

# Temporal/Linear order, antisymmetry and externalization

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**Abstract.** The study of cross-linguistic word order gaps supports the antisymmetry hypothesis, which in turn indirectly supports the claim that the language faculty has met the challenge of externalization by partially integrating temporal order into its core, via the integration of order into Merge. Possible implications for phonology are discussed.

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## 1 Introduction

The term ‘linear order’ is a familiar and useful one when talking about word order, but it leaves unsaid something important that is present in the more explicit term ‘temporal order’. The ‘order’ in ‘word order’ is temporal order. To say, for example, that English has P-DP order is to say that the preposition is pronounced (apart from cases where it might be silent) prior to the pronunciation of DP. Sentences and discourse unfold in time. I will return to the question of time later in this paper.

## 2 Word Order

Chomsky (2020) has correctly emphasized that one hears linear order, but not hierarchical structure. Yet, despite this, the long-standing head parameter approach to cross-linguistic word order variation has over the years taken it for granted that English-type VO sentences and Japanese-type OV sentences are straightforwardly showing us sisterhood relations (despite our not hearing the structure), with VO and OV both corresponding in this view to (often derivation-final) head-complement and complement-head configurations.

At the same time, (almost) everyone agrees with Pollock (1989) and others that French VO sentences, in particular those with a finite verb, involve V-raising. In which case, French VO does not at all correspond to a derivation-final sister relation. With this in mind, and thinking also of Pearson (2000) on Malagasy, let me, in opposition to the head parameter tradition, make the following much more general proposal:

- (1) Neither VO nor OV ever reflects a derivation-final sister relation, in any language.

Whether verbs raise to one degree or another in all languages remains to be determined. (Johnson 1991 has argued that they do even in English.) But the following conjecture related to (1) seems to me likely to turn out to be valid:

- (2) Arguments invariably raise at least once, in all languages.

A further, more general conjecture is the following (which rests in part on Baker’s (1988: 46) UTAH principle):

- (3) All cross-linguistic word order differences are traceable back to movement differences.

A natural extension of this, as in Kayne (2019a), is:

- (4) All cross-linguistic morpheme order differences are traceable back to movement differences.

For example, with respect to (4), English reversive *un-*, as in *undo*, *unpack*, seems to have a (partial) suffixal counterpart in Bantu languages (cf. Schadeberg 2003: 79). From (4) it then follows that English and the relevant Bantu languages must differ either in V(P)-movement or in the movement of this (counterpart of) *un-*, or in both.

### 3 More on OV

Although Japanese-type OV incorrectly, I think, does lend itself to the idea that O and V can be sisters derivation-finally, there are other languages in which O normally precedes V that show directly that derivation-final sisterhood is immediately implausible. These are languages with canonical/neutral OXV order.<sup>1</sup>

One case of OXV comes from languages of the sort studied by Dryer (1992), with ONegV as a possible canonical order (as in Korean). As noted by Whitman (2005), on the standard assumption that Neg is outside VP, and therefore above the external merge position of O, the pre-Neg position of O in SONegV sentences must have been produced by movement of O to the Spec of some higher head. In a SONegV sentence, O is clearly not occupying the complement position of the pronounced V.

Whitman argues more specifically that SONegV is produced by remnant VP-movement. The verb moves out of the VP by head movement;

1. In effect, then, OV order in Japanese is to be reduced to one or another (perhaps more than one) of the various instances of canonical leftward object movement mentioned in this section for other languages.

Whether or not these object movements are ‘triggered’ is a partially separate question. The triggering of movement was of little importance in Kayne (1994) (cf. p.140, note 3), and has been turned away from in Chomsky, Gallego & Ott (2019: 237-238).

