The English extended verbal projection

Annabel Cormack & Neil Smith

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1 Preamble

This article is part of a book currently in preparation. It is the first of four chapters which set out our theory about how 'movement' in natural language should be treated in a Minimalist grammar where Merge, and hence underlying order, is primarily driven by LF demands. This chapter and the next are sisters, accounting for 'head movement' in this chapter and 'phrasal displacement' in the next. Here, we investigate the requirements for 'head movement', using the heads and affixes of the clausal spine as initial data. We argue that head movement is obtained by selective Spell Out of terminals obtained within narrow syntax solely by 'Agree'. We argue for an 'Agree' system using simple or paired morphosyntactic features associated with heads in the lexicon, regulated entirely by Merge with unification. We show that Agree need not be specified as 'upward' or 'downward', nor is c-command required. Intervention effects fall out from the Merge rules. Relevant lexical entries including morphosyntactic features are given for verbs, auxiliaries, modals, negations, and dummies.[1]

2 Outline of chapter

In this chapter, we begin to give a basic account of a simple clause in English, concentrating on the extended verbal projection (V-EXT) in the sense of Grimshaw (1991, 2000). We argue for an architecture supporting the following procedures.

The speaker has in mind an LoT representation of the explicature he intends to induce in the hearer. LoT items are semantically unambiguous. The LoTF is a string, made up of LoT units that include combinators, with the string being uniquely structured by the types of the units of which it is composed under Functor First Application. He selects a possibly simplified or modified version of this for the target LoTF of the utterance he will produce in some NL. The aim is to produce a well-formed structure such that (i) the LF is equivalent to the desired LoTF modulo ID elements, and that (ii) this and the associated PF will have appropriate pragmatic effects.

As a first approximation, we can see the sentence underlying the utterance as produced by three processes. The first ('Merge') is effected by recursive merge of items from the NL lexicon (triples of an LF feature, a complex Category feature and morphosyntactic features). The second process ('Prune') determines which morphosyntactic features of the terminals are to be pronounced at each position, and depends on the structural properties of merge. We call the resulting MSyn features the MS associated with the terminal item.

[1] Full acknowledgements will appear in the book, but we have to recognise here the help we have already received from Greg Stump, Grev Corbett, Anders Holmberg and especially Maria Polinsky.

The third process is a mapping from MS to phonological form (PF), the MS→PF mapping. We justify this division in detail below.

We largely ignore the MS to PF mapping, the domain of morphology and phonology. Similarly we ignore most aspects of information structure (IS) and intonation. This has to be structure-based because of near minimal pairs such as (1) (from Bresnan, 1971:258) which are intonationally systematically distinct in correlation with the syntax.

(1) a Helen left **directions** for George to follow (non-restrictive relative clause)

b Helen left directions for George to **follow** (complement clause)

For relevant discussion see Steedman (2000b). The main point to note is that the IS system is recursively defined on the basis of the syntax of a CCG. We assume that something along these lines is compatible with our system.

There are three kinds of feature involved in the recursive Merge of items from the lexicon. One of these is the LF of an item, which is a semantic feature, being interpretable by virtue of correspondence to an LoT item (a simple atomic element, or a phrasal item). Other features are varieties of syntactic feature. We argued in Chapter 2 that structured categories such as V/D are needed to account for the compositionality of c-selection, so syntactic category is one syntactic feature associated with a lexical item. But this is clearly not sufficient: it accounts neither for agreement phenomena nor for LF-vacuous displacement. A second kind of syntactic feature is needed, one which we call an MSyn feature (‘morphosyntactic feature’). This, we argue, consists of a set of <attribute: value> specifications of a more familiar kind, such as <VERB: *HOIST*>, of which more below.

For any language, these features are accessed as parts of a ‘lexeme’ as it is listed in the lexicon, and may be merged in a structure for which the speaker intends to produce an external representation. The result of each binary merge is an item (a phrase), with LF, category, and MSyn features, defined by the rules of Merge for each of these three components. ‘Agree’ as we understand it is a process operating on MSyn features which occurs as part of Merge.[2] We will refer to the MSyn features associated with the terminal nodes of an item as the MSyn of the item. It is this MSyn that is mapped by Prune to MS — a stripped down MSynF.

We concentrate here on the ‘TAMP’ heads available in a finite clause: tense, aspect, mood and modality, and polarity, together with diathesis (e.g. passive), but omitting phi-features. At the same time, we necessarily begin to explore the properties of the grammar that require and enable the inflectional reflexes of these heads that appear on the verb or other TAMP heads.

[2] ‘Agree’ as we use it in this chapter corresponds to Hornstein’s 2010: 120 ‘local Agree’.

We begin by arguing that the traditional notion of a lexical item as comprising a triple of LF, categorial, and PF features is not adequate. In particular, it does not account for heads that surface at PF modulated by or contributing inflection (including agreement). For these, we argue that the LF item must be associated not with a PF but with categorial and MSyn features. Some of these features may be partially unvalued; only when the feature bundle is fully valued, during the course of the derivation, can it be mapped to a PF form.

The second part of the chapter examines what MSyn features, as indicated above, are required in addition to categorial features, and how they behave under Merge. Under the maximally simple merge-driven version of minimalist 'Agree' that we construct, we are able to show that neither c-command nor any locality restrictions need to be specified. The rest of the chapter then explores a range of data which can be explained by exploiting the postulated MSyn features under this version of 'Agree'. This includes the displacement known as 'head movement', which is manifest at PF (and hence falls under what we loosely call 'PF displacement'), but which results from the way Prune treats certain MSyn features.

3 Arguing for Morphosyntax and Morphophonology

3.1 Lexical information: why morphosyntax and morphophonology?

Our argument for morphosyntax is based on three assumptions, and four claims, made against a background of the LF-driven theory of grammar we are pursuing.

Assumptions

- Merge is driven by the lexicon, as in Chomsky (1995a:243) and most formal theories of grammar
- Variation between grammars must be represented
- Storage of information in the lexicon is economical[3]

Claims

- Assuming an ordered LF, the minimal information needed for generating externalised phrases is a lexical pairing of an LF item with a PF item, together with

[3] Some economy in the form of defeasible generalisations is demonstrably necessary to account for speakers' treatment of neologisms along the same lines as regular examples. Strikingly, in this case the 'regular' (default) need not be the most frequent (see Clahsen, 1999:995).

merge rules for LF and for the associated PF. Suppose the merge rule for LF is function argument application under Functor First; and that for PF is linear concatenation respecting the same order. Assuming binary merge, the required merge rule would be as in (2), where '$\alpha.\beta$' represents function argument application of α to β and *f* is some function determining how δ and γ appear jointly at PF (e.g. δ precedes γ, δ is cliticised to γ):

(2) Merge <{LF: α, PF: δ}, {LF: β, PF: γ}> => {LF: $\alpha.\beta$, PF: $f.\langle\delta, \gamma\rangle$}

The LF-PF pairing for lexical items could reflect NL variation in concepts lexically encoded (at LF, for instance, the verb *pout* in English has no real equivalent in French), and in PF forms permitted (e.g. English allows initial *sp*-, *tr*- but not **ps*-, **rt*-), but it could not respond to syntactic variation between languages, nor to morphological variation of the sort influenced by syntactic structure.

- Syntactic variation requires a further system of representation utilising purely NL syntactic features (uninterpretable at LF and LoT), which we will argue include morphosyntactic features as well as category.

- It follows that the lexicon contains categorial and morphosyntactic information, and associated rules of merge.

- As indicated above, there must also be a morphophonological component, taking the output of the syntactic system and mapping it onto PF, the interface with the motor system, for externalisation.

3.2 The relation between morphosyntax and morphophonology

3.2.1 Capturing generalisations

Our exploitation of the syntactic system for NL must be adequate to capture significant generalisations in terms of the categories and classes provided by the theory, in particular, in being able to access morphological paradigms or their equivalent, even though the detailed content of morphological paradigms falls under the MS→PF mapping.

We assume here that all generalisations are entered in the lexicon for a given language, by means of specifications which include underdetermined MSyn features. Any legitimate pairing of an LF item (including its type) with MSyn features which is listed in the lexicon constitutes a lexeme in that language.[4] These features are utilised in a derivation under a default logic with unification.[5] It is the valuation of underdetermined feature values during Merge that gives 'Agree'.

We predict that the parametric differences between two languages can be characterised by (i) differing generalisations made for relational and functional heads, or differing syntactic (category and MSyn) properties for functional heads; (ii) differing choices for a particular item in LoT as to whether it is encoded in NL as a relational or a functional item.[6]

3.2.2 Category

The least controversial element of NL syntax is that of syntactic category. To specify this, as discussed in Chapter 2, we use Categorial Grammar, which registers not only a category such as N or V or C, but also notates the selections associated with these items. Thus a typical LoT one-place predicate of type <e, t> has category V/D or A/D or N/D or P/D; operators, binders, and combinators have more complex categories. Both types and categories are merged by function-argument application. Categories serve, via selection, simply to restrict the well-formed phrases otherwise generated by LF types alone. For example, [TRULY [PUPPY FIDO]] is well formed in LoT and LF, assuming the epistemic to have type <t, t>, PUPPY <e, t>, and FIDO, <e>, but if TRULY has category T/T or V/V, PUPPY has category N/D, and FIDO, D, the phrase will be ill-formed by category.

3.2.3 Word class

Neither LoT types nor categorial grammar categories make a distinction between heads and phrases. Lexical entries are generally heads, but might be phrases, as in the case of idioms, clichés, proverbs and so on. But the notion 'head' is nonetheless required: for example, it is typically heads that are involved in agreement and inflection. For these reasons, a head is assigned a 'word class' such as NOUN or PREP. Phrases do not need such features — category is sufficient. For heads, category is not sufficient, as we show below.

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[4] The only relevant restriction is that type and category must agree in arity, as discussed in Ch CCG. Note that this notion of lexeme is broader than that used by Beard 1995, since it includes lexemes whose LFs relate to both relational ('lexical') and functional heads.

[5] For a general plea for unification grammars, see Sag et al 1986.

[6] As discussed in Ch CCG, examples under (i) might arise from the different cut-off points for unaccusatives vs. unergatives in different languages (Sorace 2000), or whether a language distinguishes syntactically between auxiliaries and Raising verbs. Under (ii) lie such choices as whether numerals are encoded as quantifiers or as relational predicates.

These features can inter alia be used to restrict the PF associated with classes of items, for example so that NOUNs must be bisyllabic, and VERBs must begin with a consonant, as in Nupe (Smith, 1964). Such restrictions may make lexical access and parsing easier.

Further, within word-classes it may be necessary or economical to make finer distinctions on distributional grounds. For example, we might set up the relations in (82a) to distinguish common and proper nouns, where the sub-classes are stipulated to be exhaustive. Similarly, we might minimally divide the items which require or assign verb-related inflection into two, as indicated in (82b).

(3) a PROPER $\subset$ NOUN; COMMON $\subset$ NOUN; PROPER $\cap$ COMMON = Ø[7]

b AUX $\cup$ VERB = V-EXT

In either case if we say that a NOUN has such and such a property, by default it applies to all NOUNs, including those falling under PROPER, and similarly for V-EXT, with respect to VERB and AUX.

It is word-class that is used in setting up the Agree system to ensure for example that PROPER names are associated in English with a null determiner,[8] or AUX with inversion in questions. Neither semantic type nor NL category are suited to elaborating such well-formedness conditions.

There is a default correlation between word-class and goal category. For example, by default an item with word-class VERB has category V/D/D with goal V, and an adjective of word-class ADJ canonically has category A/D/D with goal A. However, we will argue that an item with word-class MODAL may have a category with goal V or goal Pol. Likewise, the word-class of an item with a particular PF may vary: *to* may be the PF related to a lexeme with word-class PREP and goal P, but *to* may also be the PF associated with the infinitival marker, with word-class AUX and goal V.

Although relational heads have special properties, we will argue that binders and operators also need a word-class. For example, determiners will be assigned DET, and adverbs, ADV.

For some lexemes, once information in the lexicon is retrieved, the PF is already determinate. Examples for English are the prepositions such as BEHIND, which corresponds directly to the PF /biˈhaind/

[7] We have chosen not to use features like [–COMMON]. Aside from the additional feature value '–' (minus), such features require more adjustment if it turns out during learning that there are three rather than two subclasses of NOUN.

[8] Hence we have also to allow for the coercion of proper nouns to common nouns, to permit 'the Oxford of the last century' and so on.

In other instances, the PF is not determined for a single lexeme, but requires information relating to two or more lexemes. Examples in English include verbs such as EAT, and tenses such as PAST, which cannot be realised independently, but may be realised jointly as *ate*; or NOUNs, which need NUMBER. In the next subsection, we discuss the structure of the features allowing — and requiring — this.

3.2.4 Morphology and paradigms

A paradigm, usually shown in tabular form, is a mapping from two or more pieces of input information to a PF, usually shown as the content of a cell of the table. The simplest hypothesis is that the inputs are LF items:

(4)

	PRES	PAST
RUN1	/rʌn/	/ræn/
BUY1	/bai/	/bɔ:t/

However, there are a number of verbs with morphology like that in table (4) which make such a hypothesis problematic. Consider RUN1, the LF of the intransitive motion verb with agentive semantics, vs. the intransitive verb RUN2 applied to the flow of a liquid, vs. transitive verb RUN3 applied to running a business or a conference (our use of the same form plus subscripting is for mnemonic purposes only). Note that the LoT representations, and hence LFs, of these verbs are very probably synchronically unrelated (any relationships are carried in Meaning Postulates). If we supply a new paradigm for each (and there are many more), we fail to capture any generalisation; but we take it that the mind/brain does store such information economically.[9] We have two alternatives: either we must provide a Morphological Generalisation stipulating that the paradigm mappings for RUN2 and RUN3 have the same outputs as does the mapping for RUN1, or we can use an intermediate Msyn representation giving, say, *RUN* and *BUY*, where distinct LFs (RUN1 and RUN2) may map onto the same MSyn representation *RUN*.

