish praise on those worthy of it, whose reputations will be elevated even among those they have never met: words can travel further than a single action.

All these complicated social acts require more than the grunts, chirrups, odours, colours and roars of the rest of the animal kingdom. They tell us why we and we alone have language: our particular brand of sociality could not exist without it.

What were the first words?

It's a fair guess that there was once an original mother tongue – the ancestor to all living and dead human languages. The evidence for this is that all human languages, unlike other forms of animal communication, string together words into sentences that have subjects, verbs and objects (“*I kicked the ball*”), and anyone can learn any language.

Comparative linguists search for sounds that come up again and again in languages from all over the world. They argue that if any relics of a mother tongue still exist today, they will be in those sounds. Merritt Ruhlen at Stanford University in California, for example, argues that sounds like *tok*, *tik*, *dik*, and *tak* are repeatedly used in different languages to signify a toe, a digit or the number one. Although studies by Ruhlen and others are contentious, the list of 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. 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.

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Happy talk: How your language shapes your brain and personality

The language you speak not only affects your brain's structure, it influences how you see the world and who you are. And as for bilingual brains...

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.

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?”).

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.”

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.

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Our future language? English rulz OK, txtspk and mind-reading

With technology changing how we communicate, a warped English scattered with txtspk and emoticons could dominate – if we're still speaking at all, that is

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.

How is technology changing language?

"Writing used to be very formal," says Lauren Collister of the University of Pittsburgh, Pennsylvania. "It was books, love letters or newspaper articles. Grammar and spelling were expected to be precise."

That is changing. Every day, millions of us have real-time conversations in writing, online and on our mobile phones. As a result, writing is evolving. "Chat rooms, instant messaging, they all contributed to informalisation of written language," says Collister. Goodbye "To whom this may concern"; hello txtspk, "_(ツ)_/" and DBEYR*. This evolution is happening so quickly that we are already seeing it move offline and back into speech and formal lexicons. In 2011, "lol" was added to the Oxford English Dictionary.

Internet-speak often bypasses language barriers, so the next netspeak could have foreign roots. Japanese forums use "Orz" to signify kneeling down: the O is the head, r the arms and body, and z is the kneeling legs. Depending on context, it is used to signify failure and despair, or sarcastic admiration. Chinese netspeak has adapted Orz to Chinese script, 囧rz, to convey a facial expression. Xiangxi Liu of the University of Massachusetts, Amherst, foresees an explosion of such online language, especially in Chinese, which can draw on thousands of characters.

Even the traditional building blocks of language – letters and words – are being upgraded. Ramesh Jain of the University of California, Irvine, thinks images will play a bigger role in future online communication,

precisely because they cross language barriers. [You only have to look at how Facebook](#), Google and chat companies like Line are continually growing their emoticon and sticker libraries to see the evidence for this. This has created a strange new linguistic barrier: money. Line users pay for stickers. The company made \$75 million from this scheme in its first year. Don't be deflated, though. If there is anything the explosion of internet memes and netspeak shows, it's how quick and crafty we are at inventing our own new words, which are adopted (or not) by the ruthless natural selection of social media.

Could we one day communicate without speaking?

Private thoughts fill your head every second of the day, safe from prying ears – for now. Lately, researchers have begun exploring ways to decipher our internal monologues from a distance. Don't jump for your tin foil hat just yet. The aim is to give a voice to people who are paralysed and unable to communicate, but fully aware of their surroundings.

Adrian Owen at the University of Western Ontario in Canada showed in 2010 that it was possible to communicate with such "locked-in" people through questions with yes or no answers. The person would imagine walking around their home for "yes", or playing tennis for "no". A scanner picked up on the distinct brain activity patterns that each scenario produces. With a small delay, the team was able to decode yes/home and no/tennis.

But a one-sided conversation isn't much fun. Philip Kennedy of Neural Signals in Duluth, Georgia, has designed a brain implant that records activity in areas that control the movement of your mouth when you shape a word. He is investigating whether this could be used to interpret a person's intention to speak, and command a speech synthesizer to do the actual talking.

An alternative is to decode brain activity associated with concepts, rather than words. João Correia at Maastricht University in the Netherlands has done this using non-invasive EEG recordings. He reckons this could one day give people enough mental "vocabulary" to form whole sentences, or at the very least a few vital words.

Meanwhile, Brian Pasley and his colleagues at the University of California, Berkeley have found that groups of neurons in the auditory areas are tuned to certain frequencies and rhythms. The activity is the same whether you hear a word or merely think it. Pasley has built an algorithm that analyses [which neurons are active when people think about talking and converts that information back into speech](#).

