

How social changes altered the Germanic past tense system

An agent-based simulation

Dirk Pijpops*[§], Katrien Beuls[§] & Freek Van de Velde*

*Quantitative Lexicology and Variational Linguistics, University of Leuven

[~]Research Foundation Flanders (FWO)

[§]Artificial Intelligence Laboratory, Free University of Brussels

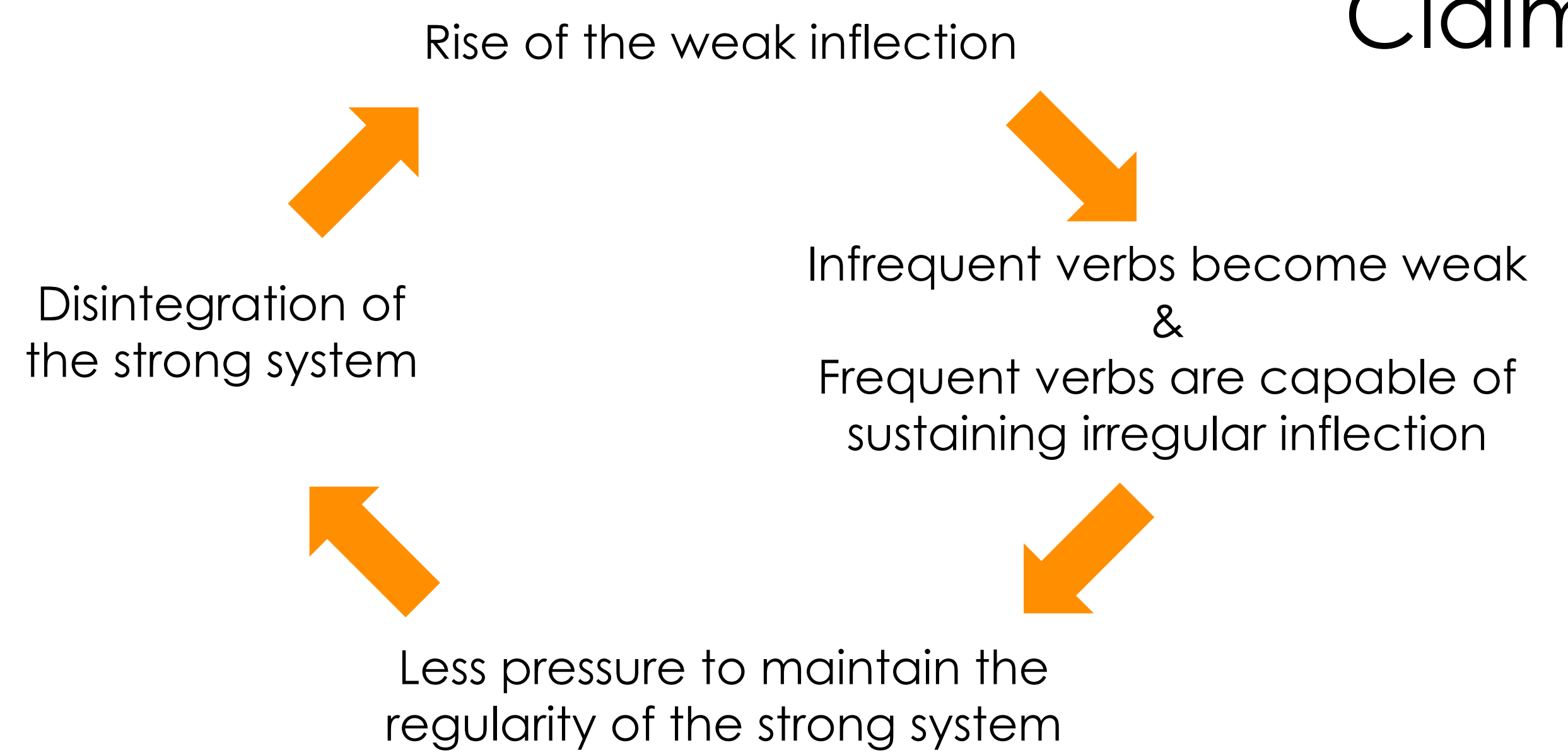
General applicability & social changes suffice to explain:

1. Rise of the weak inflection in type & token frequency¹⁻²
2. Gradual Rise³
3. Conserving Effect^{1,3}
4. Class Resilience²

➤ **Single mechanism: No need for special treatment of the weak inflection as the only regular inflection⁵⁻⁷**

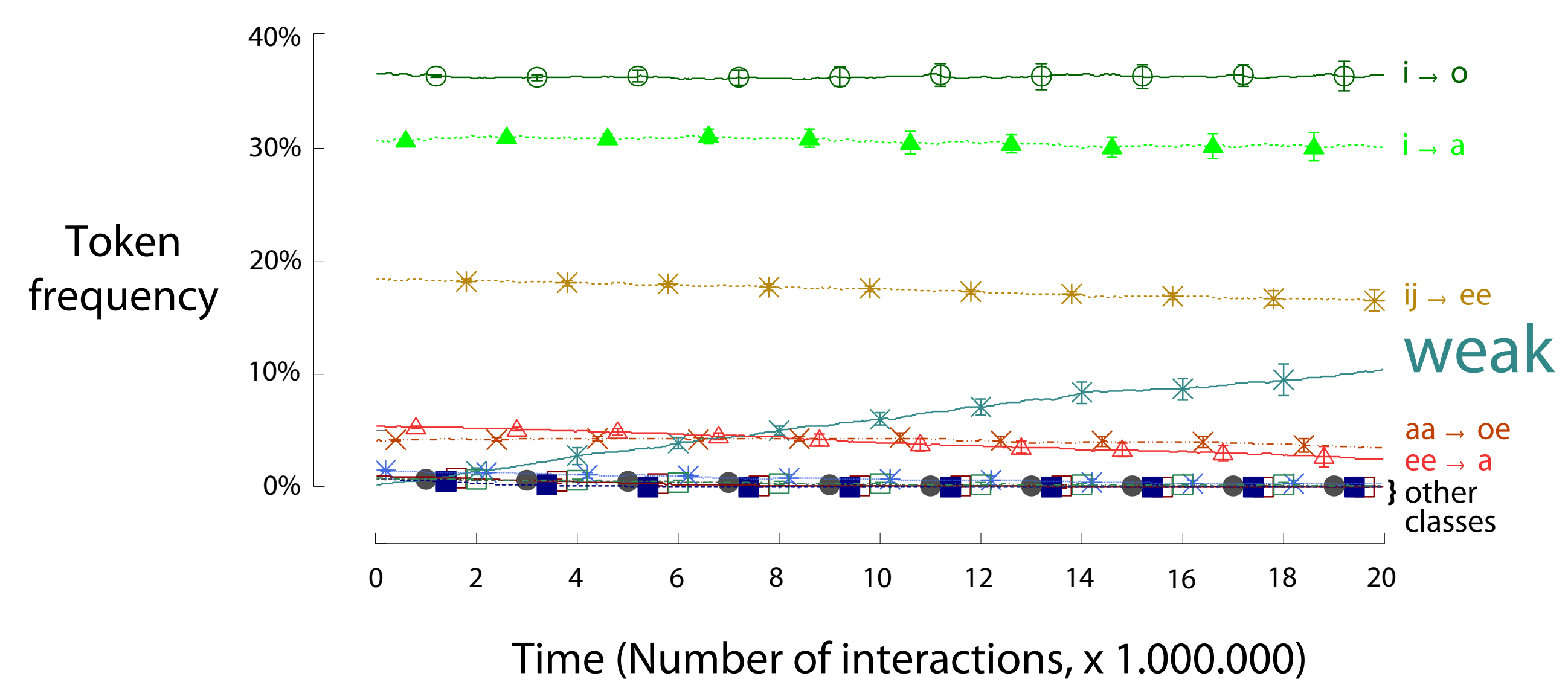
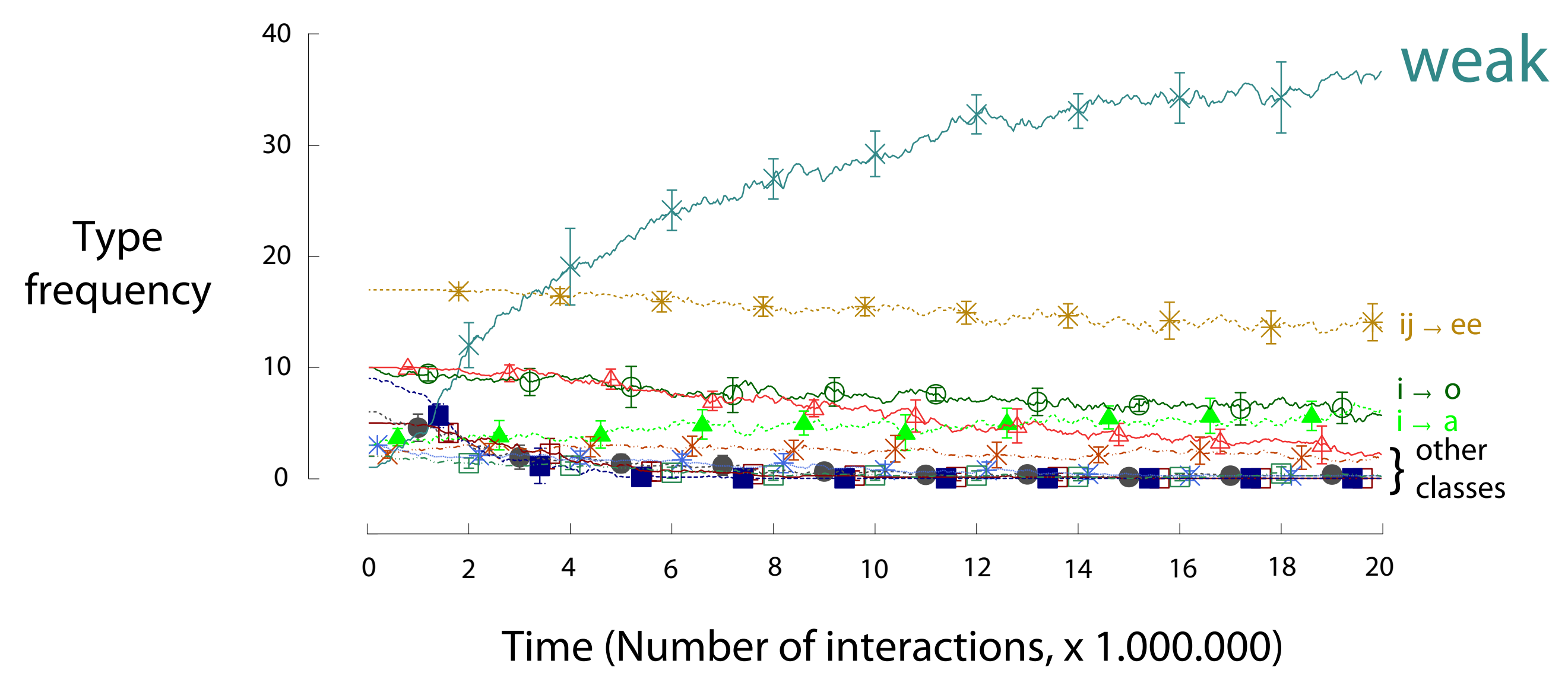