Also partially separate is the question of ‘shape preservation’ discussed by Shu (2018) and references cited there. Taken as a general principle, shape preservation (which could perhaps be formulated in a way compatible with antisymmetry) would have to come to grips with counterexamples such as negative phrase movement in Scandinavian (cf. Christensen 1986 and Svenonius 2000), stylistic fronting in Icelandic (cf. Ingason & Wood 2017), the movement of *tout* (‘all’) and *rien* (‘nothing’) in French (cf. Kayne 1975 chap. 1), many instances of the movement of object clitics in Romance languages (cf. Kayne 1991) and V-2 of the Germanic sort.

subsequently the entire (verbless) VP containing O moves past Neg, much as in Nkemnji's (1992, 1995) analysis of one word order pattern in Nweh.

An alternative to remnant VP-movement for SOXV is to have O move past X by itself. Kandybowicz & Baker (2003) in fact argue that both options are available. While remnant VP-movement is appropriate for Nweh and also for Lokaa, movement of O by itself is called for in Nupe. (This difference correlates, as they show, with the fact that Nweh and Lokaa allow S-PP-X-V, whereas Nupe does not.)

The OAuxV order that Lokaa also allows is again a clear instance in which O cannot be in the complement position of V. Such sentences are also found in some cases in Dutch and German, in particular in (embedded instances of) so-called IPP sentences, as discussed by Zwart (2007) among others. An example from German would be:

- (5) Ich glaube, dass er das Buch hätte lesen wollen.  
 I believe that he the book would-have to-read to-want  
 'I believe that he would have wanted to read the book.'

In this example, the object *das Buch* ends up preceding the auxiliary *hätte*, which in turn precedes the lexical verb *lesen*.

There is in addition the case of Malayalam, in which objects must surface in a position preceding that of VP-external focus (i.e. Malayalam has OFocV), as emphasized by Jayaseelan (2001). Somewhat differently, returning to Dutch and German, we can note that in both those languages the infinitive marker (*zu* in German) must intervene between object and verb and so, too, must (abstracting away from V-2) what are called separable particles (*mit* in the following example), with an example from German being:

- (6) ...das Buch mitzubringen.  
 ...the book with to bring  
 '...to bring along the book.'

The object *das Buch* here precedes the infinitival verb *bringen*, but does not immediately precede it, and is clearly not in a sister position to it. (Cf. the fact that in West Flemish embedded sentences objects precede one of the negation markers, as discussed by Haegeman 2001, 2002.)

## 4 How not to study word order variation

Greenberg (1966) has shown that studying word order variation pairwise is not sufficient. He found that if you look, for example, at the pair Dem and N, you find that both ordering possibilities (Dem N, as well as N Dem) are attested cross-linguistically. And the same holds for Numeral and N, with Num N order attested in some languages, and N Num order in others, as well as for Adj and N. In other words, looking at these three pairs separately gives the initial impression that the language faculty is highly flexible.

Yet, as Greenberg showed in his Universal 20, if you examine combinations in which all four of these categories occur together, the picture changes dramatically. A strong asymmetry appears. If N is final, then the order of the other three is in fact fixed, and one has ‘Dem Numeral Adj N’ order. Whereas if N is initial the order of the other three is not fixed; for details and theoretical underpinning, see Cinque (2005, 2020).

As Cinque shows in those papers, this asymmetry between prenominal order and postnominal order fits directly into the antisymmetry proposal that I made in Kayne (1994), from the perspective of which such left-right (pre-N/post-N) asymmetries are expected.

As Cinque (2009) further shows, such complex left-right (pre-X/post-X) asymmetries are in fact more widely found than just in the case corresponding to Greenberg’s Universal 20. As in Greenberg’s case, these asymmetries come to the fore only if one examines the relative order of larger sets, not just pairs, of elements.

## 5 Antisymmetry

In general, empirical arguments that support antisymmetry (which could be taken to be an instance of anti-optionality) also rest on more than just observations concerning the relative order of pairs of elements. Often, they involve cross-linguistic gaps (in the study of syntax, as we know, it is essential to see and examine what is not there); antisymmetry can then be thought of as grouping together a substantial set of Greenbergian cross-linguistic generalizations and providing a single theoretical account for all of them.

