SVO – Attractors in the declarative-to-procedural shift in grammar evolution

Hubert Haider
Dept. of Linguistics & Centre for Cognitive Neuroscience, Univ. Salzburg

Abstract

Diachronic changes of phase or clause structure are vectored rather than oscillating. A century ago, this prompted Sapir to coin the term drift. What he observed is a drift towards fixed word order and another one towards "the invariant word" (including the levelling of the forms for subject and object marking). What is still missing is a theory that predicts these drifts. As will be shown, the theory of grammars as targets of cognitive evolution is the theory that explains Sapir's observations and, in passing, makes the concept of "Universal Grammar" dispensable. It will be argued that Sapir's drifts are shifts from systems primarily based on the declarative network to systems that primarily employ the highly automatic procedural network. This also explains why SVO is a point of no return and why languages do not change in the reverse direction, starting with a grammar like English, arriving at a grammar like Sanskrit.

1. Background

It is a fact that already in the Middle Paleolithic, 300.000 years ago, homo sapiens settled in North Africa, as excavations in Jebel Irhoud have revealed (Richter et als. 2017). This contrasts with the fact that even the oldest texts available for the study of grammar, such as Sumerian (Dietz 2003), reach a time depth of little more than 3000 years. Hence, the data available for theorizing about diachronic changes cover less than 1% of the relevant time span, and less than 1‰ of human languages. This is a fact and we should bear it in mind whenever we speculate on the diachronic dynamics of grammars. Essential data on the emergence & development of grammar systems are principally inaccessible to us. It is a truism that grammars don't leave fossils. Since the time depth of deciphered documents is a painfully narrow, unsurpassable horizon, research on grammar change is bound to deal with only the most recent[1] changes of grammars of languages, knowing that each of them has a buried history of more than *three hundred millennia*.

As for the general idea behind this paper and for the sake of argumentation, readers are asked to grant the following hypothesis, explicated in detail in Haider (2019, 2021a, 2021b): Grammar changes are steps on ramifying paths in the ongoing cognitive evolution of grammars when they concern aspects subserved by the procedural memory network, which, unlike declarative contents, is inaccessible to introspection. Cognitive evolution is an instance of Darwinian evolution, that is, the interplay between random variation and constant but 'blind' selection (i.e. the sieving out of variants). Subject of evolution is the cognitive capacity that linguists refer to as the mental representation of a grammar. It is not *biological* evolution, which operates on the genome, but it is evolution that operates on a cognitive entity, shaping a cognitively based system, namely the domain-specific 'programme package' that in modern diction, constitutes the mental 'language app'.

[1] If we compress the 300k years onto a single year, the available data would cover the time span from Dec. 29th to New Year's Eve. We cannot reconstruct the rest of the year based on data about three and a half days, can we?

As explicated in the papers just cited, the evolutionary approach is explanatorily superior to the mainstream Generative concept of an allegedly innate UG, which Jackendoff (2002: 234) has rightly criticized as "*a retreat to mysticism*". Others[2] regard it as a linguistic equivalent of "intelligent design" (Numbers 2006) and secular creationism. The main reason for the joint dismissal from outside of the school of Generative Grammar is the lack of any biological substance for the innateness claim. Chomsky's UG in the rich[3] version of the Principles & Parameter Theory cannot be innate, contrary to the rhetorics accompanying it. There is no evidence of a species-specific, innate complex grammar capacity, and there are no predecessor systems in closely related species. Bees have an innate grammar for their communication system even with dialectal differences being innate (Johnson et al. 2002), but neither the Journal of Heredity nor any other pertinent journal has published a paper that documents any evidence for an *innate* UG.[4] If there were any evidence, at least pieces of it would have had to show during the past fifty years of genomic research. The UG theory is a catchy narrative without empirical substance, metaphorically motivated only by innate behavioural programs that ethology and behavioural biology discovered in the second half of the 20th century, the fine difference being that the latter have been demonstrated to be real.

Evolution is not substance-bound. There is biological evolution, operating on the genome, and there is cognitive evolution, an instance of evolution by natural selection, by drift or flow (see Haider 2021:18), just like biological evolution, but operating on the level of cognitive systems. Its target is the pool of grammar variants in a population of language users. Only those grammar variants will spread that find a brain of a child who acquires this grammar variant. A grammar is a domain-specific cognitive system that runs on a domain-general computational system (viz. human brain with its neuro-cognitive 'operating system'), or in other words, our general information processing system embodied in our brains. The mental grammar is the core part of a mental language app, arguably with a long but unknown history of *cognitive* evolution.

The bonus-program that functions as the selection environment for grammar variants in cognitive evolution is the general mental computational system itself. Grammar variants that happen to be better adapted to the computation resources of our brain involved in language processing will receive a bonus since they will be preferred by more brains than less adapted, more clumsy variants, since they are 'easier' to acquire and use. In the long run (of more than 300 millennia), grammars have adapted to the brain resources since these resources underly language acquisition, language production and language understanding. A language with grammar G_i can survive only if G_i happens to enter (enough) brains and this is why cognitive evolution leads to neuro-cognitive adaptation of grammars to brains. If G_i is better compatible with factors of acquisition or use than the 'competing' variant G_c, G_i is likely to spread, that is, it enters more

[2] "*The arguments for intelligent design from irreducible complexity bear an uncomfortable similarity to that originally posited for the necessity of a genetically specified universal grammar*." Finlay (2009: 262).

[3] The rich version equals a fully assembled mental switchboard with numerous switches (aka parameters) to be set during language acquisition. The version of the Minimalist Program, on the other hand, is minimalist too. It merely defines the starting point with 'merge' as the basic cognitive-grammar procedure. Being minimalist, it cannot and does not account for cross-linguistically invariant grammatical intricacies.

[4] The author is well aware that the notorious FoxP2 gene is implicated in speech production, but this gene is not species specific. Moreover, there is no evidence for recent selection in the evolution of homo sapiens, see Atkinson et als. (2018). The gene has been found to be involved in birdsong (Teramitsu et al. 2004), but birds don't use human grammars, so obviously FOXP2 cannot be regarded as the 'language gene' of homo sapiens.

language learning brains than other variants and the change will spread. "*Overall, language appears to have adapted to the human brain more so than the reverse*" (Schoenemann 2012: 443). The following paragraphs draw on Haider (2019).

