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# Diachronic evidence against source-oriented explanation in typology

***Evolution of prepositional phrases in Ancient Greek***

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**Abstract**

Source-oriented explanation in typology challenges a number of well-established universals, including the correlational universals of harmonic ordering of heads and dependents. It dispenses with functional or cognitive explanations of these because harmonic orders may simply be explained as one order emerging from the other and thus as historical accidents. We provide twofold evidence against this approach and show that (i) universally preferred structures may emerge without any preconditions in the grammaticalization source and (ii) that universally dispreferred structures of the source disappear in the course of time. First, we demonstrate that the development of the three harmonic, head-first word orders (VO, AdpN, NGen) in Postclassical Greek can hardly be considered a historical coincidence, because they match chronologically and, at the same time, are entirely unrelated etymologically, and because neither of these had a bias for ordering heads before dependents in the source. The emergence of the three harmonic word orders is extremely improbable under the null hypothesis of a development by chance (odds 0.037). Secondly, we provide evidence for the reverse case: cross-linguistically dispreferred properties inherited from the source are abandoned in the course of the development.

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**Keywords**

source-oriented explanation – development of prepositional phrases – implicational universals – word order universals – efficient processing – Greek – configuration – directionality in language change

## 1 Introduction

The importance of diachronic explanations of universal patterns has been repeatedly emphasized in the typological literature. A diachronic perspective not only provides explanations of various typological quirks in terms of historical accidents rooted in a given grammaticalization source and path, but it also challenges in many ways a number of universal patterns established on the basis of synchronic data (Givón, 1984; Garrett, 1990; Aristar, 1991; Bickel, Witzlack-Makarevich and Zakharko, 2014; Cristofaro, 2013, 2014, 2017, 2019; Grossman, 2016). More specifically, a growing number of researchers argue that source-oriented explanations (henceforth *the source-oriented approach*) provide a potential confounding factor for many universal patterns that may thus reveal themselves as historical accidents (the null hypothesis), yielding assumptions of functional or processing motivations redundant by Occam's razor (Cristofaro, 2013, 2014, 2017, 2019; Collins, 2019; Sansò, 2018).

More specifically, with regard to the order of adpositions and nouns, it has been found that these tend to be harmonic with the order of verb (V) and object (O) as well as with the order of the possessed (N) and possessor (Gen) nouns in such a way that heads and dependents are ordered the same way across these domains (since Greenberg, 1963; Dryer, 1992, 2013, 2019). There have been two competing explanations of these harmonic orders in the literature. The first explanation assumes that a harmonic ordering of heads and dependents in different domains has a functional motivation in that it serves processing ease (Dryer, 1992; Hawkins, 1994, 2004, 2014). By contrast, the second, source-oriented approach challenges functional explanations as potentially insufficiently motivated because the harmonic correlation may be explained diachronically: one grammatical domain being the grammaticalization source of the other. Accordingly, the correlations between the two domains in the order of elements may reveal themselves as just residual properties of the source pattern in the resulting pattern and thus be accidental (Aristar, 1991; Cristofaro, 2017, 2019; Collins, 2019). We refer to this possibility as *source confounder*.

Indeed, verb-object combinations as well as adnominal-possessor constructions are among the frequent sources for adpositions cross-linguistically (see

the discussion in Section 3 below). In view of this, the source confounder is a legitimate challenge for the pure synchronic evidence here and therefore has to be taken seriously. Having said this, there is a large leap between acknowledging the potential existence of (i) a source confounder in the data to (ii) adopting a purely source-oriented explanation of the data. We suggest that these two should be strictly kept apart in typological research. The former is an important methodological caveat, whereas the latter is an approach to causality in linguistics. In what follows, our criticism focuses on the latter while we accept the former.

The practical application of the source-oriented approach often involves additional assumptions that are unwarranted. First and crucially, the historical analysis of the diachronic patterns leading to synchronic universals often overestimates the available diachronic evidence. Since there are not that many well-documented cases of diachronic developments leading to, e.g., harmonic word orders, this approach resorts to extrapolation from the well-understood cases to other, apparently similar cases in unrelated languages based on the synchronic match between these. For example, the argumentation may go along the following lines: the development from verbs into prepositions has been described for a number of languages (e.g., Lord, 1973; Bisang, 1992; Givón, 1975: 82–84, 86, 93; Heine and Reh, 1984: 66; Kortmann and König, 1992: 684; Vincent, 1997: 212); accordingly, many other languages that have harmonic VO+AdpN (Adp—adposition) may be assumed to have undergone the same pathway. Below we document a counterexample for this line of thinking and suggest that such an extrapolation is ill-advised because synchronic correlations might be misleading in the diachronic interpretation if taken at face value. Thus, if we had no historical data for Greek, the source-oriented approach would have produced the wrong assumption that VO (or NGen) is likely to be the source of AdpN in Greek, which is demonstrably not the case (see Section 3).

Second, this approach makes an important tacit assumption that the process of grammaticalization does not affect the result, crucially that the order of elements remains unchanged from the source into the resulting pattern. Below (Section 4) we provide evidence that this assumption is also ill-advised. It has been repeatedly observed in the literature that the word order of a grammaticalization source is not always transmitted unchanged into the target construction, and deviating orders do develop by processes other than just a functional reanalysis of the components of a pattern (Harris and Campbell, 1995: 210–215). In particular, we argue below that adpositions, once grammaticalized, generally develop into clitics. Yet, clitics are cross-linguistically, and in Ancient Greek in particular, subject to a very different set of rules of ordering of elements than orthotonic words. Their placement is, therefore, hardly determined by the orig-

inal placement of their source lexical item, whether it is a verb in a verb-object or a noun in an adnominal possessum-possessor construction. In view of these facts, a retention of the original order of elements through the entire grammaticalization process need not be viewed as a simple unmotivated drift but rather as a complex diachronic process constrained by universal selectional pressures which are, in turn, motivated by the preferences of the human processor.

Finally, the source-oriented approach makes the explanation of correlations in the resulting configurations redundant by resorting to the alleged source configurations. The selection of precisely these and not some other source configurations is considered as accidental and therefore remains unexplained. For example, the source-based explanation does not offer any explanation for the fact that genitive-noun or verb-object patterns are frequently selected as grammaticalization sources of adpositions.

To summarize, we argue that these assumptions overestimate the power of any explanation that is solely based on the properties of the hypothesized grammaticalization source and does not take the synchronic function as well as the intermediate historical developments into account.

Furthermore, Dryer (2019) has recently argued that a source-oriented explanation is not sufficient to account for the synchronic distribution of harmonic word orders cross-linguistically. While Dryer (2019) relies only on synchronic data and his diachronic accounts are, therefore, unavoidably somewhat hypothetical, we demonstrate the poverty of a pure source-oriented explanation on the basis of detailed diachronic data. We believe that in order to verify the power of the source-oriented approach, one has to detail the developments of a set of relevant cases. In order to do so we explore the emergence and further development of prepositional phrases in Ancient Greek and look into the development of the harmonic VO and NGen orders. Even though we discuss just this one language, the chances of the null hypothesis being true here are less than 0.04, as we illustrate below (Section 7).

More specifically, we argue that the development of prepositions in Ancient Greek chronologically correlates with the gradual expansion of VO and NGen word orders, with both processes leading to the harmonic word order in Post-classical Greek and away from OV and postpositions inherited from Proto-Indo-European (cf. Lehmann, 1974; Hock, 2013). Crucially, even though the source-oriented approach would assume here that prepositions emerged from verb-object or noun-genitive combinations if no historical data for Ancient Greek were available, we show that neither of these is the source of prepositions. All these domains developed independently from each other, but we still observe harmony throughout all the periods.

What is more, our study reveals that cross-linguistically infrequent patterns of spatial adpositions may emerge, but these patterns gradually disappear in favour of more common patterns. Thus, we argue that historical accidents are likely in the development of a language but the effects of these accidents are not particularly stable diachronically and may be lost in the long run. This is another piece of evidence against the source-oriented approach as it shows that properties of the source that represent typological rara in the new category are likely to disappear in the course of time.

Thus, our study provides twofold diachronic evidence against the source-oriented approach and, more generally, against viewing diachrony of a language as a drift, i.e. as a series of spontaneous changes and non-changes which are unconstrained and do not underlie any adaptive selectional pressures. Instead, we claim that the evidence provided in Section 5 below (summarized in Table 13) can hardly be explained just as an accidental historical match but rather call for higher-order explanations. Processing efficiency is one such explanation for the harmony between word orders across different domains (cf. Hawkins, 1994, 2004, 2014).

More specifically, our study explores expressions of spatial relations and their development from the Archaic into Early Byzantine period of Ancient Greek. We selected 16 ancient adpositions: *PROS* 'to', *PERI* 'around', *ANTI* 'in front of', *AMPHI* 'around', *PARA* 'at, beside', *KATA* 'below, downward', *META* 'with, among', *DIA* 'through', *SYN* 'with', *PRO* 'before', *HYPO* 'under', *APO* 'from', *EK* 'from inside', *EIS* 'into', *EN* 'in' and *EPI* 'on'.[1] Our study is based on previous research to a large extent (*inter alia*, Delbrück, 1893: 647–665; Kühner and Gerth, 1898: 526; Smyth, 1920; Schwyzer and Debrunner, 1950: 419–436; Chantraine, 1958; Dunkel, 1979; Horrocks, 1981; Vincent, 1999; Luraghi, 1996, 2003; Hewson and Bubenik, 2006; Haug, 2009; Bortone, 2010).