It's a little rough and ready, and electrodes have to be implanted in the brain, but the outcome is impressive. Listening to one of the recordings, I was able to recognise the word "Waldo", produced from imagined speech. It may be far-fetched, says Correia, but it's also "the closest we've come to speaking with the mind".

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Appy talk: How tech is changing the way we learn languages

Apps now promise to fast-track your route to fluency, but can you really learn a new language on your commute?

IT WAS time to say tawa pona, or farewell in a language most of us had never heard of 48 hours before. I had joined a group of 17 language enthusiasts who signed up to learn a new way of communicating in just two days. It seemed a lofty goal, but by the end of the experience, we were all reasonably fluent. As someone who flunked French and German in my teens, the idea that I could pick up a new language so quickly was a revelation. I had labelled myself a lifelong monoglot, and, like many others who never took to languages at school, was discouraged by the idea that once the precious easy-learning window of childhood has passed, the task of mastering a new language becomes an uphill struggle.

Research has now dispelled that notion. The brain does get rewired as you age, and kids do grow up surrounded for much of the day by the language they want to acquire, but [being an adult does have advantages when it comes to learning](#). One of them is probably in your pocket right now.

“Technology is really the way that learning is going,” says [Rosalind Potts](#), who studies memory and learning at University College London. Gone are the days of parroting stock phrases from a chalkboard. Mobile devices and the internet are offering us adaptive, personalised ways to absorb more information and make the most of every spare second. “Learning is coming out of the classroom and into the big wide world where people are much more in control,” says Potts.

The idea that technology can fast-track us to fluency during stolen moments in our busy lives is an attractive one. My two-day boot camp to learn an artificial language called Toki Pona made use of an app called Memrise – a kind of intelligent flash-card deck that taps into the latest findings in cognitive science to make learning vocabulary easier. It bills itself as “the ultimate memorisation tool for language”, and has 5 million users. Another language app, [Duolingo](#), one of the most popular, has accrued 105 million registered users since it launched in 2011, and there are many other similar tools out there (see “[Teacher in your pocket](#)”). Such is their popularity that several of the companies behind the apps are now hoping to get their tests approved as recognised language certificates. But does the technology work, and can people really multitask their way to being multilingual?

It’s no secret that children tend to find it easier than adults to pick up language skills. Part of that is because children’s brains are [tuned to discern the sounds of any language](#), allowing them to develop the right accent. But that ability doesn’t last forever, and later in life clumsy accents are hard to shake.

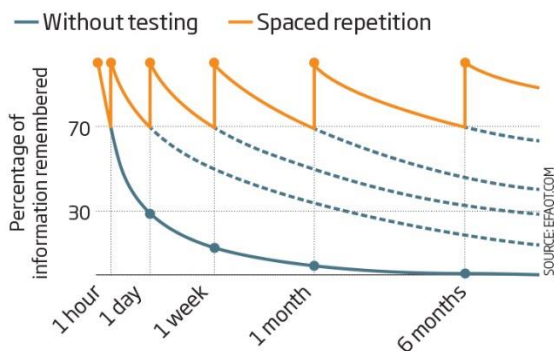
That doesn’t mean we should lose heart. There are other reasons why children are quick on the uptake, and insights into the way adults think and learn can help technology recreate the benefits. For a start, kids have adults correcting them whenever they err. Adults are more likely to learn new words through study, and tend to rely on self-testing instead.

This is one area where technology can step in. Testing not only helps us find out what we don’t know, but is itself a good way to make words stick. Without a top-up, the strength of memories can halve within a day or two of learning something. After this we continue to forget at a less dramatic rate for some time.

But when is best to test yourself? Test too soon and the benefit might be wasted; too late and you’ll have to do some relearning. In 2008, psychologists at Carnegie Mellon University in Pittsburgh, Pennsylvania, put testing to the test. They found that each exam gives your memory [a little boost](#) that weakens over time. For optimal learning, you need to be tested soon after first studying, and then at carefully timed and ever expanding intervals (see graph). Using this knowledge, the team developed algorithms for optimal test scheduling.

Timetabled testing

Scheduling tests at just the right time can stop you gradually forgetting what you have learned. The longer since you first encountered the information, the less often you need to practise



Several companies are trying to capitalise on this idea. Memrise, for instance, shows you a word, then immediately tests you on it. The app also sends notifications to tell you when to practise to boost your decaying memories.

