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Editorial: Complexity in language variation and change

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Editorial on the Research Topic

Complexity in language variation and change

The Research Topic “*Complexity in Language Variation and Change*” in Frontiers in Complex Systems gathers a Research Topic of research contributions covering a wide range of issues in the field of language dynamics.

Language dynamics is a highly interdisciplinary field of research that employs the concepts and methods of complex systems theory in order to address the questions that are relevant to and traditionally belong to the field of linguistics. The interest of physicists in modeling language dynamics began 20 years ago with the work of [Abrams and Strogatz \(2003\)](#). Motivated by the increasing rate of language death, [Abrams and Strogatz \(2003\)](#) developed a simple model for the dynamics of language populations in situations of languages in contact. Subsequent studies have focused mainly on theoretical models of language shift. The majority of these models have been inspired by ecological modeling, reaction-diffusion equations, network theory, and individual-based models. While many models of language dynamics treat languages as fixed entities, more recent models include or address language change and variation.

Importantly, in recent years language dynamics has had a multi-fold development. On the one hand, models of language dynamics have become more refined and realistic, allowing for closer comparisons with real data. This has made it possible, for example, to improve linguistic strategies for the promotion of local minority languages and the protection of endangered languages. On the other hand, it is now possible to build different kinds of corpora, including massive social media datasets, extending the study range of language variation and change into the field of big-data analysis. Furthermore, the cognitive framework, i.e., the way in which the human brain processes linguistic knowledge, has now become a relevant dimension in language dynamics studies. These developments require the adoption and application of additional tools, such as Bayesian analysis, statistical learning techniques and artificial intelligence methods, which in turn broaden the field of application of language dynamics and connect it to studies in computational linguistics. Overall, we have been observing a strong interaction and convergence between the methods and goals of complexity science and linguistics. The contributions to this Research Topic cover some of the cutting-edge topics in language dynamics, ranging from agent-based models of language shift to empirical analyses of language varieties, providing a representative sample along this relatively new and challenging research trend.

The study *A three-state language competition model including language learning and attrition* addresses the importance of the cognitive dimension for language shift

phenomena. The first obvious aspect of the cognitive dimension is memory. Scialla et al. show that taking memory-related aspects into account may play a crucial role in determining the outcome of language shift processes. Furthermore, this contribution investigates the impact of population diversity in terms of language learning and retention skills on language dynamics models. It is shown that adding heterogeneity to the model significantly changes the temporal evolution of speaker fractions and the final linguistic state of the population.

The study *Language dynamics within adaptive networks: an agent-based approach of nodes and links coevolution* builds on the idea that language is not only an agent's property but more importantly a property of the link established between two agents engaged in communication. Charalambous et al. consider a population of bilingual individuals seen as nodes in a network. Within a coupled node-link theoretical framework, the authors allow for a rewiring mechanism in the case that the link state is not aligned with a speaker's preference. Remarkably, their numerical simulations show that rewiring reduces the probability of language death, leading to bilingual societies that exhibit language coexistence.

Networks are also useful tools for analyzing language variation. In the paper *Syntactic variation across the grammar: modelling a complex adaptive system*, Dunn analyzes syntactic differences between English dialects. To do so, grammar is viewed as a complex network of constructions from which a dialect classifier can be built. This classifier not only distinguishes between dialects based on syntactic features but also determines the robustness of grammatical subsets with the goal of accurately characterizing the difference between, e.g., Canadian English and American English. A key finding is that syntactic variation occurs globally in the grammar but in an inhomogeneous way.

The study *Is language change chiefly a social diffusion affair? The role of entrenchment in frequency increase and the emergence of complex structural patterns* looks at language change within the lexical realm. Feltgen takes the constructions from a French corpus and analyzes the frequency change of tokens through entrenchment stages. Here, entrenchment refers to the repeated usage of a construction with a given function. It turns out that entrenchment dominates the increase in token frequency, whereas the magnitude of this increase is better explained by the increase in diversity. These findings, supported by empirical evidence, stress that language change is more complex than just social diffusion.

The study *Revisiting Southern Gallo-Romance from a Complexity Theory Standpoint: Occitan* unfolds the complexity of the Occitan dialect network, through a multifold method that uses both cumulative and reductive hierarchical algorithms. Leonard starts from the empirical basis provided by the linguistic THESOC database (Université de Nice/CNRS) and goes through a series of complexity-inspired analyses that enable the author to obtain an organic overview of the Occitan dialects finally revealing a complex network of relations with interesting internal structures and patterns. The results offer a complex and dynamic picture of

Occitan dialects that goes far beyond the traditional view of dialectal entities as objects of study categorized in a hierarchy of national language *versus* local smaller languages.

In conclusion, this Research Topic highlights the impact of integrating complex systems theory into linguistic research. By advancing both theoretical and empirical approaches, the contributions presented offer novel insights and findings that enrich our comprehension of language variation and change. We hope that these works will inspire researchers in complexity science and/or linguistics to start further discussions and fertile projects between the two fields.

Author contributions

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Conflict of interest

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