As an initial example, let me take Cinque’s (1977) demonstration that Italian has two distinct types of left-dislocation, one of which he calls “hanging topics.” Hanging topics occur at the left-hand edge of the sentence. As far as I know, there has never been a claim to the effect that there exists something exactly comparable on the right-hand edge of the sentence, in any language. (The core reason for the absence of

right-hand hanging topics, from the perspective of antisymmetry, is the prohibition against right-hand specifiers.)

The other type of left dislocation that Italian has, namely clitic left-dislocation (CLLD), as discussed in detail in Cinque (1990), does at first glance seem to have a right-hand counterpart, usually called (clitic) right-dislocation. Yet the pairing of CLLD and clitic right-dislocation (CLRD) is misleading. As argued by Cecchetto (1999) for Italian and by Villalba (1999) for Catalan, there are sharp asymmetries within each of those two languages between CLLD and CLRD, a fact that would be quite surprising if the linguistic universe were not antisymmetric. (More specifically, the antisymmetric prohibition against right-hand specifiers forces a remnant movement analysis and/or a bi-clausal analysis of CLRD (cf. Kayne 1994: sect. 7.3 and, for Japanese right-dislocation, Tanaka 2001); but this does not hold for CLLD, at least not in the same way.)

## 6 Antisymmetry and relative clauses

In a symmetric syntactic universe, one would have expected prenominal and post-nominal relatives to be similar, merely differing in their order with respect to the “head” of the relative. However, Downing (1978) and Keenan (1985) noted substantial differences. These can be stated as follows (setting aside correlatives, and keeping to relatives that are in their canonical position for the language in question):

- (7) Prenominal relatives (as opposed to postnominal relatives) generally lack complementizers akin to English *that*.
- (8) Prenominal relatives (as opposed to postnominal relatives) usually lack relative pronouns.
- (9) Prenominal relatives (as opposed to postnominal relatives) tend to be non-finite.

These differences fed into the proposal in Kayne (1994) to the effect that prenominal relatives always originate postnominally. A particularly striking piece of evidence in favor of such post-N origin comes from Kornfilt (2000), who observes that the Turkic languages Sakha and Uigur have prenominal relatives whose subjects trigger agreement such that the agreement morpheme actually appears following the “head” noun. She proposes that this agreement is produced via leftward movement of an originally postnominal relative containing a high Agr element that is stranded by that movement.

In an antisymmetric syntactic universe, the following should turn out to be correct (as seems to be the case):

- (10) No postnominal relatives ever have their subject determining agreement such that the agreement morpheme precedes the “head” noun.

In other words, the ‘mirror image’ to Sakha and Uigur should not and seems not to exist.

## 7 Antisymmetry and coordination

A somewhat similar window on the architecture of the language faculty is provided by a certain type of coordination, as Zwart (2009) shows. According to Zwart, if one looks cross-linguistically at NP/DP-coordination counterparts of English *and*, and if one limits oneself to coordinations in which this *and* appears only once, one finds that *and* and its counterparts invariably occur between the two conjuncts:

- (11) a. NP and NP  
 b. \*and NP NP  
 c. \*NP NP and

Zwart draws the reasonable conclusion that this limitation to one possible order must be reflecting absence of movement. In antisymmetric terms, this seems to be telling us that *and* is a head, that the two conjuncts are specifier and complement of *and*, and that the order is as it is in (a) because S-H-C order is the only order made available by the language faculty.<sup>2</sup>

Concerning (11b), Zwart is in agreement with Stassen (2000: 15). However, Stassen (2000: 14) notes that (11c) does not hold in Latin, Pitjantjatjara and Tubu. At the same time, Stassen makes the plausible proposal that these apparent counterexamples to (11c) can be thought of as involving deletion of a second ‘and’, i.e. they would in fact be of the ‘NP and NP and’ type, and hence not true counterexamples to (11c).