If it were viable, the first of these options would be the more parsimonious. But it is not viable — ultimately because languages manifest synonymy and homonymy. For

[9] Economy of storage may be one reason why there is such a lot of homophony in NLs, including sign languages (where both manual and oral gesture is taken into account). Even where a new term is required, there is a tendency to re-use old forms (for example, *group*, *ring* and *field* as technical terms in mathematics (see Cormack 1978)). The consequent higher burden on the hearer in pragmatic processing seems to be outweighed by storage economy, or perhaps familiarity of the oral/manual gestures required for output and recognition.

example, the verbs whose citation forms are *buy* and *purchase* have lexical entries with the same LF, say PURCHASE. This means that the LF alone, or even the LF in conjunction with the category, cannot be used as the input to the paradigms required. We cannot instead use the citation form to call up the correct paradigm entries, as we can see from consideration of verbs whose citation form is *ring* in English. The transitive and intransitive verbs concerned with the ringing of bells are irregular, having a past tense *rang*; the other verbs, concerned with forming a ring (circle) are regular, with past tense *ringed*. There is a further paradigm entry involved, with the same citation form, that for *wring*, with past tense *wrung*. The use of the past tense form instead would be unambiguous here, but perhaps not always.[10] In any case, the content of a cell of the table is not appropriate for child learners, whose task is to establish the right PF content; they may very well not have learned the past tense form /ræŋ/ or /rʌŋ/. We are forced then to adopt the MSyn solution, with *PURCHASE* and *BUY*, say, for LF BUY, and *RING1* vs. *RING2* vs. *RING3* for the various verbs with citation form pronounced /riŋ/. We refer to *BUY*, *RING1*, as 'word-names'[11], and usually represent them by an italicised version of the LF. For example we will use *GO* for the word-name indexing the paradigm entries including /gəuz/ (*goes*) and /wɛnt/ (*went*).

(5)

	PRES	PAST
RING1	/riŋ/	/ræŋ/
RING2	/riŋ/	/riŋd/
RING3	/riŋ/	/rʌŋ/

The question immediately arises as to whether the LF items PRES and PAST as axis labels for the tables should also be replaced by MSyn word-names. The answer is yes, though it is surprisingly difficult to come up with many clear examples. There are atypical nouns in English like *trousers*, which are semantically singular but syntactically plural. Thus the LF 'PLURAL' won't do for the morphosyntactic feature, which we give as '*PLURAL*'. There are atypical verbs, like the Latin deponent verbs, which inflect as if they were in the local scope of the semantic Passive operator, but are semantically active — so that LF 'PASS' is

[10] For instance, *lean* and *lend* share the phonological form /lɛnt/ for the past tense: the orthographic distinction between *leant* and *lent* is presumably irrelevant, though there may be separate orthographic paradigms for literate subjects.

[11] 'Word-name' corresponds to the 'lemma' used in psycholinguistics to embrace the semantic and syntactic properties of words, but excluding their morphophonological properties (see Caplan, 1992:106, following *inter alia* Levelt, 1989). Our word-names here have the same paradigm-addressing function as Stump's 'root' (Stump 2001:32), but 'word-name' applies to inflection-supplying heads too

distinct from MSyn '*PASS*'.[12] The paradigm related to LF PAST in English is the same as the one required in Sequence of Tense (SoT) contexts for both PRES and PAST Tenses (see section 10), so that economy dictates an LF-free labelling for the horizontal axis in (5).

We now assume that the paradigms shown in (5) should rather appear at least as in (6), with MSyn correlates for the labels of both axes, as indicated by the italics:

(6)

	PRES	*PAST*
RING1	/riŋ/	/ræŋ/
RING2	/riŋ/	/riŋd/
RING3	/riŋ/	/rʌŋ/

We argue further that both axes need word-class in addition. In English, a verb needs inflection (possibly null), which must be licensed by a higher item, such as Tense. If we give the inflecting items their morphosyntactic name only on the inflection axis, we miss the appropriate generalisation: it is verbal items that need inflection. Similarly, we need to capture the generalisation that every AUX licenses inflection on a VERB. Then we can stipulate that for English, TENSE ⊂ AUX. We may now state that the parameters for a paradigm for some verb <VERB: *u*> always include <AUX: *u*>.[13] Accordingly, the simple paradigm given in (5) instantiating this for three VERBs and two inflections should rather be as in (7).

(7)

	TENSE: *PRES*	TENSE: *PAST*
VERB*: RING1*	/riŋ/	/ræŋ/
VERB*: RING2*	/riŋ/	/riŋd/
VERB: *RING3*	/riŋ/	/rʌŋ/

Note that although we use 'word-class' and 'word-name', these are not in a one-one relation with the phonological words such as /riŋ/ or the orthographic equivalent (*w*)*ring*. A 'phonological word', such as /rʌŋ/, is the PF correlate of some well-formed set of

[12] We sketch how this might work in the Appendix to this chapter.

[13] We generally use *u* or *v* for underdetermined MSyn features, and X, Y etc. for underdetermined categorial features, Sometimes we use α, β for features which would be determined at some point in a particular derivation, so that for instance we can say that α unifies with *u* to give α. This is comparable to the use of a, b, c vs. *x* in the general quadratic equation '$ax^2 + bx + c = d$'.

features each of the form <word-class, word-name>. We will refer to features using these forms as MSyn features, in contradistinction to categorial features, which are the other syntactic features.

The mini-paradigm in (7) can be interpreted as representing the MSyn to PF mapping (MS→PF) for certain pairs of attribute-value features, where one member of the pair is drawn from each axis. Overwhelmingly, this mapping is a function, giving exactly one output for any input.[14] In English, all such paradigms have two dimensions, one for a 'root', under which a VERB falls, and one for an 'inflection' (we abstract away from phi features). The English TAMP system is complex largely because some TAMP heads provide only inflection, others provide only a root, and some provide both.

As mentioned above, we assume that the lexicon is subject to economy principles of storage, so that not all forms of verbs will be stored, but simply the minimum, with the rest being constructed by rule. Whether the mature speaker represents the information with the aid of rules is in fact an empirical question, though there is not much doubt that rules are necessary for agglutinating languages like Georgian. A complete verbal paradigm can always be derived by default rules from some *n* specifications: in English, one, two or three are required —(*love, lose/lost, break/broke/broken*) — whereas in Latin four are needed (*amo/amare/amavi/amatum/, ferro/ferre/tuli/latum*). We can take the required *n* specifications as seeding the paradigm with stems, with the other cells being filled as required, by rule.[15] Anticipating the notation we will be arguing for later, such rules would have the form in (8), for the English passive – past syncretism:

(8) MS→PF.<VERB: *u*, AUX: *PASS*> = MS→PF.<VERB: *u*, TENSE: *PAST*>

Such a rule falls under Zwicky's 1985 'rule of referral'. Given some paradigm, it is the task of the morphophonological system to give an economical account of the MS→PF mapping itself, for each language.

Consider now a noun and verb pair such as *ring* (the shape) and *ring* the verb of motion for traversing such a shape. These have meanings that are related by associated Meaning Postulates, which ultimately motivates the relation between the PF forms. It seems possible then that this overlap is carried over to the MSyn. If the MSyn include <NOUN: *RING2*> and <VERB: *RING2*> respectively, this connection is encoded. Indeed, the MSyn to PF mapping could include a step stipulating that for <*u*: *RING2*>, the stem for the

[14] Cases of multiple output include the choice of plural for *roof*, /ru:fs/ or /ru:vz/; the past tense *dived* or *dove* for some speakers. An example of an output failure is that of past tense for *beware*.

[15] We are using 'stem' in the sense of Stump 2001: Ch 6. We are, perhaps optimistically, taking it that further complexity and generalisations related to paradigms are within the province of morphophonology, not morphosyntax.

paradigm is /riŋ/. This could not be captured directly if the word-name were unique to the paradigm. If the paradigm parameters always include the word-class, this economy is possible, so we will assume it for mnemonic reasons, though nothing crucial for our purposes hinges on it. Whether it is ever or sometimes used by native speakers is an empirical question.

Accordingly, we propose that the minimal feature appearing in MSyn specifications is always of the form <WORD-CLASS, *WORD-NAME*>. In the simplest instances, such as the preposition BEHIND, this is all the MSyn information needed, and we have the PF associated with a single-cell paradigm.

(9) LF: BEHIND MS→PF. <PREP: *BEHIND*> = /biˈhaind/

Many lexemes require more complex paradigms. Every lexeme is associated with a canonic MSyn feature, which we often use as an abbreviatory device to indicate the lexeme itself. For instance, the lexeme with canonic MSyn <NOUN: *DOG*> cannot be realised at PF without number information, to yield a PF of /dɔg/ or /dɔgz/. If we want to express the generalisation that nouns must bear number features, where we assume that this arises from the head within the noun-phrase, we need to treat singular and plural features as values of the word-class — NUM. Then we can state the generalisation in (10), where ‘α’ is a lexeme.

(10) Canonic MSyn.α = <NOUN, *u*> → <NOUN: *u*, NUM: *u*>> ∈ MSyn.α

The feature pairs in (11) may then be partially valued as {<NOUN: *u*>, <NUM: *PLURAL*>} and {<NOUN: *u*>, <NUM: *SING* >}.

For English nouns, morphophonology might provide a default mapping rule as follows,

(11) MS→PF. {<NOUN: *u*>, <NUM: PLURAL>}

= <MS→PF. {<NOUN: *u*>, < NUM: SING>} + MS→PF.<AFF: *IZ*>

Here, we show an underdetermined noun, <NOUN: *u*>, associated with the feature <NUM: PLURAL>. Its PF form can be obtained if that of its singular is known, by adding the affix whose word-name is ‘*IZ’*. The MS→PF mapping of the affix offers a choice of three forms, /-s/, /-IZ/ and /-z/, where the selection is determined by the phonology of its host. The MSyn < AFF: *IZ*> serves the purpose of the structuralists’ ‘morpheme’ with its three ‘allomorphs’ (cf. e.g. Hockett, 1958). It appears again in the default rule for obtaining the PF for possessive marking, and that for the singular number marking on regular 3rd person verbs.

We have justified MSyn features in terms of phonological words involving inflection. The question arises then as to whether items never assigning or showing inflection or otherwise entering into Agree need an MSyn <attribute: value> specification, or whether there is a direct mapping for these from LF and category to PF. We take the line that there should be uniformity here: all lexemes include some such feature.[16] If word-class is a classification of lexemes (LF and category) into sub-classes according to some uniformities of behaviour, it seems reasonable that any lexeme falls into some such subclass. The child acquiring its language probably sets up these classes before learning related inflectional or Agree requirements. An example might be that of an adverb, where no inflection, case or agreement is generally observed.

We argue that all the variation across syntax not carried by categorial features is carried by various arrangements of <attribute: value> features of this kind. These features are responsible then not only for familiar morphosyntactic effects such as number agreement between a verb and the head noun of one of its arguments, but for verbal inflection relating to TAM heads, and for 'head movement' and phrasal displacement not accounted for by Merge.

All these language-specific variations produce PF effects not accounted for by LoT properties of the structures concerned and a simple <LF, PF> lexicon. Further, they all involve relations between a pair of items: the verb and the noun that agree; the TAM and the verb that result in inflection on the verb; the 'moved from' and 'moved to' positions in displacements of heads or phrases. For this reason, not only the actual features of an item, but how the features behave under Merge, is essential, as will become clear below. In particular, locality effects must be captured, for which MSyn is crucial. We will show that the <attribute: value> features of the kind illustrated above can be used to regulate Agree and displacement and, under an appropriate rule for Merge, automatically induce minimality effects — that is, locality restrictions for agreement and displacement.

4 How MSyn fits in the grammar

4.1 The basics

As we have argued in earlier chapters, the structure of a clause is generated by the relevant lexical items, together with Functor First merge for LF, and the concomitant feature-merge operations resulting in 'displacement' of heads or phrases. The strategy we follow, then, is to begin with LF for some subpart of clausal structure, and then consider the selection options for the lexical items involved. After this, the necessary displacements can be considered, and hypotheses made about the MSyn features and Merge rules that result in this displacement.

[16] In other words, we are espousing a form of 'Late Insertion', as in Distributed Morphology (Halle and Marantz 1993,1994), where "terminal nodes consist exclusively of morphosyntactic/semantic features, and lack phonological features" (1993:121).

As indicated in the Introduction and Chapter 2, phrases are constructed by merging lexemes. A lexeme consists at least of an LF item, which has a semantic type, and its morphosyntactic properties including its category. Merge must respect type and category. The PF related to a lexeme is never available directly from the LF, but is determined via its own minimal feature (canonic MSyn) or from this and other lexemes' morphosyntactic properties, as sketched in section 3.1 above.

Although we refer to an 'MS→PF' mapping, we understand this to consist of several successive parts, at least one mapping MSyn to a morphophonological representation, and another mapping this to a phonological representation. This is to allow for the capturing of generalisations, such as the morphological decomposition of *UNDERSTAND* into *UNDER* + *STAND*, to account for the relation between *understood* and *stood*. All this, together with the language specific well-formedness conditions on the constituent representations falls under our MS→PF mapping.

We account for the inflectional properties of a head with MSyn features. These bear some resemblance to the features of HPSG, but the reader familiar with that system should bear in mind that the rules we set up for percolation and unification are partially different. The system diverges too from the often implicit feature system of P&P, as seen in (e.g.) the Minimalist program. In particular, a lexeme cannot acquire features by means analogous to set union: all its morphosyntactic features must come from its own lexical entry. That is, we subscribe to a version of inclusiveness, though a given feature may be underspecified in the lexicon, becoming specified completely ('valued') by unification during the derivation.[17]

Three main areas need to be investigated in any account of the simple LF structures of a language: the clausal 'spine'; the merge of arguments; and the merge of adjuncts. Here, we will consider optional adjuncts only in as much as they shed light on the other structures. The essential P&P items generating the maximal clausal spine are C, T (Infl), (little) v, and V. We will argue that the CCG style of LF too requires heads with licensing functions for arguments, between the complementiser and the verb, but that they are distinct at least in position and category from the P&P ones. Each of these heads has a category, which will include its selection requirements. Rather than referring to the items by category, we will use 'Tense' to refer to our operator version of T, Comp for C and so on, with 'Ev' for our event binder replacement for 'little v'. We assume for the moment that 'finite' Tense licenses the merge of a subject, and some property of Ev licenses the merge of an object, or of a 'trace' for unaccusatives. We suppose, following Cormack 2006, that an argument may not be merged until its licensor is already in place, ensuring a locally well-formed structure —from which it follows that each of these heads must be

[17] There is a large literature on feature checking. For background, see Pesetsky and Torrego 2007.

merged below the argument it licenses (see chapter X). The basic clausal spine then has heads we may refer to informally as in (12):

(12) **Comp** subject **Tense** object **Ev** **Verb**

We assume that Comp has a dedicated goal category C, and that all the heads on the projection path between Verb and Comp have goal category V, until it can be shown that dedicated categories are required. Then Comp would have category C/V, and Tense and Aux items would have category V/V as operators, or V/D/V with Raising.

As was observed in chapter 2, the use of Functor First alone gives partially incorrect PF for English. We argued that this should be accommodated by allowing displacement affecting PF only. Such PF displacement needs to be licensed: it will not occur unless there is a demand. In this chapter, we discuss the major demands for displacements of heads in simple Functor First structures, exploring whether the proposed displacements can be identified and characterised in a way that captures the right generalisations. The displacement of phrases in a simple clause is the subject of Chapter D. The more formal details are in chapter Y, where PF requirements for agreement of various kinds (phi-feature agreement) are also discussed.

