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**How our brains cope with speaking more than one language**

Speaking a second or even a third language can bring obvious advantages, but occasionally the words, grammar and even accents can get mixed up. This can reveal surprising things about how our brains work.

*By Nicole Chang; 20 July 2022*

1. I’m standing in line at my local bakery in Paris, apologising to an incredibly confused shopkeeper. He's just asked how many pastries I would like, and completely inadvertently, I responded in Mandarin instead of French. I'm equally baffled: I'm a dominant English speaker, and haven't used Mandarin properly in years. And yet, here in this most Parisian of settings, it somehow decided to reassert itself.
2. Multilinguals commonly juggle the languages they know with ease. But sometimes, accidental slip-ups can occur. And the science behind why this happens is revealing surprising insights into how our brains work.

**Declerck: explanation and experience with using multiple languages**

1. Research into how multilingual people juggle more than one language in their minds is complex and sometimes counterintuitive. It turns out that when a multilingual person wants to speak, the languages they know can be active at the same time, even if only one gets used. These languages can interfere with each other, for example intruding into speech just when you don't expect them. And interference can manifest itself not just in vocabulary slip-ups, but even on the level of grammar or accent.
2. "From research we know that as a bilingual or multilingual, whenever you're speaking, both languages or all the languages that you know are activated," says Mathieu Declerck, a senior research fellow at the Vrije Universiteit in Brussels. "For example, when you want to say 'dog' as a French-English bilingual, not just 'dog' is activated, but also its translation equivalent, so 'chien' is also activated."
3. As such, the speaker needs to have some sort of language control process. If you think about it, the ability of bilingual and multilingual speakers to separate the languages they have learned is remarkable. How they do this is commonly explained through the concept of inhibition – a suppression of the non-relevant languages. When a bilingual volunteer is asked to name a colour shown on a screen in one language and then the next colour in their other language, it is possible to measure spikes in electrical activity in parts of the brain that deal with language and attentional awareness.
4. When this control system fails, however, intrusions and lapses can occur. For example, insufficient inhibition of a language can cause it to "pop up" and intrude when you're meant to be speaking in a different one.
5. Declerck himself is no stranger to accidentally mixing up languages. The Belgian native's impressive language repertoire includes Dutch, English, German and French. When he used to work in Germany, a regular train journey home to Belgium could encompass multiple different language zones – and a substantial workout for his language-switching skills. "The first part was in German and I'd step on a Belgian train where the second part was in French," he says. "And then when you pass Brussels, they change the language to Dutch, which is my native language. So in that span of like three hours, every time the conductor came over, I had to switch languages. "I always responded in the wrong language, somehow. It was just impossible to keep up with it."
6. In fact, language-switching scenarios – albeit in a laboratory rather than on a train – are often used by researchers to learn more about how multilingual people control their languages. And errors can be a great way to gain insight into how we use and control the languages we know.

**Gollan’s research**

1. Tamar Gollan, a professor of psychiatry at the University of California San Diego, has been studying language control in bilinguals for years. Her research has often led to counterintuitive findings.
2. "I think maybe one of the most unique things that we've seen in bilinguals when they're mixing languages is that sometimes, it seems like they inhibit the dominant language so much that they actually are slower to speak in certain contexts," she says.
3. In other words, a multilingual person’s dominant language can sometimes take a bigger hit in certain scenarios. For example, in that colour naming task described earlier, it can take longer for a participant to recall a word in their first language when switching from their second, compared to the other way around.
4. In one of her experiments, Gollan analyzed the language-switching abilities of Spanish-English bilinguals by having them read aloud paragraphs that were just in English, just in Spanish, and paragraphs that haphazardly mixed both English and Spanish.
5. The findings were startling. Even though they had the texts right there in front of them, participants would still make "intrusion errors" when reading aloud, for example, accidentally saying the Spanish word "pero" instead of the English word "but". These types of errors almost exclusively happened when they were reading aloud the mixed-language paragraphs, which necessitated switching between languages.
6. Even more surprising was that a large proportion of these intrusion errors weren't words that participants had "skipped over" at all. Through the use of eye-tracking technology, Gollan and her team found that these mistakes were made even when participants were looking directly at the target word.
7. And even though the majority of participants were dominant English speakers, they made more of these intrusion errors for words in English rather than their weaker Spanish – something that Gollan explains is almost like a reversal of language dominance.
8. "I think the best analogy is, imagine that there's some condition in which you suddenly become better at writing in your non-dominant hand," she says. "We've been calling this reversed dominance, we've been making a really big deal out of it because the more I think about it, the more I realise how unique this is, and how crazy it is."
9. This can even happen when we are learning a second language – when adults are immersed in the new language, they can find it harder to access the words from their native language.

**Effect 1 - reversed dominance in vocabulary**

1. Reversed dominance effects can be particularly evident when bilinguals switch between languages in a single conversation, says Gollan. She explains that when mixing languages, multilinguals are navigating a sort of balancing act, inhibiting the stronger language to even things out ​​– and sometimes, they go too far in the wrong direction.
2. "Bilinguals try to make both languages about equally accessible, by inhibiting the dominant language to make mixing back and forth easier," she says. "But they sometimes 'overshoot' that inhibition, and it ends up coming out slower than the non-dominant language."

