

## Exploiting phylogenetic modeling to uncover directionality in the emergence of universals

Extensive investigations into word order and hierarchical universals have uncovered well-supported cross-linguistic tendencies for certain features of languages to go hand in hand (Greenberg 1963, 1966, Keenan & Comrie 1977, Kozinsky 1981, Hawkins 1983, Dryer 1992, Jäger and Wahle 2021, Authors). Many linguists hold that such universals are to be accounted for in terms of diachrony, i.e. in the words by Bickel et al. (2015: 29), "most – perhaps even all – statistical universals are not really synchronic in nature, but are rather the result of underlying diachronic mechanisms that cause languages to change in preferred or 'natural' ways". However, we still know very little about these 'diachronic mechanisms'.

Here, we initiate an investigation into possible mechanisms through which correlated change proceeds in a strict quantitative, phylogenetic context. We consider for a set of highly supported word order universals (including the correlation pairs identified by Dryer 1992) and highly supported hierarchical universals (including well-known dependencies in the (morphological) marking of person, number and gender) which of the two features changed first. For example, in the well-supported universal "In languages with prepositions, the genitive almost always follows the governing noun" (Greenberg's 1963 Universal no. 2), which word order feature changed first: the order of adposition and noun or the order of genitive and noun?

The data that we use comes from Grambank (Skirgård et al. 2022), a large typological database featuring morphosyntactic data on 2400+ languages. The global language tree we use has been created by Bouckaert et al. (2022). We use two methods to investigate directionality in correlated evolution. First, Nunn and Cooper's (2015) so-called "species-pairs evolutionary lag test" (SPELT), which explicitly tests whether change in one feature lags behind change in another feature. Second, ancestral state estimations at various time depths are contrasted to show which feature changed to the state predicted by the universal first. This is done using *BayesTraits* (Meade and Pagel 2022).

We envision a number of possible outcomes of this study. First of all, we may find that there are no global patterns at all: to go back to Greenberg's (1963) Universal no. 2, we may find that it is (1) sometimes the order of genitive and noun that changes first, and the order of adposition and noun that changes second, and (2) sometimes the other way around. Secondly, we may find that there is some evidence for directed change, but only for a subset of the universals that we investigate. Thirdly, we may identify strong patterns of directionality, possibly unveiling what are the central pivot features (potentially including the order of object and verb, Dryer 1992) that trigger change in related features. Confirming or rejecting this third hypothesis would advance our understanding of the causal factors in grammatical change and also point toward explanations for cross-linguistic tendencies that all syntactic theories should be able to account for.

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