As indicated immediately above, PF displacement can occur only if there is a demand due to morphosyntactic features. This much is standard in the Minimalist program, but our feature descriptions and some of the displacements argued for are not standard. Differences in the feature descriptions arise from our strict separation of LF, MSyn and PF information in the grammar.[18] Differences in displacement required here arise largely from our assumption of the basic Functor First at LF, with no displacement of LF parts.

MSyn features that regulate displacement and agreement pertain to relations between two phrases or, perhaps, heads. But features must always emanate from a lexeme, which has no intrinsic phonological properties, but which instead must have sufficient relevant morphosyntactic properties. One such property is its syntactic category, which we take to be accessible to morphosyntactic operations. As argued above, we now assume additionally, MSyn properties. These consist at a minimum of an ordered pair of a word-class and a word-name. Every lexeme utilises one such pair which is its ‘canonic MSyn feature’; and such pairs are the essential ingredient of the lexeme’s full morphosyntactic form. LF together with category and MSyn will uniquely identify a grammatical object, whether a lexeme from the lexicon or a phrase. Arguably, following the minimalist strategy, this should be all that is utilised for regulating the relations above (Emonds

[18] Such separation is reminiscent of Jackendoff’s 1987 ‘Parallel Architecture’ (summarised in Jackendoff 2010).

2000: §1.2).[19] Similar feature structures will be used in accounting for phrasal displacement (Chapter X) and phi-feature agreement (Chapter Y). It is important to note that although individual MSyn components are interpretable at LF, once they appear as components of <attribute: value> structures, they make no contribution to the LF of the head or phrase in question.[20] Equally, they are not interpretable at PF, though appropriate feature bundles are input to the MS→PF mapping operation. Morphosyntactic features are identified by their essential relation to syntax: not all morphologically relevant features are morphosyntactic.

When a head acquires some feature by our version of Agree, taken to account for agreement, displacement and concord, this will require a pair of such attribute−value pairs, since attributes of two heads are involved.[21] For example, a verb bearing inflection induced by Tense PAST might have a (complex) MSyn feature such as {<VERB: *WANT*>, <TENSE: *PAST*>}; when this is realised overtly by the MS→PF mapping, it appears as /wɔntɪd/, informally '*wanted*' as in (13).[22] Below, we will supply only standard orthography for PF unless the phonology is required.

For a verb and tense, there is apparently no problem in identifying which of the pairs refers to the 'root' axis of a paradigm, and which to the 'inflection' axis. If there were any ambiguity, as is apparently the case in (13b), then we might need to impose some disambiguation, such as replacing the two-member (unordered) set of attribute-value features by an ordered pair of attribute-value features.[23] We will consider this question at the end of section 4.2.1; meanwhile for reasons of caution, we use ordered pairs of features, as in (13c), where the pair characterising the root is always given first and the inflection second. In either case, we dub a pair of attribute-value features a 'diploid'.[24]

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[19] Emonds 2000: 42 "(2.13) Lexicon Interface Condition. The lexicon uses only morpheme categories in its statements. It cannot mention phrases, nor distinguish between X and XP." This is a highly restricted 'inclusiveness' principle in the sense of Chomsky 1995a: 228.

[20] For instance, if the feature '<ADJ: *RAMPANT* >' is accessed, the fact 'ADJ. *RAMPANT*' is thereby also accessed, but the fact that the word-name *RAMPANT* (and by extension, the PF realisations in the paradigm, here just *rampant*) falls under the word-class ADJ (ADJECTIVE) is not part of the LF of the utterance as such.

[21] 'Case' is discussed in Chapter X.

[22] The PF '*wanted*' has no morphosyntactic properties — only phonological and perhaps morphophonological ones. It cannot be a value of VERB, for instance.

[23] The theoretical possibility of ambiguity as illustrated in (13b) arises as a consequence of the parsimony achieved by adopting Emonds' hypothesis. For instance, one might instead use <AUX: PERF> for the root and <INFL: PERF> for the related inflection (as we did in earlier work), rather than the same for both, making comparable distinctions with respect to other TAMP heads. This is unambiguous, but unparsimonious.

[24] See discussion in section 9.

(13) a {<VERB: *WANT*>, <TENSE: *PAST*>} => *wanted*

b {<AUX: *BE*>, <AUX: *PERF*>} => *BE* as root: '*be* + *en*' — *been*
or HAVE as root: '*have* + Ø' — *have*

c <<AUX: *BE*>, <AUX: *PERF*>> => *BE* as root: *been*

We attempt to be specific about the information and processes required to derive the well-formed fully specified MSyn structures needed for the correct PF, though for expository simplicity, we frequently abstract away from many features, including those related to worlds and times, and, most often, person, number, case and gender (phi-features). We will say little about the morphophonological and phonological components of the MS→PF mapping itself. So far as notation is concerned, we have aimed for perspicuity, sometimes at the cost of redundancy.

In the feature model we explore here, we exploit underdetermination and unification to implement our Merge-driven version of 'Agree'. Once Agree is merge-driven, other useful results fall out, as we see. In order for the required processes to be accounted for, it is necessary for there to be a compositional account of how a feature merged in one position can value a previously unvalued (underdetermined) feature merged in another position. The required information must be represented as a result of the successive merges in the derivation. As usual, we represent this information on the nodes of the Merge tree. Under this view of Agree, unification is automatic where possible, so that an 'Earliness Principle' as in Chomsky 1991 (based on Pesetsky 1989) is not additionally required. No c-command relation between the two items in an Agree relation is required by the procedure indicated, nor any 'probe-goal asymmetry' (cf. Brody 2005, Carstens 2012). We claim that neither of these conditions should be stipulated: the bottom up derivation in itself should and does provide sufficient locality restrictions.[25.]

The absence of probe-goal asymmetry has two consequences: both 'lowering' and 'raising' are in principle possible; and MSyn feature checking cannot contribute well-formedness conditions on linear ordering. The latter property means that some ordering effects can be ensured only via categorial selection, so that certain heads which could in principle simply have the category of a canonic operator of category V/V or of a Raising verb, both with goal V, must project a dedicated goal category. One such head is the polarity head for sentential negation, (with goal Pol rather than V), as we argue in section 7.

Much of this chapter is based on proposals in Cormack and Smith 2000a and 2002b, and earlier papers (Cormack and Smith 1996, 1997, 1998), but under a different system of features. The current revised feature system with its explicit Merge rule allows us to

[25] For a discussion of various versions of Agree, see Zeijlstra 2012/ in press. For the problem raised by Preminger 2012, see Ch Y.

dispense with the LF-null ‘INFL’ heads and the soft constraints of our earlier account. A central claim that we argued for in Cormack and Smith 1997, and still maintain, was what we called a ‘Split Sign’ account of ‘displacement’: the merge position of the LF features of an item is never changed, but MSyn features responsible for the related PF may be dispersed, and realised at PF in some position other than that of the LF features. A simple illustration is provided by the relation between the heads and affixes in the familiar array in (14b) underlying examples like that in (14a).

(14) a Henry could not have been being attacked

b Tense Neg Modal Perfect Pass Prog Verb

Our basic premise is that each LF head has its relative position in the array fixed at Merge, and that both the connection between a head and an affix and any surface displacement from the LF position must be accounted for using MSyn features to give the ‘split sign’ effect at PF. The first task then is to attempt to account for this order. With the exception of negation, every head in this array between Tense and the verb bears one and only one affix relating to the head immediately commanding it. Because of this relation, there may seem to be ambivalence in determining the LF position of the various heads. For example, is there a lexical entry for the progressive LF which is instantiated by an auxiliary *BE*, or is the progressive LF rather instantiated by a distinct lexeme *PROG* which provides inflection but no root? Until such questions are answered, the MSyn features required to induce ‘affix hopping’ (Chomsky 1957) cannot be determined. When a verb is assigned inflection, is the affix displaced to the head, or the head to the affix? Until this question is answered, we cannot account for word order with respect to intervening heads such as negation. For both questions, the answers we obtain in section 4.2 differ from one case to another, though we argue for a default.

An additional puzzle concerns ‘*do*-support’, as illustrated by the familiar data in (15).

(15) a *John not left b John has left c John did not leave d # John did leave

An account of ‘*do*-support’ where no auxiliary or modal is available to precede (in particular) negation at LF is required. Further, we have to determine for each auxiliary or modal whether its LF position is higher or lower than that of negation, before we can determine whether displacement is required, and if so, to which position, and what MSyn features induce this. We showed in the papers mentioned that with respect to modals in English, there is no systematic answer: some are merged above, and some below, negation, as indicated in (16) and discussed further in section 7:

(16) a	Georgia shouldn't come	NECESSARY > NOT	(high modal)
b	Georgia needn't come	NOT > NECESSARY	(low modal)

The reader should keep in mind that this 'displacement' cannot by its nature affect the LF so, inasmuch as it has any interpretive effects, these can only arise pragmatically. However, it is, we will argue, the appropriate vehicle for all 'head movement', and also some phrasal displacement.[26] Our proposal sidesteps the problems associated with movement accounts such as lack of c-command and failure to meet the Extension Condition on Merge (Chomsky 1995a: 190, 327) – problems which led Chomsky and others to eject head movement from narrow syntax, relegating it to the PF component of the grammar (Chomsky 2001:37-8); but see Matushansky 2006, for a dissenting view, and Roberts 2011, for discussion).

Before elaborating our account of 'affix-hopping' and '*do*-support', we will begin by disregarding negation and the modals, and consider the other heads. The first of these is Tense, where we assume the modified version of Reichenbach's (1947) proposals argued for in Ch 2.

4.2 Heads requiring Mutual Checking

4.2.1 Tense, perfect, progressive, and passive

We treat these heads together because they raise similar questions for the grammar. Each must be merged at its LF-interpretable position, but contributes a root, or an inflection, or both. The question then arises as to whether the verb is displaced at PF, or the inflection is obtained by 'agreement' (concord). In either case, the MSyn feature structure determining the result needs to be ascertained, and it is to this that we turn first, deferring the question of 'displacement' to section 4.2.3. Modals and negation, which raise similar problems, are discussed later (sections 7, and 8 and 8.2).[27]

What options are there for answering the question whether the auxiliary or the inflection affix is given by MSyn features of the LF head for perfect, progressive, and passive? Stowell (2008) considers the following options for the perfect:

(1) a. Past-shifting is conveyed by the auxiliary verb *have*;

[26] There are a few cases where head movement is claimed to affect interpretation. We discuss in chapter T (to reject) the cases put forward in Lechner 2006, 2007, and those in Roberts (2011). These turn out not to be problematic under our analyses. Conversely, if A or A-bar movement is subject to 'semantic reconstruction' then it will appear not to affect PF, but only because the distinct combinators required have no PF distinct reflex.

[27] For a comprehensive overview of the problems arising in the English auxiliary system, see Sag (forthcoming).

b. Past-shifting is conveyed by the perfect participle affix;

c. Past-shifting is conveyed by the perfect construction as a whole (i.e. by the combination of the auxiliary verb *have* and the perfect participle affix).

He goes on to say:

> Thus, in order to maintain (1a), one would have to posit two (or more) distinct subtypes of *have*; only one of which conveys past-shifting (the subtype occurring in the perfect construction). This is undesirable from a meta-theoretical point of view, because it violates the desideratum that each morpheme has a uniform semantics. Moreover, (1a) is close to unfalsifiable if one is free to posit additional subtypes of *have* at will.

We disagree. Natural languages very often re-use existing morphemes for new items (often with partially related meanings). Children during acquisition work on the premise that a new morpheme entails a new meaning, but the reverse has not been argued for as far as we know (see Lust 2006: 235).[28] Moreover, in second language acquisition, chance phonological similarity is used as a mnemonic device to remember vocabulary. For example, because of the phonological similarity it is easier to remember that the Russian for 'captain' is [kapiˈtan] than that 'gentleman' is [gospoˈdin]. But it is also easier to remember that 'country' is [kraj] if one postulates a mnemonic relation between [kraj] and the novel '*Cry, the Beloved Country*'. There is also experimental evidence from semantic priming which indicates that homophony should not give rise to processing problems. Swinney (1979) gave an elegant demonstration of what happens when you are confronted with sentences like *The spy hid the bug in the hotel room* and *The hygiene inspector found the bug in the kitchen.* He showed that, independent of context, **both** meanings of the ambiguous *bug* are initially accessed, and the irrelevant one is subsequently dismissed. Even though retrieval of the 'wrong' meaning associated with some PF may be triggered by a homophonous word such disambiguation takes place within four syllables. Further, it seems that homophony and polysemy may even be advantageous in a language (as noted footnote 9 in section 3.2.4). It is clear that Stowell's 'desideratum' cannot hold of NL. The third of Stowell's options does not make sense within the structure of the grammar that we are working within, other than for idioms (i.e. a periphrastic analysis is ruled out). Further, there are at least two ways of ascertaining whether the 'root' or the inflection is the canonic MSyn name of the relevant LF. First, we advert to the occurrence of the inflection without the putative root, in nominal modification. The second test is VP ellipsis where the antecedent and deleted VP may or may not show certain mismatches in inflection; we discuss this in section 4.2.5 Our claim is that these tests give convergent results. We demonstrate the first test immediately.

[28] Children "assume different words have different meanings" (ibid) but not that different meanings require different words, even though – as Lust observes – 'mutual exclusivity' "**would** eliminate *synonymy* in early child language" [our emphasis].

In (17) to (19), we give post-nominal modifier phrases attempting to incorporate perfect, progressive, and passive by utilising only the inflection associated with the structures.[29, 30]

(17) a The motor had failed by morning

b *[The motor [failed by morning]] was almost new

(18) a The children were growing beans

b [The children [growing beans]] were excited

(19) a The door was opened by Kate

b [The door [opened by Kate]] was already unlocked

From these we may conclude that (i) the canonic MSyn name of the LF PERFECT head should relate to *have*, rather than *-en*, since the inflected form in (17b) without *have* fails as the head of a postnominal modifier;[31] (ii) the progressive LF head relates to *–ing*, since (18b) has a progressive postmodifier in the absence of *BE*; and (iii) that the passive head relates to *–en*, (surfacing here as *–ed*) since the passive meaning is present with the affix but without *BE*.[32] This entails that both instances of *BE* in (14), *Henry could not have been being attacked*, are 'dummy' verbs, like the *DO* of *do*-support (see section 4.2.4).[33] We give the Perf head the MSyn word-name *PERF*, for Perfect, to avoid confusion with the verb *have*; we use *PROG* for the Progressive, and *PASS* for the Passive head. Thus *PERF* supplies a root, but *PROG* and *PASS* do not, so that the presence of the heads is detectable at PF only via inflection.