A second possible way in which such apparent counterexamples to (11c) might be dissolved would rest on the claim that in (some of) the relevant languages, the apparently coordinating element in question does not actually correspond to *and* (a key sort of question in all comparative syntax work). This has some plausibility for Latin *-que*, to judge by

2. An alternative approach to coordination (and disjunction) compatible with antisymmetry is given in Jayaseelan (2016).

Gildersleeve and Lodge's (1895: 300) statement that Latin *et* "is simply *and*, the most common and general particle of connection" and that "*-que* (enclitic) unites things that belong closely to one another",<sup>3</sup> which suggests that *-que* might be closer to English *as* (cf. *just as*, *as well as*) than it is to *and*; if so, Latin *-que* would not be relevant to (11c).

The head status of *and* is also suggested by the apparent fact that the '*and* NP *and* NP' type of coordination (possible in French, e.g. *et Marie et Jean*) is only found in languages that would otherwise informally be thought of as 'head-initial'; and by the related fact that the 'NP *and* NP *and*' type is only to be found in 'head-final' languages. (Indirectly related to this is Johannessen's (1998: 270) discovery that "out of 12 OV languages, 11 have the deviant UC [Unbalanced Coordination] conjunct in the first position; out of 14 VO languages, all have the deviant UC conjunct in the second position".)

That coordination is not symmetric is supported in a number of different ways by Johannessen's (1998) general discussion of Unbalanced Coordination, as well as by the following contrast involving the bound reading of *his*:

(12) ?Every little boy and his mother came to the party.

(13) \*His mother and every little boy came to the party.

This contrast suggests that the first conjunct c-commands the second, but not vice versa. In addition, we can note the following:

(14) They went to the store and bought food.

(15) They bought food and went to the store.

The first of these has a very natural interpretation that is temporally asymmetric, with the *going to the store* leading to the *buying of food*. That exact interpretation is absent from the second example, in a way that would be surprising if coordination were symmetric. (What may further be at issue here is the presence of a silent THEN in the second, c-commanded conjunct that is not allowed to appear in the first, c-commanding conjunct, in a way that recalls Condition C of the Binding Theory.)

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3. Wayles Browne (p.c.) points out that Latin *que* is, more strictly speaking, "an enclitic after the first member of the second NP", which makes it even less like English *and*.



## 8 Antisymmetry and adverbs

As another example of the way in which antisymmetry ‘shows through’, let me briefly mention some adverb facts. AuxV languages often allow intervening adverbs between Aux and V, as in English *John has recently seen both those films*, whereas VAux languages generally do not. In addition, there are VO languages (such as English) in which V and O cannot be separated by adverbs. What seems to be unattested, though, is an OV language (of the sort that has all the pieces of the VP ending up preceding V) that would systematically forbid its adverbs from intervening between O and V (in particular when O is definite). In a symmetric syntactic universe, these asymmetries concerning adverbs with respect to AuxV vs. VAux and with respect to VO vs. OV would be unexpected.

## 9 Antisymmetry and the antecedent-pronoun relation

English readily allows both of the following:

(16) The fact that John is here means that he’s well again.

(17) The fact that he’s here means that John is well again.

Both (16) and (17) have the property that in them neither *John* nor *he* c-commands the other, with English thereby giving the impression that in such non-c-command configurations anything goes. This impression fed into Lasnik’s (1976) claim that pronouns could in general freely take antecedents subject only to conditions B and C of the binding theory.

But English is not representative. Michel DeGraff (p.c.) has told me that in Haitian Creole “backward pronominalization” of the sort seen in (17) is systematically impossible. Huang (1998: sect. 5.5.2) indicates that Chinese has much less backward pronominalization than English. Craig (1977: 150) in her grammar of Jacaltec says that Jacaltec has no backward pronominalization at all. Allan et al.’s (1995: 473) grammar of Danish says that Danish has either none or at least much less backward pronominalization than English (cf. Thráinsson et al. (2004: 331) on Faroese). Jayaseelan (1991: 76) says about Malayalam that some speakers of Malayalam allow no backward pronominalization at all.

