Teaching & Learning Guide for:
The Emerging Field of Language Dynamics

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Author's Introduction

The field of language dynamics encompasses the study and modeling of how languages develop (language evolution), change, and interact (language competition). It contrasts with traditional historical linguistics in several ways: the focus is on the world's linguistic diversity rather than just on specific languages or language families; methods are quantitative rather than qualitative; computer simulations are employed for elucidating situations that are not immediately observable, being too complex or pertaining to prehistory; the data used are systematic ones gathered in large databases rather than data that happen to be available for select languages. A crucial feature of the methodology is the fine-tuning of simulation models through empirical observations of quantitative distributions such as those of speaker populations or of grammatical features shared among languages.

Author Recommends

Among the following papers the two first are recommended because of the great impact on the field of language dynamics that they have had, and the following three are recommended because they provide useful and up-to-date overviews.

1. Abrams, Daniel, and Steven H. Strogatz, 'Modelling the dynamics of language death', *Nature* 424 (2003): 900.

A now-classic paper proposing a simple differential equation (macroscopic model) for the competition between two languages. Using the fractions of speakers of the two languages and a prestige measure as the only two variables the authors set up a function that may be fitted to empirical data for the decline of Scottish Gaelic, Quechua, and Welsh.

2. Sutherland, William J., 'Parallel extinction risk and global distribution of languages and species', *Nature* 423 (2003): 276–279.

This paper compares extinction risks and causes for languages and biological species and also compares correlates of linguistic diversity and biodiversity.

3. Castellano, Claudio, Santo Fortunato, and Vittorio Loreto, 'Statistical physics of social dynamics' (2007). http://arxiv.org/abs/0710.3256.

Reviews work by physicists on various social phenomena, including languages. It also contains a section describing some social models often used.

4. Schulze, Christian, Dietrich Stauffer, and Søren Wichmann, 'Birth, survival and death by Monte Carlo simulation', *Communications in Computational Physics* 3.2 (2008): 271–294.

A review of studies of language competition with a focus on the agent-based (microscopic) Schulze and Viviane models.

5. Ke, Jinyun, Tao Gong, and William S.-Y. Wang, 'Language change and social networks', *Communications in Computational Physics* 3.4 (2008): 935–949.

The diffusion of linguistic variants is simulated for four different kinds of networks: regular, small-world, random, and scale-free networks.

Online Materials

The World Atlas of Language Structures Online

http://wals.info/
This website makes freely available the data and maps from *The World Atlas of Language Structures*, edited by Martin Haspelmath, Matthew S. Dryer, David Gil and Bernard Comrie and published in 2005 by Oxford University Press.

Languages of the world (Jazyki Mira) database

http://dblang2008.narod.ru/
A database of typological features for 315 Eurasian languages. It is still mainly in Russian.

The Automated Similarity Judgment Program

http://email.eva.mpg.de/~wichmann/ASJPHomePage.htm
A regularly updated webpage devoted to a project of lexical comparison among the world's languages.

The Typological Database System project

http://languagelink.let.uu.nl/tds/index.html
A system for making queries across several typological databases.

Ethnologue

http://www.ethnologue.com/
A catalogue of the world's languages.

Language Evolution and Computation Bibliography and Resources

http://www.isrl.uiuc.edu/~amag/langev/
A website privately maintained by Jun Wang that indexes literature on the computational aspects of language dynamics.

Sample Syllabus

Week 1: Language evolution

Kirby, Simon, 'Syntax without natural selection: how compositionality emerges from vocabulary in a population of learners' in *The Evolutionary Emergence of Language: Social Function and the Origins of Linguistic Form*, eds. Chris Knight, James R. Hurford and Michael Studdert-Kennedy (Cambridge: Cambridge University Press), 302–23.
Steels, Luc. 'The synthetic modeling of language origins', *Evolution of Communication* 1(1), 1997, pp. 1–34.

Week 2: Language competition: macroscopic vs. microscopic models

Abrams, Daniel, and Steven H. Strogatz, 'Modelling the dynamics of language death', Nature 424 2003, p. 900.
Schulze, Christian, and Dietrich Stauffer, 'Monte Carlo simulation of the rise and fall of languages', *International Journal of Modern Physics C* 16, 2005, pp. 781–7.
de Oliveira, Viviane M., Marcelo A. F. Gomes, and Ing Ren Tsang, 'Theoretical model for the evolution of linguistic diversity', *Physica A* 361, 2006, pp. 361–70.

Weeks 3–4: Social networks

Latané, Bibb, 'The psychology of social impact', *American* Psychologist 36, 1981, pp. 343–356.
Axelrod, Robert, 'The dissimination of culture: a model with local convergence and global polarization', *Journal of Conflict Resolution* 41, 1997, pp. 203–26.
Barabási, Albert–László, and Réka Albert, 'Emergence of scaling in random networks', *Science* 286, 1999, pp. 509–12.

Week 5: The evolution of linguistic diversity

Nettle, Daniel, 'Linguistic diversity of the Americas can be reconciled with a recent colonization' *Proceedings of the National Academy of Sciences of the USA*, 96, 1999, pp. 3325–9.
Wichmann, Søren, 'On the power-law distribution of language family sizes', *Journal of Linguistics* 41, 2005, pp. 117–31.
de Oliveira, Paulo Murilo Castro, Dietrich Stauffer, Søren Wichmann, and Suzana Moss de Oliveira, 'A computer simulation of language families', *Journal of Linguistics* 44, 2008, pp. 659–675.

Week 6: Linguistic diversity and geography

Nerbonne, John, and Peter Kleiweg, 'Toward a dialectological yardstick', *Journal of Quantitative Linguistics* 14, 2007, pp. 148–67.
Holman, Eric W., Christian Schulze, Dietrich Stauffer, and Søren Wichmann, 'On the relationship between structural diversity and geographical distance among languages: observations and computer simulations', *Linguistic Typology* 11(2), 2007, pp. 395–423.
Patriarca, Marco and Els Heinsalu, 'Influence of geography on language competition', *Physica A*, in press.

Week 7: Demography and language change

Nettle, Daniel, 'Is the rate of linguistic change constant?', *Lingua* 108, 1999, pp. 119–36.
Wichmann, Søren, Dietrich Stauffer, Christian Schulze, and Eric W. Holman, 'Do language change rates depend on population size?', *Advances in Complex Systems* 11.3, 2008, pp. 357–369.

Week 8: Discussion of focus questions and exploration of items for future research

Focus Questions

1. Find examples in the literature of cases where empirical data and computer simulations together have clarified a question better than either could alone.
2. What do simulation results suggest regarding possible ways of helping to prevent a minority language from going extinct?
3. Describe the parameters of a model that may successfully be used to simulate the evolution that led to the present-day linguistic diversity.
4. Do small languages change faster than large languages? Describe the evidence for the answer to this question and try to explain the result.
5. Different models have been used in the simulation of language evolution and language competition. Make a categorization of the different models and group papers read into the different categories according to the model they are using.