It is an educated guess that our human ancestors, just like today's children, started with two to three word utterances, with little to no restrictions that would deserve the denomination 'grammar'. From then on, cognitive selection has been working steadily and inescapably, rewarding and conserving (emerging) variants that turned out to be more effective and easier to process and acquire. Note that in this scenario, poly-genesis of languages is a plausible option. The cross-linguistic invariants of grammars are the result of convergent evolution[5] (see Reece 2015: 586) in the same cognitive 'habitat', that is, the human brain.

The processes of evolutionary selection (as a channelling factor of change) are dependent on the availability of variation on the one hand, but on the other hand, selection is not deterministic. Just as in biological evolution, it is unpredictable which specific step will happen and when. Evolution does not provoke changes. It merely channels changes in terms of sieving out variants. It may happen that in absence of competing variants, a system attains a relatively stable and undisturbed equilibrium and continues without significant changes for longer periods of time. An extreme example from zoology is the species of coelacanths, viz. Latimeria menadoensis and Latimeria chalumnae, who are considered living fossils with a pedigree of 400 million years.

For the present purpose, Haeckel's biogenetic law of 1866 – "*Ontogeny recapitulates phylogeny"* – is a good starting point, even if it has been revised in relevant details by Von Bear (1928), claiming that the general characters of a taxonomic group show earlier in an *embryo* than the specialized characters do. He concluded that only the stages an embryo passes through during ontogeny represent *embryonic stages* of other species, but not *adult* forms, as Haeckel had originally thought. Species diverge from one another as development progresses.

As for the evolution of grammars, the analogous situation seems to be the following: The acquisition paths in first-language acquisition recapitulate steps in the evolution of grammars in the history of mankind. Von Bear's linguistic version would be this: In early stages of language acquisition – until leaving the two and three-word stage – children proceed independently of the type of their respective mother tongues. For instance, children may choose V-before-subject orders even in languages in which the subject would invariably precede the main verb (Deprez & Pierce 1994: 64-65), or they prefer an OV order when acquiring a VO language. These behaviours arguably resemble the "*embryonic stages"* of human languages in the evolutionary history. Another window into the 'embryonic phase' is the isolated emergence of new languages, as in the case of a Nicaraguan sign language (Senghas et al., 2004) or in experimental tasks (Goldin-Meadow et al., 2008). In each of these cases, an SOV word order is preferred for denoting transitive events.

[5] Today, the descendants of some mammals that returned to sea superficially look like prototypical fish (e.g. dolphins, whales, etc.), with streamlined bodies, dorsal fins and flippers. This is a result of convergent evolution (Foote et al. 2015). Not only sea-dwelling mammals, but grammars, too, inevitably adapt to their respective habitat in the course of evolution, without an innate UG for sea-life or language. This is true for sea-dwelling mammals as well as for language-gifted ones.

For children, grammar acquisition takes at least seven years during which they proceed from a "*Me Tarzan, you Jane*" kind of stage to end up in a steady state that governs complex utterances such as "*There are more things in heaven and earth, Horatio, than are dreamt of in your philosophy".*[6] It will remain unclear how many millennia it took for mankind to arrive at this point. A precondition on the way to phrase structuring, with phrases differentiated by their head categories, was lexical categorization. The lexical categories of heads as formal distinctions partition the set morphological markers that are attached to them. This design of morphological identification is in turn a precursor of a design in which the *morphological* coding of grammatical relations (as in 1a) gets replaced by *structural* coding in terms of head-initial and thus strictly linearized phrase structures (1b), which allow for an efficient *procedural* identification of essential relations without much recourse to morphological marking. Cognitively, this amounts to a shift from declarative memory load to cognitively less costly procedural memory capacities. (1a) is an example of classical Latin (Titus Livius[7], 59BC – AD17), a language dreaded for its rich morphological inventory by generations of pupils who have to memorize it.

(1) a. Datur haec venia antiquitati, ut miscendo humana divinis
primordia urbium augtstiora faciat.
b. is-given this privilege (to) antiquity so-that (by) mingling (with) human divine (things)
(the) beginnings (of) cities more dignified become
'It is the privilege of antiquity to mingle divine things with human,
and so to add dignity to the beginnings of cities'

The English gloss of (1a) in (1b) contains four prepositions and no case or agreement morphology on nouns and adjectives. The Latin original contains no preposition but a lot of case and agreement morphology. This state of affairs – morphological coding (as in Latin) replaced by structural coding (as in English) – is diachronically a one-way road. No language is known to have developed in the reverse direction, that is, starting from an English- or Chinese-like grammar and ending up with a grammar resembling that of Latin or Sanskrit; see Gell-Man & Ruhlen (2011).

From a typological point of view, languages like English, that is, languages with strictly head-initial phrases and a structurally unique subject position preceding the verb, are diachronically younger. It is a vastly more probable end point of diachronic changes than a starting point for the reverse direction. In other words, many SVO languages have free-word-order languages as ancestors, but SOV or free word order languages with SVO ancestry in the course of evolutionary changes are predicted to be inexistent. The rare cases of SVO-to-SOV are cases of disruption, that is, cases in which a dominant SOV language supersedes the dominated language.[8] Other cases are misunderstandings because of the ill-defined typological category "SOV".

[6] The physicists Georg Christoph Lichtenberg (1742 – 1799) felt tempted to complete Shakespeare's insight by "*But in exchange, our compendia contain more things than ever occur in heaven or earth*." (translated$_{HH}$).

[7] http://data.perseus.org/citations/urn:cts:latinLit:phi0914.phi0011.perseus-lat1:pr.7

[8] Language contact and bilingual populations are stronger factors in language change than evolution by positive selection of favourable treats. The corresponding concept in population genetics is Horizontal Gene Transfer (HGT). Because of HGT, "*gradualism is not the principal regime of evolution*" (Koonin 2009:1027). However, word order properties may also resist a dominant language in bilingual settings, as the example of Farsi demonstrates after the Arab conquest of Iran in the middle of the 7th century. Modern Persian is still SOV.

