Third Factor in the development of P[*]

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1.   Introduction

We take language variation to be brought about by experience, and consider the impact of factors reducing complexity, so called 'third factor' in Chomsky (2005), on language evolution and variation. Following Di Sciullo (2011), we consider symmetry breaking as part of the third factor. We further substantiate this hypothesis on the basis of the development of Prepositions (P) in the phylogeny of Indo European languages. First, we define the general properties of a model of language development taking into consideration the third factor. Second, we relate symmetry breaking in developmental biology to language development. Third, we consider the predictions of this hypothesis and present empirical evidence supporting it. Fourth, we discuss the properties of the computational procedure deriving the variation in the development of P. In the last section, we summarize the results.

2. Model of language development

A standard Minimalist assumption is that the Language Faculty is stable, in the sense that it does not vary through time and space (Chomsky 1995, and related works). Language variation however requires experience, which may introduce choice points, viz., complexity, in the computational system, which is designed to preserve maximal efficiency. We posit that language development is the result of the computational procedure associated to Merge, such as probing/unvalued features, and factors reducing complexity. It follows from this model that language phenotype is limited by the stable properties of Merge, the language genotype.

   We focus on the development of P in Indo-European languages, and the variation

observed in the position of P-elements, including postposition (Po), inpositions (In), and prepositions (Pr). We take P to be minimally defined as a functional element with valued prepositional features as well as unvalued features, including the unvalued (u) determiner (D) feature [uD].[1] This study shows that a model of language development taking into consideration factors reducing complexity provides an account of word-order variation in the prepositional domain in a way that is not accessible to other models of variation. For example, in the Principles and Parameters model (Chomsky 1981, and related works), parameters are options left open by Universal Grammar (UG). Parameters are generally thought of as being associated with the lexicon (Borer 1984), where the values of the features associated with functional elements are subject to variation. A model of language development that takes into consideration factors reducing complexity provides a rationale for the fact that parameters arise and has to be reset at a latter point in time. It also provides a rational for the fact that a parametric choice fails to cover residual cases, as evidenced, for example, in the resetting of the head directionality parameter in the shift from OV to VO in Germanic languages, including German, English, Dutch and Frisian.

2. Factors reducing complexity

We take symmetry breaking as part of the third factor. Symmetry introduces choice-points, thus instability in a system that seeks to eliminate it in order to reinstate an asymmetrical stable state.

Several works in evolutionary developmental biology provide evidence that symmetry breaking is part of evolution and variation of body shape in different species (Graham, Freeman & Emlen 1993: Lewontin 2004; Palmer 1996, 2004, a.o.). Phylogenetic analyses of asymmetry variation, inheritance, and molecular mechanisms reveal unexpected insights into how development evolves. For example, Palmer (1996, 2004, a.o.) identifies phylogenetic patterns of variance in the evolution of bilateral asymmetric species. Three stages in evolution are identified. In the first *symmetric* stage, there is no left or right difference in the organism. In the subsequent *antisymmetric* stage, random prominence of the right or the left side of the organism. In the last *asymmetric* stage, prominence is observed only to the right or only to the left of the organism. Thus, according to these works, symmetry breaking occurs in the evolution of body shape, where it has been systematically observed that a fluctuating asymmetry (or 'antisymmetric' stage) stage is followed by a stage of directional asymmetry (or 'asymmetric' stage):

(1) *Fluctuating asymmetry > Directional asymmetry*

Because of its simplicity, the binary-switch nature of left-right asymmetry permits meaningful comparisons among many different organisms.

