The eloquent ape

Frogs croak, birds sing and monkeys chatter. But no other species has our rich and infinitely adaptable language skills. Without them, trade, tribes, religions and nations couldn't have existed, to say nothing of the internet or the ink on this page.

To what do we owe our ability to share thoughts and influence others? How does it shape us, and how will it change?

Here's our guide to the nine biggest questions

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. **Mark Pagel** is an evolutionary biologist at the University of Reading, UK

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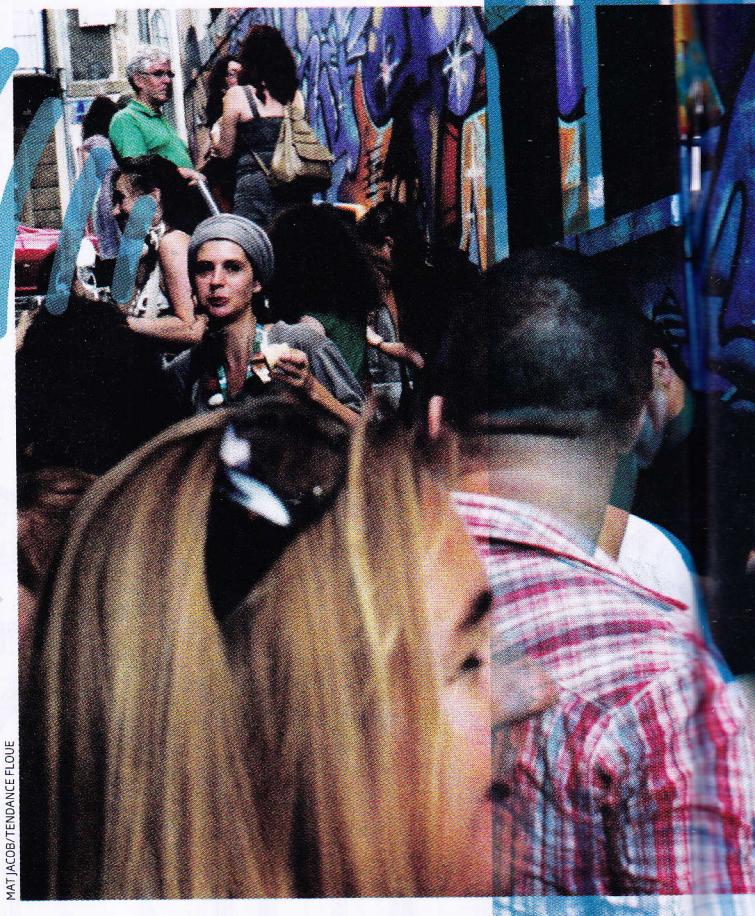
We take the complexity of our social behaviour for granted, but all these actions rest on the ability to negotiate, bargain, reach agreements and hold people to them. This requires a conduit – like a modern USB cable – to carry complex information back and forth between individuals. Language is that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

"TOK, TIK, DIK AND TAK MAY ALL DESCEND FROM AN ANCIENT WORD FOR TOE"

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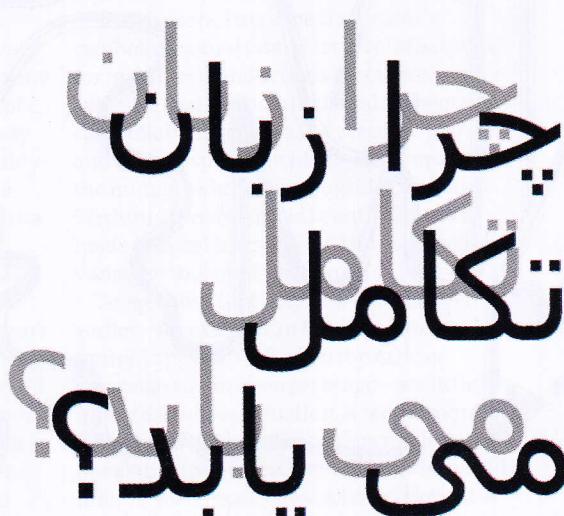
WHAT WERE THE FIRST WORDS?

