

Spatial evolution of human dialects

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When the speakers in a geographical region share a set of linguistic idiosyncrasies, these define a dialect. Language surveys may be used to define dialect regions, measure dialect differences, and map boundaries isoglosses between language features. We claim that dialect domain formation is driven by individuals tendency to conform. We show that the evolution of isoglosses is driven by two opposing effects: Surface tension makes isoglosses smoother over time, but variations in population density create curvature. These two effects, encapsulated in a single equation, make the final spatial distribution of dialects predictable.

Using census data for UK population density, we predict the most likely pattern of English dialects. Our predictions are derived by generating large numbers of synthetic isoglosses, and using these to define a local dialect at each point in space. Cluster analysis is then used to define coarse grained dialect regions which may be compared to linguistic maps prepared by dialectologists. Using standard metrics such as the Rand index and areal overlap, we find substantial similarity between our pattern and their predictions. In addition, our theory explains several observed phenomena, including isogloss bundles which often divide two major linguistic areas in a given country: for example High from Low German, or Northern from Southern English. We are also able to explain fanning, the expansion of urban dialects, the transition from dialect continua to distinct zones, and the relationship between linguistic distance and geographical distance. This relationship, of longstanding interest to dialectologists, is known as Seguys Curve.

Our assumptions are extremely simple. Observations about human mobility and linguistic behaviour suggest that long range correlations, memory, differences between individuals, and social network structure are important to language evolution. Our model, and its predictive power, lays a theoretical foundation to investigate these.

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