I don’t know of any languages, though, that completely or partially prohibit forward pronominalization of the sort seen in (16) in a parallel fashion. There thus seems to be a precedence-based asymmetry concerning antecedent-pronoun relations in contexts of non-c-command, of a

sort that would be unexpected in a symmetric syntactic universe. (For relevant discussion, see Kayne 2002.)

## 10 Externalization

In his recent work, Chomsky has suggested that linear order is not part of core syntax and that linear order comes into play only as the result of externalization. This differs from the position taken in Kayne (1994). We can now ask to what extent antisymmetry might nonetheless be compatible with Chomsky's view of externalization.

One very general way to think of antisymmetry is in terms of trees and mirror-images, with antisymmetry holding that for every given pair of mirror-image trees, at most one can be well-formed. More specifically, antisymmetry claims that linear order is dependent on structure; in particular for every projection, the mapping to linear order must invariably yield Spec-Head-Complement order. There is no optionality of the head-parameter sort.

Antisymmetry as in Kayne (1994) also required that there be only one Spec per projection, in a way that has fed into cartography work, as exemplified by Rizzi (1997) and Cinque (1999).

My impression is that in externalization terms one could, if one agrees that S-H-C is basically correct for any or all of the reasons given above, incorporate antisymmetry into the mapping from core syntax to PF.

A question remains, though. Why does antisymmetry hold? (In 1994 terms, why is the LCA part of UG?). In Kayne (2011, 2019a), I suggested that an answer to this question is available, but that it requires taking linear order to be part of core syntax, via a certain use of an alternative to standard Merge that was mentioned but not pursued in Chomsky (2008) (cf. Chomsky 2020 on Pair-Merge, though his use of it is different from mine, as is Saito and Fukui's (1998), which retains a head parameter orientation), namely that Merge should always be taken to form the ordered pair  $\langle X, Y \rangle$ , rather than the set  $\{X, Y\}$ .

(One would like to know to what extent human cognition favors temporal ordering in non-language domains.)

Chomsky (2020) takes the opposite view, i.e. he takes the view that linear/temporal order is not at all part of core syntax, in part on the basis of the point that differences in linear order do not feed differences in semantic interpretation, which depends only on structure (and on lexical items and features).

But this point rests on the assumption, denied by antisymmetry, that linear order can vary independently of structure (as it could have in the head parameter tradition). If, on the other hand, linear order is

fully determined by hierarchical structure, then there is no reason to expect it to be able to make its own independent contribution to semantic interpretation. If so, then linear order can, as far as interpretation is concerned, still be part of core syntax.

Another (long-standing) reason why Chomsky has taken linear order not to be part of core syntax has to do with examples that show that internal merge cannot take the linearly closest auxiliary in English subject-aux inversion.<sup>4</sup> Thus starting from:

(18) Somebody who is in Paris is on the phone.

one cannot conceivably derive:

(19) \*Is somebody who in Paris is on the phone?

The question arises, though, as to whether this strong prohibition might derive from independent structural factors, e.g. from the general impossibility of extraction from within a subject phrase, or from within a relative clause. Such extraction, however, does not always yield a violation as strong as that of (19); to my ear the following is less sharply deviant than (19):

(20) ??? a man who close friends of like us a lot

especially with parasitic gaps:

(21) ? a man who close friends of admire

One can, on the other hand, reach a violation as sharp as that in (19) if, instead of extracting an argument, as in (20) and (21), one tries to extract a non-argument such as an adverb. Thus, starting from:

(22) Somebody who was speaking loudly left very suddenly.

it is sharply impossible to derive:

(23) \*How loudly did somebody who was speaking leave very suddenly?

and similarly even for parasitic gaps (where the notion of ‘closest’ is not obviously relevant). For example, starting from:

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4. Indirectly relevant here is the question whether Internal Merge is triggered; for Chomsky (2019: 268) it is not.

