Meeting Interface Requirements on Coordinate Structures: the need for interface input at Selection[*]

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abstract

In this investigation I consider primarily coordinate structures in English, German and Dutch for determining what coordinate symmetries the semantic interface requires in them, and what these symmetry requirements suggest about the design of a generative grammar. Of particular interest is the fact that they, like many binding relations, extend across phase boundaries and thus challenge the Phase Impenetrability Condition (PIC), even without the assumption that all conjuncts are phases. I argue that if we assume that the interfaces determine conditions on the derivation, then it follows that the semantic interface must also be present at Selection so that all the semantic features required at Spell-Out are part of the numeration. The need for invasive interfaces of this sort is created by the limitations of Narrow Syntax and Selection, in particular that operations do not extend across phase boundaries and that semantic symmetry requirements are not checked in Narrow Syntax. To overcome this design limitation, I propose that many semantic symmetries are established at Selection with features chosen by an invasive semantic interface (Logical Form, LF), and that LF is also active in Narrow Syntax with feature valuation. In this way an invasive LF-interface prevents crashes at Spell-Out due to unacceptable semantic asymmetry in coordinate structures.

1. Introduction

In recent years an area of increased interest in the generative literature concerns the degree of interaction that is possible or necessary between the components of a derivational grammar, cf. especially Boeckx (2007), Embick (2010), Müller (2011), Putnam & Stroik (2011) and Vasishth & Lewis (2006). One aspect of this interaction that will be the focus here concerns

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the interface requirements on coordinate structures for their interpretation.[1] I will argue that these requirements cannot be met unless the selection of the lexical items (LIs) for the second conjunct is guided by feature information from the first conjunct via the LF-interface. As a simple illustration, consider the derivation of (1):

(1) *Bill placed the book on his lap and soon he was enjoying it again*

There are a number of coordinate symmetries, which I will also call 'matches', that must obtain for the interpretation of this structure. These symmetries can be categorized according to feature type: i) semantic, ii) formal, and iii) phonological. To keep the length of this investigation manageable, I will not consider the matching of phonological features, which involves the interface with Phonological Form (PF). The semantic features that must match for interpreting the subject *he* as coreferential with *Bill* are i) the gender and ii) number features of *Bill* and *he*: both must be [MASC], and [SG]; for *the book* and *it* to be coreferential, the features on both must be [NEUT] and [SG]. The verbs must also meet at least one symmetry requirement for the interpretation of the two conjuncts as constituting one event with sequenced actions: both verbs mut have the feature [PAST]. Of the formal features that contribute to the symmetry of the coordinate structure are i) the Case of *Bill* and *he*, both must be [NOM], and ii) the Case of *the book* and *it*, both [OBJ].[2] It is assumed in Minimalist approaches that Case is an uninterpretable feature and is therefore eliminated from the derivation before it reaches the interfaces, since the Case feature is redundant with the syntactic configuration. I will argue below that Case features can nevertheless play a role in deriving a symmetric structure, with the difference that the LF-interface cannot read them. Also relevant to the interpretation based on these coreference relations is the structural (possibly only linear) relation between the two conjuncts; note that if the reverse ordering of the DPs is used, the coreferential relations are no longer possible:

(1') **He*$_i$ *placed it*$_j$ *on his lap and soon Bill*$_i$ *was enjoying the book*$_j$ *again*

The coreferential relations in (1) between *Bill* and *he* and between *the book* and *it* that extend across clause boundaries require, I will argue, a Selection operation for at least the second

[1] Structures involving binding relations, especially of variables and Principle C items, often require relations extending across phases and thus also illustrate essentially the same problem as coordinate structures.
[2] Unlike the gender and number features, the Case features do not need to match for a well-formed structure:
(i) Bill$_i$-NOM placed the book$_j$-OBJ on his lap and it$_j$-NOM soon had him$_i$-OBJ captivated

conjunct that has access to features in the first conjunct. Unless Selection is guided by this feature information, it is impossible for LIs to be selected that can be matched with equivalents in the way just described; it is precisely these matches that the interpretation is dependent upon. Note that in (1) an optional reading without the coreferences discussed above is also possible, a fact that provides further evidence of matching as a necessary operation to get the reading with the coreferences. The seletion of the LIs for this reading requires input from LF, I argue, because the coreferential relations that extend across clause boundaries are beyond the scope of the relations handled in Narrow Syntax. Simplex structures in which coordinate relations extend across phase boundaries, for instance in the conjunction of DPs, also require this kind of LF-guidance at Selection.

Thus, the core of the problem investigated here is explaining how LIs in conjoined structures are selected so that they are interpretable at the interfaces and do not cause a (fatal) crash; in that sense my investigation follows the line of reasoning put forth by Frampton & Gutmann (2002) who argue that a crash-proof syntax is better able to address the issue of optimal design, which is of central interest to Minimalist inquiry. Although Frampton & Gutmann outline briefly how Selection should operate in a crash-proof syntax, their proposal does not account for the symmetries described above. My proposal will following the same general logic but it will require, as stated, input from LF, whereas the Frampton & Gutmann proposal does not.

Earlier I stated that Case features can play a role in Narrow Syntax for determining the symmetries required. I will assume that Narrow Syntax must be assisted by Working Memory (WM) as a temporary storage space for making Case-feature matches.[3] WM is also more generally useful in the derivation of conjoined clauses because, as we will see below, both/all conjuncts cannot be merged simultaneously; rather, after one conjunct has merged, I will assume that it is held in WM while the next conjunct merges.

In summary, the central problem addressed here can be stated like this: How can a derivational grammar that concatenates syntactic objects (SOs) in an assembly-line fashion get the required coordinate symmetries right if these are not checked until after the structures generated are spelled out and transferred to the interfaces, which have no say about what LIs initially enter the derivation? This problem might seem manageable, if we assumed that a generative grammar were able to derive conjuncts in parallel, with the added capability of

[3] Other studies have also identified the need for a memory capacity in syntactic derivation. Collins (2002) proposes the Locus Principle for deriving structures without category labels. This principle, he states (op. cit., p. 48), "presupposes a kind of memory in the derivation (the locus)." See also Roehrs (2012) for an example of WM assisting the derivation of DPs in which an element sits in a pre-determiner position.

looking back and ahead as needed. But lookback and lookahead are limited to the space of one phase, and we have seen that the matches required for coordinate symmtries often extend from one phase to another. No models to date propose that Selection can look ahead all the way to the interfaces.[4] Therefore, coordinate structures, I argue, cannot meet the interface requirements on coordinate symmetries unless the kind of integration that replicates this degree of lookahead is possible.[5]

My investigation is organized as follows: in section two I outline the evidence behind the assumption that the interfaces impose requirements on coordinate symmetries, requirements that cannot be accounted for with purely syntactic or purely semantic accounts. In section three I review some proposals and what facts and theoretical issues they are not able to address. Then in section four I sketch a way to re-design the grammar to better account for the facts of coordinate symmetry; the design I propose is inspired by Boeckx (2007) and Epstein & Seely (2002), and it is informed by several studies that discuss problems of derivation, notably Brody (2002), Collins (2002), Surányi (2010), and psycholinguistic studies that address the role of WM in linguistic computation. In section five I draw some conclusions and outline areas for further research.

2. Evidence of coordinate symmetry and some theoretical assumptions

In this section we consider first more data that support the proposal that LF must provide input to the selection of LIs for the second (and all subsequent) conjuncts of a coordinate structure. Then we turn to some theoretical assumptions about Selection as the initial operation of a generative grammar that provides feature bundles for the derivation of structures in Narrow Syntax. The central focus is on how these feature bundles can be made suitable for the LF-interface so that they meet its symmetry requirements on interpretation.

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[4] A grammar with a computational system that has direct access to the lexicon such as Stroik's (2009) might be able to solve the selection issue discussed here.

[5] I am in no way asserting here that ALL coordinate structures must be perfectly symmetric both syntactically and semantically. Asymmetries of various sorts are very common, but it is also noteworthy that sometimes a syntactic asymmetry carries over into a semantic asymmetry that creates a stark contrast with the equivalent symmetric version. Consider (i) versus (ii):

(i) Bill loves his wife and never cheated on her

(ii) Bill loves his wife and never cheats on her

Both sentences are grammatically acceptable, but the truth value of (ii) is significantly different than the truth value of (i).

2.1. Data

In §1 we noted that a coordinate structure with coreferential pronoun-antecedent relations requires matching features for their interpretation, as well as matching tense features for the interpretation of the event as a sequence of actions. In this section we consider a variety of other coordinate structures that have their own symmetry requirements. In (2) subject-verb and pronoun-antecedent agreement across conjuncts must also be symmetric:

(2) a. *Paul* [*write**s***] *and* [*reflect**s***] *on his writing*
a' **Paul* [*write**s***] *and* [*reflect–*] *on his writing*
b. *Paul and Patrick are/*is writing a book together*
c. *Paul*$_i$ *and Patrick*$_j$ *are publishing their*$_{i+j}$*/#his*$_{i/j}$*/*its*-NEUT *book soon*

In (2a) the conjoined verbs must have the same ending for sharing the subject; in (2b) the reverse arrangement exists: two subjects must be sufficiently symmetric for sharing one (plural) verb. In (2c) not only the subject-verb relation, but also the symmetric binding of the pronoun must be generated so that two conjoined subjects (symmetrically) agree (together) with a single plural verb, and (symmetrically) bind a single plural pronoun. The operations needed to generate these symmetries might be easy to formulate for English, a language that does not look inside each conjunct but simply resolves the agreement based on a single feature [PL]. But the problem goes a bit deeper: the two conjuncts consist of LIs that must be symmetric in specific ways, e. g. the two verbs *write* and *reflect* have certain semantic features that allow them to both agree with a subject like *Paul*. This symmetry can be assured only if sufficiently symmetric LIs are chosen from the lexicon as the first step of the derivation.

In languages such as German that rely more heavily on grammatical affixes for case marking, coordinatively symmetric affixes must mark the same case (though nouns of different gender may be conjoined); thus, there are correspondingly more coordinate symmetry requirements than in, for instance, English, which places no syntactic – only semantic – restrictions on conjoined nouns, and requires symmetric case forms on a conjoined noun-pronoun pair when the pronoun has a distinct objective form, cf. *her* in (3c), which the inanimate pronoun *it* lacks in (3d):

(3) a. *Paul schreibt* ***ein*** *Buch über Syntax und* ***einen*** */ *ein Artikel*

P. writes a-ACC,NEUT book on syntax and a-ACC,MASC/ a-NOM,MASC article
über Politik
on politics
'Paul is writing a book on syntax and an article on politics.'

b. *Paul und ich/*mich schreiben zusammen einen Forschungsbericht*
P. and I/ me write together a research-report
'Paul and I are writing a research report together.'

c. *Paul writes his* ***mother***-OBJ *a letter and*
*sends *she/**her***-OBJ *flowers on Mother's Day*

d. *Paul writes it*-OBJ *on parchment, and it*-NOM *always looks nice*

The sentences in (2) and (3) thus illustrate simple properties of coordinate symmetry that nevertheless rely on a selection operation that is able to pick and choose LIs with the right features for these properties. There are of course an infinite number of such examples in both English and German, and this investigation is based on the reliability of the prediction that all languages require certain coordinate symmetries; just what these are in other languages will be left to further research.

