

## How to model language diffusion

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We discuss the application of physics to the study of language spread: Can language diffusion be modelled by techniques used in solid state physics?

Many of the world's around 6000 languages are in danger of disappearing as people give up use of a minority language in favour of the majority language in a process called language shift. Language shift can be monitored on a large scale through the use of mathematical models by way of differential equations e.g. reaction-diffusion equations. We proceed in a different way: we propose a model for language dynamics based on the principles of cellular automata and combine it for the first time with very detailed empirical data. We note, however: Only when empirical data over a certain time and space scale are available and

used for calibration can the strength of this method be fully. Cellular automata models can be used even in cases where models based on differential equations are not applicable e.g. in situations where one language has become dispersed and has retreated to language islands. Using data from a bilingual region in Austria, we show that the most important factor in determining the spread and retreat of a language is the interaction with speakers of the same language.

### References

Prochazka K. and Vogl G., What drives language shift? submitted  
Kandler A. and Unger R., Modelling language shift, in: Diffusive Spreading in Nature, Society and Technology, Springer 2017

