



Taking the “Temperature” of Languages

The sounds and structures of the world’s approximately 7,000 languages never stop changing—just compare the English in *Romeo and Juliet* or the Spanish in *Don Quixote* to the modern forms. But historical records give an incomplete view of language evolution. Increasingly, linguists draw upon mathematical models to

figure out which features of a language change often and which ones change more rarely over the course of thousands of years. A new model inspired by physics assigns a “temperature” to many sounds and grammatical structures. Features with higher temperatures are less stable, so they change more often as time goes on. The linguistic thermometer will help researchers reconstruct how our languages came to be—and how they might change in future generations.



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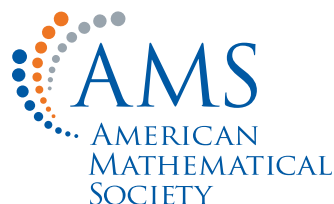
Language features can change vertically, when children speak differently from adults in their community, and horizontally, when speakers of two different languages influence each other. The new model uses the mathematics of stochastic processes to account for both possibilities. It turns out that the present-day geographic distribution of a linguistic feature gives researchers enough information to determine its temperature. A “hot” feature prone to change, like the presence of definite articles (“the”), is scattered evenly around the world. By contrast, a “cold” feature that resists change, like placing objects before verbs, is found in geographic clumps. In the future, similar models could help reveal the evolution of other elements of culture, such as the rules of marriage and the inheritance of possessions.

For More Information: “Geospatial distributions reflect temperatures of linguistic features,” H. Kauhanen, D. Gopal, T. Galla, R. Bermúdez-Otero, *Science Advances* 7, eabe6540 (2021).

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with the researchers!



MM/157



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