These data are not novel or unusual; they serve here as a reminder of the fact that symmetry between conjuncts is very common, and furthermore that it is required for purely syntactic as well as for semantic/interpretive reasons. Given that symmetry requirements exist in language processing, a generative, crash-proof grammar must explain how Selection can "know" which LIs to choose so that the required symmetries are present at the interfaces, a question that is also related to the First Merge issue (for discussion see Putnam & Stroik 2011). Surányi (2010) proposes a radical model that eliminates Merge altogether and thus might offer a way to address the selection question raised here. No evaluation of this model will be offered here since my data and the issues they raise do not force a choice between a Merge model and Surányi's model; I will take the less radical position that preserves Merge.

Complicating the matter of coordinate symmetry for syntactic theory is evidence that asymmetries of the sort in (4) are common. In (4a & b) the more local of two case assigning elements determines the form of the case marker, and in (4c) agreement is determined by just one of two subjects – presumably the more local one:[6]

[6] Although *in* assigns accusative case with verbs expressing a change of location, it can only assign dative with a verb like *gibt* (3SG of *geben* 'give'). There is an alternate analysis in which deletion occurs:
(i) … *in ~~der~~ und um die Stadt*

(4) a. *Es gibt viele Parks in und um die /*der Stadt*
it gives many parks in-DAT and around-ACC the-ACC /the-DAT city
'There are many parks in and around the city'

b. *Karl dankte und begrüßte den /*dem Mann*[7]
K. thanked-DAT and greeted-ACC the-ACC /the-DAT man
'Karl thanked and greeted the man.'

b' *Karl begrüßte und dankte *den / dem Mann*

c. *There is/*are a man and his dog behind the house*

There is extensive literature on the topic of the asymmetric properties of coordinate structures beginning with Munn (1987), expounded upon most extensively by Johannessen (1998), which I will not summarize here out of space considerations (see te Velde 2005). These discussions are largely orthogonal to the present focus on coordinate symmetries of any sort, but particularly those that extend from one phase to another, as is the case in (1), and below in (5). For this structure I assume that each vP is a (separate) phase and that the subject *Paul* in the first conjunct binds *he* in the second conjunct, which in turn binds the anaphor *himself*:

(5) [$_{\text{TP}}$ *Paul$_i$ wrote a letter to the editor and* [$_{\text{TP}}$ *then he$_i$ chastised himself$_i$ for it*]].

Regardless of the theory used to account for the binding of *he*, this binding quite clearly involves syntactic and semantic relations generated by the grammar (i.e. they do not rely exclusively on cognitive processes outside the grammar) while also extending across a phase boundary by means other than the edge (cf. Chomsky 2000, 2001 and much related work on the phase edge). This binding fact cannot be accounted for unless the gender, number, case of *Paul* matches the equivalent features of *he* and *himself*, without which the binding relations cannot be interpreted.

Before further investigation of coordinate feature matching, we turn in the next subsection to aspects of the operation Selection.

An investigation of which analysis is better is not relevant here, only the point that there is an asymmetry (in both analyses) that clearly indicates the presence of structural asymmetry "within" coordinate symmetry.

[7] The asymmetry evident in (4b) apparently exists only in the surface morphology:
(i) *Karl dankte und begrüßte Herr Schmidt/*dem Herrn/den Herrn*
K. thanked and greeted Mr. S. /the-DAT gentleman/the-ACC gentleman
Because *Herr Schmidt* doesn't require a case marker but *Herr* by itself does, only the latter causes an error in this construction, i.e. presumably *Herr Schmidt* has only an abstract Case feature that is valued appropriately in the derivation, possibly with the same mechanism that selects the correct case endings for *d-- Herr-*.

2.2. Some theoretical assumptions about Selection

An area of grammar design that has not received much attention since Chomsky's (2000) discussion is how LIs (essentially feature matrices) are selected from the lexicon by the computational component for creating the numeration, from which Narrow Syntax begins to assemble structures.[8] Chomsky makes an interesting assumption about this operation in the context of a discussion on how to reduce computational complexity (op. cit., p. 101):[9]

> Is it also possible to reduce access to Lex [lexicon], the second component of the domain of L [language]? The obvious proposal is that derivations make a one-time selection of a *lexical array* LA from Lex, then map LA to expressions, dispensing with further access to Lex. That simplifies computation far more than the preceding steps. If the derivation accesses the lexicon at every point, it must carry along this huge beast, rather like cars that constantly have to replenish their fuel supply. Derivations that map LA to expressions require lexical access only once, thus reducing operative complexity in a way that might well matter for optimal design.

This discussion leaves open at least two aspects of Selection that must be addressed for designing a grammar that can derive coordinate symmetries. The first of these could be called a SIZE LIMITATION: Are all of the LIs for a coordinate construction selected at once, i.e. do they constitute one lexical array (LA)? In the extreme case, are all of the LIs for a coordinate structure made up of multiple clauses selected at once? Presumably not, if we follow the implicit assumption that a single clause constitutes a sentence, for which one LA is selected separately. Thus, the grammar must have a mechanism for checking whether the symmetries required ACROSS CLAUSES have been generated BEFORE TRANSFER to the interfaces. But even such a mechanism will fail unless we assume in addition that the critical features that make up these symmetries are in place already at Selection.

This point brings up a second aspect of Selection left open in Chomsky's discussion, the one introduced in the previous section; it could be called a CHOICE LIMITATION: What determines the choice of LIs? This question becomes particularly critical with coordinate structures that

[8] See Stroik & Putnam (2005) and Stroik (2009) for proposals that address the selection of LIs by the computational system and could possibly offer a solution to this problem.
[9] Although the studies of Ramchand (2008) and Cinque & Rizzi (2010) are undoubtedly relevant here, space considerations do not allow discussion of them.

must meet symmetry requirements imposed by LF as we saw in (1) – (3) and (5). This is also the case in (6) and (7):[10]

(6) a. *das Geld der Damen und Herren*
the money the-GEN,PL ladies and gentlemen
'the money of the ladies and gentlemen'

b. *das Geld der Dame und des Herrn*
the money the-GEN,SG lady and the-GEN,SG gentleman
'the money of the lady / the lady's money'

(7) *Florian schrieb seiner Mutter und den Verwandten /#Aufsatz*
F. wrote his-DAT mother-ANIM and the-DAT,PL/ACC,SG relatives-ANIM/ essay-–ANIM
'Florian wrote his mother and the relatives/#essay'

Let's assume – supporting arguments are presented in sections 2-4 – that the selection of LIs for the numeration of the two conjuncts in (6a, b) occurs in one operation whereas the valuation of the features in each of the conjuncts occurs in two separate phases. The data indicate that the second conjunct must be symmetric with the first conjunct in certain ways. In (6a) the valuation of *der* [GEN,PL] to agree with *Damen* rules out any DP-conjunct that does not have a plural head. Because *Herren* has [PL], it may share *der* with *Damen*. In (6b) *der* has [SG,FEM] and therefore the DP-conjunct *Herrn*, because its head has [MASC], must have its own determiner. I assume that no lookback or lookahead is required for this derivation. How it proceeds will be examined in more detail in §4.3.

In (7) the oddity of the conjunction results from the mismatch between the objects: one is [+ANIM],[recipient], the other [–ANIM],[theme]. In German this distinction must be reflected in the Case assigned, the former dative, the latter accusative. The coordinate structures in (6) and (7) do not involve cross-phasal matching, if we do not assume that DP is a phase; this assumption runs contrary, however, to much current work and for this reason I will propose

[10] For the derivation of (6a, a') I assume that the conjuncts are vPs that share the subject *the car/the boy* in Spec,TP (further detail in §3). In other words, what is selected for the second vP must have certain semantic features that "match" (are compatible with) certain features of the shared subject and the other vP; that is, the selection of the second vP rules out the ill-formed verb on the basis of this matching. Sharing relations in coordinate structures are common and always require a certain kind of matching. In (i) the subject *Bill* and the verb *wrote*, both external to the coordinate structure in brackets, share DP-objects. Note that this relation does not obtain if an object such as *a computer* is selected because it lacks a feature common to the other objects:
(i) *Bill wrote* [[*an essay*], [*a short story*], [*a poem*] *and* #[*a computer*]] *over spring break*
Relevant to the immediate discussion is simply the point that Selection must be able to identify the features constituting the symmetry, if the coordinate structure is to be interpretable at the LF-interface.

in §3 that the conjunction of DPs must meet the LF-interface for completing the matching of the semantic features; the matching of formal features such as Case –required in the derivation of (7) – relies also on WM in Narrow Syntax.

In the next section we consider some proposals currently available for deriving coordinate structures to examine whether they provide mechanisms for generating the symmetries required in (6) and (7) and the previous data.

3. Proposals to date

Of the proposals currently available, Citko's (2005) parallel merge operation, can generate certain symmetries of coordinate structures and probably comes the closest to meeting the interface requirements on coordinate structures using Narrow Syntax, but as we will see, the proposal does not address all types of semantic symmetries. By contrast, Boeckx's (2007) analysis does not address coordinate symmetries of any kind but rather design aspects of a generative grammar. His ideas can, I believe, be fruitfully extended to coordinate structures, the objective of §4.

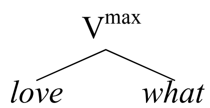
3.1. Citko's Parallel Merge proposal

Citko (2005) proposes "Parallel Merge" to generate the relations that exist in ATB *wh*-questions of the sort in (8), which constitute a type of coordinate symmetry in that two clauses share one fronted element. Citko uses the structure in (8) to illustrate such relations:

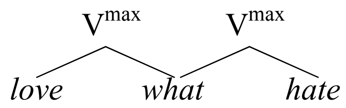
(8) *What did Sam love* t *and Sally hate* t ?

When Merge and Parallel Merge are applied in sequence, the multiple-dominance and sharing relation in (9b) results so that *what* is dominated by two nodes and shared by two verbs:

(9) a. Merge *love* and *what*; project *love*:

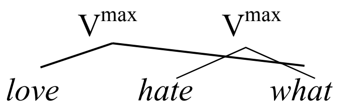


b. Parallel Merge *hate* and *what*; project *hate*



The linearization of the elements in (9b) results in (10):[11]

(10)



The merit of Citko's proposal is that Parallel Merge requires no new operations or principles; it simply combines the power of External Merge (EM) for joining distinct rooted objects with the power of Internal Merge (IM) for taking a subpart of one of them and locating it elsewhere.