The test above cannot be used to ascertain the status of finite tense morphemes in languages like English where finiteness licenses a subject argument, and the VP anaphora test fails too, but pseudo-serial structures indicate that PAST (or PRES) must be a higher

[29] The homophonous pre-modifiers are unaccusative adjectives.

[30] Similar arguments are used by Bjorkman 2011, with discussion of other languages using dummy verbs.

[31] This claim does, as Stowell (2008) points out, raise interesting problems for languages with 'have'/'be' alternation for the perfect root, if the analysis is the same.

[32] It follows that the passive and perfect participles are distinct. That the same PF form is used may have diachronic explanation, or be due simply to re-use of a form for a related meaning.

[33] Alternatively, we could run this argument in reverse. Suppose the child acquiring its language already knows that *BE* in *Jamie is happy* and other predication structures is an identity element that receives but does not assign inflection. Then it can assume that it is present as a dummy for the same inflectional reasons in examples with *PERF* and *PROG*. This in turn predicts that phrases headed by *PERF* and *PROG* should be able to appear as adjuncts.

head, with the verbal morphology acting as 'agreement' with this head (Cormack and Smith 1996; see Ch Z). This is in line with the standard P&P arguments based on high temporal adverbs and the contrast between French and English. Consider a temporal adverb like *often* in *John often worked late.* This needs to be in the scope of the LF tense source, since it does not relate to Speaker time,[34] but it appears canonically at PF above the inflected verb. Hence the LF for tense must be an independent higher head, merged higher than the adverb, rather than inhering in the inflection on the verb. The subject is merged above Tense, as discussed in chapter X. Under a Reichenbach style interpretation of tense, the morphology which we designate as *PAST* is related to an LF which determines a past shift relative to S, speaker time, designating a past interval. In a bottom-up compositional system, this corresponds to the introduction of a new current time selection which is prior to the event time introduced by the verb. This new time selection will in the simplest instance be bound by Speaker time. As mentioned above, to remind the reader of the shifting interpretation of past tense, we give its LF as PAST-SH, and that of the future shifting operator given by *will* as FUT-SH.

A simple sentence with PF as in (20a) then has an LF as in (20b):

(20) a PF: *John often snored*

b LF: ↑JOHN PAST-SH OFTEN SNORE

We are now in a position to see what is required to obtain the surface forms of the various heads.

4.2.2 Checking for inflection

As previously emphasized and as illustrated immediately below, the idea is that LF gives the initial structure, and that morphosyntactic features are associated with LF items. Lexemes each have an MSyn name, for which we have used mnemonic forms, usually the same as the LF, but in italic small capitals; but many items have more elaborate language particular requirements. First, the MSyn name is given a morphological word-class, such as 'NOUN'. By default, a minimal item with goal-category N/D/D will have word-class NOUN, and so on for the other relational heads.[35] Second, split signs, agreement, or other checking require further elaboration. Such information is given in the

[34] That is, the interpretation is: 'It is true at speaker time that there are many times in the past relative to speaker time at which John worked late', not 'There are many times within speaker time such that in the past relative to that time, John worked late'.

[35] Categories are justified and learned largely on the basis of the distribution classes of items with respect to phrases. Word classes will be justified and learned on the basis of distribution classes of items with respect to categories. See Manzini & Savoia 2011:9 and also chapter 2).

part of the lexicon containing <LF, MSyn> pairings. MSyn structures for an item, whether simple or complex, are interpreted at PF by appeal to the MS→PF mapping — also a part of the lexicon.[36]

The lexical entry for the tense item PAST-SH could either have a dedicated category, or it could be an operator on some lower category, and likewise for the other TAMP heads. We assume that the default is that all have the simplified adjunct category V/V, unless it is shown that a dedicated category is required, and we proceed on that basis.

Thus each lexical item is associated with MSyn features, which may contain not only the expected canonic MSyn particular to the head in question, but MSyn features relating to other heads. It is the occurrence in more than one position of features relating to some head that gives the 'split sign' effect, and enables us to mimic displacement without either movement or remerge. In particular, in (20), the PF *snored* is obtained by the MS→PF mapping from at least the MSyn feature complex in (21) (we omit agreement features in this discussion, and usually abbreviate (21a) etc. to (21b)).

(21) a <<VERB: *SNORE*>, <TENSE: *PAST*>>

b <VERB: *SNORE*, TENSE: *PAST*>

Here, VERB is the morphological word-class to which verbs canonically belong. *SNORE* is the label for the appropriate paradigm in the MS→PF mapping.[37] *PAST* is the value of TENSE in the clause in question. Obviously, such MSyn features on the verb must enter into some checking relation with Tense. At this point, there is a choice in how to proceed. The lexicon might provide an MSyn feature like that in (21), not only for Tense but for all the other possible inflection sources, or it might provide only an underdetermined entry, with the checking relation supplying the missing information. We opt for the latter, more parsimonious view, for the general case. Then since Tense is not the only potential source of an inflectional value, we take it that the lexical entry for the verb has an underdetermined inflection value. Anticipating later discussion, we take it as a first approximation that all the items capable of assigning inflection to a VERB have the word-class AUX. A VERB cannot assign inflection to another VERB (verbs selecting for verbal projections, such as Raising verbs, are discussed in section 4.2.4). Standard auxiliaries and modals having the NICE properties will fall under AUX, since these all assign some inflection (perhaps bare) to a verb.

[36] This part of the lexicon is unlikely to be spelled out in toto. Part of the lexicon consists of partially underdetermined entries expressing lexical generalisations of the familiar kind, such as those accounting for regular past tense endings in English. For languages such as Pirahã, where Everett (2008:8) states that: "each Pirahã verb has at least 65,000 possible forms", this is presumably essential, not just economical. See section 5.3 for some indication of how and why the frequently observed nested order arises.

[37] A paradigm is a (partial) function from sets of MSyn features to PF output.

Tense items and the PASS and PROG heads will also be assigned this word-class; see further in section 4.2.4 for discussion. These last may supply roots in other languages (e.g. Vietnamese for TENSE, and Hindi for PASS and PROG). The feature TENSE is to unify with AUX to give TENSE. The underdetermined value of AUX (as of any other word-class) is given as '*u*'. This is maximally underdetermined, so that it will unify with any item α to give α.

We will assume that the MSyn features associated with a head are relevant to the realisation at PF, and will be input to the MS→PF mapping. These may or may not contain partially underdetermined features as they come from the lexicon. We assume initially that the mapping accepts only fully valued features; underdetermined features must get valued during Merge.[38] Typically, some of these features will be partially underdetermined in the lexicon. For example, verbs must be inflected, so for *SNORE*, we postulate (22), where in each of the MSyn specifications from the lexicon, the sub-feature <AUX: *u*> is underdetermined:

(22) LF: SNORE category: V/D MSyn: <VERB: *SNORE*, AUX: *u*>

The general form of the MSyn feature pair for verbal inflection for a VERB α is that in (23).

(23) LF: α; category: V/D… MSyn: <VERB: *α*, AUX: *u*>;

Now consider the MSyn for PAST at Tense. Its canonic MSyn is <TENSE: *PAST*>. As in most, but probably not all, languages, a TENSE value is realised at PF if at all only in conjunction with the PF associated via MSyn with a verbal item, so it needs to launch an underdetermined MSyn feature which will check for the item to which its inflectional feature relates. This must be comparable in structure to the AUX-seeking MSyn feature on a VERB given in (23), but must also be compatible with those on an AUX, in case this is the highest verbal element in the structure. We therefore use the more inclusive word-class V-EXT (see (82b) in section 3.2.3)), as indicated in (24),

(24) LF: PAST-SH MSyn: <V-EXT: *u*, TENSE: *PAST* >

What is required to accomplish the MSyn checking and valuation is that the two MSyn diploids can unify. MSyn features percolate up the tree until any underdetermined features are valued. Features are valued by unification, and fully valued diploids do not

[38] It may be possible for the MS→PF mapping to accept as input a partially unvalued feature bundle, returning a 'default' value with respect to the input.

percolate.[39] Frequently, but not always, diploids involved in checking come in 'converse' pairs, <X: α, Y: *u*> and <X: *u*, Y: β> for given values X, Y and α, β. Converse pairs necessarily unify; we call checking under unification of a pair of converse diploids 'mutual checking'.

(25) **Mutual checking**

a MSyn diploids percolate if and only if they are partially unvalued

b Underdetermined features are valued under unification

In the example to hand, the diploids given in (22) and (24) will each percolate, and will necessarily meet at some node unless percolation is blocked. When they do meet, they unify, giving <VERB: *SNORE*, TENSE: *PAST*>. Then the AUX value for the MSyn of the VERB *SNORE* will be valued as PAST, and a VERB value *SNORE* for the MSyn of Tense will be passed to the appropriate head, One of these two identical MSyn diploids will be spelled out overtly as *snored* by the MS→PF mapping.

Now suppose that the clause contains perfect *have*. We informally refer to the position in the tree at which this head is merged as Perfect. We argued above that the *have*, rather than the *–en* was associated with the LF 'PERF'. Morphosyntactically, the head assigns inflection to a verb, so we assign it the word class AUX. We give it the value *PERF*, for mnemonic reasons, so that its canonic MSyn is <AUX: *PERF*>. The associated inflection *–en* is registered only as the PF realisation of an MSyn feature. In addition, the AUX, like most other AUX items, needs to be assigned some inflection. The MSyn entry is as in (26):

(26) MSyn: {<V-EXT: *u*, AUX: *PERF*>, <AUX: *PERF*, AUX: *u*>}

In these representations, within each diploid, the first feature is to relate to the root, and the second to its inflection, so that the correct paradigm can be accessed. But there are two such diploids: which is to be realised under Perfect, and why? The answer is that it has to be that with *PERF* as the head value, for reasons which we consider in section 4.2.3. However, there is still a problem. AUX unifies with V-EXT. This means that the two diploids specified in (26b) could unify, giving {<AUX: *PERF*, AUX: *PERF*>}, which is not what is intended: no verbal head can licence its own inflection. To prevent this, we need to stipulate the well-formedness condition on MSyn diploids given in (27):

(27) '**No Twins' rule**

No MSyn diploid is of the form <α, α>

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[39] Thus for a diploid to be partially unvalued and able to percolate corresponds to the minimalist notion of a feature's being 'active' (Chomsky 2000a: 123 and much subsequent work). Note that there is no involvement of phi-features in the 'activity' condition for Tense, contra Chomsky op. cit. Instead, the fact that Tense needs a host for its inflectional realisation is stated directly.

This prevents the two diploids from indulging in the untoward unification which would yield <AUX: *PERF*, AUX: *PERF*>.

It is the MS→PF mapping applied to the MSyn features which relates the Perfect item to the paradigm for <VERB: *HAVE*> associated with LF OWN etc.[40] A rule of the kind indicated in (28) may be given for this, and a similar one for the 'semi-modal' VERB *HAVE-TO*, as in *I have to leave now*.

(28) MS→PF. {<AUX: *PERF*, AUX: γ>} = MS→PF. {<VERB: *HAVE*, AUX: γ>}

Consider now the MSyn features for the Perfect, repeated here as (29):

(29) MSyn: {<AUX: *PERF*, AUX: *u*>, < V-EXT: *U*, AUX: *PERF*>}

If the Perfect head lies between Tense and a verb, the upshot will be correctly that HAVE obtains its AUX value from Tense, while the verb obtains its AUX value from *HAVE*. In particular, for the PF *John has left*, the MSyn of the verb will be mapped as in (30):

(30) MSyn: <VERB: *LEAVE*, AUX: *PERF*> => PF: *left*

Now consider the progressive. If PERF is present, then the progressive LF PROG must be merged lower, for semantic reasons.[41] Suppose then we have the LF string in (31).

(31) Tense Perfect Prog Verb

Of these, the MSyn features associated with TENSE, PERF and PROG introduce inflections. Suppose the MSyn of PROG, like that of PERF and the VERB, supplies to the MS→PF mapping a root which may bear inflection, except that for PROG it is phonologically null. Then the string of heads in (32a) would be realised as in (32b), rather than as the required (32c):

(32) a	PAST	PERF	PROG	LAUGH
b		had	–	laughing
c		had	been	laughing

It follows that PROG does not supply a root that bears inflection. English, with its 'one head, one-inflection' property in a paradigm, requires the insertion of another root, and in particular, one which does not induce a new inflection. This is the function of 'dummy' *BE*. Dummy BE is to contribute nothing semantically. Its LF will be shown as ID, for 'identity operator' for this reason, though it is just one of a family of such functions. The simplest ID is a binary operator of type <t, t>; here, we will argue for an auxiliary of type <t, <*u*, t>> (the type of a raising verb). This LF must appear in the structure between PERF

[40] The LF is of course more general than this, with Meaning Postulates requiring that in 'HAVE *y x*', *x* is associated with *y* in some canonic way; ownership is one such way.

[41] Sag and Wasow 1999: 301.See Ch Z for the ordering of other TAMP heads.

and PROG, since PROG can have its inflection associated with the VERB, but the inflection for PERF in (31) has no accessible root host. The assignment of inflections for *John has been laughing* will then be as indicated schematically in (33):

(33) PRES **PERF** **BE** PROG **LAUGH**

Here, the lexemes marked in bold contribute roots, and the curves relate these to heads contributing inflection (*PERF* contributes both a root and an inflection). The lack of any required MSyn connection between BE (or any other 'TAMP' head) and PROG enables a progressive phrase to stand alone as a modifier, as in *the man laughing*.

PROG will have the word-class AUX, since it may assign inflection to a VERB. It needs just the MSyn diploid in (34):

(34) **<AUX: *PROG*>**: MSyn: {<V-EXT: *u*, AUX: *PROG*>}

What of *be* here? The default assumption is that it is the same item as 'copula *be'* in examples like those in (35). This item has a type like that of a Raising verb, <t, *u*, *u*, t>, and a category V/D/D/R, for R a relational category. We argue that its semantics is the Raising equivalent of an identity function (Cormack and Smith 1997; see chapter W).

(35) Rudolph is hungry / at home / a numismatist / drinking beer / surrounded by cats

Crucially, it assigns no inflection. In this respect, it differs from dummy *DO*, which assigns 'bare' inflection. These are plausible properties for its use as a dummy with the progressive, and also with passive, as well as being required in its uses related to (35). We would expect the item to have a word-class VERB, since it receives inflection but does not assign it. But its MSyn word class must be AUX, not VERB, because of its NICE properties: see further in section 4.2.4. The MSyn will be as in (36).

(36) LF: ID, <AUX: *BE*>: MSyn: <AUX: BE, AUX: *u*>

The MS→PF mapping will produce the familiar irregular morphology for the auxiliary *BE* from the specification for the MSyn in (36), when a value for inflection is supplied by unification.