(24) Somebody who was behaving badly was near somebody else who was behaving badly.

one cannot reach:<sup>5</sup>

(25) \*How badly was somebody who was behaving near somebody else who was behaving?

Similarly, a parasitic gap counterpart of (19) remains strongly deviant:

(26) \*Is somebody who in Paris on the phone?

If (19) is sharply deviant for the same reason as (23), (25) and (26), then (19) is compatible with taking linear order to be part of core syntax.

## 11 No counting

Chomsky (2020) also mentions work by Moro (2003) showing that Broca's area activation does not take place when subjects are presented with an 'unreal' language in which, for example, negation would be the third word in a sentence. This is obviously a telling point, but I don't think it bears directly on the question whether linear order is part of core syntax. Rather, what it shows, I think, is that the language faculty doesn't count numerically. Clearly it doesn't count words in linear order.

But it also doesn't numerically count structural notions such as depth of embedding. As far as I know, no syntactic operation takes, or could possibly take, as its goal a phrase that would be exactly three nodes down from the (node immediately dominating the) probe. Nor could any syntactic operation search for a phrase that is the third closest, structurally speaking.

That numerical counting is not countenanced by the language faculty is itself something that needs to be understood (in particular against the background of Chomsky's (2019: note 27) proposal that arithmetic is an offshoot of the language faculty), but its unavailability does not imply that linear order is not part of core syntax.

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5. The same holds of Chomsky's (2020) example:

(i) Carefully the guy who fixed the car packed his tools.

The adverb *carefully* cannot originate within/be extracted from the relative clause embedded within the subject, whether there is in addition a parasitic gap or not.

## 12 Semantic interpretation and core syntax

Returning to the question of semantic interpretation, where I have taken the position that even though linear order doesn't directly feed into it (since linear order is antisymmetrically determined by hierarchical structure) linear order is nonetheless part of core syntax, let me take all this to be part of a broader question, namely whether or not semantic interpretation must take into account all aspects of core syntax.<sup>6</sup>

Semantic interpretation ignoring some aspects of core syntax would have something in common with phonetic interpretation not requiring that all aspects of phonological structure have a phonetic counterpart (e.g. deleted phonological segments).

This broader question ties into one raised by Chomsky, Gallego & Ott (2019), who state that “Whether...semantically vacuous scrambling, extraposition, clitic movement etc., ...reflect narrow-syntactic computations or are part of the mapping to PHON...is an open question”. (Relevant here is Arano's (2022: sect. 4.2) argument that scrambling in Japanese must take place in narrow syntax.)

If (2), repeated here:

(27) Arguments invariably raise at least once.

is correct, then even arguments that appear in their canonical/neutral position in the language in question (including in VO languages) will have been moved there in what appears to be a semantically vacuous way (unless the semantics pays important attention to the link between even an argument in canonical position and its trace).

But what I'm really getting to is the fact that semantically vacuous syntactic operations can in principle also be diagnosed as being part of core syntax in another way, namely through their interactions with other core syntactic operations. Take, for example, relative clause extraposition, which feels semantically neutral in pairs like:

(28) Somebody who I used to know in high school just walked in.

(29) Somebody just walked in who I used to know in high school.

Yet there is a restriction seen in:

(30) The only person who I liked in high school just walked in.

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6. Relevant here is Chomsky's (1995: 151) Full Interpretation principle, whose interaction with idioms needs to be clarified.

