

LANGUAGE EVOLUTION

What is it ?

- We use Physics to study language as a complex system.
- Topic became popular the last decade.

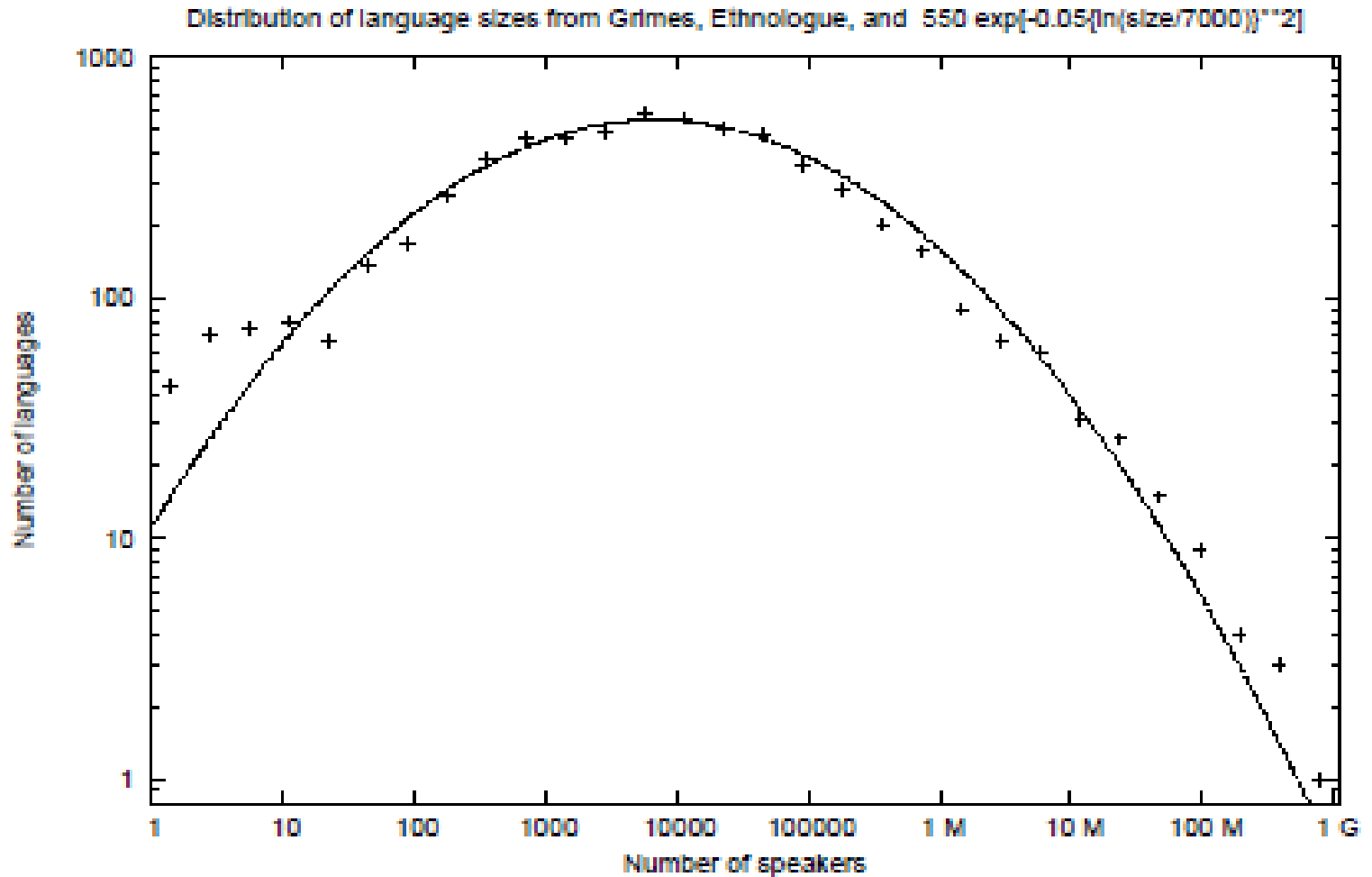
Main areas

- Language Competition
- Language learning
- Language Analysis.

Empirical Facts

- There are a little more than 5000 Languages in the World.
- Some of the have only one speaker!
- Several have less than 10 speakers.