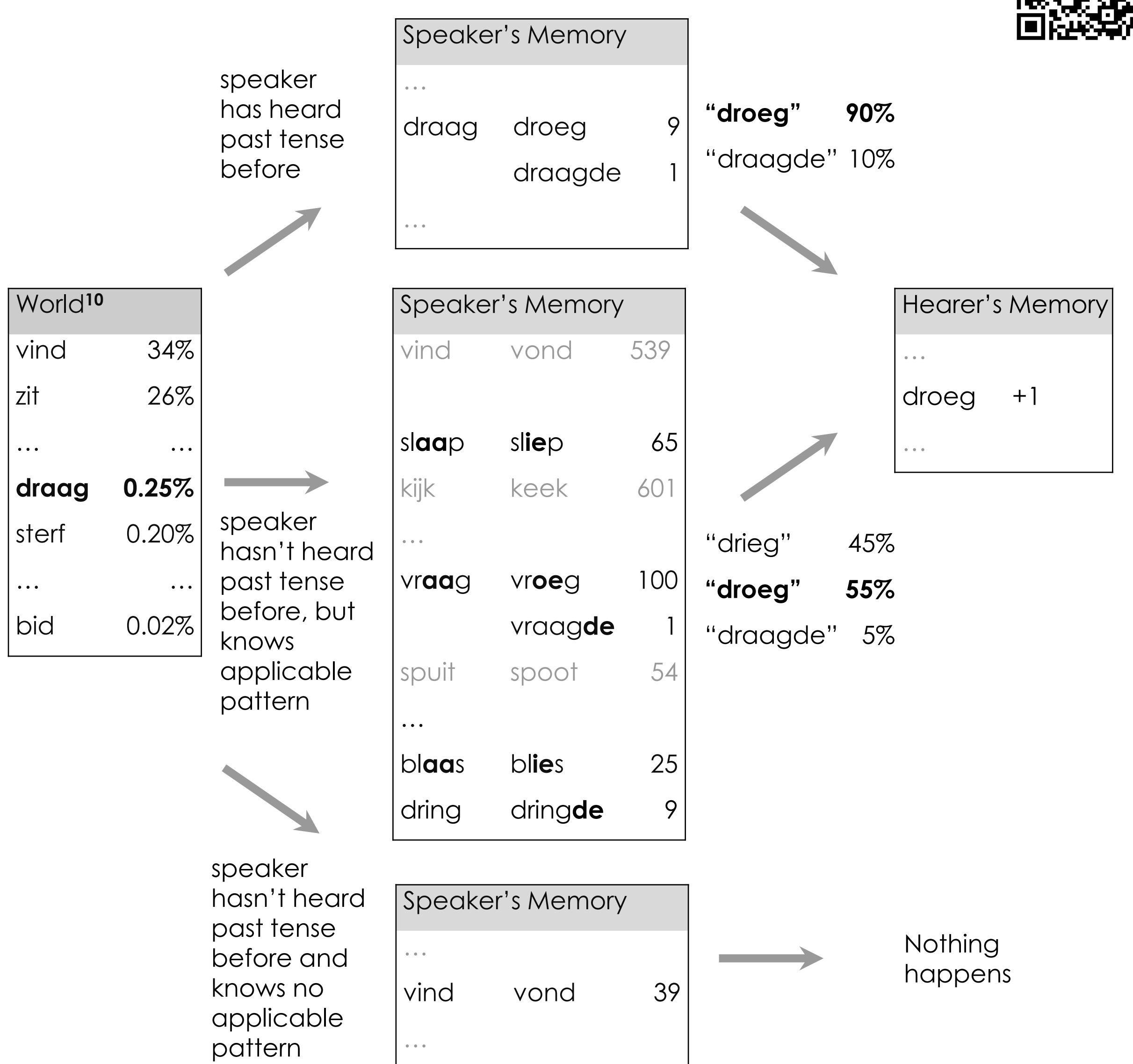
➤ **Disintegration of the strong system may be result rather than cause of the rise of the weak inflection⁸⁻⁹**