An example is a widely cited paper on VO to OV, namely Li & Thompson (1974). They claim to deal with "so-called" VO to OV, but what they discuss is not object-before-verb but PP-before-verb. In Chinese, nominal objects are obligatorily postverbal. Chinese is a language with category-specific headedness directionality and in this respect the opposite of the West Germanic languages. It is head-initial for verbs and head-final for nouns, and moreover, it has a reanalysed a serial verb construction. The former serial verbs 把 (bă: take) and 给 (gěi: give) have been reanalysed as prepositions and thereby this new PP ended up in the preverbal position. Object noun phrases however are canonically postverbal. If Chinese were on the way to VO, noun phrase objects would have to be licit in immediately pre-verbal positions, which is not true.[9] OV languages are languages with obligatorily preverbal noun phrase arguments of the verb.

Let us return to the general issue. Word order changes are not instantaneous, they usually take several generations and centuries, as in the case of the fixing of OV vs. VO in Germanic languages (Prell 2003). However, due to the absence of script in the past of the majority of modern languages, the historical depth of documented grammar changes is extremely shallow, namely less than 1% of the relevant time depth. Nevertheless, even the little we know is sufficient for recognising clear effects of the ongoing cognitive evolution geared by variation & selection. Here are just two examples of the numerous insights produced by population genetics research that linguists can cautiously insource and apply to their own domain of research.

Fisher (1930) detected and proved a fundamental theorem of natural selection: "*The rate of increase in fitness of any organism at any time is equal to its genetic variance in fitness at that time*." In other words, the intensity of selection and hence, the rate of evolution due to selection, is proportional to the magnitude of variation in an evolving population, which, in turn, is proportional to the effective population size (Koonin 2012:7).This accounts immediately for the fact that Logudorese Sardinian (Sardu logudoresu), Faroese, or Icelandic[10], to name a few examples, have changed less and have conserved more of the earlier traits than Italian or Norwegian, although they are offspring of the very same ancestor languages, respectively. A small population confined to a small region produces less variation and therefore less chance for change. This is what Fisher's theorem predicts when applied to grammars as targets of evolutionary changes.[11]

A second illustrative parallel is the fact that the paths of evolutionary changes in an organism (Northover et als. 2020) and in grammars (Dunn et als. 2011) are *lineage-specific*. What this show is the interdependency of evolutionary steps. Changes do not arise from an arbitrary revaluation of any odd parameter but they develop like cascades. The individual change is an

[9] Mandarin Chinese is a topic-prominent language, with options of fronting phrases to clause-initial areas, which produces word order variation, as for instance object fronting in (i). However, (ii) is unacceptable, as Tai (2008:10) reports, based on native Beijing informant interviews, although (ii) would be a canonical SOV order.

i. 狮子，老虎吃了. (Shīzǐ, lǎohǔ chī le) — lion, tiger eat PFV ('a lion, the tiger eats')

ii. *老虎，狮子吃了. (Lǎohǔ, shīzǐ chī le) — tiger lion eat PFV ('The tiger eats a lion')

[10] The major settling up of Iceland by Norwegians took place in the 7th to 9th century. Today's Icelandic is closer to the language of the ancient settlers than to modern Norwegian.

[11] Note that communicative functionalism would have to come to exactly opposite, wrong predictions, since small communities can change their habits rapidly and homogeneously. Consequently, the concomitant communicative functions would change homogenously und these changes would therefore be easier to stabilize and retain than in speech communities covering large territories.

arbitrary event, the following steps are partially necessary. In biology, this is the message that Jaques Monod's title motto "Le hasard et la nécessité" is meant to convey.

2. The basic organization of phrase and clause structure

Even in our days, that is at least 300.000 years after the first documented appearance of homo sapiens in the Mediterranean region, we see at least three major types of phrasal and clausal architecture. Generally, phrases are organized 'around' phrasal heads, which presupposes the existence of lexical categories. In field-linguistics literature, Salish languages have been showcased as testimonies for languages without lexical categories. Later, this has been vehemently contested.[12]

Grammatical morphology is a successor of the previous means of differentiation the expressions for the participants of the eventualities denote by the verb. Languages with noun classifiers have conserved traits of this predecessor stages. Evolutionary streamlining has yielded formal markers of formal relations, namely case and agreement. Note that such systems are indispensable steps on the road to structural systems. Generative UG theory predicts that a language like English out come into existence out of the blue.[13] Evolution theory, on the other hand, presupposes a stepwise development, starting from the 2-3 word stages, that eventually reach a stage like English after the free-word-order and morphological marking stages.

Typical morphology-based systems provide morphological tags for linking the dependents to the head. The best known examples are the oldest documented Indo-European languages and their classical successor languages. In the absence of tight order relations, these languages are so-called free word order languages, as illustrated by the Latin[14] example (1). If morphological linking is the only order relation for a given languages, the resultant word order freedom has motivated the term "non-configurational" language.

A frequently observed step in the grammatical evolution is the step from 'morphology only' to 'morphology plus structure', followed by "structure only". 'Structure' means that order relations are imposed by the grammar in terms of phrase structures based on the syntactic category of a lexical item. The effect of phrase structuring imposed on a string of elements becomes evident in bracketing when used as a syntactic notation. Phrase structures map a one-dimensional string of items on a two-dimensional box-in-box structure, which greatly enhances parsing and production.

The fundamental order relation in phrase-structuring is the linear order of the head relative to its dependents. Logically, there are two serializations which can be implemented in three alternative structural options, namely 'before, 'after' and 'before or after' (= flexible). If we disregard for the moment the internal structure of the respective phases, we see the following linearization patterns for a VP with a ditransitive verb. (2a) is the option we see in SOV languages. (2b) is the option of SVO and VSO languages. (2c) is the option that typically diachronically

[12] Jelinek & Demers's (1994: 698) claim on the absence lexical-category distinctions in Salish is contested by Koch & Matthewson (2009) and Davis et. als. (2014: e199): "*No one working on Salish holds to category neutrality these days*."