Phylogenetic studies in evolutionary biology may bring further understanding of the evolution and variation of human languages. Symmetry breaking, seen as a dynamic force external to the Faculty of Language, may provide a biolinguistic explanation for language

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[1] We will not consider other features of P other than the syntactic valued and unvalued features in this paper.

evolution. Di Sciullo (2011) hypothesized that this was the case, and provided empirical evidence to this effect on the basis of the development of genitives to possessive pronouns from Classical Greek to Modern Greek, and from Latin to Italian, to modern dialectal variants of these languages.[2] The fact that fluctuating asymmetry observed in earlier stages of languages in the position of a constituent to the right or to the left of a head tends to be eliminated in later stages of the languages can be seen, we propose, as an instance of reduction of complexity. In the following section, we illustrate how symmetry breaking accounts for the diachronic development of P.[3] We start with the predictions of our hypothesis for a large set of Indo-European languages.

3. Predictions and supporting evidence

3.1 Prediction A: directional asymmetry should be synchronically widespread

Given a language property involving the respective ordering of two (or more) elements (e.g. head-complement or head-modifier), we expect the number of languages displaying a consistent choice (e.g. P DP or DP P) (*directional asymmetry*) to be far higher than the number of languages allowing for variation (e.g. both P DP and DP P allowed) (*fluctuating asymmetry*). Fluctuating asymmetry is both unstable and more computationally intensive than directional asymmetry (computing different options as opposed to a predictable one), and as such it is more likely to be a transient phase.

This approach contrasts with a purely parametric one, which predicts that parametric fixation should be absolute and leave no room for fluctuating asymmetry. Data from early studies appeared to support the absolute nature of the parametric model, no ambiguous setting is presented for any language in Greenberg (1963), Hawkins (1983) (but see Friedrich (1975) for an early work on Proto-Indo-European syntax recognizing the existence of mixed cases).

(2)

Study	# lgs	Pr	Po	Pr / Po
Greenberg (1963)	30	16	14	0
Greenberg (1963) appendix II	142	63	79	0
Hawkins (1983)	336	148	188	0
WALS (queried 2011)	1185	512	577	58
SSWL (queried 2011)[4]	97	70	31	13

More recent projects show that while a clear polarization is attested, residual cases cannot be factored out; in the WALS database 58 languages out of 1185 (around 5%) are classified as showing no dominant order between P and DP. This class would be larger if

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[2] "The processes of language change are unidirectional, but the changes in language states are cyclic. States: isolating agglutinative > inflectional > isolating Process: particles > affixes > fused affixes > loss. Bidirectional processes are, in fact, the simplest form of unidirectional cyclic processes: type A can change to type B by one mechanism and type B can change (back) to type A by a different mechanism… " (Croft 2002: 252)

[3] We will take fluctuating asymmetry in [P DP] at the sensorimotor interface to be a situation where a given category P may either precede or follow DP at a given stage of development of a language. We will take directional asymmetry in [P DP] to be a situation where P may only precede or only follow DP at a given stage of the development of a language. See section 3 for the derivation of fluctuating asymmetry and directional asymmetry in the prepositional domain.

[4] For three languages the value was N/A for both P DP and DP P (or N/A and nothing). For this sample we have assumed that where information is provided only for one of the values (P DP or DP P), the language does not allow the other option.

it considered languages where both Pr and Po are attested, as opposed to just languages where no dominant order is found. This is confirmed by the data in the SSWL database. Despite the small size of the sample and the lack of balance in areal coverage, witnessed by a large preponderance of Pr languages, the data here appear to show that 13/97 (=13%) of the languages allow for both Pr and Po.

A simple WALS query reveals that out of 1185 languages, roughly 92% of languages are either consistently prepositional (43.2%) or postpositional (48.7%). The remaining 8% is made up by three residual cases: **R1.** no dominant order (i.e. fluctuating asymmetry) **R2**

(3)

Order of Adposition and Noun Phrase (WALS)	
Postpositions	577 languages
Prepositions	512 languages
Inpositions[5]	8 languages
No dominant order	58 languages
No adpositions	30 languages
	1185 languages

Prediction A is thus fully confirmed by the quantitative data in databases such as WALS, SSWL.