Thus, Citko's proposal can account for ATB *wh*-questions because in them Parallel Merge can appropriately relocate the *wh*-element to the left of the conjuncts.[12] Citko's proposal could presumably derive structures like those in (1), (2), (6) and (7), which also involve sharing relations. For the structure in (6a), repeated below as (11), the vP-internal shared subject stands in the same relation to each vP-conjunct as the *wh*-element in (10) and simply gets linearized to the shared Spec,TP position:

(11) [$_{\text{TP}}$ *<u>The boy</u>* [$_{\text{vP}}$ *sped down the street*] *and* [$_{\text{vP}}$ *leaped over the railing*]]

While Citko's proposal has applicability to many coordinate structures, it unfortunately does not provide an account of the SEMANTIC symmetries in these structures. In (8), the contrasting semantic features of *love* and *hate* must be considered at Selection for how they enter into the interpretation. Furthermore, the two verbs *love* and *hate* must minimally both be [transitive] and have a subject marked [anim]. Citko's proposal does not to my knowledge address how Selection makes these choices so that (8) satisfies the semantic symmetry requirements at the LF-interface.

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[11] Citko points out that the relations resulting from Parallel Merge do not cause problems for the linearization requirements of syntactic derivation, as formulated by Kayne (1994) in his Linear Correspondence Axiom (LCA), because the LCA, following Chomsky (1995), does not apply until the derivation reaches the sensori-motor (SM) interface, i.e. its effects remain invisible. As long as Internal Merge (IM) repositions the shared object *what* before the SM interface, the derivation will not crash.

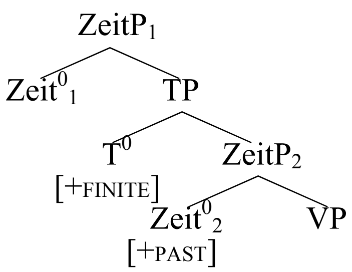
[12] I will leave open whether these operations conform with assumptions about Merge and Copy. Chomsky (2007) states (n. 10): "Citko argues that parallel Merge is 'predicted' as is, but that is not quite accurate. It requires new operations and conditions on what counts as a copy, hence additional properties of UG."

A proposal that attempts to meet this challenge is outlined in the next subsection; it does so within the context of certain assumptions about their syntactic structure and thus offers an interesting opportunity to address the question of how to design a syntactic structure that can account for semantic symmetries.

3.2. Semantic symmetry through an expanded TP-projection: Camacho (1997, 2000)

Camacho's work bears directly on the present investigation because it addresses tense symmetries in conjoined verb phrases and thus deals with both syntactic and semantic coordinate symmetries. He uses the strategy of expanding the TP domain with the projection ZeitP, following work of Zagona (1999) (where [Zeit] is a temporal determiner that maps its predicative complement to a time-denoting expression):

(12)



Camacho argues that structural symmetry must be maintained in coordinate structures in the form of Spec-head checking relations; he focuses on the checking relations required for the feature [Tense], arguing that conjoined verbs must have symmetric tense features.

Although this proposal has some limitations (see te Velde 2005), it has at least one advantage over others because it accounts for semantic symmetries within Narrow Syntax, that in fact the syntactic and semantic properties interact with each other in the computational component. In that sense its design is superior to Citko's Parallel Merge; on the other hand, Camacho's proposal does not address conjoined *wh*-questions. To his credit, Camacho recognizes the semantic symmetry requirement in sentences such as:

(13) *Paul writes and reflects/*reflected on his writing*

However, like many other proposals for coordinate structures – see also Frazier and Clifton (2001), Grootveld (1994), Nunes (2001, 2004), and many others cited in te Velde (2005) – Camacho does not explain how the grammar selects the two verbs *write* and *reflect on* as sufficiently semantically symmetric that they can share the object *his writing* (the CHOICE LIMITATION in §2); his proposal addresses only the tense feature. A study that focuses on the semantics of coordination, Lasersohn (1995), not surprisingly has little to say about the syntactic symmetries and also does not address selection from the lexicon per se. Kehler's (1996, 2000) work, much like Lasersohn's, focuses primarily on the semantics of coordinate structures, but it also does not address the lexical selection issues addressed here.

The studies that focus on the syntactic properties of coordinate structures as a rule relegate the symmetries of coordinate constructions to the semantics and claim that coordinate constructions in some form or another are syntactically asymmetric like any other syntactic structure, i.e. the syntactic relations such as c-command, probe-goal, Agree, etc. are all inherently directionally constrained: the asymmetry allows licensing only from left to right, following to one degree or another the seminal work of Chomsky (1981), Kayne (1994) and others. There is some evidence that relations between conjuncts are subject to this kind of syntactic asymmetry, as pointed out by Munn (1993) and Johannessen (1998). Consider (14):

(14) a. *Paul$_i$ and his$_i$ dog go for walks every day*
b. **His$_i$ dog and Paul$_i$ go for walks every day*

These data can be accounted for on the assumption that the first conjunct c-commands the second one and that the coordinate structure is a binding domain in which the pronoun must be free, as stated in Principle B of binding theory. There must be a c-command relation between conjuncts; if there were not, then both (14a) and (14b) would be acceptable.

Further data can be accounted for by extending this assumption to other areas, for instance binding relations in coordinate structures. If we assume that a coordinate structure creates its own binding domain, much like a DP, then as Hartmann (2000: 26ff) points out, the reverse distribution of pronoun and anaphor binding in (15a) and (15b) is predicted:

(15) a. *Peter knows the filmmaker$_i$ and a movie about *himself$_i$/him$_i$*
b. *The filmmaker$_i$ made a commercial and a movie about himself$_i$/*him$_i$*

The binding in (15a) follows from binding theory for simplex structures on the assumption that a preceding conjoined DP creates a separate binding domain; thus, the DP-object of *about* must be valued as the R-expression *him* and has the antecedent *filmmaker*. This same relation is not possible in (15b), however, but not because of the syntax. Rather, the preceding conjunct has no DP that can be interpreted as the antecedent of the DP-object of *about*, which then must be valued as an anaphor, since it is c-commanded by the subject *filmmaker*.

These examples illustrate that the binding and valuation of the object of *about* must be determined on the basis of both the structure and the semantic features of the conjuncts. It appears that the two conjuncts must at some point in the derivation be matched with each other to determine what qualifies as an appropriate antecedent, following this principle: If the preceding DP conjunct contains an appropriate antecedent, then the P-object in the second conjunct is valued [pronominal] on the assumption that each of the conjoined DPs constitutes a binding domain in the coordinate structure,[13] whereas if the subject is the antecedent, then a [pronoun/anaphor]-variable must be valued [anaphor], following the assumption on binding that, because the subject c-commands both conjuncts in (15), the entire coordinate structure is the binding domain for both conjuncts.

Thus, binding in coordinate structures must rely on more than just the syntactic relations at the simplex level; sometimes an additional level of analysis based on coordinate (semantic) relations, is required. I will argue in §4 that Narrow Syntax, when assisted by the operation Copy, linked to WM, is capable of matching/valuing the symmetric features of the relevant LIs in the conjuncts of a coordinate structure.[14] This use of Copy for deriving coordinate symmetries is to a large extent independent of syntactic relations in the sentence; it is, however, subject to the over-all phrase-structural asymmetry of the construction. Most important for the present analysis is the fact that derivation relies on a version of Selection that has input from an invasive LF, without which the LIs selected could not be matched in the several ways just described, as required by the LF-interface.

Thus we see on the one hand that Narrow Syntax is crucially involved in the over-all determination of coordinate symmetry, serving the requirements of the LF-interface. The most important fact for the present investigation is that Narrow Syntax must have the right LIs to work with from the start, hence the argument that integration between the components, guiding Selection, is necessary for deriving the coordinate symmetries.

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[13] This assumption follows from conclusions reached by Chomsky (1986) about DPs as binding domains; in this study he consolidates much previous work.

[14] There is very little discussion in the generative literature about the role of WM in derivation (but see, for instance, Vasishth & Lewis 2006 and works cited there). Presumably it is assumed that WM is required for any Copy operation; if that is true, Copy in coordinate structures is not unique for that reason alone; rather, Copy across phase boundaries, as posited here for coordinate structures, is not required for that reason in the derivation of simplex constructions, but might be for other reasons.

In the next section we consider a proposal that capitalizes on the fundamental asymmetry of syntactic structure within coordinate constructions for explaining certain agreement requirements that sometimes appear to defy coordinate symmetry requirements.

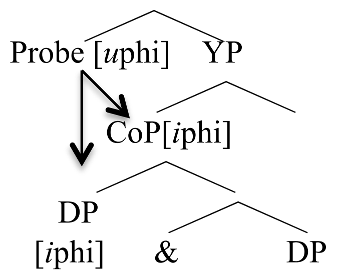
3.3. One probe, multiple goals: van Koppen (2005, 2006)

The proposal developed by van Koppen is designed primarily to accommodate asymmetric agreement phenomena such as (16a) found in varieties of Dutch, though it can also accommodate cases of symmetric agreement such as (16b):

(16) a. *…de-s* *doow en ich* *ôs* *kenne treffe* (Tegelen Dutch)
that-2SG [you and I]-1PL each.other-1PL can-PL meet
'… that you and I can meet'

b. *…da-n* *Bart en Jan* *mekaar* *wel* *kunne verdraagn* (Nieuwkerken-Waas Dutch)
that-PL [Bart and Jan]-3PL each-other PART can-PL stand
'…that Bart and Jan tolerate each other'

The structural relations underlying this proposal are given in (17):[15]

(17)


(CoP= conjunction phrase)

For asymmetric agreement as in (16a), van Koppen assumes that the more local DP determines the agreement morphology, while in the symmetric agreement in (16b), the two DPs are equally local because, as she argues, the probe c-commands both of them, and the set of nodes that c-commands the one is equal to the set of nodes that c-commands the other. Thus, in (16a) the probe *des* has a singular ending because it agrees with just the first DP, while in (16b) the probe *dan* has a plural ending because it agrees with both DPs.

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[15] For a more recent analysis of essentially the same type of construction, see van Koppen & Cremers (2008). This study will be addressed in §4. The label for the intermediate projection dominating [&] and [DP] in (17) is omitted by van Koppen for reasons that I was not able to determine.

An additional assumption must be made with this proposal for constructions in which there are three or more conjoined subjects without the probe *da-n* and thus lacking the coindexation for [PL] indicated in (16b), as in *Bart, Peter en Jan kunne mekaar wel verdraagn* 'Bart, Peter and Jan tolerate each other well'. One possibility is that CoP has multiple heads in order to maintain the local relation of each subject to this head for the agreement relation in (17), as in *Bart en Peter en Jan…*, all projecting one CoP. The other option, each &˚ projecting [CoP], would require multiple c-command relations of the sort in (17); the problem here is that for each &˚ there must also be a probe as indicated in (17). Since structures like *Bart, Peter en Jan…* have only one lexical probe, additional unspoken probes would have to be posited; empirical evidence to support one or the other approach is not provided by van Koppen.

