

Word order in IE: an evolutionary approach to parameter hierarchies

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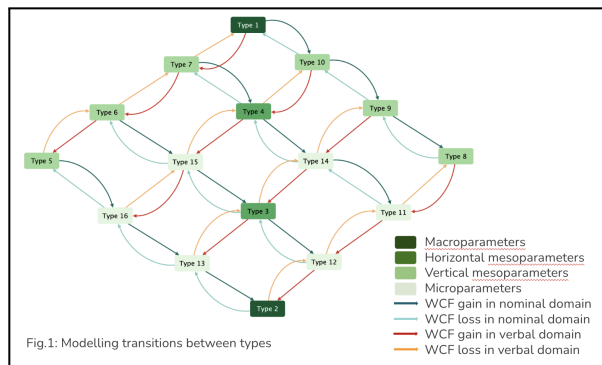
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1. Introduction. Within the generative tradition, variation in word order is commonly captured through head directionality parameters associated with particular heads (see the Borer-Chomsky conjecture). Not all conceivable combinations of values (head final/head initial) for the available heads are possible, and not all attested orders are equally frequent. This has recently been explained as the result of interdependencies between values of different heads (Roberts, 2019) leading to a parameter hierarchy, which predicts just 16 language types with respect to word order in the clausal and nominal domain, each corresponding to a different parameter size, macro, meso, or micro. Inherent in Roberts' work is the notion that parameter size is expected to correlate with diachronic stability (i.e. macroparameters are expected to be more stable diachronically than mesoparameters etc.). In this work we develop and apply a quantitative method to test Roberts' head directionality hierarchy based on diagnostic criteria for each of the 16 Types and a model of evolution based on parametric change. By fitting this evolutionary model on a well-established phylogeny of Indo-European (IE) (Heggarty et al., 2023), we show that the stabilities of three out of the four attested types are as predicted in Roberts (2019). The one case that does not follow can be explained through interaction with the V-raising hierarchy.

2. Unpacking Roberts (2019). Roberts (2019) proposes that **macroparameters** are aggregates of **microparameters** acting together: they arise when **all** functional heads in a language are 'harmonic' w.r.t. a designated feature. This makes macroparametric states more stable diachronically due to their pervasive presence in Primary Linguistic Data (PLD). **Microparameters**, affecting fewer heads, are less salient in PLD and therefore less stable. Regarding word order, Complement-Head ordering results from a head possessing a "weak categorial feature" (WCF) driving complement movement to the head's Spec. Input Generalization dictates that a WCF on a higher head necessitates a WCF on all lower heads within the same extended projection (nominal or clausal). The order of the heads prior to any movement is as follows: (a) **nominal spine**: [D Num *n* N]; (b) **clausal spine**: [C T *v* (Object) V]. A language may be *v*-final but T-initial: [C [T [[O <V>] V-*v*]]] and it may also be *v*-final and T-final: [C [[[O <V>] V-*v*] T]], but it may not be T-final and *v*-initial due to Input Generalization, which in turn derives Sheehan et al's (2017) Final Over Final Condition (FOFC). This yields $4^2=16$ language types, since there are 4 possible orders for the clausal spine and 4 possible orders for the nominal spine. Besides macroparameters (T1 and T2, where all heads are harmonic) and microparameters, Roberts also acknowledges mesoparameters: (a) **horizontal mesoparameters**, i.e. types in which head-finality affects heads of the same height on both spines, which predicts parallelisms in the clausal and nominal domain to be fairly stable diachronically. Such symmetry is exhibited in T3 (head-finality up to second highest head in both spines, i.e. T and Num) and T4 (head-finality up to the second lowest head in both spines, i.e. *v* and *n*). And also (b) 6 **vertical mesoparameters**: the nominal spine is all head-initial and the clausal spine has head-finality up to C (T5), up to T (T6), up to *v* (T7); or, the clausal spine is all head-initial and the nominal spine has head-finality up to D (T8), up to Num (T9), up to *n* (T10). The remaining non-symmetric patterns are considered **microparametric**.