3.2 Prediction B: fluctuating asymmetry should characterize older diachronic stages

"Older" languages are more likely to show fluctuating asymmetry than "younger" languages. Since directional asymmetry is stable, languages reaching this stage will not revert back to fluctuating asymmetry: evolution is directional and non-cyclical[6]. We tested this prediction on a number of languages closely related to Proto-Indo-European (PIE).

The table below summarizes the results, collected from Hewson and Bubenik (2006) (H&B henceforth), Friedrich (1975), Campbell, Bubenik, and Saxon (1988) and others. The table clearly illustrates that fluctuating asymmetry is attested in virtually all these languages: this is true even for languages which display a clear preponderance of pre(post)positions. The remainder of this section will provide evidence drawn from a subset of languages in Table 1; space consideration prevents us from presenting and discussing the full range of data.

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[5] Inpositions are defined as follows in WALS (Chapter 85): "adpositions which occur or can occur inside the noun phrase they accompany. In Anindilyakwa (isolate; Northern Territory, Australia) the inpositions are second-position clitics within the noun phrase, attaching phonologically to the end of the first word in the noun phrase, as in (i), in which the inposition attaches to the word for 'small' in the noun phrase meaning 'small stick'.

(i) ...narri-ng-akbilyang-uma [eyukwujiya=manjaeka]
...NC$_1$.PL-NC$_2$-stick.to.end-ta[small=LOC stick]
'... they stuck them (the feathers) to a little stick.'

[6] "The processes of language change are unidirectional, but the changes in language states are cyclic. States: isolating > agglutinative inflectional > isolating Process: particles > affixes > fused affixes > loss. Bidirectional processes are, in fact, the simplest form of unidirectional cyclic processes: type A can change to type B by one mechanism and type B can change (back) to type A by a different mechanism… " (Croft 2002: 252)

Language/time	Dominant	Fluctuat. asym.	Direct. asym. in later stages/derived lgs
Old Hittite 17th-16th c. BC	Po	**Yes** (12), (13)	**Yes**: New Hittite (14th-13th c. BC): *andan* (4) PostP only
Tocharian A (3.2) **Tocharian B** (3.2) 5th-8th c. AD	Po	**Yes**	**?**: No languages derived from Tocharian
Old Armenian (3.3) 5th – 9th -c. AD	Po	**Yes** (ex.5)	**Yes**: Modern. Armenian (Po, few relics of prepositions)
Homeric Greek 1000-800 BC	Pr	**Yes**	**Yes**: Modern Greek (fully Pr);
Albanian	Pr	**No** (Pr only)	**Yes:** Modern Albanian (Pr)
Old Persian from 2nd millen. BC	Po: Cuneiform Persian Pr: Gathic Pr: Younger Avestan	**Yes** **Yes** **Yes**	**Yes**: Persian (PreP); **No** : Pashto (still mixed, both PreP and PostP attested)
Indo-Aryan **Vedic Sanskrit 1200BC**	Po	**Yes**	**Yes**: Hindi (fully PostP)
Old Slavic	Pr	**Yes**	**Yes:** Czech, Serbian, Bulgarian **No:** Russian
Old Germanic	Pr	**Yes?**	**Yes:** Germanic (Pr only)
Latin	Pr(very strongly)	**Yes?**	**Yes**: Romance (Pr only)
Celtic	Pr	**No**	**Yes**

Table 1

3.2.1 Hittite

3.2.1.1 Old Hittite. H&B consider Old Hittite as a strongly (though not exclusively) postpositional language. Luraghi (1990) reports that according to Starke (1977) when a direction is expressed through a nominal complement of a 'place word' (an adposition in our terms), the order observed is # S (DO) PlW Compl/IO V #.[7] Luraghi shows however that this is incorrect as postpositional examples are attested and whenever the complement of a motion verb is a Source bearing ablative case, then the adposition always follows the complement, as illustrated in (4)