So while van Koppen's proposal provides an interesting and useful solution to asymmetric agreement, a question remains about constructions with symmetric agreement consisting of more than two conjuncts that lack a probe such as *da-n*; this question relates directly to the central focus here: coordinate symmetry. My proposal in §4 will be based on the general assumption that the symmetry of coordinate structures should be the property that theories of coordination attempt to account for first, with cases of asymmetry following from the syntax of simplex structures. Underlying this assumption is the evidence that every coordinate structure has some form of symmetry and that this symmetry, as required at the interfaces, can be guaranteed only with input from the LF-interface at Selection.

3.4. Sideward movement in coordinate structures: Nunes (2004)

The last of the proposals for deriving coordinate structures to be considered here involves a novel use of Copy. Nunes argues that the copy-and-merge approach to displacement in Narrow Syntax proposed by Chomsky (1993) can be applied to the derivation of the well-known across-the-board (ATB) relation of a *wh*-element to *n*-number of base positions in multiple conjuncts of a coordinate structure. Instead of ATB-movement in the classic sense, which cannot be maintained in Minimalist theory,[16] Nunes shows how this structure can be derived using Copy and Merge:

[16] The most obvious problems with ATB-movement are i) the lack of sufficient features in the one position targeted by the *wh*-elements – one feature must trigger *n*-number of *wh*-movements, and ii) the need for the deletion or "absorption" of all but the first *wh*-element that is moved to this position.

(18) *Which book did Paul write and Patrick critique*

Construct the last conjunct:

Patrick critique which book

Merge *which book* in Spec,CP and insert *do*-PAST:

Which book did Patrick critique

Copy *which book* from the above conjunct and merge the copy in the first conjunct:

Paul write which book

Merge this copy of *which book* in the Spec,CP position of the first conjunct:[17]

Which book did Paul write

Form the resulting chain with the lower conjunct:

Which book did Paul write ~~which book~~ and Patrick critique ~~which book~~

The principle Form Chain along with the *wh*-parameter of English (overt *wh*-movement) result in the phonetic realization of only the leftmost copy of *which book*; the others remain silent.

This novel approach to ATB-relations in conjoined *wh*-questions leaves a key question unanswered: How does Narrow Syntax handle the parallel structures that must remain active – they cannot be transferred to the interfaces – until the derivation of this structure is complete? In other words, how can this approach be maintained in a grammar that is phase-based? On the one hand this approach addresses the Parallelism Requirement on coordinate structures mentioned already many years earlier by Chomsky (1995: 203) and taken up by Hornstein and Nunes (2002), and for that reason it has an advantage over many studies that focus only on the asymmetries of coordinates structures. On the other hand, it does not provide an answer to the dilemma posed here, which has a theoretical problem at its core: How do we unify phase theory and the Parallelism Requirement. It also poses a psycholinguistic problem: How does the brain manage parallel processing for this kind of derivation? These questions will be taken up in §4.

3.5. Replacing Spell-Out with invasive interfaces: Boeckx (2007)

In his brief investigation into design features of the Minimalist model, Boeckx argues that Spell-Out, the operation that splits the derivation into two streams, one for LF, the other for

[17] For brevity's sake I ignore the copy and merge operation for *did* as well as the chain formation required for it.

PF, should be eliminated; at this point in the derivation, he states, the interfaces need to interact with Narrow Syntax and be able to pick and choose what they want. This interaction is necessary, he claims, to account for very fundamental syntactic and semantic relations in sentences. He points out that, if we assume Phase Theory and the assumptions outlined in (6), then the relations between some antecedents and anaphors cannot be established, simply because sometimes the antecedent is located in a previous phase, such as in (19):[18]

(19) *Paul$_i$ wrote the book and then he$_i$ contacted a publisher*

Boeckx's suggestion for deriving the cross-phase relations is not to eliminate phases or the PIC, but rather to enhance the functionality of the interfaces. He proposes interfaces that are active and invasive rather than mere recipients of information; the interfaces need to be able to look into Narrow Syntax and "pick and choose" suitable objects. However, he does not provide the details for formalizing this idea. In the next section I will attempt to apply his notion of invasive interfaces to the derivation of coordinate structures in a way that their symmetries can be accounted for in a grammar model that retains key principles of the Minimalist Program (MP).[19]

In this section we have reviewed several proposals for the derivation of coordinate structures. The conclusion that I will argue must be made is that none of them provides a fully satisfactory solution to the problems outlined in the previous section, even though they provide good solutions to other problems of coordination. In the next section we consider in greater detail the proposal that I sketched in §2 involving an invasive LF-interface.

4. Selection, Matching and Transfer in Coordinate Structures[20]

We recall that the primary locus of the semantic symmetries in coordinate structures is in the semantic feature matrices of the LIs in that structure. Not all of the features contribute to the

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[18] Boeckx does not provide an example structure for which his proposed invasive interfaces would be required, but he mentions binding relations (he doesn't discuss coordinate structures), presumably of the sort in (19). See also the numerous studies Boeckx (2007: 419) mentions that provide evidence of invasive interfaces. For a discussion of an area of syntactic derivation in which, according to Haider & Rosengren (2003), the PF-component needs access to Narrow Syntax, see Sapp (2011: 202 ff).

[19] A theory of agreement and categorization such as Ouhalla's (2005, 2010) based on previous work by Halle & Marantz (1993) in which the PF-interface accesses the lexicon for the insertion of "vocabulary" also presumes that at least the PF-interface must be able to access the lexicon and is thus in this sense invasive.

[20] For another account of the coordinate symmetry facts in a different framework, see te Velde (2009).

interpretation in LF, however; the derivation in Narrow Syntax determines which of them are valued for this purpose.[21] Nevertheless, getting their selection right is the most important step in meeting the coordinate symmetry requirements of the LF-interface. Syntactic symmetries, by contrast, are established in Narrow Syntax (though they require the "right" LIs), for instance the matching Case and ϕ-features in (2). To these we turn first in the next subsection, as they constitute a more localized form of the central problem being addressed.

4.1. Deriving matching formal features in coordinate structures

In structures like those in (2), repeated here as (20), the matching features are located in different phases, assuming that vP and CP are phases and that conjoined verbs in English require a vP-phase for each verb. However, I will leave this assumption aside for the moment and focus just on the fact that at least two features on the conjoined verbs, [tense] and [number], must match (even though only one morpheme, the **–s** ending, is realized):

(20) a. *Paul* [*write**s***] *and* [*reflect**s***] *on his writing*
 b. **Paul* [*write**s***] *and* [*reflect–*] *on his writing*
 c. **Paul* [*write**s***] *and* [*reflect**ed***] *on his writing*

The challenge of these structures for a Minimalist grammar can be stated very simply: What operation, based on what principle, guarantees that these features match? If we adopt the operation Agree that derives subject-verb agreement between the subject and the first verb when the probe T induces subject raising to Spec,TP, as proposed by Chomsky (2000), we still have to explain how the same ending is realized on the second verb. Van Koppen's (2005, 2006) proposal cf. §3.3 focuses on one probe with multiple goals, i.e. a complementizer or finite verb with two conjoined subjects in a C/V – [Subj & Subj] configuration. Presumably this proposal could also be applied directly to the relation between a verb and two conjoined objects, but it would require some adaptation to account for the relation between one subject and two conjoined verbs, as in (20). Camacho's proposal is designed to handle such relations, but as stated earlier, it relies on an additional projection

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[21] We must keep in mind an important difference between the selection described above, and a similar selection process that occurs in Narrow Syntax. In Narrow Syntax a transitive verb, for instance, selects its direct object (DO) from the numeration, NOT from the lexicon. This DO is just one element in the numeration, and the verb's selection of it is not global in the same sense as the selection of the (entire) numeration from the lexicon. That is a significant difference that will come up for discussion later.

that is hard to motivate independently, particularly in a model that addresses the central Minimalist concern of positing only operations and representations that can be motivated by the needs of the interfaces.[22] Nunes's sideward movement operation can derive structures like (20a-c), if we assume that *Paul* is copied and deleted in the same way as the *wh*-element in (18). Detailed discussion of this derivation must for space reasons be left to future research.

The syntactic derivation of these constructions may seem straight-forward: two conjuncts are merged as are any two SOs. But the derivation must be made precise enough to address these questions: When and how do the conjuncts merge? If we assume van Koppen's structure with CoP, following Johannessen (1998) and others cf. (17), the conjunction, as the head of the phrase, selects the second conjunct as its complement, and the first conjunct is merged in the Spec,CoP position. But this second merger raises the question of what agreement relation must be satisfied. If we assume that elements in Spec positions (in this case Spec,CoP) must agree with the head of that phrase, then how does the first conjunct in (20), a verb, agree with the conjunction? There is no apparent need for this agreement, unless we assume a form of agreement that is unique to coordinate structures, but this assumption is ad hoc. A second question is: Why would a second conjunct merge ahead of the first conjunct, as required by a model using the projection CoP in which the element in Spec,CoP merges internally in that position? Following the asymmetry assumption about coordinate structures, why would the more embedded conjunct be selected for merger ahead of the less embedded one? Even if all of these questions can be answered satisfactorily, we still don't know how coordinate structures with more than two conjuncts can be handled.

Because of the questions raised by proposals like van Koppen's that rely on the projection CoP, I will present an alternate proposal in which this projection is not needed and conjunction as an operation that constructs coordinate structures follows from very basic principles of Merge: the first conjunct is merged as any "normal" LI, i.e. it has no status as a conjunct at this point.[23] The second (and third and fourth, etc.) conjunct is merged as a SO of the operation 'conjunction' which can apply freely at various points in the derivation, much like the adjunction of any phrase, but with the crucial difference that certain symmetry

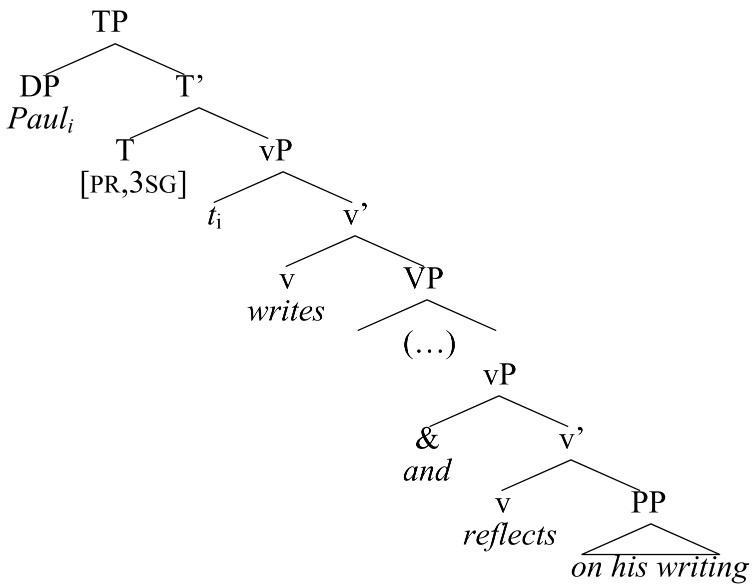
[22] Camacho's proposal is motivated by the LF-interface, which dictates the requirements for matching tense features. However, LF does not motivate the use of a separate category for meeting this requirement, and meeting it without this category is preferred on general Minimalist principles.