We scrutinize the diachronic development of these adpositions and proceed as follows. First, in Section 2, we describe our two databases created for this study and some methodological choices. Section 3 sketches the prehistorical source of the selected prepositions and the overall historical scenario. Section 4 describes how constituency gradually emerged, detailing positional and morphological evidence from our database. Section 5 discusses the harmonizing changes in the word order from head-final order in Proto-Indo-European to the transitional order with no dominance in the Archaic period—OV/VO, AdpN/NAdp, GenN/NGen being similarly frequent,—into VO/AdpN/NGen in Postclassical Greek on the basis of previous research. Section 6 is devoted to

1 Since these have a number of allomorphs (see below) we refer to the actual morpheme by capitalizing its spelling.

TABLE 1 Six periods with the N of words per period

| Period | Date | Source | N of words |
|---|---|---|---|
| Archaic | 750–450 BC | Homer, Hesiod, Aeschylus | 349,448 |
| Classical | 450–315 BC | Plato, Xenophon, Thucydides, Aeschines, Aristophanes, Demosthenes, Gorgias, Isaeus, Isocrates, Lysias | 1,056,874 |
| Hellenistic | 340–0 BC | Diodorus, Polybius, Menander, Archimedes, Chrysippus, Nicolaus Damascenus | 862,053 |
| Roman period | 50–250 AD | Longus, Flavius Arrianus, Flavius Philostratus, Appianus, Chariton, Dio Chrysostom, Flavius Josephus, Lucianus, Heliodorus | 1,198,445 |
| New Testament Koiné | 100 AD | New Testament[a] | 137,938 |
| (Early) Byzantine | 500–700 AD | Ioannes Antiochenus, Ioannes Malalas | 209,507 |

a While New Testament belongs chronologically to the Roman period, we split it off into an extra period because it is a good approximation to the vernacular of the time (Browning, 1983: 22 ff.).

some typologically infrequent properties rooted in the historical source of the Greek prepositions and to how these properties have been abandoned in the course of time. Finally, Section 7 summarizes the main conclusions.

## 2 Our data and corpus

Our study is based on two databases compiled by various text searches in the corpus *Thesaurus Linguae Graecae* (TLG).[2] Both databases are structured along the following six idealized periods, following largely Horrocks' (2010) periodization (cf. also Browning 1983), as illustrated in Table 1 above.

The greater part of our exposition below relies on the *Quantitative Database* that we created by textual or lemma search in TLG (during autumn 2016) for all 16 prepositions.[3] The prepositions selected represent the earliest layer of Greek prepositions. This allows us to trace their development across all periods. While Ancient Greek had a few other prepositions, we delimited our scope to these 16.

2 http://stephanus.tlg.uci.edu/index.php.

3 As of autumn 2016. Note that TLG keeps updating its corpus and the totals of authors may vary in both directions.

When it comes to the text selection for our subcorpus, we used the following guidelines. We tried to avoid metric texts in favour of prose except for the Archaic period where the only texts available are all metric. We also tried to balance the contribution of each author to a period in terms of the number of words that a particular author brings into his period in order to counterbalance author-specific preferences. For example, we originally had Plutarch in our database but then excluded him because the amount of his texts (> 1 Mio.) was comparable to the word total of all other authors of his period.

Our periods are not balanced with regard to the totals because the periods vary as to the amounts of texts available. For example, the Archaic period and New Testament are much smaller in terms of the number of words than the Roman period. To neutralize the effect of the word totals on the periods we only operate with proportions within a period. Below we always provide the figures that are relative either to other prepositions or to the total of the same preposition within the period while never operating with the absolute token frequencies.

Additionally, we have created a *Qualitative Database*. This database has been collected manually by annotating all instances of *PERI* for case, semantic role, period, linear position, argumental/adverbial usage vs. modifying an NP, and some other properties.[4] This database is still under construction and some of the periods are under-represented (see Table 2 below).

In total, the qualitative database consists of 634 utterances of *PERI*.

Below, we primarily rely on the quantitative database—something that, therefore, will not be indicated in the text. Only figures from the qualitative database will be explicitly marked as such.

Before we turn to the presentation of our diachronic data, we briefly introduce our terminology. We talk about the *adpositions* to include both the prepositional, postpositional and adverbial usages of our 16 adpositions. We reserve the term *prepositions* to only their prepositional usage.

## 3 The source of Ancient Greek prepositions

In this section, we demonstrate that there has been no source bias for a particular word order of adpositions and their dependent NPs in Proto-Greek despite the fact that, by the Roman and Early Byzantine periods, these prepositions

4 This database is a work in progress involving very resource-intensive work. We plan to extend it in the future.

TABLE 2 The Qualitative Database

| Period | Author | Works | N of entries |
|---|---|---|---|
| Archaic | Aeschylus | Persae, Septem contra Thebas, Choephoroe, Eumenides, Prometheus vinctus | 26 |
| Classical | Plato | Euthyphro, Ion, Apologia Socratis | 372 |
| | Xenophon | Anabasis, De republica Lacedaemoniorum, Atheniensium respublica (Pseudo-Xenophon) | |
| | Thucydides | Historiae (until 2.80) | |
| Hellenistic | Polybios | Historiae (until 1.69) | 200 |
| | Diodor | Bibliotheca historica (until 1.37.5) (excluding the proem) | |
| Roman | Longus | Daphnis et Chloe | 36 |
| | | Total | 634 |

become synchronically indistinguishable from those that emerge via pathways such as (1) or (2) below.

Cross-linguistically, adpositions often develop from constituents that already involve a syntactic dependency in the source construction, for example, from relational nouns and their complements. The following two pathways are frequent (*inter alia*, Blake, 1994: 163 ff.; Svorou, 1994: 90, 101; Dryer, 2019: 66–67):

(1) From adnominal-possessor phrases
*possessum NP* (head) + *possessor NP* (dependent) > *adposition* (head) + *dependent NP*

(2) From verb-object phrases
*verb* (head) + *object NP* (dependent) > *adposition* (head) + *dependent NP*

An example of the former is English PP *in front of the house* in which *front* is originally a lexical, relational noun while the dependent NP (*the house*) is

its complement (cf. other examples from Romance in Lehmann, 2002: 10–11). In turn, (2) is found, for example, in many African and South East Asian languages (Lord, 1973; Bisang, 1992; Givón, 1975: 82–84, 86, 93; Heine and Reh, 1984: 66) but also marginally in languages of Europe. For example, English *regarding* (in *regarding this issue*) developed from a verb into a preposition (cf. Kortmann and König, 1992: 684; Vincent, 1997: 212).[5] Many languages combine both pathways, and adpositions arising from the strategy in (2) are more typical for non-spatial relations, while the strategy in (1) is more typical of spatial relations to begin with (Svorou, 1994: 109–121).

Yet, there are other ways than (1) and (2) in which adpositions may emerge—something that has been disregarded in many studies on word order harmony (Aristar, 1991; Cristofaro, 2017, 2019; Collins, 2019; Dryer, 2019). In particular, many adpositions (later prepositions) of Ancient Greek developed from syntactically loose structures that were bound only by semantic dependency in terms of Talmy's Figure-Ground relations (cf. Talmy, 2000), to begin with.[6] The sixteen adpositions to be discussed in this paper developed originally from *adverbials* or *adverbs* (Smyth, 1920; Chantraine, 1958; Dunkel, 1979; Hewson and Bubenik, 2006: 4; Bortone, 2010: 133), sometimes referred to as *local particles* (Hewson and Bubenik, 2006; Reinöhl 2016)—henceforth *adverbials*—that did not entertain any syntactic dependency relation with the semantically related Ground-NP to begin with (Delbrück, 1879: 153, 1893: 647–665; Kühner and Gerth, 1898: 526; Chantraine, 1958; Schwyzer and Debrunner, 1950: 419; Holland, 1976; Horrocks, 1981: 19; Vincent, 1999; Hewson and Bubenik, 2006; Bertrand, 2014: 18). Thus, alongside the pathways in (1) and (2), adpositions not infrequently also develop along the pathway in (3):

(3) *relational noun* > *adverbial* > *juxtaposition* > *adposition*[7]

Most of the 16 adverbials represent "petrified" or lexicalized inflected forms of lexical nouns of Proto-Indo-European. For example, *PERI* 'around, about' stems from **per-i*, where *-i* is the locative ending of what was originally the noun for 'house' in Proto-Indo-European (cf. Hittite *per* 'house', see Kloekhorst 2008:

5 In From verb-object phrases, "verb" subsumes participles, converbs and other types of non-finite predication, as well as argument taking adjectives (cf. Latin *saluu-* 'safe' > Italian *salvo* 'except', Vincent, 1997: 212; Maling, 1983).

6 Traditionally, spatial relations are decomposed into "two fundamental cognitive functions": *figure* that is an entity whose path, spatial configuration or site are variable, and *ground* that is the reference entity for the path, configuration or rest (Talmy, 2000: 312).

7 Adverbials also gave rise to preverbs in Greek as a parallel development.

770).[8] Analogously, *ANTI* 'in front of' corresponds to Hittite *hanza* (< *hants*) 'front' (*inter alia*, Frisk, 1960–1970; Sihler, 1995: 439–441). Furthermore, the archaic layer of Ancient Greek, the language of Homer (= the Archaic period), still attests the intermediate, adverbial stage of cline (3).[9] The following example illustrates *EPI* 'to, near, on':

(4) *elyth'* ***épi*** *psykʰḗ* *Agamémnonos*
go.AOR.3SG **near** soul.NOM.SG Agamemnon.GEN
'the soul of Agamemnon approached' (Hom. *Od.* 24.20; Hewson and Bubenik, 2006: 6)

These adverbials originally were not positionally bound to their Ground-NPs (5):

**(5)** ***amphì*** *dè* *khaîtai* ***ṓmois*** *āḯssontai*
**around** PRT hair.NOM.PL **shoulder.DAT.PL** float.PRS.3PL
'and his mane floats **about** his shoulders' (Hom. *Il.* 7.509, Smyth, 1920: 366)

To modify a case-inflected NP or the verb, these adverbials were just juxtaposed to that NP (or the verb, respectively). Note that such juxtaposition is not an infrequent situation across languages. For example, English has *together*, which may modify the comitative preposition *with* by mere juxtaposition to yield a complex PP *together with X*. Another example is the German adverbial *runter/unten* 'down, underneath' used in juxtaposition to yield a complex PP *runter vom* in (6):

(6) *Er* *fiel* ***runter*** *vom Dach.*
3SG fall.PST.3SG down from roof
'He fell down from the roof.'

