A model for language shift in Carinthia, Austria

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Motivation

Languages are an important part of our culturally diverse world, yet many of today's languages are being used less and less. To find out why, one needs to first understand the dynamics behind this language shift.

Use of the minority language Slovenian in Carinthia, Austria has been steadily declining over the past century. Despite supportive measures, language shift (speakers giving up use of one language for another) is taking place.

One way of monitoring this language shift on a large scale is using methods from the natural sciences where dealing with big sets of data is common.

We present **a microscopic model to follow language shift over time and space** in Carinthia based on data from the Austrian census.

The data from the Austrian census

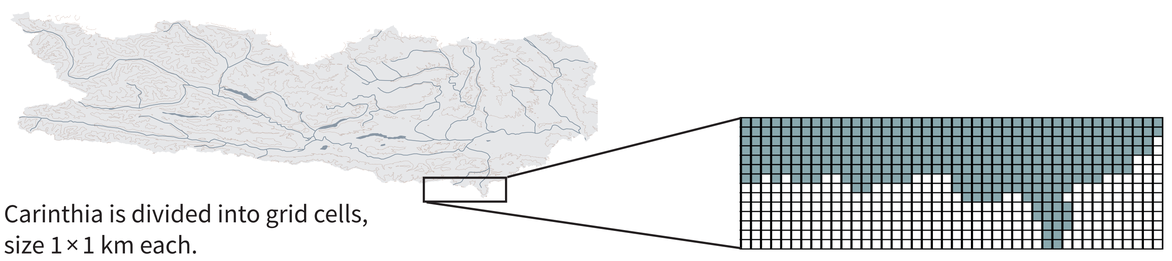
The Austrian census was **the primary method for collecting data on language *use*** in Austria between 1880 and 2001. Data is **available every ten years between 1880 and 1910 and 1951 to 2001**, plus for some years in between the two periods (with varying data quality).

A page from the **1890 census** with information about the "vernacular language" (*Umgangssprache*) in each village (Slovenian or German).

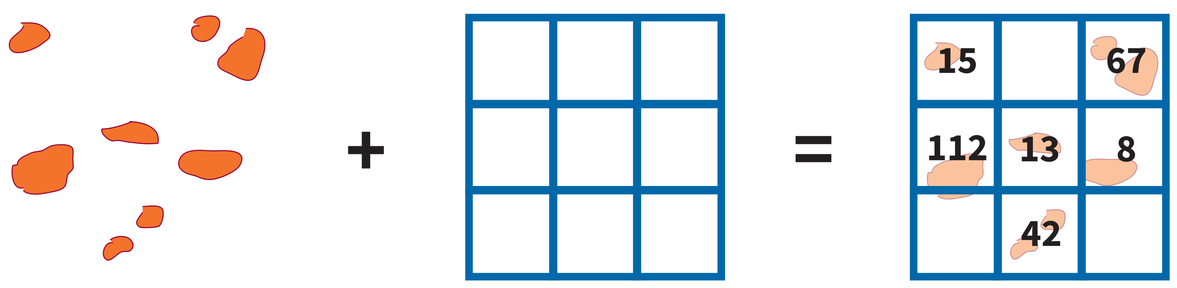
Kärnten, Koroško. — Völkermarkt, Velikovec. 91

Bezirke, Gemeinden, Ortschaften (Okraji, občine, kraji)	Häuser (Hiše)	Anwesende Bevölkerung (Pričujoče prebivalstvo) männlich (moško)	weiblich (žensko)	zusammen (vkupe)	Confession (Po veri) katholisch (katoliški)	evangel. (evangeljski)	israelit. (izraelci)	andere (drugi)	Umgspr. d. einh. Bevölk. (Obč. jez. domač. prebiv.) deutsche (nemški)	slovenische (slovenski)	andere (drugi)
Mitterdorf, Ober-, Srednja ves (Dorf, vas)	18	56	68	124	124	.	.	.	17	107	.
Mitterdorf, Unter-, Spodnja ves (Dorf, vas) Sch. (š.)	17	51	62	113	113	.	.	.	1	112	.
Nikolai, St., Miklavž Sv., Dorf mit E.-H. (vas s p. h.) Tiefenbach Cur. [St. Nikolai in Gorentschach] (kur.)	23	63	70	133	133	.	.	.	5	128	.
Radigund, St., Radigunda Sv. (Dorf, vas)	11	35	44	79	79	.	.	.	2	77	.
Ruden, Ruda	21	48	70	118	118	.	.	.	23	95	.

Digitising the data



Carinthia is divided into grid cells, size 1 × 1 km each.



Each village (●) is assigned to a grid cell based on its geographic coordinates and speaker numbers are attributed to the grid cells.