This leaves Passive to be considered. For this, we argued from noun-modifier structures that the LF head PASS must be associated with the inflection leading to PF *–en*, rather than to a head surfacing as BE. The MSyn features for PASS will be as in (37), so that it may assign its associated inflection.

(37) LF: PASS, <AUX: *PASS*> : MSyn: < V-EXT: *u*, AUX: *PASS*>

Once more, the number of inflections will be larger than the number of heads, so that the dummy auxiliary *BE* must be inserted again.

The LF array for *The hay has been being harvested* would be as in (38), with the curves beneath showing bidirectional information transfer derived from the MSyn checking.

(38) LF: PRES **PERF** **ID** PROG **ID** PASS **HARVEST**

PF: *has* *been* *being* *harvested*

Here again we remain neutral about where the inflected heads are realised, though there is a determinate position in each case (section 4.2.3). The answers encode the difference between French and English with respect to 'V to T' displacement, and impact on the well-formedness of VP ellipsis (section 4.2.5) and the viability of pseudo-coordination with respect to PROG and PERF (Chapter Z).

We can now address the question of whether or not the two features comprising a diploid must be internally ordered. Consider (39):

(39) {<AUX: *PERF*>, <AUX: *BE*>}

It so happens that for the English inflections, various factors conspire to render ordering inessential. The pair above can only have PF *been*. But we have only to turn to Italian to see that this is not the general case. Here, modals do not have to be tensed, and both the sequences *MUST CAN* …and *CAN MUST* …occur, as shown in (40 a, b) from Moscati 2007. In both instances, on our current assumptions, the second of the modals will have after unification MSyn features of the form in (41a) if unordered, or as in (41b) vs. (41c) if ordered.

(40) a Gianni deve poter parlare
G. must can to-speak
'it is necessary that G. can talk'

b Gianni può dover parlare
G. can must to-speak
'it is possible that G. must talk'

(41) a MS→PF. {AUX: *MUST*, AUX: *CAN*} = ??

b MS→PF. <AUX: *MUST*, AUX: *CAN*> = *poter*

c MS→PF. <AUX: *CAN*, AUX: *MUST*> = *dover*

The diploid in (41a) is either uninterpretable or ambiguous, in that it may target two distinct paradigm cells. We take it that ambiguity is not tolerated in the MS→PF mapping

— that is, mapping should be a function (albeit a partial function). It follows that the diploids should be ordered, as in (41b) or (41c).

The discussion above has been largely limited to the morphosyntactic features required to account for 'affix hopping' and what one might call '*be* support'. '*Be* support' will be compared to '*do* support' in section 4.2.4, where we also discuss infinitival *to*.

4.2.3 MS positions in the Phase

MSyn features which may be spelled out by the MS→PF mapping are of three kinds: simple attribute-value features, unitary diploids, or sets of diploids. All MSyn features have to be spelled out somewhere, though the PF may be null. A diploid which is drawn underdetermined from the lexicon, but becomes fully determined during merge, will always have a congener at some other position. For economy reasons, only one of these will be pronounced. Thus some process, our 'Prune' (section 2 above) must determine which congener is sent to the MS→PF mapping, and which are not. The locus of Prune is the Phase (closely related to the notion of Chomsky 2000a and later), and its output is a reduced set of MSyn feature-bundles associated pair-wise with the LF units of the phase.[42] As observed earlier, we call the remaining MSyn feature bundles the 'MS' of the LF item, and will also refer to the MS and LF of the phase.

In the system as we see it, a Phase is not a UG stipulated unit giving effects not otherwise obtainable, but a naturally occurring phrase identifiable by its properties. A Phase is defined as a syntactic phrase whose MSyn features are fully saturated, though its category and type may still be complex (i.e. unsaturated). Such a phrase necessarily has the property that no access to its internal structure can be obtained from outside — because under our assumptions, such access can only occur via underdetermined features. It also follows that the phase has a determinate LF and associated MSyn features. Thus the first V-EXT head in a phase must be an initiator, in the sense of (56) in section 4.2.4: that is, one of *COMP*, *PROG*, *PASS*, or *TO*. It is important to note that phases as defined here are labels for an existing phenomenon: they cannot without stipulation determine effects such as cyclicity, which should have alternative explanations.

Prune requires access to the intermediate nodes of the tree in order to determine which pairs of MSyn diploids are related by checking. But once any phrase has fully determined features, and has been subject to Prune, only the ordered LF and MS pairs, together with the features of the mother, are any longer required. The rest is discarded — by what may be seen as a second stage of Prune.[43] We give an example below, noting that more

[42] We will in fact show Pruned MSyn features as 'Ø'.

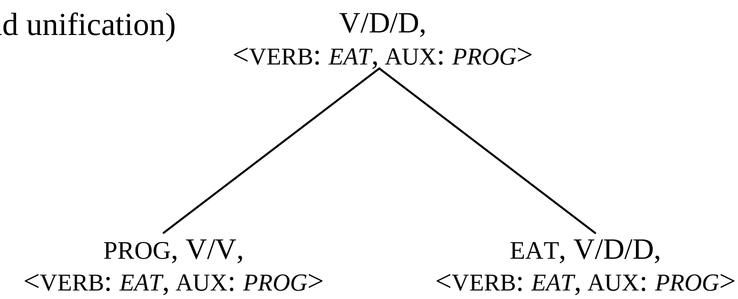
[43] Note that 'phase' as defined is expected to correspond to the complement of the head of a phase as usually understood in the Minimalist Program (see Gallego 2010 for extensive discussion). The usage here corresponds to that of Svenonius 2004 §4.

properly, there would be a combinator also, so that the LF string encodes the constituency of Merge.

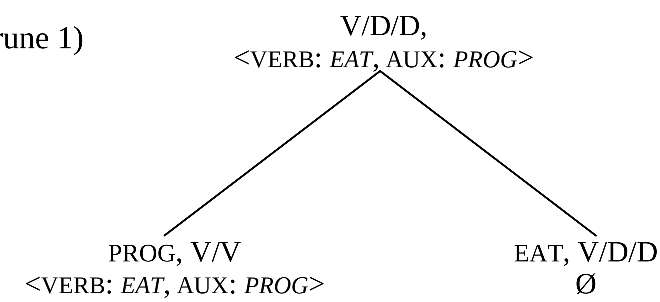
(42) a <VERB: *EAT*>. LF: EAT; category: V/D/D; MSyn: <VERB: *EAT*, AUX: *u*>

<AUX: *PROG*>. LF: PROG; category: V/V; MSyn: <VERB: *u*, AUX: *PROG*>

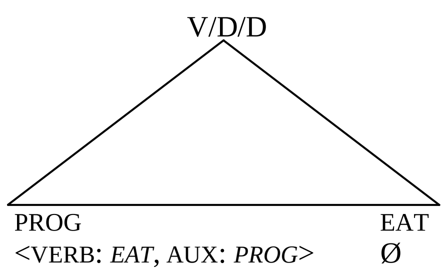
b (after Merge and unification)



c (after Prune 1)



d (after Prune 2)



The question arises as to whether at this point the MS items should be submitted to the MS→PF mapping, giving pairings of LF with PF instead of LF with MS. We suggest that given the MSyn representations, there is no further economy to be obtained by making this move, which requires interleaving one or more completely distinct modules of the grammar (morphophonology, phonology) with narrow syntax and, moreover, that there is empirical evidence against such a move.

There is evidence from slips of the tongue that a speaker may make morphosyntactic errors implicating the complement of a phase head. Consider (43) (Garrett 1980:264) where 'T' is the target utterance, and 'A' the actual utterance.

(43) T: I don't know that I'd know one if I heard it

A: … that I'd hear one if I knew it

There is a phase boundary delimited by Comp immediately at or after *if*. In the actual utterance (43) A, the PF output *knew*, in the embedded clause, is not obtainable except via the MSyn features <VERB: *KNOW*, TENSE: *PAST*>. It follows that if the CP is subject to economy processes, the MSyn of the phase must be accessible at the point at which *knew* is output.[44] We conclude that early Spell Out of phases to a PF representation does not take place.[45]

Returning now to Prune, we suggest that it takes place from left to right in the phase, in line with later Spell Out. The idea is that generally, at a certain terminal node, a new simple MSyn feature or diploid will be retained as part of MS, and a later, checking-related duplicate, which is redundant, will be subject to Prune for economy reasons. But Prune must retain only sets of features that are usable by Spell Out, and this entails that the set of features retained all pertain to a single root. If features at a node pertain to two roots, and neither subset has already been spelled out, then one subset must be pruned (and a later copy retained), as exemplified below. This pruning will also of course reduce processing at the S-M interface. The relatedness of the items is ascertainable via the unification positions for the diploids on the tree, provided that fully valued diploids have not been deleted until after Prune. The upshot will be that, by default, PF displacement is upwards. If the MSyn of a head is drawn from the lexicon fully valued, it lacks congeners, so is represented at MS only in situ. Prune belongs to narrow syntax, as it depends on structural relations between MSyn features.

[44] On a Functor First analysis, the LF will be relevantly as in (i), where the *if* clause is an adjunct to the verb (see Ch D). This gives the correct LF ordering of *it* and its antecedent *one*.

(i) … THAT I PRES WOULD [**A** ONE [[IF [I PAST **A** IT HEAR]] KNOW]]

At MS, <VERB: *KNOW*, MODAL: *WOULD* > should appear under the first **A** combinator shown and be spelled out there; instead, <VERB: *HEAR*, MODAL: *WOULD* > is spelled out there. This suggests that the speaker is searching left to right through the MSyn features for <V-EXT: *u*, X: *u*>, so as to produce the Msyn and MS of the matrix clause on the fly, but failed to note the phase boundary of the adjunct. After this error, the MS under the second **A**, <VERB: *HEAR*, TENSE: *PAST*> is changed to accommodate the MSyn feature <VERB: *KNOW*> related to KNOW, which is otherwise missing. If there were just PF here, this process would be impossible.

[45] For final articulation, a buffer containing PF and articulatory representations is used, potentially giving rise to the more frequent and local sorts of slips of the tongue.

With Prune in mind, consider the well-known contrast exemplified in (44) between French and English with respect to high adverbs.

(44) a Jean (*souvent) embrasse (souvent) sa soeur

b John (often) kisses (*often) his sister

c LF: PRES OFTEN KISS

The standard account (e.g. Pollock, 1989), which we follow here, is that in French but not in English, the VERB is displaced to Tense. The displacement for French and the lack of it in English generalises to AUX items, though the data are slightly less clear owing to the possibility for English of lower merge positions for the adverb. [46]

(45) a Jean (*souvent) a (souvent) embrassé (*souvent) sa soeur

b John (often) has (often) kissed (*often) his sister

Returning to the array in (33), repeated here as (46), only the order of the heads is explicit, but not the PF positions at which the associated MSyn features are realised. With respect to the heads shown, the links can be read as connecting items necessarily falling within the same phase. If the structure is formed in the standard way, with successive merges from right to left, then three phrases will be produced, one headed by PASS, one by PROG and one by PRES (but see below re PRES).[47]

(46) LF: PRES **PERF** **ID** PROG **ID** PASS **HARVEST**

PF: *has* *been* *being* *harvested*

Now we add a high adverb to the array, in the highest permitted position, as in (47). Under the left to right Prune rule suggested above, the outcome will be as in PF1, where the arrow-heads show where a root is realised other than at its LF position. This is right for French, where high temporal adverbs must appear at PF below the highest V-EXT item, but not for English, where a high temporal adverb may precede a V-EXT item. English requires PF2.

(47) LF:	PRES	**OFTEN**	**PERF**	**ID**	PROG	**ID**	PASS	**HARVEST**
PF1:	*has*	*often*	*been*	*Ø*	*being*	*Ø*	*harvested*	*Ø*

---

[46] For the highest position shown here, the tensed AUX needs stress.

[47] Using the flexibility of the combinators, they could fall into three phases, which could then be merged into two and then one. This would allow more rapid use of Prune; intonation should supply empirical evidence as to whether this strategy is actually used.

PF2: **Ø** *often* *has* *been* *being* *Ø* *harvested* *Ø*

Within the MSyn features and categories we are deploying, there is only one way of achieving this: the TENSE heads in English must be ‘roots’, albeit with null PF. This is perhaps more plausible if we observe that Tense needs to be licensed by a ‘finite’ complementiser, surfacing either as *that* or null for embedded clauses, and always null for root clauses. The features under Tense are then much like those for PERF or PROG:

(48) **<TENSE: α>**: {<TENSE: α, COMP: *FIN*>, <V-EXT: *u*, TENSE: α>}

For a finite complementiser, the specification for English includes a non-inflecting root specification, <COMP: *ROOT*>, plus the converse diploid checking tense, for example as shown in (49a, b), where *THAT* ⊂ *FIN* and *ROOT* ⊂ *FIN*.

(49) a **<COMP: *ROOT*>** : {<COMP: *ROOT*>, <TENSE: *u*, COMP: *ROOT*>} (English)

b **<COMP: *THAT*>** : {<COMP: *THAT*>, <TENSE: *u*, COMP: *THAT*>}

Simple <attribute: value> features, unlike diploids, are necessarily spelled out *in situ*. The MSyn under the Comp node has items pertaining to both COMP and TENSE. For the complementiser under (a) or under (b), the first feature shown pertains to the root COMP, and the second feature pertains to the root TENSE. They cannot both be spelled out at PF here. Prune must eliminate one set; since the one pertaining to COMP is a simple feature, this must be retained, and the diploid pertaining to TENSE pruned. At the next head, Tense, with features as in (48), <TENSE: α, COMP: *FIN*> is retained, because it was subject to Prune at its other checking-related position, under Comp. This will force PF2 under (47).

Suppose that the French COMP specifications do not include a bare root feature for COMP, but rather a COMP-related TENSE-checking diploid, as in (50 a, b). The features under Tense will then be as in (50c).

(50) a **<COMP: *ROOT*>** : {<COMP: *ROOT*, TENSE: *u*>} (French)

b **<COMP: *THAT*>** : {<COMP: *THAT*, TENSE: *u*>}

c {<COMP: *FIN* , TENSE: *α*>, <V-EXT: *u*, TENSE: α>}

Here, the COMP-related diploid will be spelled out under Comp, as Ø or *que* for (a) and (b) respectively. Then under Tense, the comp-related diploid will be Pruned, allowing the V-EXT-related diploid to be retained here, giving the ‘V to T’ effect for French.

What we have shown is that it is possible — though not necessarily correct — to characterise the French vs. English difference here using only MSyn features of the sort we have been discussing. It is not clear from the discussion here whether the French or the English setting would be the default.