The adverbial *runter* does not take the Ground as a syntactic complement because the Ground can be omitted freely:[10]

8 A different etymology of the root is suggested in Beekes and van Beek (2010: 1176) and Dunkel (2014). However, crucially, all sources agree that this is originally a noun in the locative case marked by *-i*.

9 Some of the adpositions such as *APO* are not found in unequivocally adverbial use in Homer (i.e. with intransitive verbs where they cannot be interpreted as postpositions) but their original adverbial use may be safely assumed on the basis of their morphological behaviour as prefixes of verbs (cf. Bortone, 2014: 134).

10 Traditionally—since the unpublished work of Klima (1965)—adverbials like German

(7) *Er ging* ***runter.***
3SG go.PST.3SG down
'He went down.'

Another similarity is that *runter* may also be used after the noun (in which case it is ambiguous between a preverb and a postposition) in German.

However, very much like relational nouns, these adverbials do have a semantic valency for the Ground because neither German *runter* in (6) and (7) nor Ancient Greek *épi* in (4) are properly interpretable without a discourse-salient referent for the Ground relative to which the movement proceeds.[11] In other words, while there is no constituency and no syntactic dependency between the Ground and the adverbial at this stage, there is a firm semantic dependency.

The path in (3) is true of most of the old prepositions of Ancient Greek such as *PARA* 'at, beside', *PERI* 'around', *AMPHI* 'around', *PROS* 'to, at', etc. (except perhaps for *SYN* 'with'). Having said this, we do not exclude the possibility that some of the relational nouns may also have undergone the development in (1) alongside the development in (3) in parallel (also suggested in Hettrich, 2012: 59–60 for the genitive of some prepositions). This double development—although intuitively implausible—is well attested cross-linguistically. For example, in Latvian, a number of recent adpositions such as *priekšā* 'in front of' (lit. front.LOC.SG) may be used with both the dative and the genitive case on the dependent NP:

(8) Latvian (personal knowledge)
a. *Viņiem priekšā*
3PL.DAT front.LOC

b. *Viņu priekšā*
3PL.GEN front.LOC
'in front of them'

While the overall meaning is the same with both variants, the dative marking may additionally encode a certain degree of affinity of the referent of the dependent NP (cf. Seržant, 2016). Crucially, while (8a) developed from a possessor phrase (1) as in English *in front of them*, (8b) developed from juxtaposition

*unten/runter* are said to be *intransitive adpositions* because they do not require any complement (Jackendoff, 1973).

11 There are various ways to implement this semantic but not overtly syntactic valency into the current generative framework (see Cinque, 2010 for an overview).

as in (3), from literally 'for them, in front'. We cannot exclude that some of the Greek prepositions underwent a two-way development as well.

The first two changes in (3)—i.e. from full-fledged nouns into relational nouns and then into petrified adverbials—must have been accomplished already in Proto-Indo-European or, latest, in Proto-Greek. Starting from the Archaic period of Greek, we observe a gradual rise of the syntactic interdependency and, concomitantly, the emergence of constituency—a process in which the linear adjacency plays the crucial role. Adjacency in the linear word order is crucial for the emergence of syntactic dependencies (cf. Bybee, 2007, 2012). In turn, adjacency itself is motivated by general constraints limiting variation in word order across languages for the purpose of efficient processing. Those items that are semantically inter-dependent tend to occur adjacently to each other (*inter alia*, Hawkins, 1994, 2004; Gibson, 2000; cf. Behagel's First Law in Vennemann, 1974: 339). It is thus not unexpected that adverbials and their semantic dependents were frequently adjacent. Frequent adjacency was, subsequently, conventionalized into constituency.

## 4 The emergence of constituency

In this section we provide evidence for the emergence of a syntactic structure—a development characterized by *increase of internal dependency* (cf. Haspelmath, 2004, cf. also Givón, 1979: 208). Two factors were preconditions for this development: (i) the inherent semantic valency and (ii) frequent adjacency of the adpositions with the semantically dependent NP, leading to the conventionalization of their co-occurrence. As for (i), the semantic valency must have been inherited from the source of these adpositions, i.e., from relational nouns (such as *front, back*, etc.) which themselves are not interpretable without a discourse-salient anchor. Frequent adjacency (ii) is the other trigger that is generally known to be responsible for the gradual emergence of constituency (Bybee and Scheibman, 1999; Bybee, 2007).

Below we demonstrate changes in the statistical preferences of the adverbials that are indicative of the emergence of a highly integrated prepositional phrase. Since we are dealing with a limited corpus of an ancient language, constituency tests such as dislocation or splits are not applicable here. Instead, we provide evidence for a steadily increasing adjacency preference with ever decreasing chances for, and even bans on, different kinds of insertions between the prepositions-to-be and the dependent NPs (Section 4.1). We furthermore provide morphophonological and morphological evidence for the development of clisis and gradual change in constraints (Section 4.2)—a highly com-

TABLE 3 Discourse particle insertion immediately after the preposition, in percentages of the total number of occurrences; the 16 adpositions averaged[a]

| | *dé/d'* | *gár* | *mén* | *kaì* |
|---|---|---|---|---|
| **Archaic** | 4.32 | 3.39 | 0.43 | 0.65 |
| **Classical** | 2.59 | 0.13 | 0.47 | 1.56 |
| **Hellenistic** | 6.79 | 0.12 | 0.54 | 1.59 |
| **NT** | 2.38 | 0.18 | 0.41 | 0.62 |
| **Byzantine** | 2.64 | 0.00 | 0.30 | 0.07 |

a We selected the four most frequent particles. We performed a text search in TLG for the word sequence of the adposition followed by one of the particles, e.g. *eis dé* (εἰς δέ) or *apó kaì* (ἀπό καὶ). Thus, our search results certainly encompass rare instances in which the combination of the adposition with the particle is not followed by the dependent NP but by something else, for example, by an inserted possessor NP. The insertion of a constituent between the adposition and the dependent NP is, however, extremely rare, especially in the latter periods (see Table 5 below). As for the figures, we observe that these must be conditioned by other factors such as literary genres or the phenomenon of learned language as well (we discuss this in Rafiyenko and Seržant, forthc.). For example, we observe an increase of some particles in the Hellenistic period which we cannot explain at the moment. Important for our point is that there is a general tendency to reduce the number of particle insertions from the Archaic period to New Testament and Byzantine Greek.

plex development eventually leading to tight integration of the preposition with its dependent NP by the Early Byzantine period.

### 4.1 *Conventionalization of adjacency*

The frequency of adjacent occurrence increased in the course of time, which is a strong indication for the conventionalization of adjacency and emergence of a phrase.[12] We start with discourse particles inserted between the preposition-to-be and the dependent NP in Table 3. As a background, contrast these data with German or Dutch which only marginally—if at all—allow discourse particles to intervene between the preposition and the dependent NP (cf. Bouma, Hendriks and Hoeksema, 2007).

Of course, these numbers are not only motivated by the ability of a PP to allow insertions or not, but also by the behaviour of the discourse particles

12 We view adjacency as a gradual and probabilistic notion: while *X NP Y* certainly contains non-adjacent *X* and *Y*, *X particle Y* may be considered as proximal, albeit not as adjacent as *xy*. Moreover, it is probabilistic in the sense that adjacency becomes more probable the later the period is.

TABLE 4 Frequency of adjacent occurrence of *PERI* with its dependent NP (the Qualitative database)

| | **Archaic** | **Classic** | **Hellenistic** | **Roman** |
|---|---|---|---|---|
| adjacent | 62% (16) | 87% (325) | 92% (184) | 94% (34) |

TABLE 5 Frequency of heavy insertions (relative to 100% of occurrences of *PERI* in the period) (the Qualitative database)

| | **Archaic** | **Classic** | **Hellenistic** | **Roman** |
|---|---|---|---|---|
| genitive NPs | – | 4% (13) | 1% (2) | – |
| negation | – | 0.3% (1) | – | – |
| adverbs | – | 0.3% (1) | – | – |
| clauses | – | 0.3% (1) | – | – |
| other full NPs | 4% (1) | – | – | – |
| verbs[a] | 27% (7) | – | – | – |
| ***total heavy insertions*** | **31% (8)** | **4% (16)** | **1% (2)** | 0 |

a All seven instances have the following order: the dependent NP – the verb – the adposition.

themselves. For example, the raw frequencies of the discourse particles in the periods might also have influenced the figures above. Having said this, the figures clearly show that—although no categorical judgement can be made here—the ability of the prepositions to be separated from the dependent NP by a discourse particle decreases considerably in the New Testament and the Byzantine period for all particles.

Furthermore, the same tendency can be observed in the figures from our qualitative database on *PERI* in Table 4 above.

While particles may still be inserted between the preposition and the dependent NP in the Roman period, heavier items cannot (*ex negativo* evidence). Insertions of possessor genitive NPs, which are the second most frequent insertion type after the particles during the Classical period, are no longer found in the Roman period, as the figures from Table 5 above show.