This kind of regular testing was a key part of our first morning learning Toki Pona. But while such drilling certainly gets some words stuck in your head, we still spent much of that time getting things wrong. Toki Pona only has 120 words – creator Sonja Lang designed it to simplify her thoughts – but getting to grips with even a simple language is a tall order before lunch.

Memorable mistakes

Unknown to us, making mistakes so soon might have been useful. The accepted wisdom suggests that getting things wrong hinders learning. “Wrong answers can be quite deleterious for memory because you run the danger of storing them,” says Ed Cooke, co-founder of Memrise.

But it’s time to rethink this idea, says Potts, whose latest research implies that we’d do well to err more often. Her team asked people to guess the meanings of Basque words. None of the participants knew the language, so their guesses tended to be wildly wrong. However, [this group had better recall](#) in a subsequent test than a group who just read translations of each word.

“As long as you get feedback then there doesn’t seem to be any harm in making errors, and in fact it’s probably better for memory,” Potts says. She reasons that a desire to know the right answer after making a wrong guess means people pay more attention to the feedback, which creates stronger memories.

The potential embarrassment of messing up renders many adults mute when abroad. But testing yourself with an app, chatting to strangers over social media or using a foreign language blogging platform like Lang-8 – where native speakers correct your errors – all provide a non-judgemental environment for making mistakes.

Our Toki Pona learning marathon rivalled another advantage that children ostensibly have over adults. Kids spend lots of time immersed in a new language. The turning point for us came on the second morning, when we banned English. There was awkward silence at first, but we soon began to venture phrases and were forced to get creative. Coffee was “telo pimaje wawa”, which means powerful dark liquid.

But according to Katie Nielson, chief education officer of Voxy, which has a digital tool for English learners, immersion might not be ideal for adults. “It’s impossible to learn a second language the way you learn a first language because your brain is structured differently,” she says. “If you take adults who don’t know anything and you put them into an environment where everyone is speaking this new language, they’re not going to learn it. They need to have it offered to them at a level that they can understand.”

Part of the reason might be because adults can think about their use of language in a way that children can’t. This helps with learning vocabulary. Children are learning new concepts at the same time as they’re learning how to express them. For adults, when it comes to learning the word for love, say, in another language, there’s no need to build the concept of love from scratch; you just attach a new label to your existing association. Love is still love in Sweden even if it is called *kärlek*.

But too much thinking about language can make learning a new grammar tougher. In one recent study, researchers asked two groups of people to listen to an artificial language. One group was told to pay attention to the words. The other was given tasks like colouring as a distraction. Although both groups picked up the rules governing word order, those who had [concentrated had a harder time](#) working out which out of three categories a novel word would belong to.

All this hints that the best approach might be a combination of techniques. If there are some aspects that we pick up more easily without overthinking them, apps that allow you to learn passively – for instance by watching a foreign film – could be just the ticket. When it comes to grammar, some digital tools can make learning more implicit.

Estonian physicist Mait Müntel was working at CERN near Geneva, Switzerland, when he realised he wasn't interacting with his French colleagues. But learning French was a daunting prospect. To make the task more manageable, he wrote algorithms that would adapt to his strengths and weaknesses as he learned. The system starts off with simple sentences, getting you to fill in easy nouns or basic present-tense verbs, but gets more challenging as you improve, adjusting the example sentences to make you practise the things you're worst at more frequently. "It constantly calculates in real time what you should do to be most efficient," says Müntel.

The method worked for him. "I learned for a couple of months, then passed the national examination of French that usually people take after learning for 10 years in school," he says. Müntel is now one of a team developing the program, called [Lingvist](#), promising to get people speaking French in 200 hours or less. So, app-based learning can be effective, and what's more, it's enjoyable. Our Toki Pona marathon proved the power of games in language learning. How do you describe a spider in a language that only has 120 words? We played Pictionary, hangman, charades – anything we could think of that might help. That interaction and competition was a boon, so it comes as no surprise that many apps use levels and badges to keep learners keen.

Research suggests that [games can lower language learning anxiety](#), but with games specifically designed to teach language, the bells and whistles can be distracting. In one study, people who watched an interactive language game being played [could recall more vocabulary](#) than those who actually played it. The cognitive burden of playing and learning was too great.

But what of other games? Dionne Palmer of the University of California, Davis, looked at whether it would be possible to use the online multiplayer game *World Of Warcraft* to learn Spanish, just by changing the location settings. After 370 hours of playing over eight months, she improved her Spanish literacy skills to an extent equivalent to two academic terms of classroom instruction, or roughly 200 hours. It's a major time commitment, but if you are playing anyway, just switch your settings and learn.

