**Languages Are Products of Their Environments**

By [Kiona Smith-Strickland](http://discovermagazine.com/authors?name=Kiona+Smith-Strickland) | November 4, 2015



The characteristics that make each language unique may actually be adaptations to the acoustics of different environments.

Language is a universal hallmark of humanity, but it sounds different in different parts of the world. On most Pacific islands and throughout Southeast Asia, words use more vowel sounds than consonants, and they’re spoken in simple syllables, made up of a vowel sound and a consonant or two. Meanwhile, Georgian, a language of the Caucasus Mountains, is heavy with consonants, often strung together into clusters, creating syllables too complex for many foreigners to pronounce. The physical surroundings of Georgians and Southeast Asians are just as varied as the words they use, and linguists say they’ve found a relationship between the types of sounds in a language and the climate and landscape in which it evolved.

**The Mechanics of Language**

All the richness of cultural identity in a language ultimately boils down to the basic mechanics of sound. Spoken words are a series of sounds in different frequencies, from high-frequency consonant sounds like f, p, or t, to low-frequency vowel sounds like e, o, and u. When you speak, sound waves travel through the air to your listener, who hears those varying frequencies as words.

The trouble, especially if you want to be heard clearly across a distance, is that sound waves can bounce off obstacles, such as dense vegetation or rough terrain, and be reflected in other directions. That can cause part of the message to get distorted or lost in transmission. Heat creates ripples in the air, which can also distort sound waves.

High-frequency sounds like consonants get lost or distorted more easily than low-frequency vowel sounds. That, according to linguists Ian Maddieson of the University of New Mexico and Christophe Coupé of the Laboratoire Dynamique de Langage-CNRS in France, is why languages spoken in warm, wet, and heavily wooded areas tend to use more vowels and fewer consonants, and mostly in simple syllables.

**Acoustic Adaptation Hypothesis**

It turns out that number of consonants in a language, and how consonants cluster together in syllables, seems to depend on the average annual temperature and rainfall, the amount of vegetation, and the elevation and ruggedness of the place where the language is traditionally spoken. Those factors all affect the acoustics of the environment, and Maddieson and Coupé say that the differences in languages’ sounds are, in part, adaptations to those different acoustics.

The idea that animal species adapt their vocalizations to get the most out of the local acoustics is called the Acoustic Adaptation Hypothesis. In 1975, biologist E.S. Morton noticed that in woodland areas, where trees might muffle or distort bird songs, birds tend to sing songs made up of lower frequencies, with less variation, than birds in open areas.

More recently, biologists have noticed that birds in some cities are adapting their songs to be heard amid the background noise of urban life. Like Morton’s woodland birds, these urban birds sing lower frequency songs with simpler structures than their relatives in quieter places.

“Our research shows a significant pattern of the same kind among human languages,” wrote Maddieson and Coupé in their presentation to the [Acoustical Society of America](http://acousticalsociety.org/) at its 170th meeting this week in Jacksonville, Florida.

**How Environment Shapes Language**

To understand how the phonology (the sounds of speech) of languages related to their environments, Maddieson and Coupé studied data on phonology from 628 languages from all over the world. The Lyon-Albuquerque Phonological Systems Database (LAPSyD) provided data on the number of unique consonant sounds used in each language, as well as how often each language combines its consonants into clusters in the same syllable. For each of the 628 languages, they compared the phonological information to environmental data about the language’s native climate, ecology, and topography.

They left out major international languages like English, Mandarin, and Spanish, along with any language spoken by more than about 5 million people, because such widespread languages made it too hard to define the specific environments that gave rise to them.

They found that environmental factors account for about a quarter of the variation in how “consonant-heavy” languages are around the world.

As for the rest, “Most linguists would suggest that the major variation between different languages is due to what might be called historical accident; that is, the random effects of languages changing as they are passed on from one generation to another,” says Maddieson. Community size and contact with other languages also play a role.

**What’s Next**

Next, Maddieson and Coupé plan to study a recordings of spoken languages. The phonological data they’ve used so far has told them about the number of consonants in each language and how those consonants are used to form complex syllables, but listening to the languages spoken out loud could reveal how often consonants and complex syllables are really used in everyday speech. Then they’ll see how that new information lines up with the environmental data for each language’s home region.

“We would be looking for confirmation of what we have found by looking at just the number of different consonants and permitted syllable structures,” says Maddieson. “If our hypothesis is correct, we would expect to find that our consonant-heavy languages in fact have more consonant sounds per unit time in their spoken form, as fluent ongoing speech is what is really important.”

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