We thus observe that the degree of adjacency and constituency increases over time by disallowing heavy and reducing light (particles) insertions. Insertions of heavy units on the level of constituents such as possessor/genitive NP,

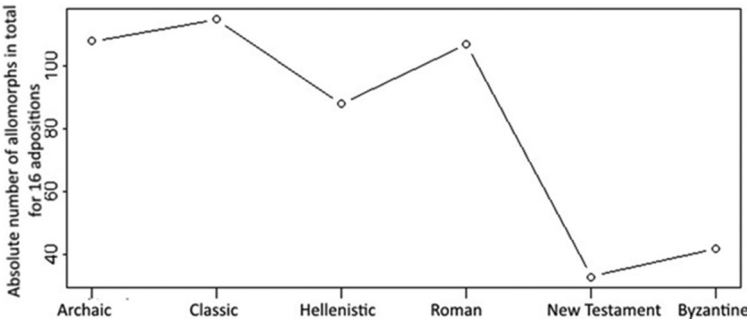


FIGURE 1 The absolute type frequency of allomorphs across periods

a verb or even a clause become impossible from the Hellenistic period on. By the end of this process, we observe the degree of integration found in PPs of highly configurational languages such as modern European languages.

### 4.2 *Morphological effects of the coalescence*

The increase of internal dependencies is also observed in the dynamics of allomorphic variation.[13] We observe a drastic loss of allomorphic variation towards conventionalizing only a few allomorphs from the Archaic into the Byzantine period, see Figure 1 above.[14]

Eventually only proclitic allomorphs survived while allomorphs employed in less integrated structures entirely disappeared. In what follows, we detail this.

The first type of allomorphy employed in less integrated structures consists in distinct placement of stress, cf. *perí* vs. *péri* 'around, round about'.[15] Almost all adpositions had two allomorphs distinguished by the placement of the stress: a stress-initial and a stress-final/unstressed form, cf. *antí* vs. *ánti* 'across' or *protí/poí* vs. *prós* (< **próti*) 'at, to'; exceptions are *sýn* 'with' (always stressed) and possibly *amphí* 'around' which do not attest a stress-initial allomorph in our Archaic period.

13 Note that lexicalized variation such as *perí* vs. *pérā* 'beyond', *pérān* 'on the other side', etc. is not considered here.

14 The increase of allomorphy during the Roman and Byzantine periods is just the effect of the literary tradition (Atticism) seen also in other phenomena, and we ignore it here (see Rafiyenko and Seržant, forthc.). The fact that the Classical period scores even higher than the Archaic period might be an artificial effect of the Archaic period being represented by a smaller number of texts.

15 Our knowledge about the accentuation is somewhat anachronistic. We know about the placement of the accent and its type only through later, Hellenistic grammarians (Probert, 2006: 15–52).

TABLE 6 Etymological comparison (cf. Frisk, 1960–1970; Sihler, 1995: 439–441; Dunkel, 2014: 66–67, 607)

| | |
|---|---|
| *PARA* | < **pṛai/prai* (cf. Latin *prae* (< *prai*), Vedic *pára*) |
| *PROS* | < **próti* (cf. Vedic *práti* 'towards') |
| *PERI* | < **péri* (cf. Vedic *pári* 'around') |
| *ANTI* | < **ánti* (cf. Vedic *ánti* 'across', lat. *ante* 'in front of' (locatives of the noun like Hittite *hanza* (< *hant-s*) 'front')) |
| *SYN* | cf. Neri (2013: 192–193) |
| *HYPO* | < **úpo*, cf. Vedic *úpa* |
| *APO* | < **ápo*, cf. Vedic *ápa* |

The stress-initial forms represent the historically original stress of the relational noun while the stress-final/unstressed ones are the result of a later development. This is based on the etymological comparison with one of the most archaic Indo-European languages, Vedic Sanskrit, for which the place of accent is known (Holland, 1976: 416), cf. Table 6 above.

The placement of the stress in *péri* is a trace of an earlier system in which it was still a prosodically independent word. Indeed, the pattern *péri* is found in adverbial and postpositional usage, but not in the strictly prepositional usage, in which only *perí* is used. Above, Table 7 illustrates the drastic decrease of the stress-initial allomorphs from the Archaic period on and thus, indirectly, of postpositional and adverbial usage.

The second type of allomorphy was derived by adding **-i*. In many instances, this is the old locative ending of the relational noun that gave rise to the adverbial (later adposition), cf. *ANT-I* 'in front of' from Proto-Indo-European noun **$h_2$ent-s* 'front' (cf. Hittite *hanza* 'front'). This ending is still found in the syncretic dative-locative of Greek, cf. *pýr* 'fire.NOM.SG' vs. *pyr-í* 'fire.DAT(=LOC).SG'. However, in some other adpositions the ending seems to have been added analogically later, possibly according to some Proto-Greek rule that is no longer reconstructible, cf. **pará* vs. **para-í* (παραί) 'at', **diá* vs. **dia-í* (διαί) 'through', **hypó* vs. **hyp-aí* (ὑπαί) 'from'. Presumably, the presence of this ending correlated with a more adverbial-like usage but we cannot corroborate this hypothesis. In any event, this limited productivity of the former locative ending **-i* is an indication that the adpositions of Proto-Greek (the time of the productivity of **-i*) were not yet fully lexicalized and were still interpretable as inflected forms much like English *in front of* with *in* being transparently interpretable as the locative marker. Below, Table 8 documents the demise of the *-i*-marked prepositions across the six periods.

TABLE 7 Percentages of the stress-initial allomorph relative to the total number of occurrences of the adposition in the period[a]

| | Archaic | Classical | Hellenistic | Roman | NT | Byzantine |
|---|---|---|---|---|---|---|
| *ANTI* | 13 | 0.8 | – | 0.1 | – | – |
| *APO* | 8 | 0.3 | 0.08 | 0.2 | – | – |
| *EPI* | 5 | 0.06 | – | 0.03 | – | – |
| *HYPER* | 12 | 0.2 | – | – | – | – |
| *HYPO* | 9 | 0.2 | 0.02 | 0.06 | – | – |
| *KATA* | 9 | 0.02 | 0.01 | 0.05 | – | – |
| *META* | 5 | 0.03 | 0.09 | – | – | – |
| *PARA* | 24 | 0.3 | 0.12 | 0.27 | – | – |
| *PERI* | 8 | 0.5 | 0.13 | 0.9 | – | 0.4 |

a The form *prós* (πρός) may be considered to have retained and generalized the stress-initial allomorph since the deletion of the final *-i* generally cannot explain the stress on the first syllable, cf. *per'* (περ') from *perí*, *ant'* (ἀντ') from *antí*, *amph'* (ἀμφ') from *amphí*. The adposition *sýn* (σύν) does not attest a proclitic allomorph. Furthermore, we have excluded *EIS, EK* and *EN* because their stressed allomorphs cannot be graphically disentangled from the proclitic forms hosting a clitic, e.g., *eís te* (εἵς τε).

TABLE 8 Percentages of the *-i*-marked allomorph relative to the total number of occurrences of the adposition in the period

| | Archaic | Classical | Hellenistic | Roman | NT | Byzantine |
|---|---|---|---|---|---|---|
| *DIA* (*diaí, diai*) | 4 | – | – | – | – | – |
| *EN* (*ení, éni, einí*) | 21 | 0.1 | 0.3 | 0.2 | – | – |
| *PARA* (*paraí*) | 2 | – | – | 0.07 | – | – |
| *PROS* (*protí, potí, poí*) | 21 | 0.06 | 13[a] | 0.06 | – | – |
| *HYPO* (*hypaí*) | 2 | 0.05 | – | 0.02 | – | – |

a The allomorph ποτί is used here.

Except for *pros*—which is special—no other adposition retains the *-i*-allomorph if the ending *-i* is not of Proto-Indo-European origin: the allomorphs created by the addition of the ending *-i* in Greek like *paraí* or *hypaí* did not survive into later periods. We take the loss of the locative forms as another indication of the loss of those forms that were not tightly integrated into the PP.

Finally, another indication of the increase of internal dependencies within the prepositional phrase is the loss of the enclitic allomorphs. In earlier periods, the prepositions could attach either to the preceding word (enclisis) or to the following word (proclisis), yielding enclitic and proclitic allomorphs, respectively. The proclitic forms are derived by final-vowel drop before words with a vocalic onset to avoid a clash between the two vowels and/or by the aspirate/non-aspirate assimilation to the respective onset of the following word. Yet, the deleted vowel is the one that otherwise carries the stress which does not carry over to the remaining vowel of the first syllable: *ant'* (ἀντ') vs. *antí* (ἀντί), *amph'* (ἀμφ') vs. *amphí* (ἀμφί), *ap'* (ἀπ') vs. *apó* (ἀπό), *di'* (δι') vs. *diá* (διά), *ep'* (ἐπ') vs. *epí* (ἐπί), *kat'* (κατ') vs. *katá* (κατά). This shows that proclisis runs along word-internal sandhi rules, cf. word-internal composition in *ep-ágō* (ἐπ-άγω) from *epi-ágō* lit. 'on-lead/urge' 'to urge on, bring on'.