[13] Note that creole languages are not 'out of the blue', they are formed on the basis of pidgins, which are devoid of grammatical morphology.

[14] Spevak (2010:1), quoting Weil (1844), exemplifies this by variants of a clause, with OV, VO, and OVS order.

precedes since (2a) or (2b) is the respective subset of (2c) that results from setting a directionality value of the head for licensing the position of its dependent:

(2) a. head-final: [IO – DO – V°] SOV
b. head-initial: [V° – IO – DO] VSO, SVO
c. variable: {[IO – DO – V°], [V° – IO – DO], [IO – V° – DO]} Type-3[15]

Let us turn now to the internal structure of the VP. There are compelling reasons[16] for assuming that complex phrases are binary branching, and not n-ary branching in 'flat' structures, as other schools of linguistics, including functional typology, assume. Across schools, there is consensus that phrases are endocentric, that is, every phrase contains a head element whose category determines the category of the phrase. Given the universal right-branching restriction (BBC[17]), the OV-structure is the most simple structure. The dependents of the head are binarily associated ('merged'). The price to be paid for the simple structure (3) is the late presentation of the head of the phrase.

(3) a. [α [β [γ V°]]]
b. [keiner$_{\alpha\text{-nom}}$ [jedem$_{\beta\text{-dat}}$ [alles$_{\gamma\text{-acc}}$ neidet]]]
nobody everyone everything begrudges

Since the lexical head is associated via its lexical entry with a lot of syntactically relevant information, early presentation of the head is an advantage for the parser of the message recipient in his time-bound task of processing the incoming information. However, the early presentation of the head of the phrase cannot be achieved in a mirror-image structure of (3) as in (4):

(4) [[[V° γ] β] α]

(4) is a left-branching structure. Such structures are known to be difficult to parse since the parser cannot know how deeply embedded the item which comes in is. In other words, it cannot know in advance, how many left brackets to open. So, it is prone to continuous backtracking.

Since the late eighties, see Larson (1988), it has become uncontroversial for theoretical linguists that the VO counterpart of (3a) is not the mirror image structure (4), illustrated in (5a), a variant of which Chomsky (1981: 171) had originally assumed for double object constructions. The evidence converges on the VP structure (5b).[18] In fact, Larson suggests a more complex derivation that starts from a structure like (5a). The re-instantiation of V in (5b) is the source of the shell structure in head-initial VPs. It has first been suggested in Haider (1992).

(5) a. *[[[Begrudges everything] everyone] nobody]
b. [$_{VP}$ Nobody [begrudges$_i$ [everyone [e$_i$ everything]]]]

Why are phrases not built up, as typologists still seem to believe, as left-branching" (Dryer

[15] The term refers to the "third" option, in addition to head-final and head-initial.

[16] In languages with head-final VPs and a fronting option to the clause-initial position, as in German, one can virtually reproduce the stepwise, binary layering of phrase. Any one of the bracketed constituents in (i) can be fronted, in order to arrive at an acceptable declarative main clause.
i. --- würde sie [jedem [etwas [darüber [erzählen]]]] (German)
would she [everyone [something [it-about [tell]]]]

[17] BBC (basic branching constraint) = *def. The structural build-up (merger) of phrases (and their functional extensions) is universally right-branching.* Haider (2013:3).

[18] In clause structures, the subject eventually will end up in a VP-external functional spec-position in English.

1980),[19] as in (4), but only right-branching, as in (3b) or (5b)? The answer is already one in terms of evolutionary selection. Although it is preferable to have the head presented early, as in (4), compared to (3), the structure (4) is disfavored by the general processing system that runs the parser. (4) is too clumsy for parsing by a left corner parser, compared to a right-branching structure (2a), as a comparison of (2a) and (4) shows. It suffices to notice the brackets accumulating at the beginning rather than at the end.

The situation is entirely different with (3). Right-branching structures, which are embedding on the left side of the head and its projections, guarantee that the item that is parsed is higher in the structure than any other item that follows within the constituent that is parsed. The constituent node is always the mother node of the phrase being parsed. So, universally, we see a basic asymmetry. Phrases are universally right-branching. Left-branching projection of lexical heads do not exist. This has been proposed and justified first in Haider (1992) and later on in several publications, e.g. Haider (1997), Haider (2000). The build-up of the structure (5b) follows directly from the interaction of directional licensing and a universal constraint, namely the *Basic Branching Constraint* (BBC), see Haider (1992), (1997), (2000), (2013:3). Given that phrases are universally right-branching and, as it is the case for VO, the verbal licensing directionality is opposite to the direction of merger in a head-initial structure, the shell structure is the predicted outcome of structuring. (6a) to (6d) are the respective steps of merger:

(6) a. [*begrudge*$_{\rightarrow}$ everything]
b. [everyone [*begrudge*$_{\rightarrow}$ everything]]
c. [begrudge$_{\rightarrow}$ [everyone [~~*begrudge*~~ everything]]]
d. [everyone [*begrudge* [everyone [~~*begrudge*~~ everything]]]

First in (6a), the lowest argument joins the verb and receives the canonical directional licensing by the verbal head. Then, the indirect object is merged with the structure (6a) in the right-branching structure (6b). Since the verb licenses to the right, it needs to be re-instantiated for licensing the indirect object directionally (6c). This is how the shell structure emerges in complex head-*initial* phrases, and only in head-initial ones.

Finally, the subject argument is merged VP-internally (6d). Again, a licenser on its left is needed. In [S[VO]] languages, this is a preceding functional head, viz. T°, or I° in previous versions. The subject phrase predictably raises to the spec position of the functional head.[20] This is enforced since the condition that triggers V re-instantiation and subject raising is the *mutual c-command requirement of* directional licensing: The licenser and the licensee have to c-command each other (Haider 2010: 29) and the licensee must be in the canonical directionality domain of the licenser. For head-initial phrases, this entails that in a complex projection, the licenser gets re-instantiated higher.[21] The position from which the subject c-commands the

[19] In fact, Dryer's „*Branching Direction Theory*" merely rephrases the *peripherality condition* of X'-Theory for phrasal heads, s. Stowell's (1981: 70) wrap up of the X'-Theory: The head of a phrase is peripheral. In Dryer's view, it either precedes or follows its dependents in a flat, n-ary-branching VP. In X'-Theory, structures are binary branching. Flat structures cannot have a branching direction.

