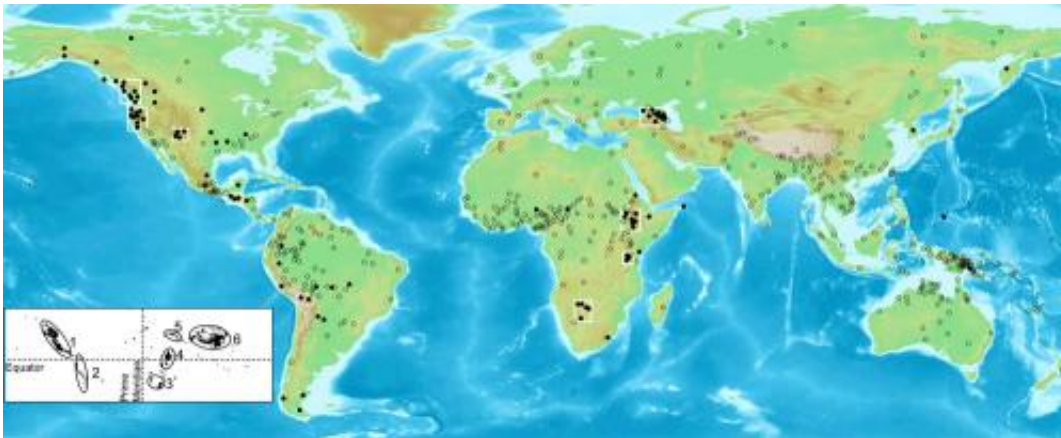


Does altitude affect the way language is spoken?

June 12 2013



Plot of the locations of the languages in the sample. Dark circles represent languages with ejectives, clear circles represent those without ejectives. Clusters of languages with ejectives are highlighted with white rectangles. For illustrative purposes only. Inset: Lat-long plot of polygons exceeding 1500 m in elevation. Adapted from Figure 4 in [8]. The six major inhabitable areas of high elevation are highlighted via ellipses: (1) North American cordillera (2) Andes (3) Southern African plateau (4) East African rift (5) Caucasus and Javakheti plateau (6) Tibetan plateau and adjacent regions. Credit: Caleb Everett, University of Miami

Language is formed by giving meaning to sounds and stringing together these meaningful expressions to communicate feelings and ideas. Until recently most linguists believed that the relationship between the structure of language and the natural world was mainly the influence of

the environment on vocabulary. Now, a new study published in the June 12 edition of *PLOS ONE* shows that there is a link between geographical elevation and the way language is spoken.

The study reveals that languages containing ejective [consonants](#) are spoken mainly in regions of high elevation. Ejectives are sounds produced with an intensive burst of air, and are not found in the English [language](#).

The findings show that 87 percent of the languages with ejectives included in the study are located within 500 km of a region of high elevation on all continents. The findings also indicate that as elevation increases, so does the likelihood of languages with ejectives.

"This is really strong evidence that geography does influence phonology—the sound system of languages," says Caleb Everett, associate professor of anthropology, in the College of Arts and Sciences at the University of Miami and author of the study. The study is titled "Evidence for Direct Geographic Influences on Linguistic Sounds: The case of ejectives."

An area of high elevation is defined as exceeding 1500m above [sea level](#). Most of the inhabitable high altitude areas of the world are found in six regions, including the North American Cordillera; the [Andes](#) and the Andean altiplano; the southern African plateau; the plateau of the [east African rift](#) and the Ethiopian highlands; the Caucasus range and Javakheti plateau; and the [Tibetan plateau](#) and surrounding plateaus.

For this project, Everett analyzed the locations of about 600 representative languages, of the 7000 or so languages of the world. Ninety two of this sample had ejectives. He utilized the World Atlas of [Linguistic Structures](#)—the most comprehensive survey of linguistic sounds. Everett imported the coordinates of these languages into the

geographic software of Google Earth and ArcGIS v. 10.0, then superimposed the locations of these sound systems on the world's landscape to analyze the patterns.

The results show a strong correlation between high altitude and the presence of ejectives in languages on, or near, five of the six major high altitude regions on earth where people live. The relationship is difficult to explain by other factors, according to Everett.

"I was really surprised when I looked at the data and saw that it correlated so well," Everett says. "It really does not rely very much on my interpretation, the evidence of a relationship between altitude and language is there."

According to the results, the only region with high elevation where languages with ejectives are absent is the large Tibetan plateau and the adjacent areas. People of this region have a unique adaptation to high altitude that may account for this fact.

"Ejectives are produced by creating a pocket of air in the pharynx then compressing it," Everett says. "Since air pressure decreases with altitude and it takes less effort to compress less dense air, I speculate that it's easier to produce these sounds at high altitude."

To make these sounds, the body uses air that is not pulmonic, this may reduce the amount of air exhaled from the lungs and decrease dehydration in high altitudes, the study suggests.

Previous studies have shown that Tibetan people breathe at a faster rate than other high altitude populations. This is believed to be an adaptation to the climate and results in a reduction of the effects of hypoxia in [high altitude](#).

The findings show an interesting pattern between elevation and ejectives appearing on all major land masses and reflecting a positive correlation between the two. Everett is now looking at other possible connections between geography and the way language is spoken.

More information: Everett C (2013) Evidence for Direct Geographic Influences on Linguistic Sounds: The Case of Ejectives. *PLOS ONE* 8(6): e65275. doi:10.1371/journal.pone.0065275
[dx.plos.org/10.1371/journal.pone.0065275](https://doi.org/10.1371/journal.pone.0065275)

Provided by University of Miami

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