By contrast, the enclitic allomorph attached to a prosodic host that was not its dependent NP, as seen in the following example with the enclitic allomorph of the preposition *ek*:[16]

(9) *hòn* *harpázō* *g'=egṑ=**'k*** *tês*
REL.ACC.SG seize.PRS.1SG PRT=1SG.NOM=**from** DEM.GEN.SG.F
*Dardánou.*
Dardanos.GEN.SG.M
'whom I seize **from** Dardanos' house' (Eur. Cycl. 586)

While the development of clisis does not reveal any particular coalescence with the dependent NP *per se*, the loss of the enclitic allomorph (and the retention of the proclitic allomorph) only does. Note that already by the Archaic period,

16 Other examples are *kantí* (κἀντί) < *kaì antí* (καὶ ἀντί) 'and in front of', *kapó* (κἀπό) < *kaì apó* (καὶ ἀπό) 'and from', *tapó* (τἀπό) < *tà/te apó* (τὰ/τε ἀπό) 'these things/and from', *ḗ 'pò* (ἢ 'πὸ) < *ḗ apó* (ἢ ἀπό) 'PRT from', *sous* (σοὺς) < *sou es* (σου ἐς) '2SG.GEN to', *keis* (κεἰς) < *kaí eis* (καί εἰς) 'and to', *kas* (κἀς) < *kaí es* (καί ἐς) 'and to', *mḕ 'k* (μὴ 'κ) < *mḕ ek* (μὴ ἐκ) 'not from', *hē 'k* (ἡ 'κ) < *hē ek* (ἡ ἐκ) 'DEF.F from', *egṑ 'k* (ἐγὼ 'κ) < *egṑ ek* (ἐγὼ ἐκ) '1SG.NOM from', *dḕ 'k* (δὴ 'κ) < *dḕ ek* (δὴ ἐκ) 'PRT from', *emplēsthênai 'k* (ἐμπλησθῆναι 'κ) < *… ek* (< ἐκ) 'FILL.AOR.INF from', *ekselô 'k* < *ek* (ἐξελῶ 'κ) 'take.FUT.1SG from', *tṑ 'k* < *ek* (τὼ 'κ) 'DEM.DU from'.

TABLE 9 Proclitic vs. enclitic allomorphs in both Archaic and Classical periods (only those adpositions that can graphically show an assimilation to the host)[a]

| | *AMPHI* | *ANTI* | *APO* | *EK* | *EPI* | *HYPO* | *total* |
|---|---|---|---|---|---|---|---|
| enclitic, after a vowel | 0 | 3 | 23 | 62 | 55 | 0 | 143 |
| proclitic, before a vowel | 117 | 177 | 927 | 2461 | 2670 | 1489 | 7841 |

a We have excluded those adpositions which, at least graphically, cannot show an effect of enclitic (e.g. *DIA*) or proclitic (e.g. *HYPER*) variation.

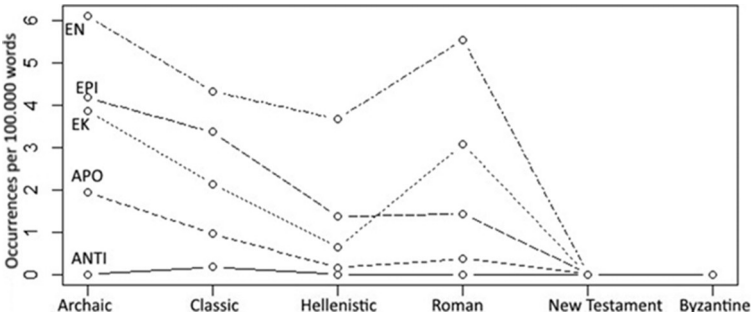


FIGURE 2 The demise of enclitic allomorphs across the periods

the proportion between proclitic and enclitic forms was not even. There were 55 times more proclitic than enclitic forms while there were only 1.6 times more words beginning with a vowel than those ending in a vowel in the texts, see Table 9 above.[17]

We conclude from this that already by the time of the Archaic (and Classical) period, the clitic allomorphs of the adpositions were predominantly procliticized and only rarely encliticized. Figure 2 illustrates the full demise of the enclitic forms (with a small heap in the Roman period created artificially by the Atticist literary tradition, cf. Rafiyenko and Seržant, forthc.).

By contrast, proclitic forms are found across all periods.

Another point of evidence for the word-internal rules of fusion is the proclitic variance of the adposition *EK: eks* (ἐξ) before vowels vs. *ek* (ἐκ) before consonants. This allomorphy remains intact across all periods. Our database does

17 We have calculated this proportion as a proxy by calculating all words ending in a vowel (486) and all words beginning with a vowel (772) in Demosthenes, *Contra Zenothemin* (in total 1,913 words).

TABLE 10 The relative chronology of the adpositions on the basis of their allomorphy

| | **Prosodically** | **Positionally** |
|---|---|---|
| Proto-Greek | stress-initial | free |
| Archaic period | stress-initial & clitic (proclitic & enclitic) | free |
| Classical period | clitic (proclitic & enclitic) | dependent (adjacency to the dependent NP preferred) |
| New Testament & Byzantine period | proclitic | fixed (preposition) |

not attest any single usage of *ek* before vowels in any of the periods. Notably, this allomorphy too runs along the rules of word-internal composition, cf. the word for 'six' *héks* (ἕξ) in word-internal composition: *hek-kaí-deka* (ἑκκαίδεκα) lit. 'six-and-ten', i.e. '16', vs. *heks-ábiblos* (ἑξάβιβλος) lit. 'six-book', i.e. 'in six books'. By contrast, before word boundaries, no *-s*-deletion is found before consonants: *hèks dè dià ptýkhas* (ἓξ δὲ διὰ πτύχας) (*Il.* 7.247) 'through six folds'. We conclude that the proclitic allomorphs are derived on the basis of word-internal sandhi rules as if the preposition and the dependent NP formed one (complex) word. The loss of the enclitic allomorphs and the retention of the proclitic allomorphs showing word-internal composition is another piece of evidence for the gradual coalescence of the preposition with its dependent NP.

We summarize the different stages of these developments in Table 10 above.

Observe that the development suggested in Joseph (1991) or Vincent (1999) for Latin cannot be carried over to Ancient Greek. Vincent (1999: 1124) suggests that it was the stressed variant of the adposition that gave rise to the order adposition-NP in Latin: the stressed form was placed clause-initially while clitic pronouns attached to it due to Wackernagel's Law, thus yielding the required order of adposition-pronoun which was then extended to full NPs. By contrast, in Ancient Greek, it was precisely the clitic allomorph that was generalized as preposition while the stressed form—originally occurring elsewhere—disappeared.

TABLE 11 Word order of adpositions and nouns in Archaic Greek

| | **Postpositionally only** | **Predominantly prepositionally and sometimes postpositionally** |
|---|---|---|
| inflectional case (Proto-Indo-European affixes) | archaic agglutinative affixes: *-de, -tʰi, -tʰen, -pʰi* | new emergent adpositions (such as the 16 adpositions discussed in this paper) |

## 5 Harmonizing developments

While Proto-Indo-European and Proto-Greek were predominantly postpositional, we have seen that Ancient Greek developed prepositions over the course of time. The Archaic period and, accordingly, Proto-Greek had a number of agglutinative affixes such as the ablative *-tʰen*, allative *-de* (usually with accusative), the locative *-tʰi* or instrumental *-pʰi*—none of which survived beyond the Classical period—as well as a rigid inflectional case system in which case affixes followed the noun.

The Archaic period is largely transitional, with no clear preference for AdpN or NAdp, see Table 11. The adpositions-to-be occurred before nouns slightly more frequently than after them.

The language of the Archaic period was thus NAdp/AdpN (possibly with a slight preference for NAdp given that the case affixes and the agglutinative affixes were only used postpositionally).

The development of the prepositional word order in later Greek was complex, involving not only the stabilization of the prepositional order of the new, emergent adpositions, but also the total loss of the agglutinative affixes and the gradual partial loss of case affixes (e.g. the dative case is lost; a number of inflectional forms become syncretic, cf., Rafiyenko and Seržant, 2020 and the literature therein).

Yet, this change was chronologically accompanied by word-order changes in other grammatical domains: the order of verbs and objects as well as the order of genitives and nouns. Importantly, we not only observe harmonic correlations at the end of this process (Early Byzantine Greek), where all three domains are predominantly head-initial, but also correlations at the intermediate stages, e.g., correlations between the placement of heads and dependents in the Archaic and Classical periods.

We begin with the changes in the word order of verbs and objects. Alongside the emergence of prepositions, Ancient Greek underwent a development

TABLE 12 Changes in the preferred word order in clauses with full NPs (from Taylor, 1994: 10)

| | **Archaic (Homer)** | **Classical (Herodotus)** | **New Testament (Luke)** |
|---|---|---|---|
| verb-final (OV) | 44% | 27% | 8% |
| verb-medial (OV/VO) | 44% | 57% | 62% |
| verb-initial (VO) | 12% | 17% | 31% |
| *total* | 100% (109) | 100% (134) | 100% (102) |

towards VO (see Hyman, 1975: 141–142 for possible triggers). Proto-Indo-European was OV (Watkins, 1963; Dressler, 1971; Lehmann, 1974; Hock, 2013). OV is still a somewhat more prevalent word order as opposed to VO in the Classical period (Dover, 1960: 25, 29–30). Table 12 displays the counts obtained in Taylor (1994).

A number of other studies confirm these counts. Thus, for the Archaic period we list the following findings: Fraser (2002: 73) finds 1,344 instances of OV, which is 60% of all OV&VO clauses in his subcorpus of late Archaic Greek (texts from Aeschylus, Euripides and Plato); OV is even more strongly represented with pronominal objects with ca. 67% (146/220, cf. Fraser, 2002: 81). Analogous counts for the position of the pronominal object *autón* 'him' follow largely the same tendency as full NPs in Table 12 (see Taylor, 1994: 15). Friedrich (1975) finds a predominance of OV over VO in the Archaic Greek of Homer's Ilias (35 OV vs. 25 VO with no S expressed, and OV 74 (i.e. SOV, OVS, OSV) vs. 27 VO (SVO, VOS, VSO)).