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

اولین کلمات را کی گفت؟

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

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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

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

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

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

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* ▶

SAVING ENDANGERED LANGUAGES

David Harrison has devoted his career to recording and studying languages that are spoken by just a handful of people. He tells **Hal Hodson** why they matter.

You've travelled the world chasing dying languages. Why?

Language diversity is an insurance against the extinction of ideas and knowledge. Ancient languages, like those of Indigenous Australians or Papua New Guineans, are an irreplaceable record of sustainable human living. These cultures have immense knowledge about plants and ecosystems, different ways of thinking. When you lose their languages, you're losing concepts that have been refined over millennia.

What pushes a language to extinction?
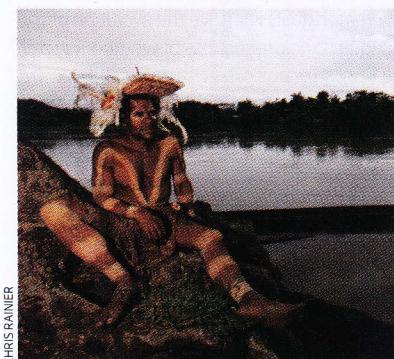
It is not number of speakers that predicts language vitality, it's the transmission rate. The largest Native American language is Navajo, with 50,000 speakers. But transmission rate is only 15 per cent.

The problem comes from an attitude, held both by dominant and minority language speakers, that small languages are backwards, obsolete, deficient in some way. I have worked in many communities where this attitude has taken hold. People abandon their language in despair. The last generation of people in a community who grow up speaking a language have a great sense of regret that this has happened.

These scenarios where you know the language is going to die are really sad. I've moved into a different area.

What are you focusing on now?

I'm working with small languages that still have speakers of all ages. Communities that

Louis Kolisi is keeping Yokoim alive through his songs

are pushing back against the hegemony of big languages in clever ways. Papua New Guinea has the lion's share of the world's linguistic diversity – a lot of small and medium-sized languages that are not at risk. People might learn between five and 10 of them. There are intangible factors that keep these languages alive. An attitude of linguistic superiority – our language is the most beautiful or complicated language in the world – will help, for instance.

The Yokoim language has about 1200 speakers in three villages. It's threatened because children go to school with other ethnic groups and speak Tok Pisin. But it has a few charismatic individuals, like Louis Kolisi, who composes and sings original songs in Yokoim. That's an astonishing thing if you think about it: children are abandoning the language, and here you have this person doing something creative with it.

Or take Siletz Dee-Ni, a Native American language. It has one fluent speaker and a handful of learners. But they're actively inventing new words for their language. They might, for instance, invent a word that means "brain in a box" instead of adopting "computer".

**So it is possible to save languages?**
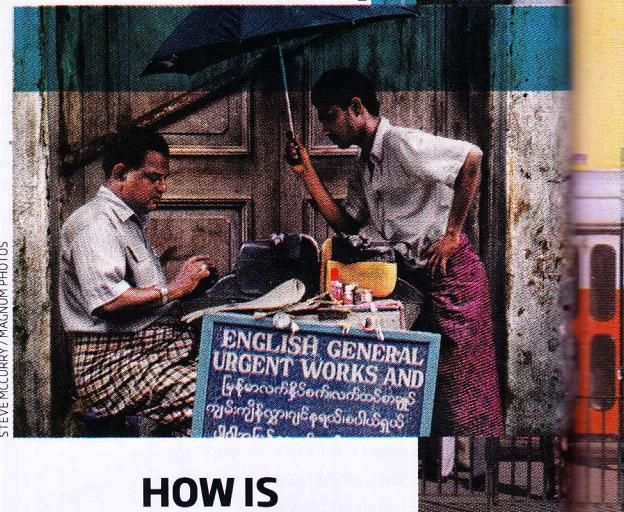
I think so. Biologists believe in storing live specimens to record and save biodiversity. You can do something similar for languages with the internet. In 2009, I visited Kundiman village, where they speak Yokoim. We made recordings and built a talking dictionary. They recorded stories and songs that are on YouTube now, and I'm recording them talking about their knowledge of plants. When I first visited, they had only heard about the internet – never used it. Now, their language has a presence online.