(31) \*The only person just walked in who I liked in high school.

presumably due to a property of the scope of *only* that must surely be (keyed to) part of core syntax. In a partially similar way, consider clitic movement, which in simple cases seems to have no semantic effect. Yet we have contrasts in French of the following sort:

(32) Combien (\*en) ont lu ton livre?  
 how-many (of-them) have read your book

(33) Combien tu \*(en) a lus?  
 how-many you (of-them) have read

When one fails to pronounce the noun that goes with *combien* ('how many'), the clitic *en* ('of them') is obligatorily present in the object case (33), yet impossible in the subject case (32). The obligatoriness in (33) tracks:

(34) Tu \*(en) a lu beaucoup.  
 you (of-them) have read a-great-deal

suggesting strongly that the movement of clitic *en* in (33) must be taking place prior to *wh*-movement. If so, then, since *wh*-movement is part of core syntax, so must be clitic movement (at least in this case), despite its semantic neutrality.

That clitic movement is part of core syntax is also suggested by its interaction with raising to subject position, in cases in French such as:

(35) Le premier chapitre semble en être intéressant.  
 the first chapter seems of-it to-be interesting

The clitic *en* ('of it') originates within the DP containing *le premier chapitre* ('the first chapter'). It clearly must move to clitic position within the embedded infinitival phrase prior to the raising of *le premier chapitre*. Since that raising is part of core syntax, so must the movement of *en* be, despite its (apparent) semantic neutrality. (Relevant here is Uriagereka 2000 on the semantics of clitic doubling; also Déprez 1998 and Obenauer 1992 on semantic effects of past participle agreement in French; as well as Ikawa 2022 on how Agree feeds interpretation with Japanese honorifics.)

Finally, take verb raising of the sort discussed in Pollock (1989), which as Chomsky (2020) emphasizes is also semantically neutral. Yet in Kayne (1991) I argued that Romance infinitival verb raising has an

effect on whether or not PRO is admissible as the subject of a Romance infinitival *if*-clause. In some Romance languages it is, and in others it is not, correlating with whether or not the Romance language in question moves its infinitives past the landing site of its object clitics. If so, then Romance infinitival verb raising must be part of core syntax, despite (apparently) being semantically neutral.

Indirectly related to this is in turn the following contrast from French (judgments from J-Y Pollock):

(36) le livre que la femme dont Jean est amoureux lui a  
 the book that the woman of-whom John is in-love him has  
 offert  
 given  
 ‘the book that the woman who John is in love with has given him’

(37) le livre que lui a offert la femme dont Jean est  
 the book that him has given the woman of-whom John is  
 amoureux  
 in-love  
 ‘the book that the woman who John is in love with has given him’

In (36) the word order within the relative clause is ‘canonical’; in (37), the VP *lui a offert* (or some larger constituent) has moved to the left of the subject *la femme dont Jean est amoureux* (for discussion of this derivation, see Kayne & Pollock 2001). What is of interest now is the fact that the pronoun *lui* can take *Jean* as antecedent in (36), but not in (37). VP-raising has affected pronoun-antecedent relations in a way that suggests that at least this kind of VP-raising is part of core syntax.

### 13 Partial linear order and total linear order

The position that I took in section 10, to the effect that Merge should always be taken to form the ordered pair  $\langle X, Y \rangle$ , rather than the set  $\{X, Y\}$ , introduces linear order into core syntax, but only in a partial way. The formation of the ordered pair  $\langle X, Y \rangle$  tells us that X is linearly ordered before Y, but at the same time it tells us nothing explicitly about subconstituents of X or of Y. In particular, it does not explicitly tell us that subconstituents of X are linearly ordered before subconstituents of Y.

Put another way, the Merge-based building up of syntactic structure via the formation of ordered pairs creates in core syntax a partial, but not a total, linear ordering. In a way reminiscent of Kayne (1994: 5), we

can move to a total ordering by adopting:<sup>7</sup>

(38) For all  $\langle X, Y \rangle$ , all the terminals dominated by  $X$  precede all the terminals dominated by  $Y$ .

If we now take (38) to be part of externalization/not to be part of core syntax, we reach the conclusion that core syntax involves a partial linear order, but not a total linear order. That partial linear order will suffice, however, if Kayne (2011, 2019a) is on the right track, to account for the fact that syntax is antisymmetric (in 1994 terms, to account for why the LCA holds).