For the New Testament, we have the following data (in addition to Table 12 above): The preference for VO in the New Testament is also observed in Kirk (2012: 35): 58% (89) VO vs. 19% (30) OV vs. other orders 23% (35) (cf. also Davison, 1989; Friberg, 1982; Rife, 1933; Lavidas, 2015).[18] Note that this trend—in the same way as with adpositions—continues in Medieval Greek, which was primarily VO, and in Modern Greek, which is regular VO (Friedrich, 1975: 23).

Pronominal clitics play an important role in this development. They were predominantly enclitic and occurred in the clause-second position in the Archaic and Classical period. Their linear position was thus subject to constraints other than the order of heads and dependents. However, already by the Classical period they are gradually generalized in the postverbal position, even

18 23% are instances in which the sequence of V and O is interrupted by S.

in those instances in which this position was no longer clause-second (Marshall, 1987: 15, 121). In Postclassical Greek, the postverbal position of pronominal clitics becomes the norm in assertive sentences with unmarked information structure (Wifstrand, 1949; Horrocks, 1990; Janse, 1993, 2000, 2008: 176). Notably, while clitic pronouns largely conventionalized the enclitic usage, clitic prepositions have entirely generalized the proclisis. This suggests that any prosodic motivation can be safely excluded.

We claim that both the change towards AdpN and the change to VO were driven by the preference for ordering heads and dependents harmonically in both domains. Crucially, the resulting head-dependent word order was neither rooted in the historical source of prepositions nor in the historical source of VO.

Finally, the order of the head noun and the genitive NP in the adnominal-possessor construction also harmonically aligns with AdpN and VO. Also here we observe a similar diachronic trend from a transitional (Lehmann, 1974) or just a mixed type (Friedrich, 1975: 13; Viti, 2008) of similarly frequent NGen and GenN in the Archaic period to a more consistent NGen in New Testament:[19] the genitive NP is mostly placed after the head noun in the New Testament (Gianollo, 2011, 2014), and the genitive pronoun is mostly placed *after* the head noun in the Roman and Byzantine periods (Stolk, 2015: 101). It is only the inalienable possession that has a different order (Gianollo, 2014) which is not unexpected because inalienable possession cross-linguistically tends to deviate from alienable possession in many ways.

We summarize the evidence for all three domains observed so far in Table 13 below.

We observe a clear trend from the head-final type in Proto-Indo-European to the mixed type in the Archaic language and to head-initial in its later stages.[20]

19 Viti (2008), following, Friedrich (1975: 12–15) and others, provides a comprehensive study of NGen and GenN with figures for Homer (the Archaic period) and Herodotus (the Classical period). She shows that the order of NGen and GenN is largely dependent on different functions of the genitive as well as, and as a consequence of the different functions, on different input types. The total counts—calculated from the separated counts for different types in Viti (2008)—are: in Homer, GenN occurs in 49% (119) and NGen in 51% (126) of the cases, and in Herodotus, the figures are: 57% (468) for GenN and 43% (359) for NGen, respectively. There is—as also argued in Viti (2008)—a statistically significant difference between the two authors (and periods) which, however, has a very small effect size, as the percentages for both authors—cf. 49% vs. 57%—are not that different.

20 Some researchers assume that already Proto-Indo-European was a mixed-type language with both orders being approximately equally frequent. While this is controversial (given the unequivocal evidence for SOV from a number of ancient Indo-European languages

TABLE 13 Summarizing the changes

| | | | |
|---|---|---|---|
| Proto-Indo-European | NAdp<br>postpositions, i.e. case | ? | OV |
| Archaic Greek[a] | NAdp / AdpN<br>case affixes, agglutinative affixes (ablative, allative, etc.), postposed adverbials vs.<br>preposed adverbials (cf. Table 11) | GenN/NGen | OV/VO |
| Early Byzantine Greek | AdpN<br>(prepositions only) | NGen | VO |

a Even though the language of Mycenaean Linear B texts predates the Homeric texts, surprisingly, Mycenaean already shows a number of innovations such as prepositional usage and even abandonment of multiple case government towards one case (Thompson, 2000). The change to VO in this variety seems also to have been accomplished (Holland, 1976: 417).

These developments not only conform to the implicational word-order universals (Greenberg, 1963; Dryer, 1992) but, even more importantly, they also show co-dependency in the evolution of verb-object, noun-genitive and adposition-noun structures—a sort of evidence that has been called for in the sceptical literature (cf. Evans and Levinson, 2009: 444; Collins, 2019). What is more, we have demonstrated that the adpositional structures emerge neither from verb-object nor from adnominal possessum-possessor constructions and that none of the three was biased towards head-initial order to begin with.

## 6 Configuration and directionality

In the two previous sections (Sections 4–5), we have argued that the universal preference for harmonic word orders across domains finds strong diachronic support in the parallel developments found in Greek from the Archaic to the Byzantine period, even though there was no etymological relationship between the sources and the resulting constructions. In this section, we examine the reverse case: how cross-linguistically infrequent properties inherited from the source disappear in the course of time in the resulting patterns. This is another piece of evidence against the source-oriented approach, which, in its radical

such as Tocharian, Hittite, etc., cf. Friedrich (1975: 32), as well as the slight preference for the OV order in the Archaic Greek), this reconstruction would not change the fact that the order of elements changed harmonically in all three domains across all periods.

application, ignores potential intermediate changes, as it typically only contrasts the result with its potential source. We argue that these gradual, intermediate changes follow their own motivations and pressures that are independent of the source.

The first atypical property of the Archaic period and, to some extent, of the Classical period of Greek (e.g. with *PERI* 'around, about') was the ability of the adpositions to occur both as prepositions and postpositions. This syntactic freedom is obviously rooted in the source of these adpositions: stemming originally from adverbials, they were not limited to any particular position in the clause. Yet, cross-linguistically mixed pre-/postpositional systems are fairly infrequent; thus, in Dryer's world-wide sample consisting of 1183 languages, there are only 58 languages (5%) which have mixed systems with no dominant order of adpositions (Dryer 2013). Mixed systems are thus dispreferred and should not be stable diachronically. As we have demonstrated above, the 16 adpositions eventually conventionalized the *pre*positional use to the exclusion of the postpositional use in Postclassical Greek, thus, abandoning this atypical property. Some adpositions such as *sýn* 'with' conventionalized the prepositional use very early (already by the Archaic period) while others did so much later, e.g., *perí* 'around, about' (by the Hellenistic period).

Secondly, the way directionality and configuration were encoded within the PPs-to-be in Ancient Greek is cross-linguistically dispreferred. On the compositional approach to topological semantics, spatial cases and adpositions express meanings that may be decomposed into at least two semantic dimensions referred to here as *directionality* and *configuration* (cf. Lestrade, de Schepper and Zwarts, 2011: 258 following Jackendoff, 1983; cf. Stolz, 1992: 30; a different version in Zwarts, 2010).[21] The dimension of *directionality* distinguishes at least the following three basic meanings: *Goal* referring to a movement towards the Ground (Talmy, 2000: 312), *Place*, i.e. rest (in some spatial relation to the Ground), and *Source*, i.e. movement away from (the Ground) (Stolz, 1992: 30; Stolz, Lestrade and Stolz, 2014; Lestrade, de Schepper and Zwarts, 2011). In turn, the dimension *configuration* specifies the spatial relation to the *ground*, for example, 'on', 'at', 'behind', etc., cf. Finnish:

21 Note that *path* is sometimes understood as directionality whereas configuration is referred to as *place* (*inter alia*, Pantcheva, 2010). There are also other dimensions such as *boundedness*, cf. English *to* vs. *towards*, i.e. whether the final destination will be reached. Moreover, directionality may also contain *path* in addition to *movement away from* or to *rest* (cf. Zwarts, 2010).

(10) Finnish (Lestrade, de Schepper and Zwarts, 2011: 256)
*sien-ten* *pää-lle*
mushroom-PL.GEN on-ALL
'(pour water) onto mushrooms'

The Allative case on the postposition in (10) encodes the type of directionality, i.e. Goal (the movement towards), while the postposition itself encodes the type of configuration, i.e. 'on'.

In those languages which morphologically disentangle directionality and configuration, directionality markers (*-lle* in (10)) take configuration markers (*pää-*) as their inputs and are placed externally to them (Lestrade, de Schepper and Zwarts, 2011: 271). For example, in (10), the directionality marker (the Allative case) takes the whole PP 'on the mushrooms' as a complement, with configuration being encoded inside of it. Thus, much syntactic work on locational PPs assume the following structure: [Directionality [Configuration NP]] (*inter alia*, Caha, 2007; Lestrade, de Schepper and Zwarts, 2011; Zwarts, 2010; cf. Cinque, 2010 for a more differentiated approach). For example, many languages of Subsaharan Africa employ just one spatial adposition while the directionality distinctions such as Source vs. Goal are expressed by the verb (Creissels, 2006), i.e. externally, on a higher phrase level. Alternatively, in languages which code both relations by distinct case affixes, it is the directionality affix that is added on top of the configuration affix and not vice versa, e.g. in many Nakh-Daghestanian languages such as Lezgian (Haspelmath, 1993: 74) or Khwarshi (Khalilova, 2009: 74).