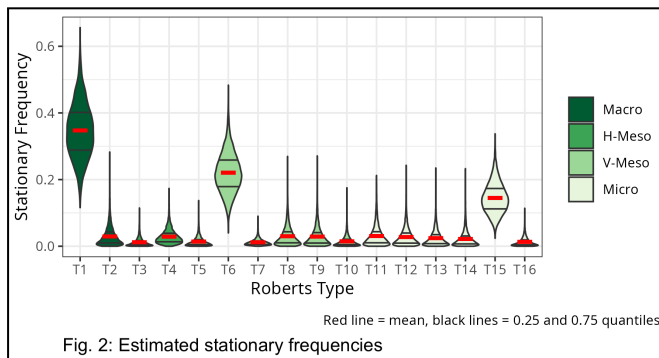
3. Our study. We developed a number of **surface order diagnostics** for each language type, taking into account possible confounds such as head-raising, the (un)availability of auxiliaries and modals, the nominal vs verbal nature of some Complementizers, the (un)availability of articles as free morphemes, the (non-)determiner-like syntax of demonstratives etc. We collected all appropriate relative order data to apply our diagnostics, crucially including: (i) auxiliary, verb, and object (main and subordinate clauses, to control for V2 phenomena), (ii) demonstrative, article, and noun, to probe the D position, for 80 IE languages. Based on the data collected and theory-internal considerations, we developed a **type-assignment algorithm** that maps each language to one (or more) of the 16 types, depending on the nature and availability of the identified surface diagnostic features.

In terms of diachronic change, the minimal step in head directionality could be either the loss of a WCF from its highest bearer on the spine (top-down, FOFC-compliant development of head-initiality), or the gain of a WCF on the lowest head that does not have one yet (bottom-up development of head-finality, still FOFC-compliant). This yields 48 steps from one type to another, which can be codified in



an **evolutionary model** (Fig. 1). According to Roberts' hierarchy, darker states should act as attractors diachronically. Lighter states should be unstable and prone to shift to darker ones.

We tested Roberts' hypothesis by fitting our data and our evolutionary model on



Heggarty et al.'s phylogeny of IE (2023). As a proxy for diachronic stability, we estimated the stationary frequency of language types i.e. the overall proportion of time a language spends in a particular type over infinite time (Cathcart et al., 2022), and compared the results to the expected attractor states according to Roberts.

4. Results-Discussion. In our sample, only 4 types are unequivocally attested (T1, T6, T7 & T15), which are contiguous in our evolutionary model (Fig.1). The estimated stationary frequencies for all types are shown in Fig.2. The relative stationary frequencies (and therefore diachronic stabilities) of T1, T6 & T15 are as predicted, with T1 being the most stable and T15 the least stable. However, T7 (Aux-O-V) is estimated to be significantly less stable than T6 (O-V-Aux), despite their common status as vertical mesoparameters. This unexpected result can be explained by the interaction with a V-raising hierarchy, as T7 is attested as a transient grammar in the reanalysis of V2 languages from T6 (O-V-Aux) to T1 (Aux-V-O) (e.g. English, Taylor &

References: Cathcart, C. et al. (2022). Decoupling Speed of Change and Long-Term Preference in Language Evolution: Insights From Romance Verb Stem Alternations. In: *Proceedings of the Joint Conference on Language Evolution (JCoLE), Kanazawa, Japan*. Heggarty, P. et al. (2023). Language trees with sampled ancestors support a hybrid model for the origin of Indo-European languages. *Science*, 381. Roberts, I. (2019). *Parameter hierarchies and universal grammar*. Oxford University Press. Taylor, A. and S. Pintzuk (2015). 'Verb Order, Object Position, and Information Status in Old English', in T. Biberauer and G. Walkden (eds.), *Syntax over Time: Lexical, Morphological, and Information-Structural Interactions*. Oxford: Oxford University Press, pp. 318-335.

Pintzuk 2015). Thus, in families where V2 is absent, T7 is expected to have a high stationary frequency, a question we address in the talk. This showcases the potential of our evolutionary method, as it yields predictions testable and falsifiable in more hierarchies and languages.