[23] One interesting question about this assumption is whether it violates the principle of endocentricity. In the proposal outlined in more detail below we will see that conjuncts do not have a projection unique from any of the syntactic categories assumed necessary for simplex constructions. Rather, the projection that dominates [&] is determined by the structure it conjoins and in this way it preserves endocentricity. My proposal thus differs from proposals like van Koppen's and similar ones in that it does not assume the projection CoP or &P or any such projection unique to coordinate structures.

requirements must be met. 'Conjunction' as an operation has no independent status; it is nothing more than the merger of a SO that must satisfy certain syntactic and semantic symmetry requirements, as dictated by matching with the first conjunct. The merger of [&] induces the coordinate matching in Narrow Syntax via WM that establishes at least some of the symmetries required by the interfaces.

More precisely, in the derivation of (20a), the verb *write* is merged and at some point enters an Agree relation with the subject. After this agreement is established, *and* is selected from the numeration and merges with the second verb *reflect*, which in turn selects the PP-complement *on his writing* for merger, resulting in roughly this structure:

(21)



The following assumptions underlie this derivation:[24]

i. [&], as a deficient syntactic category, does not project a phrase level. Rather, [&] is merged on the left branch of the (projection of the) phrase selected for conjunction. For supporting arguments and evidence, see te Velde (2005).

ii. When [&] is selected from the numeration, it must come with a complement, the next conjunct; the LIs of this conjunct have been pre-selected from the lexicon, if they are

[24] Additional assumptions and aspects of the analysis in (21) that are not central to the core of my proposal are: 1) The second conjunct is vP, not TP, based on the fact that the tense feature must be the same in both conjuncts:
(i) Paul writes and *reflected/reflects on his writing
If a TP must be generated for other reasons, then there is generally greater flexibility with tense:
(ii) [$_{\text{TP}}$ *Paul writes every day and* [$_{\text{TP}}$ *has always written well*]]
(iii) [$_{\text{TP}}$ *Paul writes every day and* [$_{\text{TP}}$ *he* (*always*) *wrote long letters in his youth*]]
(iv) [$_{\text{TP}}$ *Paul writes every day;* [$_{\text{TP}}$ *he even wrote a poem yesterday*]]

part of the same clause; if not, then Selection must be induced again for the second clause/conjunct, as discussed earlier.

iii. The conjunct that is merged with [&] will ususally have the same categorial status as a preceding category with which it is to be conjoined because of properties of [&] that induce matching for the purpose of conjunction. Exceptions, i.e. cross-categorial coordination, are possible if the conjuncts have sufficient matching features.

iv. The determination of what constitutes an appropriate conjunct requires the copying and matching of certain features, as triggered by the merging of [&].

v. Copying and matching in coordinate structures, assisted by WM, provide the bridge between the conjuncts for the symmetric valuing of features in conjuncts located in different phases.

In (21) we have an example of two conjuncts located in different phases, across which certain matching requirements must be met. The challenges that coordinate feature matching face go beyond the constraints of the PIC, however. Note that both semantic and formal features are part of the feature set that is evaluated for determining whether the coordinate structure has the necessary symmetry for meeting the interfaces. Another interesting example is (22):

(22) *Paul is finishing a book and Paula* e *a series of articles*

This example of Gapping (see Repp 2009 and references therein) also requires both syntactic and semantic matches, the former for the verb morphology, the latter for the interpretation: in a precise interpretation the gap must have the same semantic features as its antecedent, i.e. if *is finishing* is interpreted as 'is completing the writing of', then the gap cannot be interpreted in some other way such as 'is finishing the reading of'. For this kind of matching to occur, the interpretation of the leading conjunct must be transferred to the second one. For this I propose that Copy, assisted by WM, provides the transfer.[25]

This derivation is intensionally sketchy because the primary focus here is on Selection for coordinate structures. Before the transfer just proposed for (21) can occur, even before the second conjunct can be merged, the LIs for the second conjunct must be selected based on

[25] I am not claiming here that the ϕ-features of the verbs must always match; as numerous studies have shown, Gapping allows asymmetric ϕ-features. In addition, there is a certain acceptable ambiguity tolerated by some speakers such that one conjunct can be interpreted as "is finishing the writing of" and the other "is finishing the reading of". For them the construction is ambiguous, due for instance to a speech context in which both options had been mentioned.

features of the LIs in the first conjunct.[26] So we must ask: How exactly can the selection of the second conjunct, *Paula is finishing a series of articles* rely on or be guided by the first conjunct?[27] An explanation of how a leading conjunct can guide the selection of the LIs for a subsequent one comes from the theory of invasive interfaces suggested earlier, to be explored in more detail in §4.4.

Before we examine this and similar derivations in greater detail, we consider research from the field of psycholinguistics that supports the assumption that WM plays an important role in the derivation of coordinate structures.

4.2. The role of WM in linguistic computation

A number of psycholinguistic studies have determined that areas of the brain outside of the core area associated with language processing are involved in the production and interpretation of linguistic structures. Hagoort (2004) has with laboratory experiments determined that Broca's area is likely involved in unification operations at the word and sentence level, and Broca's area is connected with temporal regions that are crucial for memory retrieval. He states in his conclusion, "I have argued that the neurobiological requirements for unification are those of WM, which include that lexical building blocks are kept activated for some time while unification operations take place" (op. cit., p. 422).

Earlier laboratory work of Waters & Caplan (1996) identified evidence for the hypothesis that processing and storage with language production are independent. The studies of Grodzinsky and Santi (2008) and Makuuchi et al. (2009) further define the areas of the brain that are activated for memory tasks (requiring WM), syntactic movement and syntactic complexity. Lewis (2011) provides evidence of a cue-based retrieval system based on a system of incremental sentence processing that utilizes a series of rapid memory retrievals; a key element of this system is its focus on just one or two items at a time, i.e. only a limited amount of linguistic information – one XP – is stored in WM at one time.

Of interest here is the evidence in all of these studies that WM is associated with an area of the brain that is separate from the area where linguistic processing occurs, but it plays an important role in language processing, namely that of a (very) temporary storage facility.

[26] Following the brief discussion in §2.2, we have been assuming that all of the LIs for a complete clause are selected at once. In (22) two complete clauses are conjoined, which means that two instances of selection from the lexicon must occur.

[27] This question leaves open the whole issue of how Gapping itself comes about, though it is clear that Gapping crucially relies on the success of the transfers and matches. A review of the literature is obviously far too involved to be dealt with here; for discussion and references see Repp (2009).

This evidence suggests a grammar model that has a transfer mechanism between the computational component and WM. At the point when [&] is selected from the numeration, a copy of the previously generated structure(s) is transferred to WM. When [&] is merged with the LIs selected from the numeration, in (20a/21) *reflects on his writing*, the syntactic and semantic features of the LIs in WM that were valued in the preceding phase can be copied onto the LIs just selected. The derivation proceeds as follows:[28]

(23) Derivation of *Paul writes and reflects on his writing* using WM:

a. Select numeration from the lexicon: *Paul write and reflect on his writing*[29]
b. Construct VP-1: *Paul write*
c. vP phase-1 (with Agree): *Paul writes*
d. Select [&], triggering transfer of output of (c) to WM
e. Merge [&] with the remaining LIs of the numeration: [*and* [*reflect on his writing*]]
f. Copy relevant features from WM (here [person],[tense],[number]) for a match
g. Merge output of (f) with structure held in WM: *Paul writes and reflects on his writing*

The advantages of WM for the computational component are i) no lookback is required for determining how features of a second conjunct should be valued for the correct match with the corresponding features in the preceding conjunct, necessary for satisfying the requirements of the interfaces on coordinate symmetry, and ii) Copy, a syntactic operation non-specific to coordinate structures, can be used for not only creating coordinate symmetries across phase boundaries, but also for establishing binding relations from one phase to another, whether they involve coordinate or simplex structures.[30]

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[28] Note that when the first conjunct is derived, a copy of it – not the conjunct itself – is transferred to WM for feature matching purposes. Because the conjunct itself remains in Narrow Syntax, the second conjunct can be merged on its right branch as indicated in (21), i.e. the two conjuncts are not merged with each other in a "normal" merge operation, which would result in them becoming sisters. They, and any other conjuncts, cannot be sisters for independent reasons, see discussion above and below, in particular §3.2.

[29] What is selected from the lexicon is likely much more abstract than this, i.e. feature matrices that do not become words until PF. I avoid the abstractions here for ease of exposition. See Cinque (2010) and Ramchand (2008) for interesting discussion.

[30] Another example of a syntactic relation that extends from one clause – and thus from one phase – to another is the agreement relation between pronoun and antecedent in constructions like (i) and (ii):

(i) *It is they*-PL *who*-PL *are*-PL *causing the trouble*

(ii) *Ich kenne diejenigen*-PL, *die*-PL *hier Unruhe stiften*-PL
I know those who here unrest cause
'I know those who are causing unrest here'

The valuation of *who* and *die* as [pl], both of which can also be valued [sg] in other derivations, depends on the matching/copying of a feature from one phase to another. Heck & Cuartero (2011) account for such data in a proposal for agreement that applies cyclically and requires feature sharing. Because these are not coordinate

In the next subsection we focus on important aspects of the semantic side of coordinate symmetry; we will see that semantic symmetry depends on the matching of semantic features at Selection as well as the matching of formal features in Narrow Syntax.

4.3. Semantic symmetries: Matching at selection and valuation

We noted earlier about (6a, b), repeated below as (24a, b), that certain semantic features must match for the constructions to meet the requirements of the LF-interface:

(24)a. *das Geld der Damen und Herren*
the money the-GEN,PL ladies and gentlemen
'the money of the ladies and gentlemen'
a' *the money of the ladies and gentlemen*
b. *das Geld der Dame und des Herrn*
the money the-GEN,SG lady and the-GEN,SG gentleman
'the lady's and man's money'

In (24a) the plural *Damen* can be conjoined with *Herren* and share *der* because they both have the feature [PL], the only symmetry requirement in German on this sharing. In the grammar model assumed here this feature is valued on *Damen* before the second conjunct, *Herren*, is merged, following the general procedure outlined in §4.1. The Case feature of *der* as the determiner for *Damen* is also valued at merger as [GEN]; the merger of the second conjunct *Herren*, which shares the determiner *der*, occurs with the merger of *und* 'and'. This sequence does not require lookback or lookahead in the computational component; it relies crucially, however, on the ability of the grammar to copy certain features of the first conjunct onto the second. Note that essentially the same operation is required for (24a'), with the only difference that *of* assigns [GEN] to the first DP, which is then copied to the second conjunct, *gentlemen*. (24b) indicates that when the number feature of the first DP-head is [SG], the sharing of a determiner as in (24a) is no longer possible: if *der* is valued [FEM,SG] then it obviously is no longer suitable as a determiner for *Herrn*.[31]

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structures, I will not propose an alternate account for them here, but only note that feature sharing is a concept that overlaps to some extent with my own proposal; however, feature sharing is not able to account for all of the coordinate symmetries presented here.