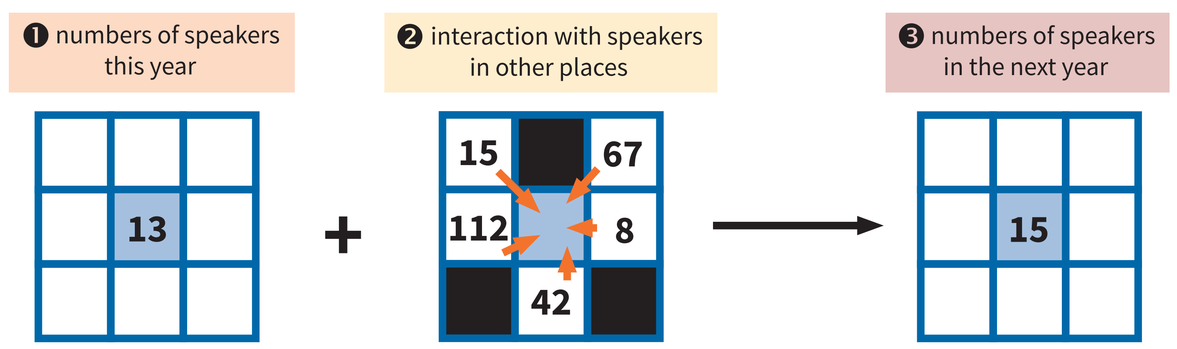
Our model: a microscopic diffusion approach

To get the number of speakers of a language α in the next year, each grid cell (□) is updated according to the mathematical rule:

$$n_\alpha(\mathbf{r}, t+1) = n_{\text{total}}(\mathbf{r}, t+1) \cdot \frac{n_\alpha(\mathbf{r}, t) + F_\alpha(\mathbf{r}, t)}{n_S(\mathbf{r}, t) + F_S(\mathbf{r}, t) + n_G(\mathbf{r}, t) + F_G(\mathbf{r}, t)}$$

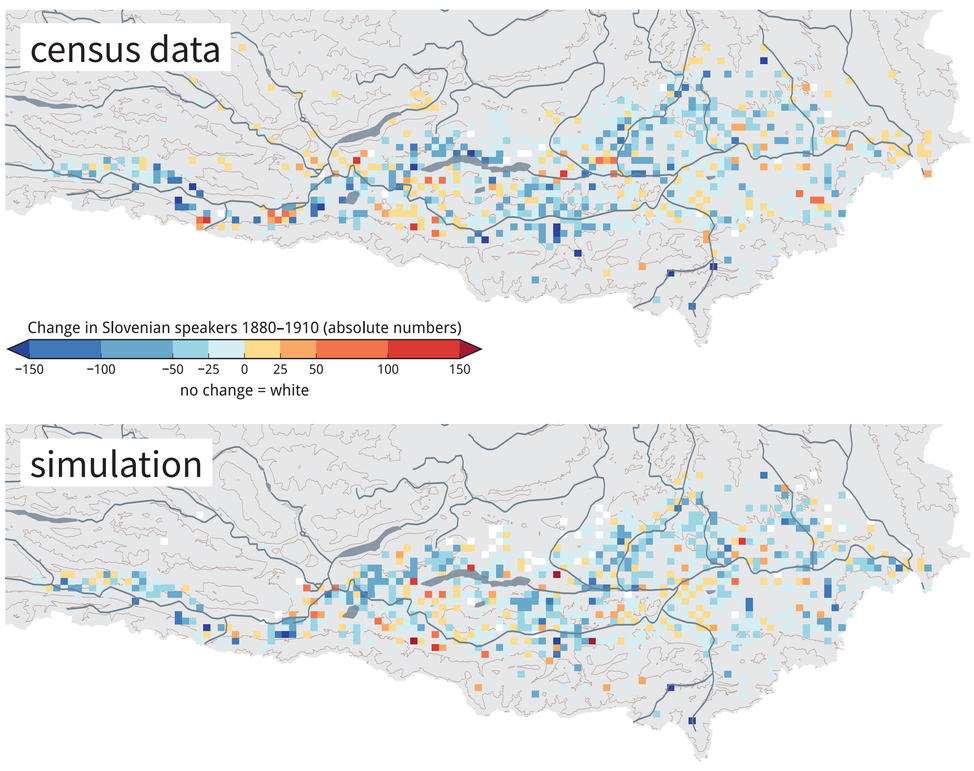
what this means: the number of speakers in the next year ❸ is proportional to:

❶ the number of current speakers and
❷ the interaction with speakers in other places



Contributions of other cells to the interaction are modelled as Gaussian functions as in physical diffusion.

Results – an example: 1880–1910



Summary

- We have successfully modelled language shift in Carinthia based on principles of physical diffusion.
- All model parameters can be calculated directly from the census data ➞ our model is applicable even in situations where data on other factors influencing language use (e. g. status of a language) is not available or not possible to obtain.
- **Interaction with other speakers of the same language is the most important driving factor for language shift.** External factors such as school or parish language seem to have only a minor influence.

http://dcs.univie.ac.at/languagediffusion

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