We've had requests from other offline Papuan communities to do the same. For several of them, their language is their first online presence. And when they do get the internet, they hear the voices of their elders speaking their languages. Think about those Papuans becoming computer programmers and technologists, and the diversity of thinking they could bring to that work.

David Harrison is a linguist at Swarthmore College in Pennsylvania

Làm sao kỹ thuật thay đổi được ngôn ngữ ?

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.

The question is, what new language is

THIERRY ARDOUIN/TENDANCE FLOUE

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.
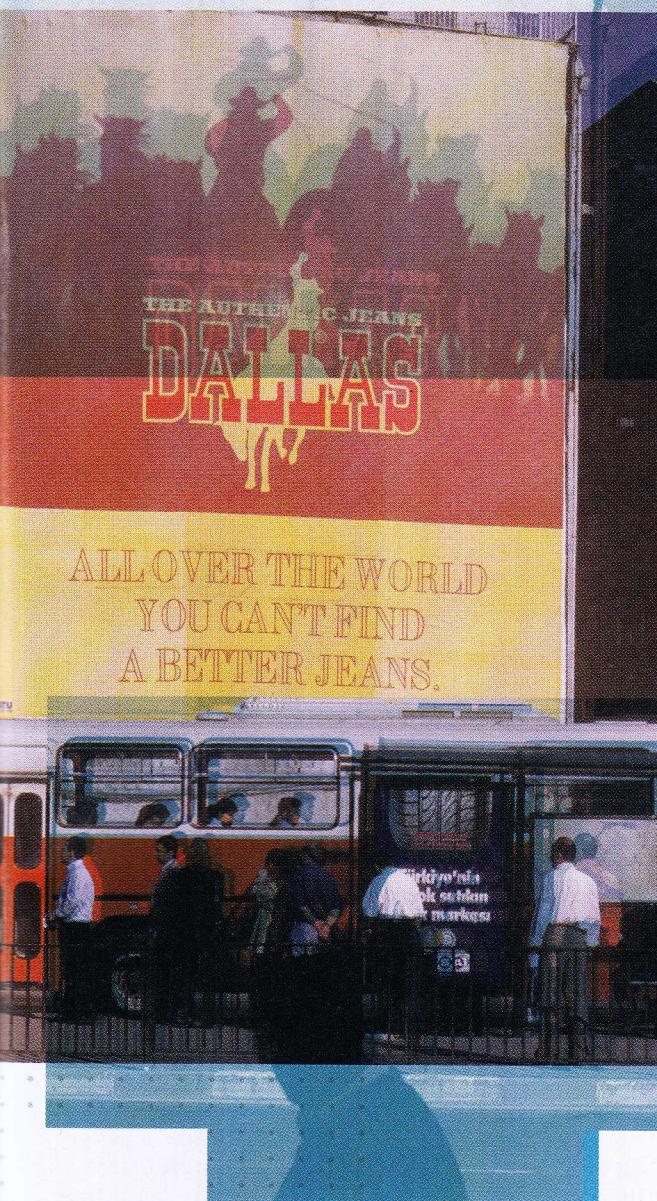
Adrian Owen at the University of Western Ontario in Canada showed in 2010 that it was possible to communicate with such "locked-in" people through questions with yes or no answers. The person would imagine walking around their home for "yes", or playing tennis for "no". A scanner picked up on the distinct 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". **Helen Thomson** is a *New Scientist* consultant

coming down the internet pipeline?

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. Hal Hodson
*Don't believe everything you read