In summary, we have argued that the PF displacements induced by Prune of the information given by the MSyn checking system are not necessarily uniform in direction.

(51) LF: **PRES** **PERF** **ID** PROG **ID** PASS **HARVEST**

PF: Ø *has* *been* *being* Ø *harvested* Ø

For English, some 'displacement' of heads is upward, and some, downward.

At this point we can explicate the notion that is usually described as a contrast between 'interpretable' and 'uninterpretable' features. Here, all syntactic features are uninterpretable. What varies is whether a particular MSyn feature is output to the MF→PF mapping by Prune at the LF (interpretable) head where that feature is lexically supplied or at some other head. For example in (51), the inflection supplied by PERF is realised under BE. This is the situation misleadingly, as we see it, described as the feature being 'uninterpretable' on *BE*. Conversely, the *PASS* morphology is realised under PASS; this is the situation described as *HARVEST* bearing an 'interpretable' PASS feature.

The claims we have made, and the resulting analyses, if correct, indicate that the notion 'periphrastic construction' as usually understood is not only otiose, but obscures the correct analysis of the related phenomena. The English passive, progressive and perfect could not, and do not, exhibit 'periphrastic tense'.[48]

The proposal for Prune here is expected to operate throughout the MSyn system: that is, phrases will be subject to the same Prune procedures as heads.

4.2.4 VERB, AUX and 'dummy' auxiliaries

We have divided the V-EXT items exhaustively into VERB and AUX, with the exception of POL NEG and ECHO POS/NEG, which are *sui generis*. However, there is one V-EXT item we

[48] Haspelmath (2000:660) defines a periphrastic construction as "one which expresses a grammatical meaning in a multi-word construction", and gives non-compositionality as a sufficient condition for periphrastic status. However, although noting that it is not always easy to identify 'grammatical meaning', he asserts that *I have broken it* cannot be compositionally derived from the components *have* and *broken*. However, non-compositionality cannot be inferred just because two items (*have* and *broken*) are ambiguous, but their combination, unambiguous. It is only in the case of idioms that more than one LF position in a structure is associated with a unitary meaning.

did not discuss above: infinitival *to*. This has no obvious LF content, so is a candidate for a dummy item, with identity (ID) for its LF.

Consider the range of dummy AUX items required in English. We characterised dummy *BE* as a head with ID semantics which requires an inflection feature, but does not assign one. It is these properties which allow it to function as a 'copula' in traditional terms. Dummy *DO* is a head which both requires and assigns an inflection feature. The third possibility is a head which assigns but does not require an inflection feature (a head which did neither would not be useful). We claim that AUX *TO* is a head of this third kind.

It has been argued that subordinating *to* is an auxiliary on various grounds, notably its ability to occur before a VP ellipsis gap, as other auxiliaries do (Levine 2012 discussing Pullum 1982 as cited in Gazdar et al. 1985: 114):[49]

(52) a John couldn't unscrew it, but Mary managed to —

b Hilary hasn't read the article, but Sonia has —

Consider then how the embedded verb gets an inflection feature value in a Control or Raising structure.

(53) a … manage to unscrew it

b … try to be quiet

As we argue in chapter R, Control and Raising structures involve the matrix verb selecting for a VP (i.e. V/D), which is obligatorily preceded by *to*.[50] In the examples in (53), *unscrew* and *be* are bare infinitives. We suggest that in English, VERBs cannot assign any INFL, and that for this reason, a dummy item must be introduced.[51] This dummy is to require no inflection from the matrix, and so itself bears no inflectional features, but assigns bare inflection to the embedded verb. This item has canonic MSyn <AUX: *TO*> and PF *to*.

---

[49] This analysis is supported by findings of Landau and Thornton (2011), who report VPE with control *want* arising in first language acquisition as soon as the requirement for *to* has been mastered.

[50] Synchronically, direct perception verbs do not usually have *to*: *I saw him* (* *to*) *jump*); but *I saw him to be a good student*, and *He was seen to smirk*. See section 4.2.4.

[51] Suppose in some language, no such dummy or other operator is ever required, while verbs are generally inflected. A phonologically null dummy in the absence of any comparable overt dummy would be absurd (cf. Kayne 2012). Then other things being equal, the relevant raising and syntactic control verbs themselves must assign infinitival or other inflection (see Chapter R). Lacking an item with the relevant MSyn properties of dummy AUX: *TO*, an infinitival phrase could not appear as an adjunct in such a language.

It seems to be typically prepositions that are pressed into use as dummy AUX items.

(54) <**AUX: *TO***>: MSyn = {<AUX: *TO*>, <V-EXT: *u* , AUX: *TO*>}

Because <AUX: *TO*> is not part of an underdetermined diploid, it must be realised *in situ*.

The properties of the three dummy auxiliaries are as set out in (55):

(55)

LF	ID	ID	ID
MSyn	{<AUX: ***DO***, AUX: *u*>, <V-EXT: *u*, AUX: *DO*>}	{<AUX: ***BE***, AUX: *u*> }	{<AUX: ***TO***> <V-EXT: *u*, AUX: *TO*>}

Dummy *DO*, like the default AUX, both gives and receives inflection information.[52] In the table, the MSyn features are set out so that those in the top line pertain to the root and its required inflection, and those in the bottom line pertain to assigning inflection. Dummy *BE* and *TO* are defective when compared to AUX *DO* and many other AUX items; but they are defective in exactly the way that makes them useful in English.[53]

That *TO* fills the position in the table above, and allows following VP ellipsis, makes the word-class AUX plausible. Its failure to participate in NICE properties is explained directly by the fact that it cannot accept inflection from Tense or any other inflection head.[54]

Consider now the distribution of inflection-requiring and inflection-assigning items in the V-EXT system. These occur as indicated in the table in (56).

[52] The arguments of Gonzáles Escribano (2012) against the dummy status of DO are not applicable to our analysis.

[53] Dummy verbs occur in other languages, including Korean (for negation: Hagstrom 1995), Monnese (Benincà and Poletto 2004), and some Basque varieties (Haddican 2007). The authors equate the respective dummies to English *do*, but given the three dummies proposed here, it is the morphosyntactic properties that should be paramount in drawing parallels.

[54] This item *to* is often assigned to C, but this does not account for *for*-*to* clauses, where the item in the complementiser position is arguably *for* (e.g. *for* participates in comp-trace effects).

(56)

	require: Yes	require: No
assign: Yes	**AUX: *u***	AUX: *COMP, PROG, PASS, TO* (initiators)
assign: No	**VERB: *u*** AUX: *BE*	POL: *u* ADV: *u*

It can be seen that AUX: *BE* is anomalous, being the sole AUX in this cell. This may well be because it is an identity item; if it were a VERB, and, as such, a relational item, it should have associated non-trivial semantics. The same may apply to the transitive AUX *HAVE* found in the ‘Baa Baa Black Sheep’ dialect (Radford 1997: 235ff), which also requires, but fails to assign, case. For transitive *HAVE*, there is no fixed meaning, but rather one derived from context (Ritter and Rosen 1997).[55] It might be thought that modal *OUGHT* is anomalous, too, but we show this not to be the case in section 7.[56]

The following generalisations then account for the distribution in the table, where (57b) or (57c) will override (57a):

(57) a V-EXT items requiring inflection are VERBs

b Inflection assigners are AUX items

c LF ID items are AUX items.

Putative counterexamples are constituted by direct perception verbs, which appear to select for an infinitival verb without the intermediary of AUX *to*. We know that for English these cannot be AUX items because of their lack of NICE properties. Moreover, they cannot assign inflection as a lexical exception, because the canonic MSyn for a VERB: δ is <VERB: δ, AUX: *u*>. Then these verbs must be associated with a variant of AUX *TO* , say AUX: ~~*TO*~~, whose PF is null; they are then not counterexamples to (57).

Should the criteria proposed be taken as universal? Aside from the possibility of making no distinction between AUX and VERB, there is one obvious related alternative. The category AUX could include just those heads that may initiate a verbal projection —

[55] It is not clear how the fact that a meaning must be contextually derived might be encoded, so we do not speculate about how the choice of AUX (dialect) vs. VERB (standard) is made.

[56] We exclude here ‘agentive *BE’*, as in *He is being foolish*. This does not have ID LF, since it entails agentivity of the subject. Since *Be not foolish* is ungrammatical (Lasnik 1995), this item is indeed a VERB, and *Don’t be foolish* is the expected negative imperative.

those behaving like TENSE, PROG, PASS and *TO* in English. The rest, perhaps excluding ID elements, would fall under VERB. Such criteria seem plausible; if this is the range of possibilities, then we have a small but real parametric space, and will expect there to be languages visibly requiring a division of this second kind.

4.2.5 MSyn features and Spell Out in VPE

We show in this section that as claimed in section 4.2.1, constraints on VP ellipsis are in line with the predictions made by using the adjunct test for MSyn features. Essentially, these are those indicated by the arrows marking PF realisation positions in example (51) of section 4.2.3, which follow from the MSyn features associated with the various LF heads.

The question which V-EXT heads can or cannot be elided under VPE has been the subject of much discussion (see e.g. Fox 2000, Johnson 2001, Lasnik 1995, Merchant 2001, Potsdam 1997, and references therein). We argue here that Lasnik's account using the 'Stray Affix Filter' (Lasnik 1995) is, somewhat surprisingly, not the right explanation.

VPE mainly occurs when there is some related antecedent, but it can occur without. Typical examples here are imperatives such as *Don't!* and *Stop!*. With these, the only requirement is that an appropriate LF for the absent VP, one corresponding to the required LoT form, can be retrieved by the hearer. The conditions relating to ellipsis where the elided phrase is related to an overt phrase are complicated by pragmatic considerations. We suspect that where informants disagree it is because one is using pragmatic inferencing based on suggestions from the overt form, rather than a strictly syntactic analysis, though it is also possible that individual speakers set up the syntactic conditions differently. Given these uncertainties, we do not attempt to provide a full discussion, but point only to certain conditions that relate to MSyn features as we have set them up.

For ellipsis related to an antecedent, LF is again paramount: the primary condition is that VPE is licensed only under LF identity of the elided VP and some antecedent phrase.[57] We take it that the speaker chooses not to produce a PF for the LF of a phrase

[57] The 'antecedent' may sometimes follow the ellipsis site at PF, if it is within a phrase that is PF-displaced to some position higher than the antecedent (e.g. as in *As his mother asked him to* [$_{\text{VP}}$ ~~*cook breakfast*~~], *John may well cook breakfast this morning*).

that has already been subject to Spell-Out to PF.[58] We use ‘VP’ to refer to an item whose ultimate head is a VERB, and whose category is (for the moment) V/D.

Lasnik argues that VPE is constrained by the ‘Stray Affix Filter’ and, as this analysis predicts that both (58a) and (59a) are ungrammatical, he is puzzled (p. 113) why (59a) is nevertheless acceptable (Lasnik’s (72) and (74); (59a) is from Quirk et al. 1972 §9.77).

(58)	a	*John	slept	and Mary	was too			
	b	PAST [SLEEP			PAST ID_{BE} [PROG		[SLEEP	
		-	*slept*		-	*was ~~sleeping~~*	-	
(59)	a	$^{\%}$John saw your parents last week,		but he	hasn’t since			
	b	PAST [SEE			PRES NOT		PERF [SEE	
		-	*saw*		-	*hasn’t*	-	*~~seen~~*

We discuss only the putative majority dialect, spoken by one of the authors, but mark with the ‘%’ sign those examples rejected by the other author. Under our analysis of TAMP heads, PROG supplies no root, but does supply inflection; PERF supplies a root as well as inflection, as we argued earlier (in the LFs, we omit null Pol and Modal elements). Then we expect (58) to be ungrammatical due to lack of LF identity of what is elided to its putative antecedent: failing to pronounce the VERB overtly necessarily involves failing to pronounce PROG. If only LF is at issue we expect (59) to be acceptable. In (59), the inflection supplied by PERF has been elided at PF; this is not, somewhat surprisingly, a problem for perhaps the majority of speakers, so that the ‘Stray Affix Filter’ as such must be rejected at least for those speakers. What does matter, we take it, is that in (58) but not in (59), an LF item is unpronounced that does not occur also in the antecedent.

(60) Ellipsis is subject to LF identity between elided and antecedent phrases

Examples related to (58) have varying degrees of acceptability, even for the same speaker.[59]

(61)	A: Why don’t you sit quietly?	NOT PAST $\text{ID}_{\textit{DO}}$ [SIT
	B: I am $^{*/OK}$ ~~sitting quietly~~	PRES ID_{BE} PROG [SIT

[58] In Prune, the units are MSyn features, and must be linked by MSyn checking. Here, the items are LF constituents, but we assume that some discourse connection must licence the linking of antecedent and elided VPs (that is, the ellipsis carries discourse information, and is not due simply to articulatory laziness).

[59] (61) is from Potsdam, as are several other examples. Others are from Lasnik; both authors have used examples from earlier work, including Warner 1985 and Quirk et al. 1972.

We concur with Potsdam’s suggestion that processing difficulty contributes to determining this cline, but regard all the examples as strictly ungrammatical, as indicated by the asterisk. The speaker has failed to produce a PF for some LF whose presence is not overtly signalled directly. He does this on the assumption that his hearer can infer the missing LF pragmatically, from indirect clues — in this instance, the presence of dummy *BE*, which will be induced when either PROG or PASS is present in the V–EXT string. PASS can be rejected, leaving PROG, as required.

Given the way our features are set up, we predict, correctly for both of us, that examples similar to that in (58), but with PASS for PROG, will equally be ungrammatical while examples with modals or AUX *TO* are predicted to be grammatical:[60]

(62)	a	John	ate the strawberries,	*and the peaches	were too, by Mary and Lou	
	b	PAST-SH	[EAT	PAST-SH ID_{BE}	[PASS	[EAT
	c				<VERB: *EAT*, AUX: *PASS*>	-
	d	-	*ate*	- *were*	[~~*eaten*~~	-

(63)	a	%John practised the piano this morning,		so Susan can now	
		PAST	[PRACTISE	PRES	[CAN [PRACTISE
		-	[*practised*	-	[*can* [~~*practise*~~

Within the framework argued for here, ellipsis could be either the assignment of null PF to the MS features of some LF, or the assignment of an empty set of MS features to the LF. VP ellipsis, as we see, provides evidence that the latter is correct. We therefore take it that it is not inspection of a putative LF and PF that tells the speaker that a particular phrase can be elided, but rather the inspection of the LF and related post-Prune MSyn features (MS). So in (62), inspection of the MS features shown in line (c) for EAT in the second clause reveals that there is nothing to elide at MS: any features have already been Pruned. It follows that elision of this constituent alone would not be detectable by the hearer, so should not be permitted. More precisely, if an LF is part of an elided phrase, then if it has a corresponding root, the LF under which the MS diploid containing that

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[60] Merchant 2008 says of Stump (1977), “However, following the widely accepted judgments of the day, he also claimed that voice mismatches were ruled out in VP-ellipsis;…” . Stump (p.c.) still rejects the examples he cited from Quirk et al 1972 (§9.78 , via Sag 1977: 17, but gives gradient reactions to Merchant’s examples, saying of *The problem was to have been looked into, but obviously nobody did <look into this problem>* that “This sounds surprisingly good”. This is consistent with the pragmatic route to construal discussed above. Huddleston and Pullum (2002: 1522) also categorise as ungrammatical voice mismatch in VPE, despite noting attested occurrences, as does Warner 1985.

root falls must also be elided.[61] But in (62), this would entail ellipsis of a phrase including PASS, which would fail the LF identity requirement.

