

Study Shows How Bilinguals Switch Between Languages

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Individuals who learn two languages at an early age seem to switch back and forth between separate “sound systems” for each language, according to new research conducted at the University of Arizona.

The research, to be published in a forthcoming issue of [*Psychological Science*](#), a journal of the [Association for Psychological Science](#), addresses enduring questions in bilingual studies about how bilingual speakers hear and process sound in two different languages.

“A lot of research has shown that bilinguals are pretty good at accommodating speech variation across languages, but there’s been a debate as to how,” said lead author Kalim Gonzales, a psychology doctoral student at the University of Arizona. “There are two views: One is that bilinguals have different processing modes for their two languages — they have a mode for processing speech in one language and then a mode for processing speech in the other language. Another view is that bilinguals just adjust to speech variation by recalibrating to the unique acoustic properties of each language.”

Gonzales’s research supports the first view — that bilinguals who learn two languages early in life learn two separate processing modes, or “sound systems.”

The study looked at 32 Spanish-English early bilinguals, who had learned their second language before age 8. Participants were presented with a series of pseudo-words beginning with a ‘pa’ or a ‘ba’ sound and asked to identify which of the two sounds they heard.

While ‘pa’ and ‘ba’ sounds exist in both English and Spanish, how those sounds are produced and perceived in the two languages varies subtly. In the case of ‘ba,’ for example, English speakers typically begin to vibrate their vocal chords the moment they open their lips, while Spanish speakers begin vocal chord vibration slightly before they open their lips and produce ‘pa’ in a manner similar to English ‘ba.’ As a result of those subtle differences, English-only speakers might, in some cases, confuse the ‘ba’ and ‘pa’ sounds they hear in Spanish, explains co-author Andrew Lotto, associate professor of speech, language and hearing sciences at the University of Arizona.

“When most people think about differences between languages, they think they use different words and they have different grammars, but at their base languages use different sounds,” Lotto said.

“One of the reasons it sounds different when you hear someone speaking a different language is because the actual sounds they use are different; they have a sound code that’s specific to that language,” he said. “One of the reasons someone might sound like they have an accent if they learn Spanish first is because their ‘pa’ is like an English ‘ba,’ so when they say a word with ‘pa,’ it will sound like a ‘ba’ to an English monolingual.”

For the study, the bilingual participants were divided into two groups. One group was told they would be

hearing rare words in Spanish, while the other was told they would be hearing rare words in English. Both groups heard audio recordings of variations of the same two words — bafri and pafri — which are not real words in either language.

Participants were then asked to identify whether the words they heard began with a ‘ba’ or a ‘pa’ sound.

Each group heard the same series of words, but for the group told they were hearing Spanish, the ends of the words were pronounced slightly differently, with the ‘r’ getting a Spanish pronunciation.

The findings: Participants perceived ‘ba’ and ‘pa’ sounds differently depending on whether they were told they were hearing Spanish words, with the Spanish pronunciation of ‘r,’ or whether they were told they were hearing English words, with the English pronunciation of ‘r.’

“What this showed is that when you put people in English mode, they actually would act like English speakers, and then if you put them in Spanish mode, they would switch to acting like Spanish speakers,” Lotto said. “These bilinguals, hearing the exact same ‘ba’s and ‘pa’s would label them differently depending on the context.”

When the study was repeated with 32 English monolinguals, participants did not show the same shift in perception; they labeled ‘ba’ and ‘pa’ sounds the same way regardless of which language they were told they were hearing. It was that lack of an effect for monolinguals that provided the strongest evidence for two sound systems in bilinguals.

“Up until this point we haven’t had a good answer to whether bilinguals actually learn two different codes — so a ‘ba-pa’ English code and a ‘ba-pa’ Spanish code — or whether they learn something that’s sort of in the middle,” Lotto said. “This is one of the first clear demonstrations that bilinguals really do have two different sound systems and that they can switch between one language and the other and then use that sound system.”

This is true primarily for those who learn two languages very young, Lotto said.

“If you learn a second language later in life, you usually have a dominant language and then you try to use that sound system for the other language, which is why you end up having an accent,” he said.

Research on bilingualism has increased in recent years as the global climate has become more intermixed, Lotto noted. These new findings challenge the idea that bilinguals always have one dominant language.

“This raises the possibility that bilinguals can perceive speech like a native speaker in both languages,” said Gonzales, whose own son is growing up learning English and Chinese simultaneously.

“The predominant view of late has been that bilinguals will never be able to perceive a second language beyond what a late learner is capable of, or someone who learns a second language late in life. So even if you learn two languages simultaneously from birth, you’re always going to perceive one of them like a late learner,” Gonzales said. “Our findings cast doubt on that prominent view in the bilingual literature.”