(4)   [LUG]AL URUKussara *URU-az*   **katta** [p]angaritu[ē]t…
        king   Kussara city-ABL down mass-INSTR he-came
        'The King of Kussaras come down from the city with great forces'

Cases of fluctuating asymmetry with the same adpositional element are attested in Old Hittite. The word *parā* ('towards') is attested both prepositionally and post-positionally

(5)   a. [UGULA LÙ].MEŠ MUHALDIM marnuandas ispantuziassar *LUGAL-I*
           chief   cook-PL   m.-GEN   vessel-N/A   king-D/L
           parā   epz[i]
           towards he holds
           'The chief of the cooks holds out to the king a vessel full of m.'

        b. [MUŠENhāranann= a   **p]arā** hilam[na]   pētumeni
              eagle-ACC   and   toward   door-DIR   we-carry
              'and we carry the eagle towards the door'

Concerning (5a), Luraghi observes that the order *parā ep-* is the only attested one in Old

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[7] Starke also proposed a postpositional analysis of adpositional elements when used as particles. Since it is not entirely clear that all alleged particles really differ from adpositions, we will ignore these cases in this paper.

Hittite, thereby signaling that *parā* in these cases is 'felt as to be more tightly linked to the verb […] *para ep-* builds at least at least a semantic unit, if not a true compound verb' (Luraghi (1990: 33). She further notices (fn. 62 p.133) that the addition of *parā* to *ep* alters the valency of the verb: *parā ep-* 'to stretch out' is trivalent, while *ep-* ('to grasp') is bivalent. This is a familiar state of affairs in Homeric Greek, as described below and in several world languages. The valency-altering pattern is consistent to what Baker (1988) described as 'preposition incorporation'[8]. It is thus tempting to treat *parā* in cases like (5a) as a verbal prefix. While this analysis is appealing for cases like (5a) it cannot be generalized: H&B p.95 report clear cases of what we call fluctuating asymmetry.

(6)   a. kuit kuit *E-ri*   **andan** harakzi tat   sarnikzi
          what   what   house-LOC   inside   is-lost   CONN=it   replace-3S
          "he   replaces   whatever   is   lost   inside   the   house"
        b. **andan**= a *E-ri*   kuit kuit   harakzi
          inside= PTChouse-LOC what what is-lost
          "But whatever is lost inside the house"

It is worth noting that in both (6a) and (6b) the valency of the verb is unchanged, thus a prefixal analysis of *andan* in (6a) can be excluded.

3.2.1.2 Middle and Late Hittite: The Old Hittite period covers roughly the span 1650-1550BC. The end of the Old Kingdom (c. 1550BC) is usually taken to mark the end of the Old Hittite period (Luraghi (1990: 5)). Both Middle and Late Hittite are consistently post-postitional. For example, while *andan* can be used both pre- or postpositionally in Old Hittite (6), it becomes exclusively post-positional in New Hittite (H&B p.96).

 (7)   *ÌD-i*   **anda**   lāhuwai
        River-DAT/LOC into   pour-3SG
        "she pours into the river"

3.2.2 Tocharian. There are two known regional varieties, known as Tocharian A and Tocharian B. We exemplify the familiar fluctuating asymmetry pattern by showing that the adposition *(e)ṣe* in Tocharian B is attested both prepositionally and postpositionally.

(8)   a. walo kauṣale   **eṣe** *wertsyaimpa*   (B) (H&B p.326)
          King Kauṣala-GEN with retinue-COM
           "the king of Kausala, together with his retinue"
        b. sankamp   **eṣe**
           saṃgha-OBL=COM with   (B)
            "with the saṃgha"

3.2.3 Armenian (H&B p168)

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[8] Lack of space prevents us from discussing this important point in detail, but see Di Sciullo and Nicolis (in preparation) for a detailed analysis of these facts.