[20] In VSO languages, the verb is re-instantiated once more, that is, above the subject position.

[21] In complex head-*final* phrases, the verb remains in the foot-position of the phrase, since each projection is a canonical licenser. In VO, the projections are on the same side as in VO, but their licensing direction is to the right while the licensee is merged on the left, just like in OV. Since the licit licenser must be on the left, the only option is the re-instantiation of the verbal head. In Generative terms, this would be called raising of the verb.

functional head licensing the base position of the subject is the spec-position of the functional head. In OV structures, the head and each projection are licit licensers. In VO languages, the projection nodes of the head are on the 'wrong' side, directionality-wise.

Finally this theory predicts the existence of a functional projection in SVO languages that is absent in OV languages, namely the projection of the functional head (i.e. T° or I°) that merges with the VP and accommodates the subject argument; for details see Haider (2015).

Next, let us recapitulate and assess the different systems. First, the morphological linking heavily draws on the *declarative* memory system since the (numerous paradigms of) case and agreement morphology must be memorized and retrieved. Second, in the T3-system (2c), linear order does not convey structural information. This provides headroom for other components of grammar (information structuring, scoping, binding, etc.) to capture and thereby pragmatically partition linearization patterns.

Fixed positions for heads are an advantage for the parser since this sharpens predictability. The minimally complex organization of phrase structure is head final (2a), with the dependents successively merged at the left. Here the position of the verb is a signal for the end of the phrase. The highest predictability and least order variation is achieved in the head-initial organization, which is more complex, however, as illustrated by (6). The head always comes first and in a high position and the preceding phrase always c-commands the phrases that follow in a single projection of a head. Eventually, strictly head initial phrases are fixed-order phrases. The latter can be observed in a kind of minimal-Pair setting in languages in which the directionality of the head is sensitive to the lexical category of the head, such as German (7), with a head-*final* VP (7a,b) and a head-*initial* NP (7c,d). Such a constellation is cross-linguistically by no means exceptional.[22]

(7) a. das Geld an die Armen verteilen
the money$_{Acc.}$ to the poor distribute
b. an die Armen$_i$ das Geld e$_i$ verteilen
to the poor the money$_{Acc.}$ distribute
c. das Verteilen des Geldes an die Armen
the distribute(ing) the money$_{Gen.}$ to the poor
d.*das Verteilen an die Armen$_i$ des Geldes e$_i$
the distribute(ing) to the poor the money$_{Gen.}$

In the head-final VP, the word order is variable (7a,b). In the head-initial NP (7c,d), the word order is rigid, just as in English. Note, by the way, that 'Scrambling' is not so much language specific than phrase-structure specific. Head-final structures provide variation space that is principally and predictably absent in head-initial structures, see Haider (2015, 2020).

As argued in more detail in Haider (2021a,b), the cognitive evolution of grammar systems entails a shift and drift from morphological to procedural coding. The cognitively encapsulated, i.e. consciously inaccessible, aspects of grammars as cognitively represented systems, that is,

[22] Numerous languages display the same directionality profile, as for instance, Afrikaans, Amharic, Dutch, Frisian, German, Kurdish, or Persian, to name but a few examples. Chinese is inverse, with head-initial VPs and head-final NPs.

the procedural parts of grammars, including structuring, are subject to, and results of, Darwinian evolution, applying to a domain-specific cognitive program. Other, consciously accessible, aspects of language, viz. the declaratively coded ones, such as the lexicon, do not fall under Darwinian evolutionary principles, but are mostly targets of social changes.

Morphologically coding systems are costly since first of all, they involve the general purpose memory system, that is, they share declarative network of language processing. Second, they become even more costly in the course of time since morphology is exposed to phonological changes, which leads to dissipative patterns. For instance, the Latin version of the inherited PIE case-system codes *six* different cases on *five* different classes of nouns, namely a-, e-, i-, and u-stems plus the consonantal class, in singular and plural. Every time a noun is used, decisions between sixty different forms, some of which are not distinct, await the speakers or hearers in Latin.

English nouns, in a clear-cut contrast, function with *one* invariant form plus *one* suffix for plural. This is the result of structural coding. Diachronically, structural coding is the precondition for the gradual loss of morphological case marking. The change to structural coding makes morphological coding redundant, as Jespersen has emphasized already more than a century ago,[23] but it does not automatically replace it, as Icelandic shows. Icelandic is a structurally coding SVO language still equipped with a rich morphological case and agreement inventory.

Let us briefly compare a few languages un this respect. In Germanic languages, unstressed pronouns are fronted within their domain. In German, this is the so-called Mittelfeld (midfield) which is the region between the position of clause-initial particles and the V-positions at the end. Structurally, this is the VP domain. Icelandic (8d), just like English (8c), does not change the relative order of objects, neither nominal nor pronominal ones, and it does not front a pronominal object across a subject, unlike German (8b) and Latin (8a).

(8) a. Tum *mihi* Roscius et *alia multa* dixit. Latin (Cicero Quinct. 78)
then (to) me Roscius also many other (things) said
b. Dann sagte *mir* Roscius auch *vieles andere.* German
then said (to) me Roscius also many other (things)
c. Then Roscius told *me* also *many other things.*
d. Þá sagði Roscius mér líka margt annað. Icelandic
then said Roscius (to) me also many other (things)

Let us turn now to the potential gain of structural coding of grammatical relations. In SOV and free word order languages (9a), case and agreement disambiguate the arguments, which may come in any surface order due to word order variation ('scrambling'). Structural coding (9b) disambiguates without case and agreement and the relative order of the arguments is always the same (unless exactly one item is fronted in wh-clauses, relative clauses, or in V2-declaratives, such as in the Scandinavian languages).