[31] Note that an ellipsis analysis of (24a) is not possible:
(i) *das Geld der Damen und der Herren*

Given that the features of the first conjunct in (24a) are [GEN] and [PL] and on the assumption that both of these features are valued in Narrow Syntax, then the matching with the second conjunct *Herren* can be completed in Narrow Syntax. We note that [PL] is an interpretable feature that is legible in LF. Therefore two matching operations are presumably required, the first in Narrow Syntax for the formal features (ϕ-features are both formal and interpretable), and after Spell-Out in LF for the semantic/interpretable features. This division of labor might be manageable for (24a), if we did not assume for independent reasons that DP is a phase. With DP a phase, the formal features of *der Damen* cannot be copied to *Herren* in Narrow Syntax because of the PIC. To overcome this problem, I assumed in (23) that the output of one phase is copied to WM where it is held until the next phase proceeds and copies from the first phase as needed. Meeting the LF-interface is required in any case for the copying of semantic features; thus WM must also be available at the LF-level.

Let's examine the derivation in more detail. Once the first DP-conjunct of (24a) meets the LF-interface where its [PL]-feature can be interpreted, it is then copied to the next DP-head.[32] I am assuming that this feature must be held in WM while the second conjunct is merged, at which point feature matching occurs. The derivation proceeds as follows:

(24') Derivation of (24a)
select from lexicon the feature matrices for *das Geld der Damen und Herren*
merge DP *das Geld* and value its features (will depend on where it is merged)
merge DP *der Damen* and value features of *der*: [GEN,PL]
transfer the derivation to the interfaces and copy from there to WM
merge *Herren* as conjunct of *Damen* (*und* merges with *Herren*)
match [GEN,PL] on *Damen* (in WM) with the same features on *Herren*

The operation 'match' is conceptualized here as essentially a version of Copy for coordinate structures: The feature values stored in WM from the first conjunct "guide" the feature valuation in the second conjunct when it merges. Without this kind of "guidance" the merge operation for the second conjunct cannot possibly value the features as needed for the coordinate symmetry requirements of the interfaces.

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the money the-GEN,PL ladies and the-GEN,PL gentlemen
'the money of the ladies and of the gentlemen' or: 'the ladies' money and the men's money'
With the addition of a second *der* for *Herren*, another interpretation is required. In (24a) the *Damen und Herren* belong together as one party/group, whereas in (i) there are two parties, each with her/his own money.

[32] For this reason the derivation of conjoined DPs supports the assumption that DP is a phase.

We have noted that the ϕ-features that must match (in our derivation only [PL]) come from valuation in the computational component. This assumption brings up an interesting issue: We recall from previous discussion that all of the LIs for a numeration are selected from the lexicon at once, as proposed for independent reasons by Chomsky (2000). If we assume that (24a) is one syntactic structure whose numeration is selected in one operation, then we must assume that the two nouns *Damen* and *Herren* are selected with an unvalued number feature that becomes either singular or plural in the derivation. Following this assumption, we get the derivation outlined above in which the [PL]-value of the number feature on *Damen* is copied over to *Herren*. But there is more to the symmetry of these two DP-heads than this. They quite obviously have more matching features than just [GEN] and [PL]; both heads are also [ANIM],[human], and the matching must be even finer-grained than this because *Damen* cannot be conjoined with *Kinder*, even though *Kinder* has all of the above features. The crucial point here is that these semantic features come from the lexicon and are not valued in Narrow Syntax. This fact underscores the importance of some kind of matching in the selection process, but just how is that possible without LF anticipating what the conjuncts are and what features must match for symmetry? A solution to this problem is available from assumptions made by Chomsky (2001): a numeration consists of subarrays that are each merged cyclically. Given that each conjunct of a coordinate structure, as a SO, is a subarray, we need only assume for coordinate feature matching that a subarray is copied to WM immediately when identified as a conjunct (by the presence of [&]) while the next conjunct is selected, based on the feature specifications of the conjunct in WM. This matching occurs prior to any Merge operation; it is handled by LF – since Selection itself has no capability of its own for finding matches – which provides Selection with feature specifications from the subarray, a conjunct, in LM; since the features that must match in this way are all semantic, no syntactic structures are required. Selection from the lexicon thus proceeds conjunct by conjunct.

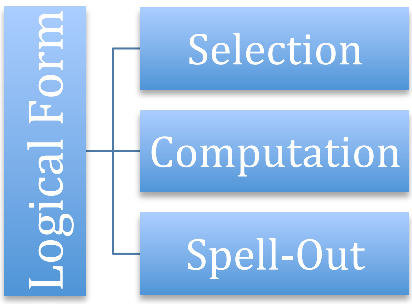
To summarize what I have outlined in this section about how a generative grammar meets the symmetry requirements of coordinate structures like those in (24), I formulate the following hypothesis:

(25) LF-interface instructions for Valuation and Selection

For the concatenation of a coordinate structure, the LF-interface provides feature specifications from the first conjunct to Valuation in Narrow Syntax when the second conjunct is merged; for assembling the numeration of a coordinate structure, the LF-interface provides to Selection the feature specifications of the leading conjunct when it meets the interfaces; if the conjuncts are smaller than a phase, the transfer occurs prior to cyclic Merge.

This hypothesis extends the general concept of Boeckx's proposal to coordinate structures in that LF invades not only the computational, but also the selection stage of derivation.[33] We cannot assume, however, that LF must reach through Narrow Syntax. Rather, the arrangement is more along the lines of (26):

(26) Grammar model with equal LF-access to all derivational stages[34]



In this arrangement LF is able to guide Selection directly rather than via the computational component, prior to Merge, though LF, as a global evaluative mechanism, is accessible throughout the derivation. Selection is able with this design to pick-and-choose from the lexicon; without an invasive LF, it could not. Indeed, if Selection had this capability on its own, it would be redundant with LF. This notion of Selection is closely related to the proposal for Spell-Out outlined by Epstein & Steely (2002). They argue that Spell-Out applies "inside" the valuation operation itself and that this is "tantamount to construing each single rule application as a 'phase'" (Op. cit. p. 85). Whether or not my own proposal

[33] Boeckx does not propose that the interfaces invade the selection process, only the computational component.
[34] Boeckx argues that Spell-Out must or should be dispensed with if LF is invasive. I will leave this question for further research. One aspect of invasive interfaces that I would like to clarify immediately is in regard to the localism-globalism debate, cf. Embick (2010) who uses this terminology to avoid the more contentious derivational vs. OT-grammar debate. My position is that invasive interfaces, at least how they are understood and presented here, do not break down or pose a contradiction to the basic derivational design of the grammar. Invasive interfaces should, in my view, be operable in such a way that they create a network that has global properties but does not undermine the fundamental derivational architecture. Rather than setting up or creating competition between structures of any kind, this kind of network prevents competition from developing.

supports or would benefit from this concept of Spell-Out and phase will be left to further research.

Coordinate structures with matching semantic features such as those in (24) share properties of traditional complex structures consisting of a main and an embedded clause in which there is a antecedent-anaphor relation. Both types of structures, the coordination of two independent clauses, and and the embedding of one clause in another, involve syntactic and semantic relations that extend from one phase to another. An invasive LF assisted by WM can also provide the semantic bridge between phases for such structures. Copy alone cannot perform the matching operations needed for (27):

(27) a. [*Paul* [*write**s** several books*$_i$ *a year and* [*always publishe**s** them*$_i$ *in the same place*]]]

b. [*Paul*$_i$ [*writes several books a year and* [*always rewards himself*$_i$ *with a vacation*]]]

In (27a) the ϕ-features of the verb, represented here by *–**s***, cannot be copied from the first conjunct to the second because each is a phase.[35] Note that in (27b) the anaphor-antecedent relation, involving formal features, is established across a phasal boundary. These Copy operations require an invasive LF because the formal and semantic features of the first conjunct that are visible in Narrow Syntax do not provide all that is needed for the matching of the second conjunct. A finer-grain matching is required: the two lexical items *write* and *publish* in (27a) and *write* and *reward* in (27b) have semantic features that match in some sense for creating a logical coordinate structure.

The role of Copy in Narrow Syntax for the derivation of (27a) is limited to the ϕ-features of the verb and the [PL]-feature of *books*.[36] One approach to account for this Copy operation is to assume that the entire first conjunct is held in WM until the second conjunct is merged (as proposed earlier). This first conjunct can thus act as a template for not only the selection of the LIs for the numeration of the second conjunct (assuming one selection operation for each clause), but also for the Copy operations that transfer the ϕ- and [PL]-feature to the second conjunct, i.e. the storage of the leading conjunct in WM significantly narrows the target area of Copy.

[35] I am leaving aside the subject-verb relation in the second conjunct since it extends from the first to the second conjunct via the conjunction in an analysis in which the conjuncts are vPs and the shared subject sits in Spec,TP. This structure and the relations it entails are complex and would thus unduly complicate the analysis at hand.

[36] An alternate derivation of (27a, b) would have an elliptical subject in the second conjunct which enters an Agree-relation with the verb, just as the lexical subject in the first conjunct does. I will leave this approach aside here out of space considerations.

The question arises: Is Copy capable of selecting the matching features, even given a template? What recognition or targeting capability does Copy have?[37] My assumption will be that Copy must be guided by the grammar, if we understand the term 'Copy' narrowly, i.e. devoid of a matching, recognition or targeting capability. A solution to this problem has been proposed here: LF picks the target for Copy, based on the matching of the two conjuncts. Only LF can match the semantic features of parallel LIs because only LF has the interpretive capability necessary for reading the relevant features; furthermore, the matching required in Narrow Syntax for the derivations of (27a, b) is based directly on the LF-based matching that is performed at Selection.[38] At both points in the derivation the two verbs must be matched for their suitability to share a single subject and thus agree with it, and at both points the two LIs in the anaphor-binding relation must be compared for minimally the [PL]-feature. Thus we see that an invasive LF-interface provides an essential matching capability, without which LIs could neither be selected nor concatenated in a way that meets the symmetry requirements of the interfaces on coordinate structures and avoids a crash.

In the next subsection we consider in more detail various sentence types that further illustrate the need for an invasive LF-interface.