By contrast, in Ancient Greek, we find a typologically very rare coding pattern in which directionality is marked NP-internally, i.e. by the case on the dependent NP. In turn, configuration is encoded externally by adpositions (later prepositions):

(11) *pàr* *nē-ôn* *élthōmen*
**at** ship-**GEN.PL** come.SUBJ.3PL
'we come from (beside) the ships.' (*Il.*13.744)

(12) *hézet'...* *pàr* *pur-í*
sit.IMPF.3SG **at** fire-**DAT.SG**
'(he) sat at the fire.' (*Od.* 7.154)

(13) *trépsas* *pàr* *potam-ón*
turn.PRTC.NOM.SG **at** river-**ACC.SG**
'turned to the side of the river' (*Il.* 21.603)

Source (11) is encoded by the Genitive, Place by the Dative (12) and Goal by the Accusative case (13) on the dependent NP while configuration 'at, beside' is coded by the adposition *pàr*(*a*) (Kühner and Gerth, 1898: II.290ff.; Bortone, 2002: 70–72; cf. Luraghi, 2003 or Dosuna, 2012 for Construction Grammar account; differently Crellin, 2016).[22] Thus, in Ancient Greek, directionality is marked internally to configuration.

Only 3% of all entries in the typological database of Lestrade, de Schepper and Zwarts (2011) parallel this pattern of the "reverse" directionality and configuration coding. All of them are found in conservative Indo-European languages and all of them encode only two directionality distinctions internally (i.e. Goal and Place but not Source). To our knowledge, apart from Ancient Greek it is only Armenian that allows for coding all three directionality types internally, i.e. by means of case on the dependent NP.[23] Below we argue that this "reverse" encoding is a residue of the source construction which is abandoned in the later developments.

Thirdly, observe that directionality distinctions are coded symmetrically in early Ancient Greek (11)–(13). This is atypical as well because cross-linguistically Place, Source and Goal tend to be coded asymmetrically. For example, Source tends to be coded by longer and sometimes even more complex markers (cf. Pantcheva, 2010; Stolz, Lestrade and Stolz, 2014: 22–30; Georgakopoulos and Karatsareas, 2017). By contrast, Place relations tend to be zero-coded (cf. Radkevich, 2010; Smith et al., 2018: 18) and the configuration marker is interpreted as Place by default. For example, English *in* denotes Place inside the Ground by default, and in order for it to denote Goal inside the Ground, an additional marker has to be added, yielding *into*. English thus adheres to the expected asymmetries. Similarly, case stacking in a number of Daghestanian languages leaves Place unmarked. For example, in Khwarshi (Khalilova, 2009: 74), Place is unmarked whereas Goal is overtly marked (*-l*), while Source is coded with even more phonetic material (*-zi*). The case system of Malayalam is similar: both Goal and Source are coded by a postposition attaching to the noun in the locative case, cf. *viiʈʈ-il-eekkə* (house-LOC-GOAL) 'to the house' vs. *viiʈʈ-il ninnə* (house-LOC from) 'from the house' (Asher and Kumari, 1997: 192, 196), while Place is marked only by the locative case itself (*viiʈʈ-il* house-LOC 'in the house'), being thus the shortest and the basic morphological option.

22 This is found only with a subset of our 16 prepositions such as *PARA, EPI, PERI* and some others.

23 In Armenian, the preposition *i* may denote Source, Place or Goal, depending on whether the dependent NP is marked by the ablative, locative or accusative case, respectively.

Thus, the morphological make-up of the directionality distinctions found in early Ancient Greek is a pattern that is cross-linguistically dispreferred in at least the three respects discussed above. Accordingly, we expect that this pattern will not be particularly stable in the long run. Indeed, Greek abandons the pattern through the following changes: first, the flexible position of the adpositions is abandoned and the prepositional use is generalized; secondly, case gradually ceases to encode directionality distinctions; and, thirdly, there is a general trend towards lexicalizing one case per preposition.

Thus, the number of prepositions selecting only one case increases. Bortone (2010: 183) observes that prepositions typically select just one case in the Roman period. Indeed, in our subcorpus, we find 7 out of our 16 adpositions attesting rigid case assignment in the New Testament while there were 5 adpositions with a uniform case assignment in the Classical and Archaic period. Moreover, even those prepositions that retain multiple case assignment patterns develop preferences. For example, *PERI* and *PARA* selected Genitive and Accusative with an almost even frequency during the Classical period, but predominantly assign the Genitive after that period.

Finally, the more general phenomenon of the gradual disappearance of the Dative case from the colloquial language also affects prepositions (cf. Humbert, 1960; Blass and Debrunner, 1979; Luraghi, 2003: 330; Cooper and Georgala, 2012), despite some increase during the Roman, Byzantine periods and in the New Testament, which is due to the impact of the conservative literary tradition (cf. Horrocks, 1997: 49; Georgakopoulos, 2014; Rafiyenko and Seržant, forthc.). Some prepositions such as *PERI* or *META* can no longer take the Dative in the New Testament (cf. Luraghi, 1996: 108). However, we do not observe any decrease of the Dative with *EPI, PARA, PROS* and *HYPO*. While the decrease of the Dative case with prepositions need not be motivated by the prepositions themselves but rather by the more general tendency of Postclassical Greek to abandon the Dative case in general (*inter alia*, Humbert, 1960; Blass and Debrunner, 1979; Luraghi, 2005, 2010; Stolk, 2017a, 2017b; cf. also George, 2010: 271), it nevertheless contributes to the development towards rigid government by prepositions (cf. Hettrich, 2012: 52).

When it comes to the competition between the Genitive and Accusative case, some prepositions eventually prefer the Accusative (e.g. *PROS* 'at, to')—which is also the only possible case with prepositions of Modern Greek—while others prefer the Genitive (*HYPO* 'under') (e.g., Mommsen, 1895: 22; Westphal, 1888; Krebs, 1884: 30; Regard, 1918; Humbert, 1960: 300; Bortone, 2010: 155; Luraghi, 2003: 330–331). We summarize our data in Table 14 below.

In order to examine the mechanism of changes in case selection from the Archaic and Classical period into the Hellenistic period, we have annotated all

TABLE 14 The number of prepositions preferring only one case (<60%, including 100%, counts as a preference)

| | Classical | NT |
|---|---|---|
| Preferring Accusative | 6[a] | 4 |
| Preferring Genitive | 6 | 8 |
| Accusative & Genitive equally frequent | 2 | 1 |

a *AMPHI* 'around' disappears after the Classical period.

utterances of *PERI* in our Qualitative database for a limited set of readings. This adposition increased the number of Accusatives from 24% in the Classical to 41% in the Hellenistic period (52% in the Roman period) while decreasing the number of Genitives from 71% in the Classical to 59% in the Hellenistic and 45% in the Roman period. Interestingly, the different readings of *PERI* were not affected by these changes in the same way. In order to have a closer look at these, we first illustrate the less frequent readings:

(14) *at*-landmark, locative
*tà* *perì* *tò* *Lilýbaion* *stratópeda*
DEF.NOM.PL PERI DEF.ACC.SG Lilybaeum army.NOM.PL
'(People in Rome and) the army at Lilybaeum.' (Plb. 1.55.3)

(15) possessive / ownership reading
About the origin of the universe:
*toû* *perì* *tòn* *hḗlion* *pyròs*
DEF.GEN.SG PERI DEF.ACC.SG sun.ACC.SG fire.GEN.SG
*katalámpsantos*
light.PRTC.PRS.GEN.SG
'as the sun's fire lighted it [scil. the land]' (D.S. 1.7.3)

(16) object of a nominalized process
'The ones, having the experience in agriculture and'
*tês* *mèn* *perì* *tḕn* *ámpelon*
DEF.GEN.SG PRT PERI DEF.ACC.SG vine.ACC.SG
*phyteías*
cultivate.NMLZ.GEN.SG
'in the cultivation of the vine (followed him)' (D.S. 1.18.2)

TABLE 15 The distribution of different readings of *PERI* in the qualitative database

| | Classical | | | Hellenistic | | |
|---|---|---|---|---|---|---|
| | ACC | DAT | GEN | ACC | DAT | GEN |
| Superlative 'above all' | – | – | 4% | – | – | – |
| Approximate number | 1% | – | – | 8% | – | – |
| *around*-landmark | 41% | 39% | – | 10% | – | – |
| *inside*-landmark | 1% | – | – | 2% | – | – |
| *at*-landmark | 12% | – | – | 28% | – | – |
| Time | 7% | – | 1% | 8% | – | 2% |
| Beneficiary | 6% | 15% | – | 8% | – | 1% |
| About | 13% | – | 70% | 4% | – | 75% |
| Topic dislocation | – | – | 5% | 2% | – | 10% |
| Be occupied with | 1% | – | 1% | 18% | – | – |
| Purposive | 2% | 8% | 11% | 6% | – | 6% |
| Relational, non-core | 6% | – | 2% | – | – | – |
| Relational, patient | 2% | – | 2% | 8% | – | 7% |
| Relational, subject | 1% | – | – | – | – | – |
| Stimulus | 4% | 39% | 2% | – | – | – |

(17) subject of a nominalized process
*tês perì tòn hḗlion kinḗseōs*
DEF.GEN.SG PERI DEF.ACC.SG sun.ACC.SG move.NMLZ.GEN.SG
'the movement of the sun (had as yet been recognized)' (D.S. 1.26.3)

Table 15 presents the frequencies of these readings with particular cases.

In general terms, we observe a consolidation of case variation, as already discussed in this Section above. However, before we find rigid case assignment in later periods, cases are employed to differentiate various meaning facets of the preposition. For example, in the Hellenistic period, the meaning of *PERI* 'about' is marked by the Genitive, while the meaning 'be occupied with' is marked by the Accusative case. At the same time, other meanings of the Genitive gradually disappear. There are only a few meanings that are not statistically associated with a particular case (such as purposive).