Enjoyment can also come from tapping into the endless online content aiming to give learners a choice of relevant material. Nielson says this maintains motivation because the learned skills seem relevant, and providing people with material tailored to their interests can also help them decipher unfamiliar words.

With so many factors influencing how we learn, it's not easy to identify the best mix of tools to suit a learner's needs. "We tend to study techniques in isolation and we don't know the effect of combining them," says Potts. But with millions of users, apps provide a mine of information about what works.

Memrise recently launched a competition to figure out the most effective way to use a single hour of study time. And Voxy has begun a partnership with the University of Maryland, using tests to measure learners' working memory and preferred learning styles in order to better personalise instruction.

The big question is whether the skills gleaned from digital tools translate to the real world, or whether people's language scores improve simply because they get better at using the technology itself. That's hard to test, and so far relatively little research has been done. One way is to pit the technology against traditional standards. Last year, Roumen Vesselinov of the City University of New York and his colleagues showed that, on average, [Duolingo](#) users took 34 hours to cover the material needed to pass one semester of a [language test commonly used for university placements](#). "What seems to matter most is not how much you do, but how regularly," he says. The team is now conducting studies on other apps.

This kind of independent evaluation is important not just for casual learners, but also because the technology is catching the eye of formal educators. "I am constantly getting questions from school district representatives looking to buy language apps," says Vesselinov. "All of them want efficacy measures for the most popular apps."

Companies behind the technologies also want to establish their credentials by having users gain recognised language qualifications. Duolingo, for example, has set up a paid-for testing service, and Voxy and another popular platform called Busuu have deals with Pearson, a company that sets one test for English as a foreign language, accepted by governments and universities.

From personal experience, I can say that digital tools are making language learning fun and engaging, and that they can give you the confidence to at least give it a try. I gave up learning Toki Pona (along with my fears about remaining a monoglot), and applied the same tools and techniques to Swedish.

By swotting up on vocabulary on my commute, watching subtitled Scandinavian dramas in the evening, and writing on my Lang-8 blog, I managed to surprise my Swedish-speaking partner by holding court on Valentine's Day, just three months later. There's no better way of showing your *kärlek* than that.

Teacher in your pocket

There's no shortage of apps to help you learn a language:

CNA SPEAKING EXCHANGE connects English learners with elderly speakers seeking social interaction

FLEEX puts subtitles on videos, gradually adjusting the mix from your native to your target language

LANG-8 lets you blog in a foreign language, while native speakers correct your mistakes

WAITCHATTER tests your vocabulary while you wait for friends to reply using instant messaging

BUSUU is a social media site for language learners around the world

HINATIVE allows you to put language questions – such as the meaning of idioms – to those who know

DUOLINGO treats learning like a game, with points and extra lives to keep you motivated

MEMRISE quizzes you on foreign vocabulary just before you forget

VOXY displays foreign media articles relevant to your interests and at exactly the right level of difficulty

This article appeared in print under the headline "Live and learn"

You are what you speak: How your mother tongue shapes you

If a language controls its speakers, not vice versa, that might help explain some uniquely German diseases, Japanese emotions, and national stereotypes

KREISLAUFKOLLAPS wasn't a concept I had encountered until a colleague phoned to say that something unfortunate might be about to happen to her as she got out of the bath. If she didn't appear at our 10 o'clock seminar, I was to inform the authorities immediately.

As it happens she did turn up, and we never mentioned it again. But as a rookie PhD student in a small town in southern Germany – in physics, not linguistics, medicine or anthropology – the incident perplexed me. From then on, *Kreislaufkollaps* seemed to be everywhere. Celebrities, acquaintances, the landlord of the pub downstairs – all succumbed. By general consent, it was a serious malady. The only sure remedy was several days of bed rest.

"Circulatory collapse", said the dictionary. But this condition was equally foreign to me. Only gradually did it dawn on me that this was not a bug, but a feature of my adopted home. To good beer, excellent sausages and peerless engineering, add terrible hypochondria. This only exposed a deeper question. Had the German language expanded to accommodate [the culture's endemic ailments](#)? Or did these conditions only exist thanks to its peerless ability to fashion words such as *Frühjahrs Müdigkeit* – the feeling of ennui that colours the dark, early months of the northern European year?