Consider now the reverse pattern to those in (58) and (62), exemplified in (64) (from Potsdam 1997) and (65).

(64)	a	The dinner will be cooking,	*but it might not in time
	b	PRES WILL ID$_{BE}$ [PROG [COOK	PRES MIGHT NOT [COOK
	c	- *will be* [*cooking* -	- *might not* [~~*cook*~~
(65)	a	Botanist: That can all be explained.	Mr. Spock: *Please do ~~explain that~~
	b	PRES CAN ID$_{BE}$ [PASS [EXPLAIN	PRES ID$_{DO}$ [EXPLAIN
	c	- *can be* [*explained* -	- *do* ~~*explain*~~

Something more than identity of LF is required. In (65), the putative antecedent phrase for the ellipsis is defective, in that it has no MSyn features; then the antecedent for VPE seems to be subject to the same condition as the elided phrase. We take it that this arises because where there is a linguistic antecedent, it is not just the LF, but the particular lexical items, that should be retrieved (synonymous items may have distinct and relevant rhetorical effects). It follows that the phrasal antecedent should include the canonic MSyn relating to each LF item. We will use the term ‘VP ellipsis domain’ for such a constituent.[62] For (64) and (65), the verb of the antecedent alone is not a VP ellipsis domain, because the diploid containing the canonic MSyn of the verb will have been subject to Prune at this position.

Comparable observations pertain to the examples in (66) and (67),[63] where the verb alone is a VP ellipsis domain in this sense. That is, the source of the bare inflection on the elided verb (ID$_{DO}$ and ID$_{TO}$ respectively) does not have to be included in the ellipsis domain unless as in (62) the head is realised under that source.

(66)	a	%Jeremy has only just seen the joke,	though the others did at once
	b	PRES PERF SEE	PAST-SH ID$_{DO}$ [SEE
	c	*has* [*seen*	*did* [~~*see*~~

[61] That is, an MSyn diploid where the canonic MSyn for the LF item is the initial feature of the pair (e.g. for PERF, <AUX: *PERF*, AUX: α>, not just <V-EXT: β, AUX: *PERF*> (from (29) after some unification).

[62] We have not investigated whether the domain defined is relevant for other ellipsis.

[63] Note that in (67), at least in an informal style the identity element *to* may be elided. We have no account for this, nor for why, with a following elided VP, *to* **is** required after modal *ought* and the semi-modal *need*, (though not of course after the true modal *need/needn't*), but again is not required after modal *oughtn't.*

(67) a Blackbirds can sing sweetly, but magpies don't even try to

b PRES CAN [SING PRES NOT ID_{DO} TRY [ID_{TO} [SING

c *can* [*sing* *don't* *try* [*to* [~~*sing*~~

We then propose the conditions in (68).

(68) a A VP ellipsis domain is a phrase such that for any LF in the domain, if the MSyn features for that head include a root diploid, then this diploid must occur in the domain.

b Both the elided phrase and the antecedent phrase in VPE must be VP ellipsis domains

Note that this implies that speaker and hearer must retain the MS information about the antecedent domain long enough to identify ellipsis domains. We suspect that the MS information related to an LF may be retained longer than PF information.

Holmberg 2001: 161 proposes that ellipsis is "a phase which has been spelled out as null". Rouveret 2012 argues rather that ellipsis targets the complement of a phase head, though observing that both are plausible under minimalist assumptions (see also Bošković 2012). In our terms, an ellipsis domain is not necessarily a phase, because the former need not contain the LF associated with every diploid of the MS, whereas the phase must do so. Nor is a VP ellipsis domain necessarily the complement of a phase head (i.e. an initiator C, PROG, PASS, or ID_{to}), as witness elision after dummy *DO*.

5 Merge for MSyn features

5.1 Now or Never

Above, we have shown that the feature system as set up and the informal rules for merge give an account of verbal inflection in English. A more explicit definition of the Merge rule for MSyn features turns out to have explanatory properties. We turn to this now.

We have used a merge system for MSyn features that is parasitic on that of the Merge of syntactic categories, and involves only unification of the sets of MSyn features. Abstracting away from combinators here, since their MSyn features are not relevant, the Merge operation is spelled out more formally in (69).

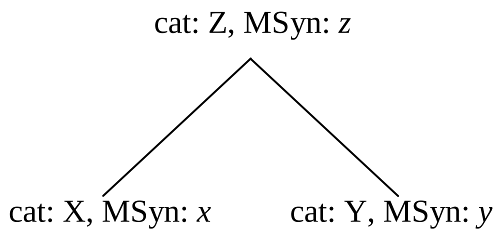
It will be important later that under this definition of Merge, unification takes place under sisterhood.[64] Below, '$\alpha \cup \beta$' represents the unification of α and β. A pair of

[64] That is, it is not required that the feature sets α and β may each independently percolate to Z. One of them might be fully saturated, in opportunistic checking, as with *ought* (*to*), discussed in section 6.2.

diploids are compatible if the attributes of each sub-feature match up or unify. They unify if additionally the associated values unify.

(69) **Merge Rule for MSyn features**

For X,Y, Z categories, and x, y, z the associated sets of MSyn diploids, if X and Y merge to give Z, (as shown in the diagram), then (a), (b) and (c) hold.



(a) **unification** (**upwards**)

If $\alpha \in x$ and $\beta \in y$ are compatible, and α or β is partially underdetermined,
then (i) $\alpha \cup \beta \in z$ [65]
else (ii) if $\alpha \cup \beta$ is not defined, the derivation crashes. (NoN Rule)[66]

(b) **unification (downwards)**

For $\alpha \in x$ and $\beta \in y$, and $\alpha \cup \beta \in z$, then $\alpha \cup \beta \in x$ and $\alpha \cup \beta \in y$

(c) **percolation (upward)**

If $\alpha \in x$ or $\alpha \in y$ is partially underdetermined, then $\alpha \in z$.

Note that (69) (a) will override (c) if applicable, by the Elsewhere principle. It is important that the NoN rule is a constraint on Merge; it says nothing about the occurrence of two compatible but non-unifying diploids in a single MSyn specification, such as the two diploids for PERF: *HAVE* (example (26) of section 4.2.2, which do not unify because of the 'No Twins' rule, or < AUX: *BE*, AUX: *PERF*>, which is realised at PF as *been*)..

The rules will give unification under sisterhood, with the result recorded at the mother as is standard under Merge rules, and also at the daughters. This has the effect of passing information from mother to daughter down the tree, so that when a feature is valued at some node, all copies of the feature are also valued. In particular, underdetermined MSyn features on the terminals become valued under unification as the derivation proceeds, leading to MSyn that can be input to the MS→PF mapping. Features remaining unvalued generally lead to a crash (see below).

[65] More precisely, if $\alpha \in x$, α is partially underdetermined and α is compatible with both $\beta \in y$ and $\gamma \in y$, then α must unify either with β or with γ; and so on.
[66] 'Now or Never'

The hypothesis is that the merge-rule given in (69) will be appropriate for all agreement, concord, inflection and displacement.[67]

As far as we can see, there can be no problems within the MSyn system as used here of the sort for which the ‘indexing’ of an item drawn more than once from the lexicon might be required (Chomsky 1995a: 227). That is, if the same lexical item is drawn from the lexicon more than once in a derivation, there is no possibility of the MSyn features of one getting entangled with those of the other, as can be intuitively verified by inspecting a derivation including two occurrences of dummy BE. We discuss other situations where indexing might plausibly be required in chapter R.

We have not justified yet the rule in (69 a ii), which specifies what happens if the diploids are compatible but do not unify. There are only two options: the diploids continue to percolate, or the derivation crashes. Intuitively, the more restrictive version, causing a crash, is likely to be the correct one, as it limits the domain over which some feature may be checked. This limit is not set at any particular point in the tree (e.g. at a ‘phase boundary’), but by the merging of some compatible feature which (atypically) fails to unify. It is thus a characterisation of an intervention effect. We see below, in discussing ungrammatical examples of mutual checking (section 5.2) and examples of ‘opportunistic checking’ (section 6), that the strict condition makes the required predictions.

What happens if in some structure, some diploid never becomes valued? The MSyn is well-formed in the sense that underdetermined features are permitted, and indeed given in the lexicon; it can only be the MS→PF mapping that determines the answer here. There are two possibilities:

(70) Suppose the set of MSyn diploids associated with a head is α, where α contains a diploid with some unvalued feature.

(i) (MS→PF).α is defined (i.e. the mapping gives a PF output for the MSyn input α). Derivation proceeds.

(ii) (MS→PF).α is not defined. Since there is a failure of output, derivation crashes.

The simplest instance of (70i) will be that where the language provides an overall default for a set of related feature-bundles to cover cases where some feature cannot be valued. For the case of (70ii), the derivation will fail. Whether the grammar of any language provides a mapping to PF for partially underdetermined features is contentious. The standard minimalist claim is that an unvalued feature causes a crash because it is uninterpretable at either interface, but arguments to the contrary have been produced, e.g.

[67] Matushansky 2006 similarly argues for a unification of head and phrasal displacement, but implements both in terms of c-selection.

by Holmberg and Hróasdóttir (2003), Marušič and Nevins (2010). We discuss a situation where default values might be invoked in Chapter W.

The MS→PF mapping can in fact fail to produce an output even when the features of an item are fully valued. We mentioned some cases in section 3.2.4 (footnote 14).

5.2 Successive AUX heads

We consider here how the MSyn Merge system as defined in (69) above ensures appropriate grammaticality in a more complex situation than we have considered before. We illustrate in (71), ignoring the COMP head and related MSyn features.

(71) a Jemima had been reading Proust

b *Jemima was have reading Proust

c *Jemima was having read Proust

d PAST-SH> PERF > PROG > READ

Merging the relevant heads bottom up, or top down by composition, and inserting dummy *BE* as required, will correctly obtain (71a), as described in section 4.2.2. This is essentially because at each successive merge, the underdetermined MSyn features of the new head will necessarily be subject to unification if possible. But in a grammar allowing composition, there are other possibilities. The question is, are (71 b and c) correctly ruled out if the merges are not entirely top down nor entirely bottom up. The relevant MSyn features are given in (72):

(72) MSyn features from (24), (29), (34) and (36) respectively:

PAST-SH	{< V-EXT: *u*: AUX: *PAST* >}
PERF	{<AUX: *PERF*, AUX: *u*>, < V-EXT: *u*, AUX: *PERF*>}
PROG	{< V-EXT: *u*: AUX: *PROG*>}
BE	<AUX: *BE*, AUX: *u*>
READ	<VERB: *READ*, AUX: *u*>

Inspection of (71b) reveals that no overt head bears the inflection assigned by PERF. The head PROG itself does not have a root (section 4.2.2, example (32)), so cannot host this inflection. In (71c), each root (PERF, BE, READ) bears inflection, and each inflection (PAST, PERF, PROG) is realised on some root. But in particular, the inflection from PROG is displayed on PERF. This requires that these two heads are merged together, since otherwise, because PERF precedes PROG, PROG inflection will be assigned to *READ*. Assuming this, the daughters in the merge have the features shown in (73):

(73) PERF {<AUX: *PERF*, AUX: *u*>, < V-EXT: *u*, AUX: *PERF*>}

PROG {< V-EXT: *u*: AUX: *PROG*>}

mother node {<AUX: *PERF*, AUX: *PROG*>, < V-EXT: *u*, AUX: *PERF*>}

The diploid under PROG will unify with the first diploid under PERF; but the result at the mother node will be a pair of compatible but non-unifying diploids. This will cause the derivation to crash, by the NoN constraint of the Merge rule in (69) above, correctly excluding (71c).

Given this, we confirm that a phrase such as *having read Proust*, the complement to *be* in (71c), cannot form an adjunct. Then (74a) is as expected, but (74b) is in need of an account.

(74) a *The student having read Proust is Greek

b The student, having read Proust, was ready with an answer

We take it that the *–ing* inflection on *HAVE* marks a gerund, which has a *pro* subject, rather than a progressive. Then the structure is comparable to that of a non-restrictive relative clause (Arnold 2007).

5.3 A note on agglutination

We have said nothing so far about languages with agglutinating morphology. The reason is that even if it were desirable, it is not possible in the general case for the morphology to be constructed by addressing a multi-dimensional paradigm using the features we have postulated. For example, consider Quechua, where, a causative head can merge below or above a reflexivising head, giving the following contrast (Baker 1985:392).

(75) (a) Maqa-ku-ya-chi-n

[beat-REFL]-DUR-CAUS-3SG

'He$_i$ is causing him$_j$ to beat himself$_j$'

(b) Maqa-chi-ku-n

beat-CAUS-REFL-3SG

'He$_i$ lets someone$_j$ beat him$_i$'

But with the MSyn features we have proposed, the head would accrue the set of features in (76), leading at best only to a single PF output, instead of to two distinct ones.

(76) {<VERB: *BEAT*, AUX: *CAUSE*>, <VERB: *BEAT*, AUX: *REFL*>}

We tentatively suggest an alternative compatible with our features. For familiarity, we discuss this in relation to PERF and PROG. Features like the following might be exploited to realise exactly the illicit combination of PERF and PROG features at the mother node in (73), repeated here as (77).

(77) PERF {<AUX: *PERF*, AUX: *u*>, < V-EXT: *u*, AUX: *PERF*>}

PROG {< V-EXT: *u*: AUX: *PROG*>}

mother node {<AUX: *PERF*, AUX: *PROG*>, < V-EXT: *u*, AUX: *PERF*>}

(78) (a) <V-EXT: α, AUX: β> => <<V-EXT: α, AUX: β>, AUX: *u*> (optional)

(b) MF→PF. <<VERB: α, AUX: β>, AUX: γ>

= MF→PF. <VERB: α, AUX: β> + MF→PF. <AUX: γ>

Here, (78a) allows an MSyn specification of an item which already bears an inflection feature to bear another. In particular, it may be applied to <AUX: *PERF*, AUX: *PROG*> at the mother, in (73), allowing the steps in (79).