**Effect 2 - reversed dominance in pronunciation**

1. Gollan's experiments also found reversed dominance in another surprising area – pronunciation. Participants sometimes read out a word in the right language, but with the wrong accent. And again, this happened more for English words than Spanish ones.
2. "Sometimes bilinguals will produce the right word, but with the wrong accent, which is a really interesting dissociation that tells you language control is being applied at different levels of processing," says Gollan. "And there's a separation between specification of accent, and specification of which lexicon you're going to be drawing the words from."

**Effect 3 – reversed dominance in grammar**

1. And even our use of grammar in our native language can also be affected in some surprising ways, especially if you've been highly immersed in a different language environment.

**Kasparian’s research**

1. "The brain is malleable and adaptable," says Kristina Kasparian, a writer, translator and consultant who studied neurolinguistics at McGill University in Montreal, Canada. "When you're immersed in a second language, it does impact the way you perceive and process your native language.
2. As part of a wider project done for her PhD research, Kasparian and her colleagues tested Italian natives who had emigrated to Canada and learned English as adults. All of them had anecdotally reported that their Italian was getting rusty, and that they didn't use it much in day-to-day life.
3. Participants were shown a series of sentences in Italian, and asked to rate how acceptable they were. At the same time, their brain activity was also measured through an electroencephalography (EEG) method. Their responses were compared to those of a group of monolingual Italians living in Italy.
4. "There were four different types of sentences, and two of them were acceptable both in Italian and in English, and two of them were acceptable only in Italian," says Kasparian. An example of the latter type would be the sentence: "I ladri che arresta il poliziotto attendono in macchina." (In English: "The thieves that arrests the policeman wait in the car.")
5. As it turns out, the Italian migrants were more likely to reject correct Italian sentences as ungrammatical if these did not match correct English grammar. And the higher their English proficiency, the longer they had lived in Canada, and the less they used their Italian, the more likely they were to have found the correct Italian sentences ungrammatical.
6. They also showed different patterns of brain activity as compared to the Italians living in Italy. Using an electroencephalogram (EEG) to record of brain activity, Kasparian and her colleagues aimed to capture a "millisecond-by-millisecond snapshot" of the electrical activity in participants' brains as language processing unfolded.
7. They found that, when presented with the sentences that were grammatically acceptable only in Italian (but not in English), the Italians living in Canada showed different brain activity patterns compared to those back in Italy.
8. In fact, their brain activity was more consistent with what would be expected from English speakers, says Kasparian, suggesting that their brains were processing the sentences differently to their monolingual counterparts back home.
9. English relies more on word order than Italian, explains Kasparian. And the migrants were relying more on the English grammar cues, she says, even though they were reading in Italian. "Even a first language can change, even if it's a language that you've used every day for most of your life," she says.
10. Of course, most multilingual people are quite capable of keeping their native language’s grammar straight. But Kasparian's study, as well as others done as part of her wider research project, show that our languages aren't just static throughout our lives but shifting, actively competing and interfering with each other.

**Goldrick: Interference as an explanation for difficulty with learning a new language**

1. Navigating such interference could perhaps be part of what makes it hard for an adult to learn a new language, especially if they've grown up monolingual.
2. "Every time you go to speak this new language, the other language is like, ‘hey, I'm here, ready to go’,” says Matt Goldrick, a professor of linguistics at Northwestern University in Evanston, Illinois. "So, the challenge is, you have to suppress this thing that is so automatic, and so easy to do, in favor of this thing that's incredibly hard to do as you're first learning it.
3. "You're having to learn how to pull back on the reins something that you normally never have to inhibit, it just comes out naturally, right? There's no reason to pull it back. And so that's I think a very hard skill that one has to develop, and that's part of why it's so hard.
4. One thing that might help? Immersing yourself in the environment of the foreign language. "You're creating a context in which you're strongly holding back this other language and you're getting a lot of practice holding back that other thing, so that gives room for the other (new) language to become stronger," says Goldrick. "And then when you return from that immersion experience, you're hopefully in a spot where you can better manage that competition," he adds. "It's never going to go away, that competition will never go away, you just get better at managing it."

**Advantages of multilingualism**

1. Managing competition is certainly something that multilinguals do tend to have a lot of practice in. Many researchers argue that this brings them certain cognitive advantages – although it’s worth noting that the jury's still out on this, with others saying their own research does not show reliable evidence for a bilingual cognitive advantage.
2. In any case, using languages is arguably one of the most complex activities humans learn how to do. And having to manage multiple languages has been linked to cognitive benefits in many studies, depending on task and age. Some studies have shown bilinguals perform better on executive control tasks, for example in activities when participants have to focus on counterintuitive information. Speaking multiple languages has also been linked to delayed onset of dementia symptoms. And of course, multilingualism brings many obvious benefits beyond the brain, not least the social benefit of being able to speak to many people.
3. But although my multilingualism may have brought me some advantages, it hasn't spared my blushes. Somewhat shamefully, I haven't been back to that particular bakery since my accidental language slip-up. So, maybe more pastry trips are in order – all in the name of practising language control, of course.