## 14 Time

Returning to the terminological question having to do with ‘linear order’/‘temporal order’, we now see that to say that (partial) linear order is part of core syntax is to say that (partial) temporal order is part of core syntax. Conversely, to say that linear order is not at all part of core syntax is to say that temporal order is not at all part of core syntax. Which is in turn to say that the language faculty has not integrated into its core any notion of time.

Put another way, the question for future work (not limited to linguistics) is whether or not the human brain has or has not entirely disregarded time at the very core of one of its most important components, as well as to what extent the human brain integrates notions of time in other areas of cognition, broadly interpreted.

The proposal made earlier (with Merge forming ordered pairs) amounts in effect to saying that the language faculty has met the challenge of externalization by partially integrating temporal order into its core.

## 15 Appendix. Speculations on Phonology

Morphemes are not atomic, insofar as they are composed of (a syntactic feature associated with) phonological segments, in turn composed of phonological features. Assume that composition, in this sense, is not distinct from merge. If so, then the language faculty will have phonological features merging to form segments (cf. in part the Government

7. Rizzi (2018: 343) notes the existence of (weaker, as compared with hierarchical) linear intervention effects. The weakness of these linear intervention effects may be due to their being dependent on the precedence relations induced by (38), outside of core syntax.



Phonology subtradition of the 1980s, as exemplified by Kaye, Lowenstamm & Vergnaud 1990; and more recently Kayne 2016, 2019b and especially Den Dikken & van der Hulst 2020), and segments merging to give the phonological form of a morpheme.

Consider now the possibility that there is and can be just one single ‘merge engine’ that covers both syntax and phonology (thereby precluding, via strict cyclicity, late insertion of the DM or nanosyntax or generative semantics type). This would mean, in effect, that the language faculty has found a way to ‘internalize’ phonology (not phonetics), differently from the strong separation associated with ‘externalization’.

If (temporal) precedence is an integral part of phonology, as seems clear, and if merge encompasses in a uniform way both phonology and syntax, then the claim that (temporal) precedence is an integral part of (core) syntax is reinforced.

If phonological features are brought together by merge, and if it holds with complete generality that the output of merge is associated with precedence/temporal order, then the expectation arises that phonological features within a segment must always be temporally ordered (in addition to being hierarchally arranged). (Such ordering has actually already been suggested for particular cases, by terms like ‘prenasalized stop’ (cf. Maddieson 1989) or ‘prestopped nasal’ (cf. Turpin 2014 and Round 2014), in the case of consonants; for vowels, one might think of diphthongs.)

Dominique Sportiche (p.c.) has pointed out that if bottom-to-top derivations include phonological features, we might expect the interpretive component to see such features, just as it sees higher level constituents, which might lead to a possible integration into grammatical theory of the tradition of phonetic/phonological symbolism.

On the assumption that signed languages are strongly akin to spoken ones, we would expect the present approach to carry over to the phonology (and syntax) of signed languages, at some suitable level of abstraction.

The syntactic transformational cycle of Chomsky (1965) had a parallel in the phonological transformational cycle of Chomsky & Halle (1968: 15). One could ask why phonological rules would happen to apply in precisely that cyclic way. A possible answer would have it that phonological rules or operations must be interpretable as instances of internal merge (including Agree, as in Nevins 2010: 192), in which case their bottom-to-top character will fall out of the bottom-to-top character of (phonological) merge in general, including external merge (both of features and of segments).

The notion of phonological cycle here will need to be fleshed out in terms of phases. If properly done, that might tell us why standard

syntactic movement operations are insensitive to phonology, i.e. they appear never to ‘see’ the phonology. (For example, no syntactic fronting operation picks out phrases whose initial phonological segment is a glide.) The reason might be that, once the point of application of these syntactic operations is reached, the phonology will be too deeply buried, phasally speaking (cf. Chomsky’s PIC).

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