3.2.3.1 Old Armenian

We exemplify fluctuating asymmetry by analyzing the adposition *handerj* ('(together) with'). This adposition is attested productively both prepositionally and postpositionally with a 24/13 preponderance of postpositional usage in the Old Armenian Gospels in Künzle (1984:394-395) (quoted in H&B p.168)

(9)   a. *ašakertawk^c-n*   **handerj**
           Disciples-INSTR/PL-CL with
           "with the disciples"
        b. **handerj** *ašakertawk^c-n*

3.2.3.2 Modern Armenian

The language became fully postpositional with 'few relics of earlier prepositions (most notably *aranc*=N+DAT "without", cf. Classical aranc^c=N+GEN "without"; t^{c}ebi=N+ACC "against", cf. Classical hakar-ak=N+GEN). Notice that = indicates that these relics are actually verbal prefixes, a rather unsurprising fact, on the basis of the discussion of Old Hittite above and of Homeric Greek below.

3.2.4 Greek (H&B p.4ff., ch. 3)
3.2.4.1 Homeric Greek

Ancient greek scholars traditionally distinguish betwen proper prepositions, used both as prefixes and as independent adpositions and improper prepositions, which are never used as prefixes. Furthermore improper prepositions, tend only govern one case, while proper prepositions can be found in association with more than one case. It is thus tempting to identify improper prepositions with the kind of syntactic objects we would call 'preposition' based on Modern Greek (or English).
It would be a mistake though to jump to the conclusion that improper adpositions are necessarily a more recent development. In fact there are some reasons to believe that the opposite is in fact true. Eight out of twelve disyllabic adpositions identified in Hewson and Bubenik (2006 p.61ff.) will shift the accent from the last syllable to the penult when postposed, as exemplified in the following examples:

(10)   ὅσσα τε γαῖαν   ἔπι πνείει
        hóssa te   gaîan   épi pneíei
        what and earth+acc on breathe+3sg
        "whatever on the earth breathes"

(11)   πκέων ἐπὶ οἴνοπα   πόντον
        pléōn epì oínopa   pónton
        sailing over wine-dark sea+ACC
        "sailing over the wine-dark sea"

This process is traditionally known as *anastrophe*; both Hewson and Bubenik (2006) and Bortone (2010) though question its characterization as a process shifting the accent from the last syllable to the penultimate when the particle is postposed. The authors argue that

this characterization is based on the classical form, where accentuation on the last syllable is the norm. However, for some of these adpositions it is possible to reconstruct their nominal origin, and nouns were accented on the penultimate syllable. It follows that cases like (10) appear to reflect an "older" syntax than cases like (11).

It follows that on the one hand "improper" propositions are syntactically much more similar to modern-day prepositions than "proper" prepositions, as they govern only one case and do not occur as prefixes, but "proper" prepositions appear to be a more recent development. This situation may be suggestive of the following developmental sequence:

1. **Pre-Homeric Greek**: both proto-prepositions and proto-postpositions are attested (fluctuating asymmetry); they likely show certain features common in Old Indo-European languages, e.g. they can occur separate from their object. As such, they can be characterized as elements independent endowed with an EPP-like feature, which allows them to independently probe for a goal (see footnote 10 for a technical implementation). Cases where the P-DP (or DP-P) relation is discontinuous are not uncommon in Homeric Greek (see discussion surrounding (23) below)

2. **Homeric Greek**: Prepositions are much more frequent than postpositions, "proper" adpositions appear and they outnumber "improper" prepositions. Fundamentally important is the fact that many prefixes (i.e. the prefixal version of the "proper" preposition) can act as if they were a postposition governing the case of the preceding or following DP. This would suggest that post-positions are ceasing to be inherently endowed with an EPP-like probing feature, but they can parasitically "borrow" one from the verb to which they are prefixed. This state of affairs in Homeric Greek is remarkably similar to what described above for Old Hittite (see discussion following (5)). It is thus tempting to characterize the prefixation of certain adpositions as the sign of the ongoing switch from fluctuating to directional asymmetry: the 'dispreferred' option (postposition in the case of Greek) is gradually abandoned, but in this phase some prefixes act 'like postpositions': they are syntactically active (they can assign case) and they assign case to their left, as in (12) (from Viti (2008: 383)