Languages distribution



Abrams-Strogatz (2003)

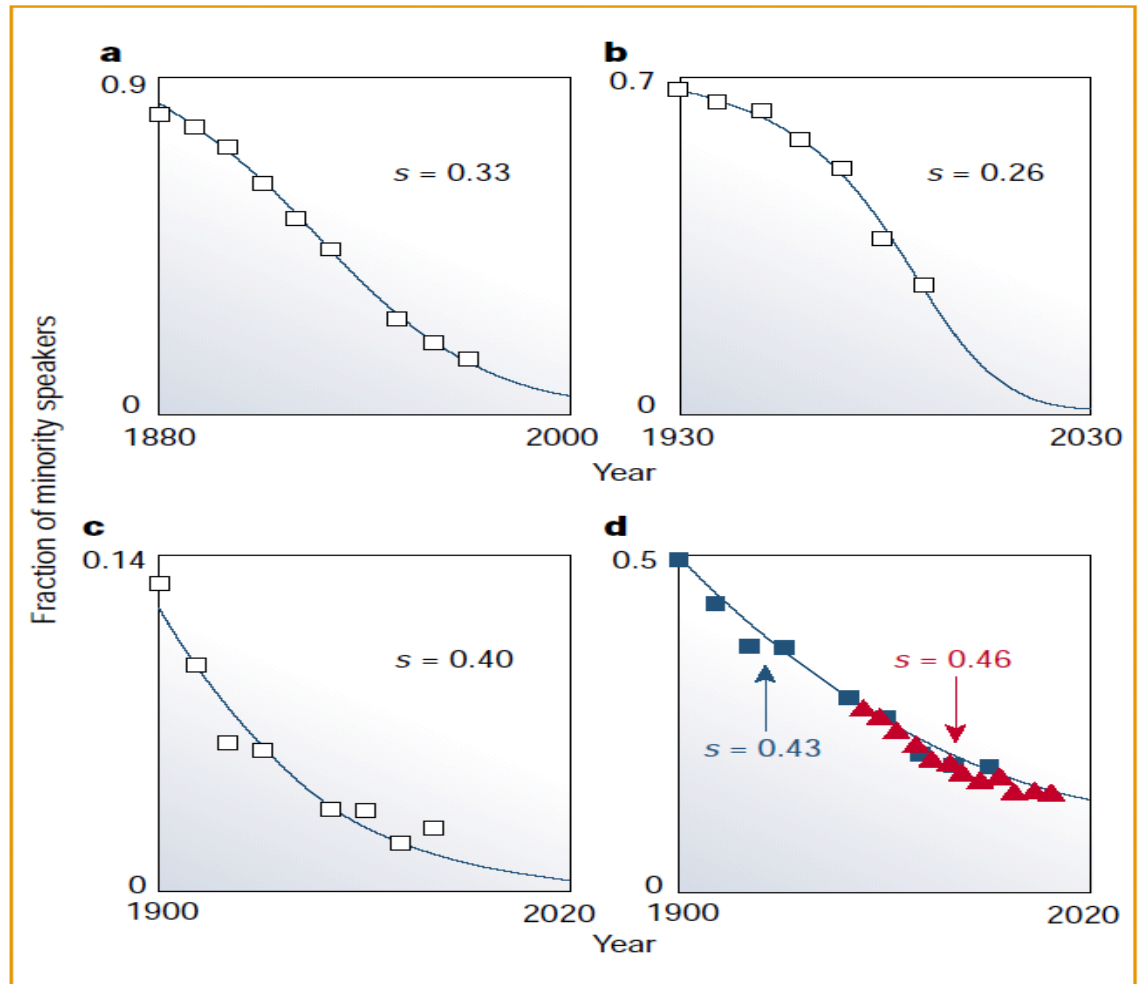
**Modelling the dynamics
of language death**

$$\frac{dx}{dt} = yP_{yx}(x,s) - xP_{xy}(x,s)$$

$$P_{yx}(x,s) = cx^a s \text{ and } P_{xy}(x,s) = c(1-x)^a(1-s)$$

Results

Figure 1 The dynamics of language death. Symbols show the proportions of speakers over time of: **a**, Scottish Gaelic in Sutherland, Scotland⁹; **b**, Quechua in Huanuco, Peru; **c**, Welsh in Monmouthshire, Wales¹⁰; **d**, Welsh in all of Wales, from historical data¹⁰ (blue) and a single modern census¹¹ (red). Fitted curves show solutions of the model in equation (1), with parameters c , s , a and $x(0)$ estimated by least absolute-values regression. Where possible, data were obtained from several population censuses collected over a long timespan; otherwise, a single recent census with age-structured data was used (although errors are introduced, the size of which are reflected in the differing fits in **d**). Using the fraction of Catholic masses offered in Quechua in Peru as an indicator, we reconstructed an approximate history of the language's decline.



Discussion

- Rather simple model
- Impressive results.
- Stimulated a lot of interest.
- Bilingualism ? Coexistence?
- Agent based modeling might be a more
Appropriate choice