4.4. Invasive LF at all stages of a derivation: evidence and arguments

In this section evidence from two construction types will be presented: 1) complex constructions with binding relations across clause boundaries, and 2) coordinate structures with symmetries (parallelisms) that extend across conjunct boundaries that are sometimes also clause boundaries.

4.4.1. Binding across clause or conjunct boundaries

The constructions in (28) provide another example of why an invasive LF is required not only at Selection, but also within Narrow Syntax and between Narrow Syntax and subsequent inducements of Selection when all of the LIs of conjoined clauses are not selected at once:

(28) a. *Paul*$_i$ *and Patrick*$_j$ *are working on a book and will soon call #his*$_{i/j}$*/their*$_{i+j}$ *editor*

[37] This question is not, in my view, adequately addressed in the literature. Nunes (2001, 2004) does not address it, even though his theory depends crucially on Copy for providing matching elements.
[38] How LF performs this matching is of course a nontrivial question, one that is better addressed in a study that focuses primarily on the design of the LF-interface.

b. (*Paul*$_i$ *and Patrick*$_j$ *are working on a book.*) [$_{TP}$ *Paul*$_i$ [$_{vP}$ *wrote the first chapter and* [$_{vP}$ *called his*$_{i/*j}$ *editor*]] *and* [$_{TP}$ *Patrick*$_j$ [$_{vP}$ *selected art materials and* [$_{vP}$ *worked on his*$_{*i/j}$ *sketches*]]]]

The symmetries in (29) must be established either at Selection or in Narrow Syntax for (28a, b) to avoid a crash at the LF-interface:

(29) Examples of coordinate symmetries required for the interpretation of (28a, b):

i. In both structures, the conjoined subjects *Paul* and *Patrick* must each have the feature [human] for the relation of being coauthors, as required to share the conjoined verbs *are working/wrote*, etc. and the possessive pronoun *their*.

ii. In (28a) the conjoined subjects *Paul* and *Patrick* must together bind *their*; *his* cannot be unambiguously bound by either one of these subjects, thus ruling out what would be an asymmetric relation of the conjoined subjects to *editor*.

iii. In (28b) the binding of the pronoun *his* is restricted to *Paul* in the first TP-conjunct and to *Patrick* in the second TP-conjunct, requiring the binding domain to extend from one vP-conjunct to the next one, but not from one TP-conjunct to the next.

iv. The objects *book*, *first chapter* and *sketches* must be co-referential across all the conjuncts of (28b), with the latter two subparts of the former.

v. The verbs *wrote* and *called* in (28b) must match as verbs and share the subject *Paul* in the first TP-conjunct; in the same way *selected* and *worked* must match and share the subject *Patrick* in the second TP-conjunct; for each of these sharing relations, the verbs must meet the same symmetry requirements as in (28a) cf. (i).

vi. More globally, several matching relations can be identified in (28b):

   a. *Paul* and *Patrick* must be semantically parallel beyond the feature [human] to be coauthors, i.e. both must be understood as educated writers, etc.

   b. *wrote* and *sketched* must be recognized as semantically parallel, specifically as two actions producing one book, shared by these coauthors.

   c. *first chapter*, *art materials* and a *sketches* must be recognized as semantically parallel, specifically as parts of a shared book, cf. (b).

   d. The matchings in (a) – (c) are not part of the syntactic computation, but they suggest a form of cognitive matching that enters into interpretation at LF; just how this all is organized must be explored elsewhere.

Note that none of the coordinate symmetries in (i) – (v) can be established in any form by Narrow Syntax alone, not by Binding, nor Agree nor any other operation, unless we enhance the computational component significantly.

The syntactic relations in (30) must, however, be derived in Narrow Syntax because they at the very minimum create the basis of symmetric relations required at the interfaces:

(30) Syntactic relations in (28) necessary for satisfying symmetry requirements of the interfaces:

a. In (28a) the node dominating *Paul* and *Patrick* must have [PL] for agreement with the two verbs *are* and *will*, and with the pronoun *their*; all the nodes of these heads must have [PL]. Thus, the syntactic conjunction in (28a) involves subject-verb and pronoun-antecedent agreement relations requiring at least this matching feature, without which the two conjuncts cannot be interpreted correctly in LF.

b. In (28b) *Paul* must bind and be co-indexed with *his* in the first TP-conjunct (only) and *Patrick* in (28b) must bind and be co-indexed with *his* in the second TP-conjunct (only). For these binding relations to be interpreted as required by the interfaces, two matching operations are required: i) the two TPs must be matched to determine the binding domains, specifically that the binding domain of each *his* is restricted to the immediate TP, in contrast to the binding domain of *their* in (28a); possibly the matching of the two TP-conjuncts values a feature that plays a role in the delineation of binding domains;[39] ii) the two verbs in each TP must be matched along the lines of (30a) for the sharing of their respective subjects.

c. The syntactic relations in (28b) necessary for restricting the binding domain of each *his* to the immediate conjunct depends crucially on the asymmetric c-command relation in each TP-conjunct NOT extending to the next TP-conjunct; this limitation does not follow directly from the structure in the phrase structure analysis given in (28b) (the first TP dominates the second one). If this analysis is to be maintained, then a matching operation must determine the binding domain of each subject.

d. Assuming (c), the syntactic structure does not directly support interpretation in this analysis; interpretation depends at least in part on a coordinate matching operation.

[39] This point is admittedly vague; more detailed discussion would take us far afield, as it involves the pragmatics of binding domains. Clearly, a precise analysis of coordinate symmetries requires such a discussion, and it points to an area or component of grammar, pragmatics, that must also be pervious to an invasive LF-interface.

> For this, Narrow Syntax depends on the LF-interface, but not only for this interpretation: Because the binding relation between *his* and its antecedent in each conjunct must bridge a phase boundary, it cannot depend on the edge for this; the derivation must first meet the LF-interface where the matches can be made.

The binding facts and my proposal to account for them above appear to put coordinate structures in a realm of their own, contrary to how a Minimalist grammar should be designed. Against this conclusion I will argue that further investigation would show that binding in coordinate structures sometimes results from the recursive application of binding principles, while in structures like (28b) coordinate feature matching interacts with pragmatic principles of binding to define a more restricted domain than in a discourse context involving only simplex sentences. The bottom line here: an invasive LF helps avoid any operations or principles that serve the needs of coordinate structures alone.[40]

The points important for the immediate discussion are i) that coordinate symmetry requirements exist to define grammatical relations such as binding relations in the interest of disambiguation, and ii) an invasive LF-interface is required in a phase-based model for the coordinate matching that underlies the grammatical relations necessary for binding across conjuncts or (other) phase boundaries.

4.4.2. Coordinate symmetries across conjunct boundaries

The classic examples of coordinate symmetries can be found in elliptical coordinate structures, the most common being Gapping (31), Right Node Raising (sometimes combined with Gapping) (32) and Left-Edge Ellipsis (33):

(31) a. *Jack rode a horse and Jim ~~rode/*rides~~ a donkey*

b. *Jill gave Jane a book and Jack ~~gave Jane/*Jill~~ a CD*

(32) a. *Jack rode a horse ~~without falling off~~ and Jim (rode) a donkey without falling off*

b. *Paul mag* e_i *aber Peter hasst Verwandtenbesuche*$_i$

Paul likes but Peter hates relatives-visits

[40] A detailed discussion is not possible here, but we can consider that restrictions on binding domains are also possible via prosodic features; thus, restrictions of this sort are not *per se* unique to coordinate structures. Related to this topic is the proposal of Lee-Schoenfeld (2008) that the definition of a binding domain for anaphors vs. pronouns follows from the definition of a phase. This proposal needs to be considered for its suitability in coordinate structures in which it appears, as in (28b), that the binding domain is restricted by the coordinate structure, which in the present proposal is assumed to be a phase (regardless of size). Johnson (2007) develops a proposal very similar to Lee-Schoenfeld's.

‘Paul likes but Peter hates visiting relatives / relatives visiting’

(33) a. *Dieses Buch findet Patrick doof und*

This book finds Patrick dumm and

~~*dieses Buch*~~ *kann Paul nicht mehr lesen*

~~this book~~ can Paul no longer read

‘This book Patrick finds dumm and Paul can no longer read it.’

b. *Den Bettlern gibt Florian keinen Cent mehr und*

the beggers gives Florian no cent more and

~~*den Bettlern*~~ *erteilt er auch kein Wort*

the beggers grants he also no word

‘To the beggers Florian doesn’t give a cent more, nor does utter a single word to them’

LF requires that both conjuncts be interpreted the same (symmetrically), i.e. the unspoken lexical items must have the same syntactic and semantic features as their spoken counterparts in the other conjunct. In order for the lexical items not spoken to be correctly interpreted, the remaining spoken items must provide enough “clues” for recovery. The structural symmetry of the constructions provides a basis for recovery, but recovery will fail unless the conjuncts have not only matching lexical items but also matching interpretations. In (32b), for instance, the word *Verwandtenbesuche* can mean two different things, as indicated by the translation. The meaning in the two conjuncts must be the same, i.e. they must match, for the structure to be logically interpretable. The precise details of how this could or should be worked out formally are not important to this fact, but it is obvious that Selection plays a crucial role, and the symmetry established by symmetric selection must be maintained all the way through Narrow Syntax, i.e. the computational cycle not only preserves this symmetry, it also values or checks features that make it more precise, e.g. with Case features. Thereafter the syntactic derivation must somehow recognize the matching lexical items and choose operations that capitalize on them in terms of derivational economy, resulting in the indicated ellipses. Again, the details of the derivation are secondary to the fact that the ellipses would not be possible if matching did not occur at Selection and Copy did not match the formal features.

Further evidence for the necessity of an invasive LF at the start of a phase-based derivation comes from the Dutch coordinate constructions in (34), analyzed by van Koppen & Cremers 2008:[41]

(34) a. (*Ik denk dat*) *Marie en* (**dat*) *jij samen moeten komen* (Standard Dutch)
I think that Mary and that you together should come
'I think that Mary and you should come together'
b. … *det Hay in Venlo mot blieve en-s toow môs verhoeze* (Tegelen Dutch)
that Hay in Venlo must stay and-2SG you-2SG must move
'… that Hay has to stay in Venlo and you must move'

Note first the ungrammaticality of (35), where (35b) translates (35a), and that both structures rule out an analysis in which two TPs or CPs are conjoined:

(35) a. *(*Ik denk dat*) [$_{TP}$ *Marie* [$_{VP}$ *samen moeten komen*
en [$_{TP}$ *jij* [$_{VP}$ *samen moeten komen*]]]]
b. *(*I think that*) *Mary should come together and you should come together*

Unless the first conjunct in (34a) is derived as a DP-phase first and is available via WM for guiding the seletion of the second, we cannot explain how *samen* 'together' needs to be selected for the VP shared by the conjoined subjects, requiring the interpretation of the two conjuncts together.[42] An invasive LF-interface must be part of this matching operation since Narrow Syntax is not able to recognize the features that must be duplicated in the second conjunct so that *samen* can be interpreted appropriately.