(12) a. chálkeon   dé moi   êtor   eneíē
         Bronze-NOM.N.SG PTC me-DAT heart(N)-NOM.SG IN.BEPR-OP-3SG
         '(Not even if) I had a bronze heart (lit. Not even if a bronze heart were in me Il 2.2490')

3.2.4.2 Classical Greek: Classical Greek is virtually fully prepositional (*directional asymmetry*). Luraghi (2003) provides the following important example from Herodotus which shows that 'incorporated prepositions' (e.g. 12) are not syntactically active any longer since they co-occur with omophonous prepositions. The prefix has become a satellite, in Talmy's terms and case assignment has to be independently carried out by a bona-fide preposition.

(13)   Hai   **epì** *Lḗmnōy*   **epi**keìmenai   nêsoi
         ART/PL/ on Lemnos-DAT lie-PART/MID/PL/F island-NOM/PL/F
         "the island lying off Lemnos"

3.2.5 Persian
3.2.5.1 Old Persian

There are three related varieties of Old Persian, all of which display fluctuating asymmetry. Their classification is as follows (from Campbell, Bubenik and Saxon (1988) p.217 and references cited therein (all caps = dominant feature))[9]:

Cuneiform Persian	SOV/svo	AN/na	GN/ng	**POSTP/prep**
Gathic	SOV	an/na	GN/ng	**postp/PREP**
Younger Avestan	SOV	an/NA	gn/NG	**postp/PREP**

Examples (14), (15) illustrate fluctuating asymmetry in Avestan and Cuneiform Persian respectively, where the adposition *aibi* "un-to" is realized as either Pr or Po.

(14)　*Asmanem*　**avi** … *zam*　　**avi**…
　　　Heaven-ACC to　… earth-ACC to
　　　"towards the heaven, towards the earth"

(15)　Anaya　　　**abiy** *mām*
　　　Lead-IMPF-3SG　　　to　I-ACC
　　　　　"He led [him] to me"

3.2.5.2 Modern Persian

Modern Persian is exclusively prepositional. H&B p.136 point out the "exception of accusative postposition *=rā* and genitive postposition *=yē*". That these two morphemes can be analyzed as postpositions is very debatable. Concerning *rā*, several proposals in the generative literature exist, none of which treats the morpheme as a postposition: accusative case morpheme, specificity marker, focus marker (see Cagri (2007) for an overview of the main proposals).

3.2.5.3 Modern Pashto

Pashto's adpositional system still allows for both preposition and postpositions. It also features circumpositions. It is thus a grammatical system where fluctuating asymmetry is still present. Notice that this does not goes against our theory, which does not treat fluctuating asymmetry as banned by grammar, but rather considers it computationally more costly than directional asymmetry. What we predict is that a switch from fluctuating to directional asymmetry is complexity reducing and thus likely to happen, while the opposite switch (from directional to fluctuating asymmetry) should be very rare and should only be attested in conjunction with major extra-grammatical factors (e.g. radical contact situations, etc.)

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[9] AN / NA (ordering of adjective and noun); NG/GN (ordering of genitive and noun)

Pashto	SVO	AN	GN	postp/prep

To exemplify, consider the possibility of expressing the notion of movement along a path by means of either a postposition *ta* "for" or a preposition *pə* "by"

(16) a. …*melmá* **to**   b. **pə** *lār*
      guests for   by road
      "[they are preserving X] for the guests"   "by the road"

3.3 Summary

We confirmed the validity of our predictions on a number of languages closely related to Proto-Indo-European. The languages in the Table 1 above all display an initial phase where fluctuating asymmetry is attested; this is true even for languages which display a clear preponderance of pre(post)positions (data from Hewson and Bubenik 2006, Friedrich 1975, and quoted references). A very clear tendency towards the development of directional asymmetry is observed: later developmental stages of the languages in the table (e.g. Classical Greek as opposed to Homeric Greek) and languages derived from them will develop full directional asymmetry in the vast majority of cases. The opposite route, namely developing fluctuating asymmetry after the language has reached full directional asymmetry is unattested in our sample.