Thus, case still contributes to the meaning of the PP, but in a rather different way: there is a gradual change from compositionality to disambiguation between different meaning facets of the preposition. During the Archaic

TABLE 16 Functions of case in adpositional phrases from the Archaic period into the Byzantine period

| **Compositional** | **Idiomatic** | **Syntactic** | **Redundant** |
|---|---|---|---|
| Both case and the adposition contribute to the meaning | Case idiosyncratically disambiguates a particular meaning of the preposition | Case indicates syntactic dependency and thus helps identify a PP | Prepositions are function words and an NP that follows them is identified as the dependent NP |

period, we still find predominantly compositional meanings. That is, the meaning of case was predominantly to signal directionality distinctions and, thus, the whole meaning conveyed by the adverbial and by case on the NP was compositional (configuration plus directionality). By contrast, already during the Classical period, cases gradually cease to express directionality distinctions. Instead, they are predominantly employed to disambiguate between various non-spatial, abstract meanings of the prepositions that assign them (cf. Table 15).

In the next step, the case assignment becomes rigid and lexicalized. This is found with such prepositions as *PROS* 'to' or *EIS* 'into'. At this stage, case no longer has any semantic contribution to make and becomes syntactically conditioned. It serves only the structural purpose of forming a PP (similar to *of* in the English preposition *in front of*; a process very much parallel to *rankshifting* in Kortmann and König, 1992: 685). Inflectional case in a PP becomes redundant as the function of forming a PP may be taken over by the preposition itself (cf. Kortmann and König, 1992: 672; Lehmann, 2002: 10; Vincent, 1999: 1132).

To summarize, we argue that the evolution into "typical" prepositions of the type found in modern European languages with no internally and symmetrically encoded directionality distinctions went through functions of case summarized in Table 16 above.

## 7 Conclusions

Cross-linguistically, adpositional phrases develop frequently from adnominal possessum-possessor constructions (see (1) in Section 3 above) or from verb-object combinations (2). By contrast, many prepositions of Ancient Greek (and of some other archaic Indo-European languages) developed from adverbials (juxtaposed to the semantically dependent NPs) along the path in (3). This source of prepositional phrases is neglected in typological research (cf. Collins, 2019; Dryer, 2019) despite the fact that it is not so infrequent after all. For example, many modern European languages attest this development quite frequently, cf. the juxtaposed adverbials *together* and *down* in English *together with X* or *down from X* and its correlates in other languages.

The developmental pathway in (3) is more complex than (1) or (2) in that it involves the development of syntactic dependency and constituency, which are not there to begin with. We examined this gradual process by looking at adjacency and frequency constraints on insertion of words and phrases between the emerging preposition and the dependent NP, at the loss of different types of allomorphs occurring in positions other than strictly preceding the dependent NP, and at the historical changes in case selection leading towards straightforward government by preposition. We have claimed that the trigger for the gradual coalescence and stronger ties between the preposition and the dependent NP was the semantic dependency between the adverbial (predating the prepositions) and the Ground-denoting NP.

At the end of this very complex process during Postclassical Greek, we observe prepositional phrases that are in no way distinct from those that emerged via (1) or (2). It is only due to the attested history of Ancient Greek, as well as the comparison with other archaic Indo-European languages, that we know that their evolution was very different.

We furthermore argued that the grammaticalization of the prepositional phrases co-occurs with changes in verb-object and genitive-noun word order, not only at the final stage of the change but also at intermediate stages.

Crucially, neither the gradual change from OV to VO, nor the change from GenN/NGen to NGen, nor the emergence of prepositions from earlier adverbials, can be understood on the source-oriented approach. The source-oriented approach in typology challenges a number of well-established universals, including the correlational universals of harmonic head and dependent orders across different domains of grammar. On its radical version, it dispenses with functional or cognitive explanations of these universals by Occam's razor because harmonic orders in languages might potentially be related etymologically by one emerging from the other. In this paper, we have argued against this

approach because it overestimates its reconstructional power, while we agree with the caveat that typological data should be controlled for the source confounder.

More specifically, we first provided diachronic evidence that neither of the harmonic VO/NGen/AdpN word orders in Postclassical Greek is a historical source of the other, and we thus provided a case of a parallel development of harmonic word orders across domains while controlling for the source confounder. We have argued above that by the end of the grammaticalization process, the prepositions discussed here are in no way different from their counterparts in many other languages, even though there was no source-bias for the AdpN order in their historical source.

Secondly, we have provided evidence for the reverse case as well. The source-biases that are cross-linguistically dispreferred are abandoned in the course of the development by the time of Postclassical Greek. Thus, directionality distinctions are no longer encoded symmetrically and, moreover, directionality is no longer encoded internally to configuration. In addition, the mixed pre-/postpositional placing of adpositions is given up. This suggests that biases resulting from the source construction tend to be abandoned in the course of time if these are dispreferred for functional reasons. Accordingly, the long-standing retention of a source bias may suggest that there is more to such a retention than just simple drift.

Thirdly, the source-oriented approach does not take into account intermediate stages of a development, only contrasting the hypothesized source with the resulting pattern. However, intermediate stages are highly important in order to estimate the impact of the source confounder. For example, we have argued that, when lexical items grammaticalize into prepositions, they typically undergo clisis. Clitics, in turn, as we demonstrate above (and as is well-known from the literature), are subject to a very different set of ordering constraints than lexical nouns. Furthermore, we have argued that the adpositions could originally assume both word orders (AdpN and NAdp), and it is only the non-harmonic NAdp order that was lost in the course of time. Thus, the assumption that a source word order may be retained into the resulting pattern by just an unmotivated retention—as is implied by the source-oriented approach—is at least unwarranted in view of this evidence.

Finally, the source-oriented approach presupposes that direct evidence of functional pressures must be gained from the diachronic processes themselves in order to corroborate their existence. It seems that this requirement is too strong and possibly not feasible within historical linguistics. However, historical linguistics can generate a large body of indirect evidence for functional pressures operating during language change. Thus, we have shown that all three

domains (VO, NGen, AdpN) develop harmonic orders during the same periods (from the Archaic period, or even earlier, to Postclassical Greek).

Since the source confounder is ruled out here, we see this development as strong evidence in favour of functional pressures, because the null hypothesis of these three orders developing accidentally at the same time is too improbable. Given that Archaic Greek did not show any clear orientation towards either head-initial or head-final word order in any of the domains discussed here (verb and object, adposition and noun, genitive and noun, cf. Table 13 above), each domain could potentially develop along roughly three main scenarios: (i) retention of the situation found in Archaic Greek with both orders being similarly frequent (different word orders in one domain perform different functions, cf. Viti 2008), (ii) developing a strong bias towards head-final order, or (iii) developing a strong bias towards head-initial word order. The odds of all three domains developing a strong bias towards head-initial order purely accidentally is thus $1/3^3$, i.e., ca. 0.037 which is clearly below the conventional chance threshold of 0.05. From this it follows that the null hypothesis of an accidental development cannot be maintained. Word order is generally one of the most stable features in language and correlating dynamics in word orders of different domains can, therefore, hardly be considered accidental.

To conclude, while cross-linguistically preferred, harmonizing structures emerged with no precondition in their respective sources, cross-linguistically dispreferred structures disappear despite being inherited.[24] We have shown that very different processes of re-structuring and abandoning of inherited properties converge on cross-linguistically preferred structures—a fact that the source-oriented approach cannot account for.

Having said this, we recognize that we have provided evidence from just one language. Our results are, therefore, somewhat preliminary, but we expect that any detailed description of a diachronic development will reveal a number of processes that cannot be explained by drift and unmotivated retention. Thus, many other modern Indo-European languages also attest the same,

24 This, of course, does not imply that disharmonic patterns may not arise in languages as historical accidents (cf. e.g. Jacques 2013). Our claim is that these patterns have a higher probability of being abandoned, especially if the domain in question becomes subject to major changes. Thus, many Proto-Indo-European case distinctions started disappearing very early, in Proto-Greek, and instead adverbials developed from relational nouns. These adverbials were not positionally restricted to preposing, to begin with. However, once the language started changing to head-dependent order in general, the postpositional variants were accordingly abandoned. With no change, a disharmonic structure may potentially persist for quite a long time as a retention drift.

harmonic developments. In contrast to Proto-Indo-European which was OV, NAdp, GenN, many modern Indo-European languages develop into VO, NGen and AdpN. By contrast, Tocharian (now extinct), for example, has lost the Proto-Indo-European case markers and grammaticalized instead totally new postpositions (cf. the overview in Carling, 2000: 378) and thus remained NAdp. Notably, this Indo-European language, in contrast to Ancient Greek, remained predominantly OV and GenN (Schmidt, 1975: 284–285).

Once the pure source-oriented explanation is ruled out, a higher-order constraint is called for to explain why Ancient Greek shows co-dependency in word order changes. Functional constraints such as processing efficiency (Dryer, 1992; Hawkins, 1994, 2004, 2014) must have been responsible for these changes. The diachronic mechanism bringing about the change towards the more efficient, harmonic word order may be viewed as a process of adaptation in which new patterns expand via functional selection (parallel to Darwin's *natural selection*) as more efficient for the speakers (Haspelmath, 1999, 2019) while patterns that are more difficult to process at some point are not transmitted to the next generation due to the selectional pressure of language learners (Christiansen and Chater, 2008: 499). "(T)he degree to which any particular trait is easy to learn or process will, to some extent, depend on the other features of the language—because language users will tend to learn and process each aspect of the language in light of their experience with the rest." (Christiansen and Chater, 2008: 499).

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**Abbreviations**

Glossing follows Leipzig Glossing Rules: other glosses are listed below.

| | |
|---|---|
| Adp | adposition |
| Gen | genitive |
| NP | noun phrase |
| O | object |

PP prepositional phrase
PRT particle
V verb

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