(9) a. [α_{nom} [β_{dat} [γ_{acc} V°]]] order variation among arguments

[23] Jespersen (1894: §75, 96-97) has explicitly rejected the still widely propagated idea that structural coding *compensates* the loss of morphological marking.: "*A fixed word order was the prius, or cause, and grammatical simplification, the posterus, or effect*". In simple words, people are not forced to give up morphology, they are glad to do so.

b. [α V_i° [β [e_i γ]]] no order variation among arguments

In the structure sketched in (9b), each argument is identified by its unique structural position. The subject is the only argument that precedes the verb in VO. The direct object is in the lower shell position of the VP while the indirect object is in the higher postverbal position which is the position preceding the empty V° base-position. The relative order is invariant, irrespective of interpretability, as (10a) illustrates.[24] In a head-final VP, the order is variable (10b,c).

(10) a.*The King awarded *to the sailor* the Albert Medal / *the Albert Medal the sailor
b. König Rudolf verleiht (*an) Kleinbasel* die Rechte der Stadt Colmar
king Rudolf awarded (to) Little-Basle the rights of the city Colmar
c. König Rudolf verleiht die Rechte der Stadt Colmar *(an) Kleinbasel*
king Rudolf awarded the rights of the city Colmar (to) Little-Basle

Present day Icelandic is particularly instructive. It is an example of a transitional period of grammar change. The clause structure is SVO but the morphological markings are still well conserved, in contrast to its sibling variant (West-)Norwegian, which transmuted into a language without morphological case or verbal agreement. Icelandic demonstrates clearly that the structural identification overrides the morphological distinctions. For instance, in the passive of ditransitive verbs, the dative may end up in the structural subject position and the object remains in-situ, in spite of its nominative case. This "dative subject" (aka "quirky subject") inherits subject properties by virtue of occupying the subject position. In OV-languages such as German, the "quirky subject" phenomenon cannot occur because there is no VP-external, *structural* subject position, see Haider (2005).

3. Reduction of work load – from declarative to procedural

The fact that numerous languages are either 'OV' or 'VO' in their phrasal and clausal structure demonstrates that both types of structuring are likely outcomes of the cognitive evolution of grammars during the past millennia. Or, in other words, grammars of either type are sufficiently well-adapted and in a stable state. Evidently, the cost-benefit relation is salutary for both, with a different price-gain profile, though. SOV offers a simple phrase structure but comes with a pricy morphosyntax and late presentation of the verb. Morphosyntax is minimal in typical [S[VO]] languages, at the price of a more complex phrase structure, but the verb appears early. It is crucial to realize that structure building is a domain of grammar that rests on the *procedural* memory system, which is cognitively encapsulated. A richer morpho-syntactic inventory, such as in typical SOV languages, draws on the more costly (in terms of brain resources needed for acquisition and processing) *declarative* network, which is powered by the consciously accessible general purpose memory system. Every L2 learner has a feeling for the cognitive work load of morphological systems.

The fact that cross-linguistically, the two structure systems have coexisted already over very long periods shows that there is no massive advantage of one over the other. Japanese, for

[24] In Dutch, an OV language without hardly any scrambling of noun phrases, PPs may scramble easily, unlike in VO languages (Geerts et al. 1984: 989):
i. Toen hebben de autoriteiten aan de moeder$_i$ het kind e_i teruggegeven
then have the authorities to the mother the child back-given

instance, is a strict SOV languages that has been SOV since the earliest available Old Japanese texts; see Katsue (1978). In this respect, Japanese is representative of a pretty big group of languages.

Which languages do change from one word order type into another one? The typical Europe-centered answer cites Indo-European language families, such as the Romance and the North Germanic one. These languages are said to be descendants of SOV languages. However, the evidence for this claim is weak and highly questionable. None of the predecessor languages was a strict SOV language and none of them was an [S[VO]][25] language. In fact they were all T3 languages, with OV as a frequent pattern, besides many other order variants. This had be realized already by Miller (1975) and is argued in detail in Haider (2014) and Haider & Szucsich (2022: 114, 125-130) for Romance, Germanic, and Slavic.

Evidence for a strict SOV IE-language comes only from Hittite (cf. Hoffner & Melchert 2008), a language without existing successor language(s). For all other IE-languages, "SOV" is merely the *least inappropriate* type assignment (out of VSO, SVO, and SOV). Unlike Hittite, in which clauses with nominal arguments in post-verbal positions do not occur, the other IE-language display a high degree of variable word order, with and without postverbal *nominal* arguments within the same text. Here is a characterization that is not only representative for Sanskrit Vedic (Viti 2010: 58):

> "*Traditionally, Vedic is assigned a basic SOV word order, which is assumed to reflect the consistent SOV word order of PIE. Alternative arrangements such as OVS are wounded up as exceptions due to poetic license. This interpretation, however, does not capture the generalization that OVS occurs in a precise set of pragmatic situations*."
>
> "*In Vedic, different word orders are associated with different pragmatic situations, according to two main principles. First, the fronted argument is more specific, animate, and topical* (*in SOV, SVO, and VSO, the subject is more topical than the object; in OSV, OVS, and VOS, the opposite occurs*). [...] *Second, subject and object tend to be adjacent when they are semantically and/or pragmatically similar* (*in SOV, OSV, VSO, and VOS*)"

Note that the word order patterns found in Vedic, as discussed by Viti (2020), are the word order patterns characteristic of a T3 grammar. Information structuring takes a free ride, captures and partitions the word order freedom of T3 clause structures (Haider 2020) but does not enforce word order variation by itself. English is a good example for a language with rigid word order that resist any loosening of it by information structuring.

Having removed the SOV prejudice from ancient IE-languages, we are in a position to sketch a more plausible scenario for the changes that happened after the Proto-Romance and Proto-Germanic times and led to the present day grammars. The starting point in both cases – varieties of Vulgar Latin for Romance and Old Germanic varieties in the case of Germanic language – were T3 grammars. The present state of affairs is the following. Presently, all Romance languages are [S[VO]] languages; all Germanic languages are V2-languages and have split into an

[25] The brackets indicate that here, "SVO" refers to languages with head-initial phrases and a clause structure with an obligatory, VP-external subject position. In typological literature, "SVO" is construed as word order tape of languages in which a clause with a typical transitive verbs is preferably serialized as subject-verb-object. This is too loose a criterion.