Van Koppen & Cremers provide no explanation for the ungrammaticality of (34a) with *dat*; it remains a problem for their analysis, as is the presence of the quantifier *idder* in (36b).

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[41] The analysis in van Koppen & Cremers (2008) follows the analysis of van Koppen (2004) based on evidence that in certain dialects of Dutch (such as Telegen Dutch) a coordinating conjunction shows agreement with the following conjunct, as indicated in (30b); however, this aspect of their analysis is rather orthogonal to my analysis here.

[42] Note here also that unless we assume, following previously presented evidence, that there is an asymmetric relation between conjuncts such that the first c-commands the second, we cannot derive the intended interpretation of (31b): *in Venlo* must be introduced first before the second conjunct *toow môs verhoeze* can be interpreted. This fact presents problems for accounts that assume a strictly "bottom-up" derivation, as does any coordinate structure in which an antecedent of a pronoun in the second conjunct is located in the first conjunct; they are very common.

Both problems stem from the CP-based Boolean coordination they assume, which requires the base in (36b) and coordination reduction for deriving (36a):

(36) a. *Hè dink det Marie en-s toow idder apart langskomme* (Tegelen Dutch)
he thinks that M. and-2SG you-2SG each separate by-come
'He thinks that Marie and you will come by separately'
b. **Hè dink det Marie idder apart langskomme ens toow idder apart langskomme*

An account of (36a) is available in a phase-based approach to coordination on the following assumptions: i) each DP conjunct is a phase – which has been supported here for independent reasons; ii) the pronoun *idder* 'each' is selected as part of the second DP-phase for completing the semantic feature matrix that is required for the interpretation (involving a binding relation with each subject as antecedent); iii) the selection of this pronoun must for reasons discussed earlier be guided by the LF interface since it involves a binding relation across phases. The derivation looks like this (ignoring the main clause *Hè dink*):

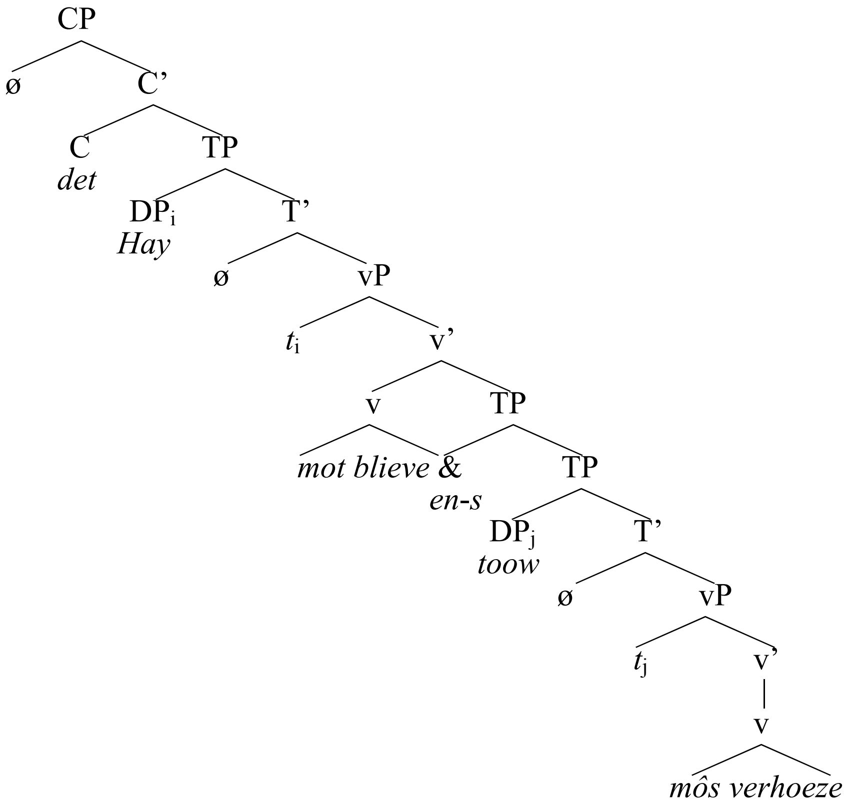
(37) select numeration *Marie ens toow idder apart langskomme*
merge *Mary* and *langskomme* as a vP
merge *ens toow idder* in the (right) adjunct position of the DP *Marie*
merge *apart* in the (left) adjunct position of VP (V')[43]
merge (internally) the DP-complex *Marie ens toow idder* to Spec,TP for Agree

Similar problems occur with the van Koppen & Cremers approach to Standard Dutch, as they point out (see op. cit. p. 1070, n. 6) These problems can also be resolved if the grammar has an LF-interface that invades Narrow Syntax and Selection, and if the conjunction in question does not require an extra projection. That is, in (38) the conjuncts are TPs, not CPs, and no CoP is required, see (38b) (van Koppen & Cremers' (15); note that *–s* is optional):

(38) a. … *det Hay in Venlo mot blieve en-s toow môs verhoeze* (Tegelen Dutch)
that Hay in Venlo must stay and-2SG you-2sg must move
'…that Hay must stay in Venlo and you must move.'

[43] I am assuming that DPs in Dutch have adjuncts on the right, while VPs have adjuncts on the left, as expected if we assume that Dutch is an SOV language. If we assume Dutch is an SVO language following Zwart (1993), then the VP-adjunct must raise from the underlying right-adjunct position in the VP to the Spec,VP position.

b.



Many details of this analysis are omitted here; they are not the focus of this investigation,[44] which is the need for an invasive LF-interface so that the following symmetries can be generated:

(39) Coordinate symmetries in (38) required by the interfaces:

a. *Hay* and *toow* must both have the semantic features [human], [experiencer]

b. *Hay* and *toow* must both raise to Spec,TP (for agreement)

c. both TP-conjuncts must have the tense feature [PR]

d. the verb clusters *mot blieve* and *môs verhoeze* must have symmetric syntactic features, roughly [modal], [infinitive] respectively, with the semantico-pragmatic feature [contrast] associated with the two conjuncts for the structure to have the intended interpretation.

[44] One detail omitted that should be pointed out here is that the optional –*s* morpheme indicated in (35a) can be affixed to the conjunction *en* and agree with the subject *toow* without any further stipulation. Furthermore, we have an answer to the question left open in van Koppen & Cremers' analysis as to why the complementizer *det* must be omitted from the second conjunct in both Telegen Dutch and Standard Dutch: there is no syntactic position available for it, and its presence would block agreement between the affix –*s* and *toow*: *det Hay in Venlo mot blieve en-s (*det) toow môs verhoeze*.

These feature symmetries require a matching or copying operation that is capable of operating within the entire grammar up to where the derivation meets the interfaces. The combination of an invasive LF-interface and Copy, assisted by WM, is capable of deriving these derivations for the following reasons:

(40) Using an invasive LF and Copy via WM for deriving (38b) and similar structures
   a. An invasive LF is required to match the two subjects when they are selected, since each subject is in a different clause, each of which must be selected separately.
   b. Copy can operate across the two TP conjuncts if the preceding conjunct is held in WM for matching with the second conjunct. This operation is completed in Narrow Syntax for the formal features of the finite verbs *mot* and *môs* 'must' but it requires an invasive LF because it extends across phase boundaries.
   c. An invasive LF guides the selection of the LIs for the second TP so that the semantic symmetries with semantic contrast generate the intended interpretation.
   d. Although the raising of the two subjects to Spec,TP in each conjunct follows from the derivation in Narrow Syntax and does not *per se* require invasive interfaces, the matching described in (40a) is nevertheless required, as otherwise the interpretation with the contrast between the two subjects and the parallel raising to Spec,TP would not follow.

A closer inspection of all the syntactic and semantic features that constitute the LIs in this construction might reveal more symmetry requirements. The above analysis is sufficient, I think, to make the point that the derivation of coordinate symmetries requires a greater level of integration in the grammar than the derivation of simplex structures, and that coordinate structures provide stronger empirical evidence for the hypothesis that the interfaces must be included in this kind of grammatical integration. I have already shown in §4.4.1 that binding relations between clauses of complex constructions (main+embedded clause) also suggest the need for invasive interfaces.

5. Conclusions

In the introduction I stated that the MP provides the right tools to account for the empirical facts of coordinate symmetry. Yet, a theoretical dilemma remains, namely, that the coordinate symmetries required by the interfaces depend on the right choice of LIs and thereafter on the derivation creating crucial matches. Selection and Narrow Syntax lack the capability to make these matches on their own; an invasive-LF is required to provide the information that Selection needs for constituting a viable numeration and that Narrow Syntax needs for valuing features with the right matches. Further research is required to make more precise the exact procedure by which the LF-interface guides Selection and Narrow Syntax.

My aim was to demonstrate through the close examination of the properties of coordinate structures that a Minimalist generative grammar must have components that are integrated sufficiently so that the LF-interface is able to provide this kind of guidance. A specific empirical finding is that Narrow Syntax cannot on its own concatenate LIs with sufficient coordinate symmetries for meeting the interpretive requirements of the LF-interface. I hope to have shown that the intended interpretation of a construction will fail hopelessly without this invasiveness. Allowing LF to invade Selection and Narrow Syntax nevertheless preserves the central concept of a generative grammar because it does nothing to fundamentally alter the design as it has been understood in the MP; it arguably only enhances the design.

As assumed in Minimalist accounts, a derivation that does not satisfy the interface requirements will crash if there is no repair mechanism available; presumably that is the fate of a coordinate structure that does not meet the symmetry requirements of the interfaces; this scenario, I argue, can be prevented with LF-invasiveness. There are, of course, alternate ways to prevent or repair a crash, see for instance the proposals in Putnam's (2010) volume and Müller's (2011) overview of an optimality-theoretic approach. Whether these in their current or modified form can account for the facts of coordinate structure presented here is a question that must be left for further research. The objective of this investigation is admittedly relatively modest; the proposal presented here must be made more precise, specifically the interfaces must be equipped with a set of instructions for evaluating coordinate symmetries, without which my proposal remains an untestable assumption.

Broader questions regarding the place of grammar in the mind that might be relevant here are: 1) How is the area of the brain, where thoughts that are to be formulated in language originate, connected to the interfaces? Surely there must be a connection between LF and this area; it seems that the answer to this question might help address the question of why LF has symmetry requirements at all. 2) If the connection between the thought- and language-generating areas and LF guides the selection of lexical items, then does it also guide the valuation of features in Narrow Syntax? 3) At what points precisely is WM required in this process? As these questions suggest, further refinement of a Minimalist generative grammar will require a collaboration of efforts in several different fields: grammar, mind and human cognition.

Abbreviations

ACC = accusative

ANIM = animate

DAT = dative

e = ellipse

FEM = feminine

MASC = masculine

NEUT = neuter

NOM = nominative

OBJ = objective

PART=particle

PL = plural

PR = present tense

SG = singular

t = trace (copy)

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