Claims

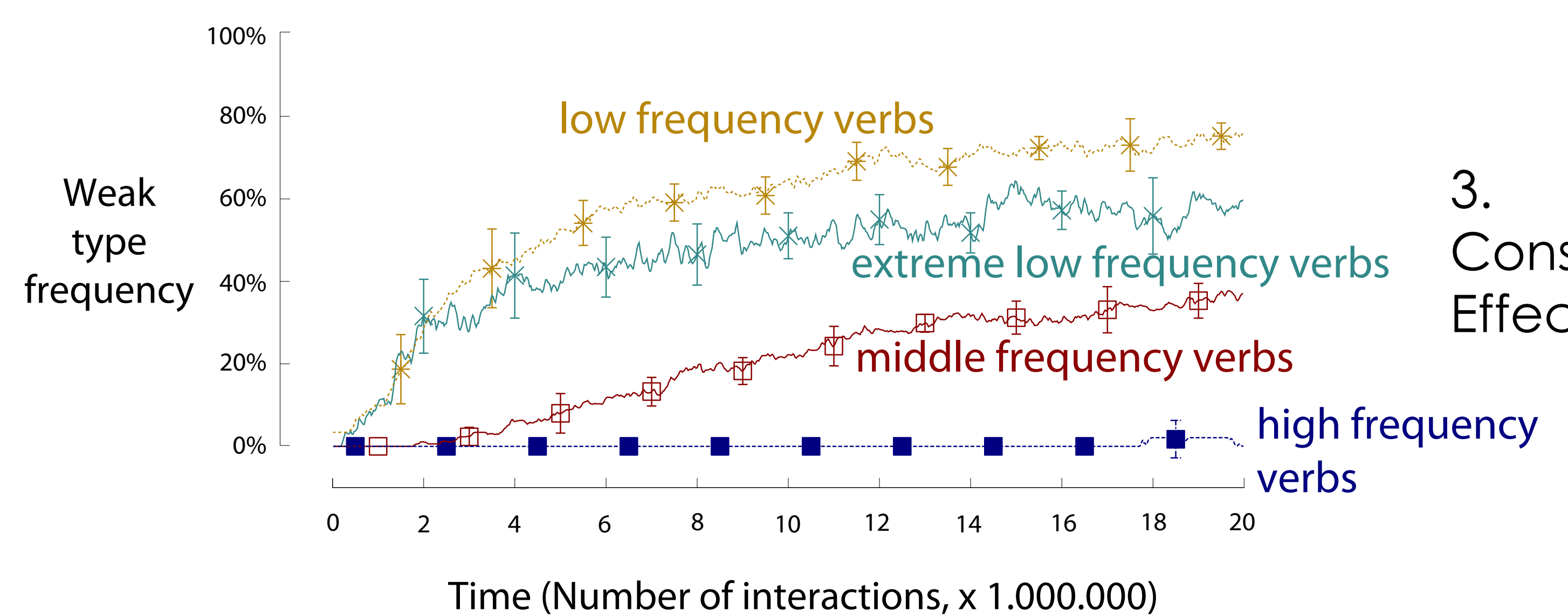


Simulation

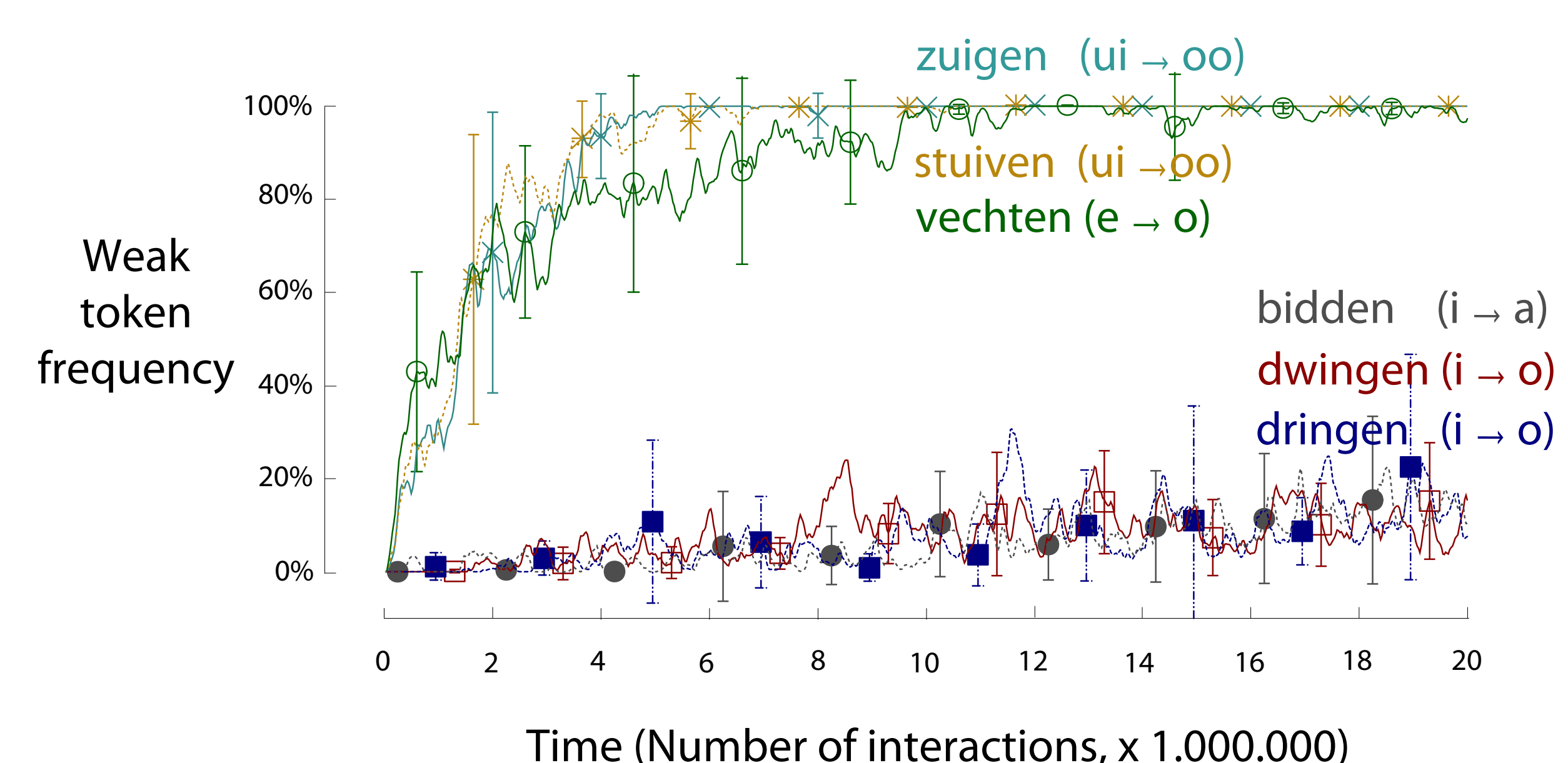
Built in open-source software Babel 2



1&2. Gradual rise of the weak inflection in type & token frequency

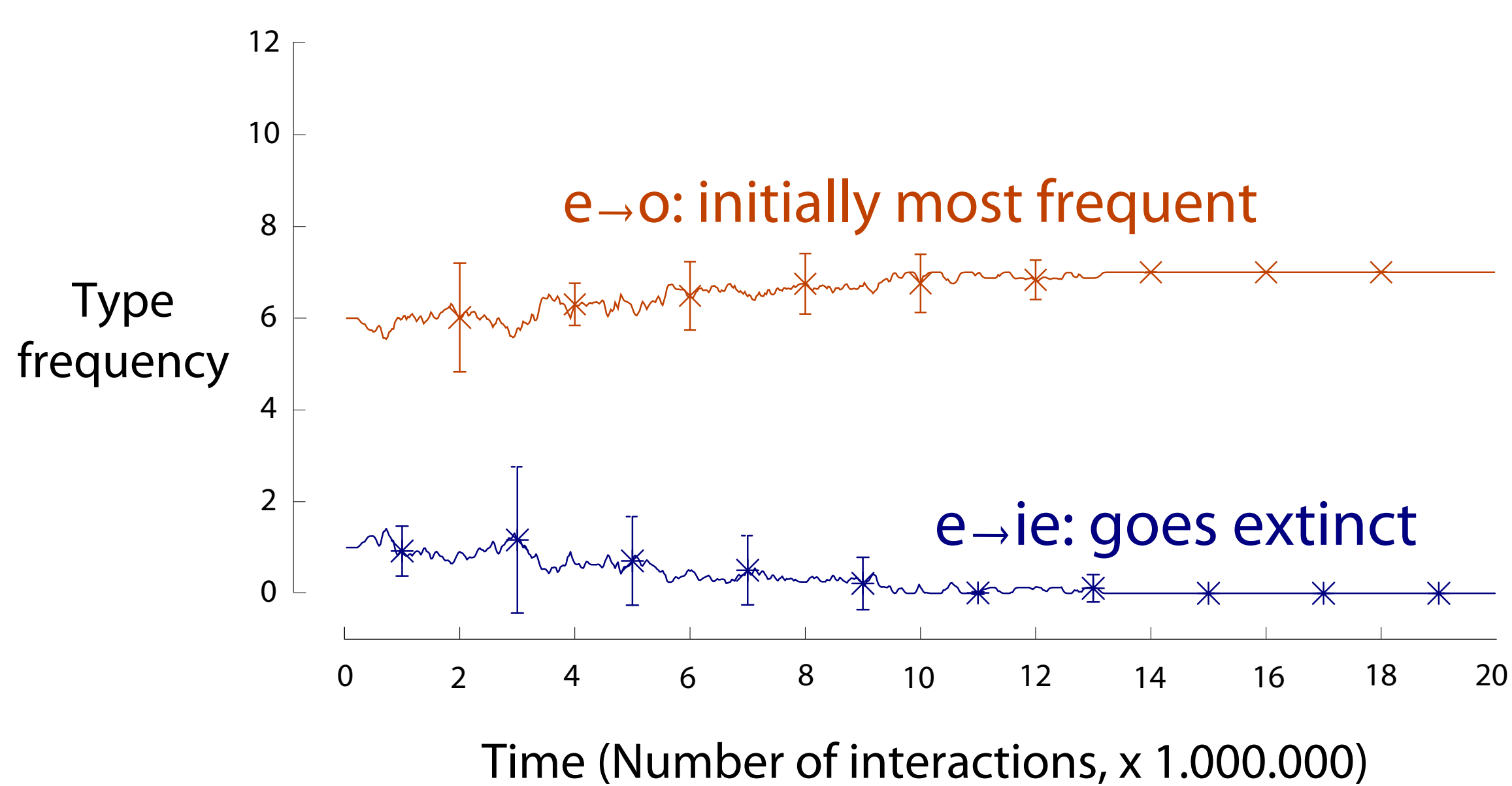


3. Conserving Effect



4. Class Resilience

Competing strong classes hold each other in balance or the initially most frequent one prevails



Acknowledgments
We would like to cordially thank Remi van Trijp for interesting discussions and useful advice about the model, as well as the participants of the SLE-48 workshop Shifting classes: Germanic strong and weak preterites and participles.

References
[1] Lieberman, Eric, Jean-Baptiste Michel, Joe Jackson, Ted Song and Martin Nowak. 2007. Quantifying the evolutionary dynamics of language. *Nature* 447(7161): 713-716.