[S[VO]] group (North Germanic) and an SVO group (continental West Germanic and Afrikaans).

The shared overarching change is the change from a directionally unconstrained licensing property of the head of a phrase (viz. T3) to a *fixed* directional licensing property, see Haider (2014). In the whole of Romance and in North Germanic, the verbal heads license 'to the right.' The result is a head-initial VP in a clause-structure with a functional head as directional licenser of the VP-internal subject in its otherwise directionally unlicensed position to the left of V°.

The Germanic situation is less trivial than in Romance because of the OV-VO type split. In North Germanic, the verbal heads license 'to the right', whereas in the continental West-Germanic group, the verb licenses 'to the left'. This split becomes better understandable once one takes into account the temporal overlapping of directionality fixing as one change and the emergence of the V2-property as another change. Because of the V2-structure of declaratives, the OV vs. VO difference was masked in large set of utterances, namely any main clause in which the finite verb is the main verb, as in (11). The licensing options amount to a binary parameter, that is, targeting left vs. right. It must not come as a surprise that either option has found its realization.

(11) a. Das Objekt folgt$_i$ meistens dem Subjekt $\leftarrow$**e$_i$** German
the object follows usually the subject
b. Objektet följer$_i$ vanligtvis **e$_i\rightarrow$** subjektet Swedish
object$_{Def.}$ follow$_{pres.}$ usually subject $_{Def.}$

The continental Scandinavian languages are strictly head-initial, caseless, and without verbal agreement. This comes close to a terminal step in the grammar evolution since such grammars are peaks in the adaptive landscapes of grammars and very stable. The arguments of a head are structurally identified, without any case and agreement morphology. This a purely procedural system of argument linking and phrase structuring.

Let's emphatically note, however, that there is no causal nexus between structural linking and loss of (case) morphology. Grammars may also provide both or even none. Icelandic, as already mentioned, uses both. It is a strict SVO language with a morphological case system. Bulgarian, on the other hand is a Type 3 language without nominal case morphology, and there are many languages with an in-between-status on the way from morphological to structural coding.

The preceding considerations entail an explanation of Sapir's (1921:174, 177, 180) three diachronic megatrends, namely the drift to fixed position, the drift to the levelling[26] between the subject and the object, and the drift toward the invariant word, as shown in Haider (2021a: 40-41): "*These three processes are entangled.*[27] *These are changes that on the one hand, shift the working load from the declarative to the procedural network in production and reception and on the other hand enhance predictability in parsing*)." The drift to fixed position is the drift to head-initial structures. This makes morphological linking redundant, resulting in a language

[26] "levelling between subject and object" = abolition of morphological case distinctions (s. Sapir 1921:714)

[27] "*The drift toward the abolition of most case distinctions and the correlative drift toward position as an all-important grammatical method are accompanied, in a sense dominated, by the last of the three major drifts that I have referred to. This is the drift toward the invariable word.*" (Sapir 1921:180).

with "the invariant word", that is, no agreement and case morphology and consequently no morphological differentiation of subjects and objects.

The interim summary is a follows: Evolutionary grammar change, based on variation & selection, gradually converges on systems with structural linking. In the course of this development, morphological linking becomes redundant. Evolutionary change is furthered by the fact that morphology strains the declarative memory network since it tends to become dissipative, with numerous patterns and exceptions. Structure-based linking, on the other hand, is a procedural task subserved by the procedural memory system, with a much better cost-benefit ratio. A structural system that subserves non-morphological linking best is one with head-initial phrases and an [S[VO]] clause structure. So, SVO has become a stable constellation and a grammar, which, after having reached this stage, is beyond the point of return in the diachronic development.

4. [S[VO]] – An inexplicable UG accident or an intelligible result of grammar evolution?

"*For every complex problem, there is a simple, easy to understand, wrong answer*" (H. L. Mencken). Here is an example: Languages tend to end up as SVO languages because SVO is the default grammar[28] defined by UG. This is the simple but wrong answer; the correct one is this. UG looks very much like English because the mother tongue of the master mind of UG happens to be English.[29] The UG idea is a how how-else-idea. How could children in the innocent age of three to six years grasp a highly complicated grammar system? Chomsky's answer is fanciful but begging the question: "*It's innate, stupid!*".

The more plausible answer is this: A language that a child could not acquire could not exist as a human language. Language acquisition is the bottle neck for grammars. This is exactly what the theory of evolution by natural selection entails. Languages are learnable for the trivial reason that each predecessor language was learnable and because a child could not learn an unlearnable grammatical feature.[30] A UG-explanation for grammar learning is tautological and dispensable: The first premise says that grammars can be overly complex and nevertheless learnable because an innate UG guides the grammar-learning processes. The second premise holds that there must be an innate UG since the UG-based derivationally overly complex grammars of languages could not be learnt otherwise. This is doubly worthless, as a tautological statement and as a how-else explanation.

There is a second explanatory pretension of UG which refers to cross-linguistic invariants of grammars. UG is seen as the explanatory background. Since UG allegedly determines the make-up of any human grammar, this will show in cross-linguistic invariants. Here is a biologist's reaction to this view:

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[28] But why on earth would they have departed from the default first of all? If UG constrains the development of grammars it would have prevented grammars from leaving the default constellation. After all, UG would have purged any deviations from the path of virtue.

[29] Try to imagine how UG would look like if N. Chomsky's mother tongue had been Japanese or Kayardild and his academic home had been in Australia or Japan. See Dixon (2010: 182), who notes that every modern grammar theory "*was developed by a native speaker of English, and is in the first place overwhelmingly justified for and exemplified by English*".

[30] This could even be proven by complete induction: Let G_0 to G_n be temporal successions of grammars of a given language in terms of generations of speakers (= learners = speakers = listeners). G_0 is learnable, otherwise there would be no later generation with grammar G. If G_i is learnable then G_{i+1} is learnable, as well, since unlearnable features of G_{i+1} would be necessarily cancelled.