4. Computational procedure

We illustrated above that R1, where both P DP and DP P orders are attested in the same language, was the norm rather than the exception in early Indo-European development. This choice in the ordering of the constituents is reduced in later developments. What is the computational procedure deriving the P DP and DP P orders?

Giusti (1993:43) proposed that the locus of Case features (KP) is a functional projection (FP) above DP that replaces KP and assimilates DP.[10] In languages with overt articles, F is realized by means of the article, in languages with morphological case, F is realized by the Case suffix, which attracts the noun to F. Bayer, Bader and Meng (2001) propose an additional KP layer for oblique Case (datives) which is missing in NPs bearing structural Cases (Nom and Acc), based on the properties of German. Thus, P is projected higher than the KP shell (FP):

(17) $[_{PP} \dots P \ [_{FP} \dots F \dots [_{DP} \dots D$

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[10] Giusti (1993) proposes that the DP has an extended projection, labeled KP and is headed by K(ase). The fact that K has to be considered the highest functional head of the noun phrase is argued on the basis of i) K bears the selectional features of the lexical syntactic category immediately above it ; or ii) it bears the agreement features of another syntactic category. Since only arguments may receive case, KP functions as a link between the selected nominal and its syntactic legitimacy (1993 :42). This claim is mainly based on the fact that al languages generate a case projection, even the ones for which most nominals show no overt case marking. For these languages, the postulation of a case projection is motivated by analogy with the presence of morphological case on particular categories like pronouns. As for the level of insertion of the K head in the nominal structure, Giusti observes that morphological case marking always appears on the article. K must therefore be higher than D in order for D to be able to incorporate it into syntax or LF. The configuration proposed for German is: $[_{KP} K \ [_{DP} D \ NP]]$.

Given Chomsky's economy condition "α enters the numeration only if it has an effect on output" (Chomsky 1995:294), which derives from Full Interpretation "minimize superfluous symbols", the operations of the grammar are not optional, and different proposals are available to derive 'optional' movement (Boškovic and Takahashi 1998, Richards 2004, Pesetsky and Torego 2001, Roberts 2006, Biberauer and Richard 2006 a.o.).

According to Chomsky (2001), lexical items are bundles of features, and they may enter the derivation with unvalued features. For example, the functional head T carries unvalued person, number and gender (i.e. ɸ) features, and DPs are unvalued for Case. The principle of 'Full Interpretation' ensures that unvalued features are valued before Spell-Out, to be legible by the external systems. Unvalued features are valued by entering into an Agree relation with valued features (18). An Agree relation is generally followed by movement (pipe-piping).[11]

(18) Agree: α Agrees with β iff:

    a. α and β are non-distinct for some formal feature F;

    b. α and β are active (i.e. have at least one uninterpretable / unvalued feature);

    c. α asymmetrically c-commands β; there is no γ, an active goal, which is both asymmetrically c-commanded and asymmetrically c-commands β (i.e. there is no intervening potential goal).

The fluctuating asymmetry between [P DP] and [DP P] orders attested in early Indo-European development may follow from the valued/unvalued D feature of P: (19) vs. (20). Given Biberauer and Richards (2006) implementation of language internal optionality, where nothing prevents a category that moves from being larger than the goal (e.g., wh-movement in Russian and in Ancient Greek), P may probe a constituent larger than D, (20).