Such questions are, like many in linguistics, mired in controversy. "The official party line is that you invent and develop words as tools," says [James Pennebaker](#), a psychologist at the University of Texas at Austin and author of *The Secret Life of Pronouns: What our words say about us*. "If you need them, you will create and use them." But there is another school of thought: "[Language might dictate perception and behaviour](#)," he says.

Take that hoary old chestnut of [how many words for snow there are in the Eskimo-Aleut languages](#). The precise number is bogged down in arguments about how to define a word, but it's quite a few. That might be because people saw many types of snow around them and invented words to describe them – but it could also be the reverse. "You have many words for snow, therefore you are able to perceive snow better," says Pennebaker.

"Once you have a word for an emotion, it flourishes – people feel it more"

Fittingly, German speakers pioneered the idea that we are shaped by the language we speak. Wilhelm von Humboldt, a Prussian linguist, philosopher and diplomat, and elder brother of the naturalist [Alexander von Humboldt](#), argued that language creates a nation's spirit. The 20th-century German philosopher Martin Heidegger went so far as to write that "man acts as though he were the shaper and master of language, while in fact language remains the master of man".

Certainly, medical conditions that seem at least partly linguistically based aren't just a Teutonic phenomenon. The circulatory condition *jambes lourdes*, or "heavy legs", is unknown outside France. Only an Italian who ventures out inadequately clothed risks the full consequences of a *colpo d'aria* – "hit of air" – to spine, head or stomach.

Effects can be more subtle. Some [languages seem to influence how their speakers think about things like space, time](#) and even emotions, says Tiffany Watt-Smith, who researches the history of emotions at Queen Mary University of London. "The thing I find most compelling is the argument that certain cultures will name an emotion because it's more acceptable and valid, and once you name it you notice it more often," she says. "The emotion flourishes: [people feel it more because they have a word for it](#)."

A good example is the Japanese word *amae* – something like the comfort of knowing you can depend on another's support. The word might have emerged from an expressive need in Japan's collectivist culture, but once in existence it might also have allowed that aspect of culture to flourish.

I can relate to this chicken-and-egg explanation. One of the most emotional moments of my brief and undistinguished academic career in Germany was when, after five years of working together, my professor scheduled a meeting in which the main agenda point turned out to be offering me the opportunity to address him with the informal form of you, *du*. The most proximate cause of this strange formality between close colleagues was clearly the language that created the distinction in the first place – manners making the man. But it might not be that simple, says Pennebaker. "The thing is, lots of European languages have that distinction between formal and informal, but I don't know of any besides German that has that sort of

formal graduation ceremony,” he says. “Language reflects psychological state, rather than driving it.” Man maketh the manners, in other words.

The digital age, with its huge databases of everyday communication, might offer new opportunities to tease out the interplay between language and speaker across nations. Earlier this year, a team led by Peter Sheridan Dodds at the University of Vermont in Burlington published a study in which people rated the happiness of the most commonly appearing words in 10 languages in Google web crawls and searches, tweets and databases of music lyrics ([PNAS, vol 112, p 2389](#)). Spanish speakers rated their words as sunniest. The Chinese and Russians were gloomiest, and Germans were middling. English speakers rated their words as generally positive (except, oddly, when confronted with lyrics to music). Perhaps that conforms to national stereotypes – with the huge caveats that languages such as English and Spanish aren’t the preserve of one nation, and national stereotypes are, well, stereotypes. But the question remains open: is the mood making the language, or the language making the mood?

Positively speaking

Keith Chen, now at the University of California, Los Angeles, is someone whose work seems to come down on one side of the argument. He looked at behaviours – smoking, exercising, condom use and financial saving – among speakers of languages that distinguish events in the future using distinctive tense markers (such as English, “It will rain tomorrow”) compared with those that don’t (ones such as German that just use the present tense, “It rains tomorrow”). He found that speakers of languages that don’t make a distinction were more likely to act in ways that would improve their future well-being, such as not smoking. [It looks like causation, says Chen](#) – although he admits he can’t discount the possibility that languages have evolved to reflect existing behaviours.

Either way, I can’t help thinking that the German language imbues some reality to those uniquely German illnesses. They are certainly catching. After moving back to the UK, my low blood sugar levels – *Blutzuckerwerte*, a prelude to circulatory collapse – seemed real enough, even though for my compatriots I might as well have been translating from double Dutch.

Eventually, though, I regained my anglophone constitution. I’ve finally worked out the English for *Kreislaufkollaps*, too. It’s “having a funny turn” – and the most effective remedy here is a nice cup of tea, a sit down, and possibly a biscuit.

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