"*Bemusement is this biologist's response when straying into cognitive territory, regarding its denizens prospecting for the universals of language and cognition. What could they be looking for, and what would the demonstration of a universal feature of language learning signify to them? [...] if any aspect of the world is structured, if available information has predictable content or history, or if information-processing capacities were limited, universals could arise from any or all of these sources, if we may draw parallels with other biological information-transmission devices*." Finlay (2009:261).

Biologists have demonstrated that the evolution of complex systems includes convergent developments when the same ecological restrictions are at work. As mentioned already in fn. 5, sea-dwelling mammals developed morphological traits of fish despite of their original terrestrial "UG". Typical fish look alike in the absence of any fishy "UG". They need not learn how to look like a fish and there is no fish UG. Their genome has been gradually tuned by evolution.

For grammars, the ecological restrictions are the restrictions of our general cognitive capacities that the language app depends on (and crucially not our communicative needs which are merely parasitic on the language app). They have a non-linguistic evolutionary history and have not been 'designed' for language processing. They act as the sieve or the bonus-malus system of selection that incurs emergent adaptation. These adaptive characteristics are what is perceived and misinterpreted as UG effects by Generativists. These traits are fully explicable without any recourse to innateness of a unique UG that would have to have fulgurated in just one species, namely homo sapiens, without any traces in closely related species. This is definitely not the way how biological evolution (s. "innateness") works, no matter how fervently one insists on innateness.

In sum, neither the poverty-of-stimulus argument nor the argument based on *partially* cross-linguistic invariants are compelling reasons to assume an otherwise completely unjustified idea of an innate universal grammar scheme.

5. Mono- or polygenesis of grammars

This is the right point to briefly touch the monogenesis vs. polygenesis topic. In a neuro-cognitive perspective, grammars are computational programs of mental language apps. Therefore, it is legitimate to ask whether there could have existed a single 'lingua adamica'[31], recte 'grammatica adamica', as the mother of all subsequent grammars. An innate UG would be the positive answer. UG would serve as the blue print for the grammar of the lingua adamica. Since highly specific mutations have their starting point in a single genome, just like the first case of HIV, an innate UG would have come into being and resided in the head of a *single* human in a *single* tribe. This person would be the 'mother of all grammars', that is, the first ancestor of all grammar-processing brains thereafter. But how would it spread and what happened to all others? This person could not take advantage of his linguistic talent since the others could not follow him. And the others? Would they die out all of a sudden as agrammatic? Some from the original population without the specific UG-mutation would maybe live on in the company of linguistically gifted tribe members, stuck in their two-to-three-word phase. Some descendants would even have made it into our days, wrongly diagnosed as SLI patients. Whoever finds this not

[31] "The idea of the divine origin of a first language was the common theory in the Western tradition from the first century CE until the first half of the eighteenth century." Schmidt-Biggemann (2016: 572).

only amusing but also a plausible narrative may remain happy with it, but nobody should expect a scientist to share such a fancy belief.

The evolutionary perspective invites a novel and promising perspective on this issue, that is consistent with the state of the art of the theory of evolution.[32] Given the scarcely populated African and Eurasian continents at that time, polygenesis of grammar right after the "*Me Tarzan – You Jane*" epochs is more probable than monogenesis. The cross-linguistic invariants of modern languages are the expected reflex of convergent cognitive evolution by constant cognitive selection of grammar variants by the invariant neuro-cognitive processing resources that constitute the human language-processing facility. In the evolutionary perspective, this is a well-known phenomenon. From the UG vantage point, the dissipative nature of UG is unexpected and hard to explain. Why are there languages like English on the one hand, and so-called *non-configurational* and *split-ergative* languages like Dyirbal on the other hand? For UG believers, this is a scandal since in the best of all Generativist worlds, every languages should be close to UG and look like English. In the evolutionary perspective, diversity is an unspectacular and expected situation. Evolution is dissipative.

Today, linguists are confronted with an apparently domain-specific language capacity. But this impression is merely a tunnel-view perspective on the problem. The specific ensemble of brain resources recruited for the language app may appear to be domain specific. However, its components are not domain-specific at all. They have all been recruited from the repertoire of already existing and therefore available cognitive processing resources of the primate brain. If viewed from this angle, there is no need for an innateness conjecture. The computational resources have been available for being recruited for novel tasks.

Take for instance human acoustic decoding. It capitalizes amongst other things on categorial perception. This capacity of our brain is not even species-specific. Chinchillas, monkeys, chicken or rats dispose of it, too (Kriengwatana et al. 2015). However, as it is an available and useful resource, it has gotten recruited for language processing. Language processing is parasitic on available brain functions. There is no single function that could be shown to have evolved just for language. The time span needed for biological evolution is much too long for such a recent capacity in homines sapientes. On the other hand, the whole ensemble of human computation resources is the selecting background environment for the evolution of grammars. Grammars adapt to them. A grammar variant has a chance to occupy more brains if it is better adapted, that is, if it is rewarded by brains that reward structures that can be learned and processed and used more easily and effectively. This is the normal course of evolution by natural selection and it is the course of cognitive evolution, too.

6. Conclusion

Grammar change, as far as the procedural components are concerned, is a facet of cognitive evolution. The degree of word order variation – from near zero to nearly free – is determined by the phrase and clause structure, which is a target of cognitive evolution of the grammar system. SOV is a stable peak in the 'fitness landscape' of grammars and so is SVO. Most alleged SOV-to-SVO changes are T3-to-SVO changes. For IE-languages, this is a fact, since no ancient IE-language was an SOV languages, except for Hittite. The particular change from T3

[32] The following paragraphs draw on Haider (2019).

to OV is a single property. Heads get associated with a directionally operating linking constraint. Instead of associating with dependents on either side, as in T3, they either follow (in "OV" structures) or precede their nominal arguments (in "VO" structures). The numerous collateral properties follow from independently motivated conditions.

Diachronically, SVO is predicted to be the most recent development. In this clausal architecture, the procedural network has completely taken over. Such grammars are at the core of the most efficient solutions to the string to structure mapping tasks of grammars.

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