[2] Clark, Ryan, Roger Stone and Joseph Grzeszko. 2012. Quantifying the evolutionary dynamics of Germanic verbs. *Journal of Historical Linguistics* 2(2): 123-172.
[3] Cuskley, Christine, Martina Fugère, Claudio Cifuentes, Francesco Casati, Wilco Lens and Francesco Riva. 2014. Internal and External Dynamics in Language: Evidence from Verb Regularity in a Historical Corpus of English. *PLoS One* 9(8): e102882.
[4] Hayes, Joan. 2006. From Usage to Grammar: The Learner's Response to Regularity. *Language* 82(4): 711-733.
[5] Pijpops, Dirk and Katrien Beuls. 2013. Agent-based models of language change: A case study in the history of Dutch. In *Proceedings of the 10th International Conference on Computational Linguistics*, 111-118.
[6] Pijpops, Dirk, Katrien Beuls, and Freek Van de Velde. 2015. General frequency model with agent-based population replacement. *Artificial Intelligence and Applications to Language Dynamics*. *Physica Review E*, Statistical, Nonlinear & Soft Matter Physics, 91(1): 012401.
[7] Pinker, Steven and Alan Prince. 1988. On language and connectionism: Analysis of a parallel distributed processing model of language acquisition. *Cognition* 28(1): 73-193.
[8] van der, Jean-Baptiste Michel, Joe Jackson, Ted Song and Martin Nowak. 2007. Quantifying the evolutionary dynamics of language. *Nature* 447(7161): 713-716.
[9] Rhoten, Christopher. 1988. The Germanic dental sibilant. *Transactions of the Philological Society* 4: 142-159.
[10] Rhoten, Christopher. 1989. The etymology of the Old High German weak verb. *University of New Brunswick*.
[11] Oostdijk, Nelke, Wim Doedeker, Frank Van Eynde, Louis Boves, Jean-François Martens, Michiel Moortgat and Harald Boven. 2002. Experiences from the Spoken Dutch corpus project.