(19) $[_{PP} \ldots P_{[P]} \ [_{FP} \ldots F_{[F \ ]} \ [_{DP} D_{[D]}$ preposition

(20) $[_{PP} \ldots P_{[P]} \ [_{FP} \ldots F_{[F]} \ [_{DP} D_{[D]}$ postposition

Thus, both derivations in (19) and (20) would be available in older languages, which present fluctuating asymmetry, whereas in later stages evolving towards directional asymmetry, this choice would be reduced to one of the two derivations. Thus, languages evolve from a state where both pre-positional and post-positional P are possible and tend

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[11] In standard views, the EPP feature triggers movement. This feature is a second order feature (Adger and Svenonius 2008). It has no substantive content or value and its sole purpose is to be checked/deleted by application of internal Merge. EPP feature may be associated with various features within a head's feature bundle (Biberauer, Holmberg, and Roberts 2010). It may be i) parasitic upon a Probe-Goal Agree relation, triggering movement of the XP containing the goal to the specifier of the probe, e.g. T[uɸ, $\wedge$] , where $\wedge$ is the movement diacritic in an "Agree-driven movement" (A-movement); ii) parasitic upon the edge-feature of a head, e.g. C[EF, $\wedge$] (A-bar movement); or parasitic upon the c-selection features of a head, triggering movement of the entire complement domain into the specifier of the head, e.g. V[D, $\wedge$] which causes the complement DP of V to raise to spec,VP. (Appleton 2011). EPP driven movement in the prepositional domain is parasitic upon the Probe-Goal Agree relation.

towards stages where P is pre-positional only or postpositional only.

Table 1 illustrates that R1 was the norm rather than the exception in early Indo-European development. The same also holds for R3 ('inpositions' or discostinuous contituents). Example (21) illustrates this property for Vedic Sanskrit (21a) and Avestan (21b):

(21) a. hiraṇyáyā̄t **pári**   yoner   [RV ii.35.10]
        golden-ABL around womb-GEN/ABL
        "from the golden womb"
    b. anā̄pǝrǝ θ a **hača** šyao θ ne   [V.3.39]
        inexpiable from deed-INSTR
        "for the sake of an inexpiable deed"

These cases show that P in this stage of development is not probing for [D], triggering Internal Merge. Modern languages which have reached the directional asymmetry stage, but allow discontinuous PPs productively (e.g Ukranian (53), from Kariaeva (2009), allow for both N>A and A>N inside the discontinuous PP, but P must always precede both:

(22) a. **Bilja   školy**   Ivan   **žyve novoji**   **(**Ukranian)
        Next-to school-F.SG.GEN John.NOM lives new-F.SG.GEN
        "As for the school John lives next to, it is a NEW one"
    b. *Novoji Ivan žyve bilja školy

Cases where an "adposition" is separated from its complement hold true both for pronominal "adpositions" (23a) and postnominal ones (23b)).

(23)   a. heúroi   d' **en** pḗmata *oikōy*
          Find-OPT-3SG   PRT in   woes-ACC house-DAT
          "may he find woes in his house"

       b. *Athēaíēn* Hḗrē   **pròs** mûthon   éeipen
          Athena-ACC Hera-NOM   to   word-ACC   speak-AOR-3SG
          "Hero spoke to Athena"

According to the proposed view of the development of P the universality of Merge and the computational procedure associated to Merge is not affected by variation, which, according to our hypothesis, is enforced by symmetry breaking, and which in turn brings about a reduction of complexity.

5. Summary

We provided empirical support to the hypothesis that language diversity is the result of external factors to the language faculty. This comes as no surprise as language is an object of the natural world and thus is subject to natural laws pertaining to evolution and variation. While further work is necessary to understand the effects of symmetry breaking on language diversity, rigid binary parameters and classical phylogenic trees do not fully

reflect language evolution, as they do not predict the fluctuating asymmetric stage. A unified model of language universals and language diversity accounts for the fact that the computational procedure associates to Merge persist through time and space, notwithstanding the complexity brought about by experience.

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