(79) mother {<AUX: *PERF*, AUX: *PROG*>, < V-EXT: *u*, AUX: *PERF*>}

→ (by (78a)) {<<AUX: *PERF*, AUX: *PROG*>, AUX: *u*>, < V-EXT: *u*, AUX: *PERF*>}

→ (by unification) {<<AUX: *PERF*, AUX: *PROG*>, AUX: *PERF*>}

The rule in (78b) specifies how to spell out these successive inflections recursively. This gives regular agglutination, following the order in which the AUX heads are successively merged — i.e. the mirror effect (Baker, 1985).

6 Heads demanding ‘opportunistic’ checking

6.1 Inflection ‘spreading’

In this section, we consider checking in the V-EXT system which does not fall under mutual checking. For checking by unification to take place at all, one diploid must be active, in the sense that it has an unvalued feature. In the cases considered here, the feature with which it must unify is not a converse diploid, but rather one which is either inactive, or is checking some other head. The active diploid can percolate, and it must unify with the features on some appropriate diploid if and when the opportunity arises. For this reason, we call such checking ‘opportunistic checking’, as opposed to the ‘mutual checking’ of previous sections. However, if the target diploid c-commands the active one, percolation of the active one will eventually give a sisterhood relation, so that checking is always possible. This will hold whether c-command is from the left (corresponding to LF scope) or from the right.[68]

We will argue for such a situation in relation to English, in section 6.2, but as an introduction, we briefly consider the Swedish ‘parasitic supine’, an instance of inflection ‘spreading’. This is one instance of a situation where one AUX head can licence inflection on two V-EXT items, where the second is the head of the complement of the first. This occurs in other structures in Swedish, and in other languages. The Swedish examples are taken from Wiklund 2001; see also Sells 2004 for further discussion and examples. Work in progress by Susi Wurmbrand (Wurmbrand 2010) is closest to what we suggest, and considers a much larger range of data. However, she is not working with diploids, as we are.

The parasitic supine (a non-finite verb form associated with the perfect) in Swedish is exemplified in (80b), where (80a), which is also grammatical, might be expected.

(80)	a	Jag	hade	velat	läsa	boken	(Swedish)
		I	had	want-SUP	read-INF	book-DEF	
	b	Jag	hade	velat	**läst**	boken	(Swedish var.)
		I	had	want-SUP	read-**SUP**	book-DEF	

‘I would have liked to read the book’

In (80a), the supine morphology on *WANT* is induced by the MSyn features of AUX *PERF*, and the infinitival morphology on *READ* is induced by those of AUX *WANT*. *READ* cannot access the MSyn features of AUX *PERF*, because of the intervention of the MSyn features of WANT. In any case, the MSyn features of AUX *PERF* would no longer have an unvalued V-EXT feature to accommodate VERB *READ*. The problem then is what MSyn features permit (80b). The problem may be overcome by setting AUX *WANT* to check its inflection requirement opportunistically, rather than by utilising the expected checking feature from AUX *PERF*. This leaves the feature from AUX *PERF* free to check the features of the lower VERB *READ*. We suggest that the lexicon contain an entry with the MSyn features in (81b) in addition to the default one in (81a). In the parasitic form, the inflection for *WANT* is already specified in the second diploid (<AUX: *WANT*, AUX: *PERF*>), and the first diploid (<**AUX: *PERF*, AUX: *u***>) is not the expected one. Rather, it is another diploid relating to PERF, one which is to ensure that the assumed perfect inflection of the second feature does indeed relate to a PERF head.

[68] An item α c-commands an item β if the mother of α dominates β. We do not make use of this relation except descriptively, as here.

(81) a LF: WANT (standard)
MSyn: {< V-EXT: *u*, AUX: *WANT*>, <AUX: *WANT*, AUX: *u*>}

b LF: WANT (parasitic supine form)
MSyn: {**<AUX: *PERF*, AUX: *u*>**, <AUX: *WANT*, AUX: *PERF*>}

c LF: READ MSyn: {**<VERB: *READ*, AUX: *u*>**}

d LF: PERF MSyn: {**<AUX: *PERF*, AUX: *u*>**, **<V-EXT: *u*, AUX: *PERF*>**}

This feature will correctly percolate until it can unify with the matching diploid on some occurrence of PERF, or crash. But it must also be ensured that if there is unification, the PERF head involved is the local inflection assigner (and not one in a higher clause). Note that when parasitic WANT and READ merge, the underdetermined diploids (in bold) from both will percolate. These two diploids are not compatible.

Now suppose that the PERF head is merged next. Both its MSyn diploids will percolate. The first is compatible with, and will unify with the ‘opportunistic’ underdetermined diploid from WANT. Any other AUX instead of PERF would cause a crash, by NoN, because its inflection-seeking diploid <AUX: α, AUX: *u*> would be compatible with, but fail to unify with, the underdetermined feature from parasitic WANT. Thus without stipulation, the PERF head must be local to the parasitic *WA NT*. The diploid of PERF involved will be unchanged, as is required to obtain inflection for PERF from Tense. The second diploid from PERF will unify with the underdetermined feature from READ, assigning it supine inflection.[69]

If instead of a verb, the complement of *WANT* were an auxiliary, the percolating feature in (81b) and that in the AUX version of (81c) would be non-unifying compatible diploids, so that the derivation would crash by the NoN rule. Wiklund (2001) suggests that in the Parasitic Supine, the two verbs form a complex predicate. Adopting this proposal would ensure that the V-EXT item with which *WANT* is merged is not an AUX item. We discuss complex predicates in Chapter R, where we give the additional MSyn feature needed to ensure this for the parasitic version of a verb.

What we have described above thus provides an alternative MSyn capable of characterising the simplest example of parasitic inflection. That is, the microparameter giving Parasitic Supine is instantiated in the grammar by means of MSyn entries like that in (81b). We can do no more here than suggest that the MSyn diploid system may be capable of accommodating more complex cases.

[69] Wiklund’s solution is similar in sprit, but requires two heads to check one inflection-source. This is incompatible with the diploid unification system we put forward; hence our use of a feature for opportunistic checking.

6.2 Opportunistic checking for *ought to*

The high modal *OUGHT* is apparently anomalous. It has NICE properties, but unlike other MODALS, appears with an infinitive headed by *to*. But AUX: *TO* by assumption does not accept inflection. We postulate that MODAL: *OUGHT* checks not for AUX: *TO* but rather for PREP1: *TO*, which is also an identity element, and that it assigns inflection (bare inflection) to the following V-EXT item as usual for an AUX item. The occurrence of PREP1: *TO* with MODAL: *OUGHT* may be a remnant from an earlier stage of English (see Fisher et al. 2000: 96, fn. 3). Similarly, for those who accept *Used there to be unicorns?*, AUX: *USED* checks PREP1: *TO*.

We give below the required features. The assumption is that PREP1 items are synchronically identity adjuncts of type X/X, perhaps serving processing purposes (cf. the disambiguating function of ditransitive *TO*). As such, they need to be licensed by some other head, as in (82).

(82) category X/X; Canonic MSyn: <**PREP1: *TO***>; MSyn: <WORD: *u*, PREP1: *TO*>

The MSyn feature here could in principle percolate freely over some distance up the tree before being sister to a compatible diploid, raising a potential locality problem.

Modal *OUGHT* has an additional feature to check for PREP1: *TO*.

(83) <**MODAL: *OUGHT***>; MSyn: {<MODAL: α, TENSE: *u*>,
<V-EXT: *u*, MODAL: *OUGHT*>, < MODAL: *OUGHT*, PREP1: *TO* >}

The PREP1 checking feature on the modal is fully saturated, and will not percolate. This means that it must c-command the PREP1 item, which will percolate. This is not sufficient to ensure that the *TO* is the head of the complement to the modal. But an ID item is never merged unless it is forced, and it cannot be forced until the item requiring it is accessible to it. This means either that it is merged after rather than before the modal is merged, or that the modal and the ID item are merged as sisters, by composing. If the two items merge as sisters, opportunistic checking is unproblematic. Further, we automatically predict that examples like (84) are grammatical, and also have the constituency allowing the special PF output *'oughta'*.[70]

(84) John both ought to and will leave on Tuesday

The general properties of checking for complements that cannot be selected by category are discussed in Chapter S. Opportunistic checking will be seen again with the MODALS (section 7), and with Pol (section 8.2).

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[70] We discuss phrasal contraction (appropriate for *wanna*, *hafta*, *hadda*, and for explaining *that*-drop) in chapter S.

7 Modals

The English modals referred to as 'true modals' are discussed here because they have the 'NICE' properties characteristic of members of the word-class AUX, have modal meanings, and cannot occur as non-finite forms. We also discuss some related properties of the rest of the items with modal meaning falling under VERB (the 'quasi-modals'). Excluded are other items with modal meanings, such as adverbs.

There are two properties of English modal verbs that are relevant to our MSyn concerns in this chapter. One of these relates to finite Tense, and the other to scope with respect to Pol negation. These give evidence for both the Merge positions of the modals, and for their MSyn properties. The simplest data concerns scope with respect to negation, so we start here.

In Cormack and Smith 2000a, 2002b, based largely on Cormack and Smith 1998, we argued that each English modal is merged at LF in a position defined in relation to the Polarity head 'Pol'. The distribution of the modal heads in relation to Pol is established by the scope interpretation in relation to negation merged under Pol (there are both higher and lower negation heads, not immediately relevant).[71] Contracted negation *–n't* is available only in Finite clauses. Scope data for some modals in the dialect of the authors are shown in (85) and (86), where NEC covers all 'necessity' type meanings, and POSS all possibility types. We omit here some items (the auxiliaries *will*, *shall*, which are arguably futurate tense elements.

(85)	a	John oughtn't to / mustn't / shouldn't eat peanuts	root;	NEC > NOT
	b	There oughtn't to / shouldn't exist more than three solutions		
			epistemic;	NEC > NOT
	c	John mightn't / mayn't have left yet	epistemic;	POSS > NOT
	d	John isn't to eat nuts	root;	NEC > NOT[72]
	e	It isn't for us to decide	root;	NEC > NOT
(86)	a	John can't swim / go to the cinema	root;	NOT > POSS

[71] Von Fintel and Iatridou 2007 show how to differentiate some high and low modals without relying on the presence of negation. The contrast accounts for the difference in acceptability of (i) and (ii):

(i) If you want good cheese, you only have to go to the North End.

(ii) If you want good cheese, you (*only) must (*only) go to the North End.

[72] There are problems with the modal interpretation of *is…to*, in relation to negation and apparent use in non-finite adjuncts, which we cannot address here. See Kayne 2012 for some discussion in a more standard minimalist framework.

b	There can't be three solutions	epistemic;	NOT > POSS
c	John mayn't leave before six	root;	NOT > POSS
d	John needn't go to bed yet	root;	NOT > NEC
e	There needn't be more than one solution	epistemic;	NOT > NEC
f	John doesn't need to go to bed yet	root;	NOT > NEC
g	There doesn't need to be more than one solution	epistemic;	NOT > NEC
h	George doesn't have to leave yet	root;	NOT > NEC
i	It doesn't have to have happened that way	epistemic;	NOT > NEC

The position of each modal in relation to negation is consistently as in the examples given, irrespective of variants in interpretation within the broad 'root' vs. 'epistemic' classes except where mentioned, so we can divide them into high modals and low modals. Within the low modals, morphosyntactically, some are true modals, some are auxiliaries, and others are simply verbs.

(87) **Merge positions of modals relative to Pol** NOT.

High modals (pre-Pol at LF)	necessity	**epistemic/root**: *should, must, ought + to*, **root**: *is + to*
	possibility	**epistemic**: *may/might*
Low modals (post-Pol at LF)	necessity	**epistemic/root**: *need, need + to, has + to* **root**: *is + for* (no epistemic)
	possibility	**epistemic/root**: *can/could, dare* **root**: *may/might*

As can be seen, there is no systematicity for root modals vs. epistemics with respect to Pol NOT, nor is there consistency for necessity vs. possibility type meanings. For the true modals, there is a bias towards the high modal position for necessity modals, and a low modal position for possibility modals; the same split occurs in French and Spanish (Borgonovo and Cummins 2007). For discussion, references, and some cross-linguistic comparison, see Cormack and Smith 2002b, Hansen and de Haan 2009, von Fintel and Iatridou 2007), and further works noted below.

The table in (87) is frequently in conflict with an expectation that might be drawn from the 'Cinque hierarchy' (Cinque 1999a), that if some modals fall above and some below Pol, then the division would be consistent with the hierarchy. Catalan conforms particularly neatly with this expectation, with all epistemically interpreted modals merging above Pol, and all root readings, below (Picallo 1990).[73] Our response to this in Cormack and Smith 2002b was to argue that the Cinque hierarchy, in putting the various epistemic readings with scope uniformly higher than those with deontic readings, represented a conceptual rather than an NL desideratum.[74] What this means under the hypothesis of an LoT is that if in the representation of a proposition, both an epistemic and a deontic modal item appear, then the epistemic will have wider scope.[75] The well-behaved speaker, then, will not attempt to produce a sentence in his NL where the canonic LF fails to conform to this LoT requirement. This seems to be just what happens in Scottish English, which has double modal structures (Cormack and Smith 2000a, 2002b). That is, some double modal structures where the modals correctly conform to a pattern similar to that for English are unacceptable if they violate the Cinque hierarchy..

Given that high modals and low modals do not form natural classes, it is reasonably clear that their positions must be given with respect to Pol NOT rather than vice versa. Since Pol *NOT* is not obligatory, the relevant item must be Pol — which might in principle be identified by MSyn, LF, category, or type. Under the simple 'percolation and unification' version of feature checking we are using, MSyn features cannot impose well-formedness conditions on LF order. Likewise, LoT in itself imposes no ordering on the modals with respect to Pol, given the variation between languages, and LF has not the means to (type being unsuited to the task).[76] This leaves category, so let us consider using the finer-grained category system to identify Pol.

The LoT type for polarity at its simplest is the operator type <t, t>, and the default assumption about the category within the verbal domain would be V/V. But such an operator category is not identifiable in the right way: it does not change the category of its input. Accordingly, the category must be Pol/V, not V/V, as already suggested in section 1. The categories must be as shown (in simplified form) in (88a). Then within the

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[73] For a discussion of various negation positions, see Cinque 1999a §5.4 and Cinque 1999b, and for an example of multiple overt negation positions, see section 8.1.

[74] See also Bobaljik 1999 with respect to adverb ordering, and also Ernst 1998, 2002: Ch. 3, and Shaer 1998.

[75] See Nauze 2006 for a formal semantic account of this distribution.

[76] It has been argued that the position of universally quantified deontic modals in relation to negation should be characterised by classifying them as NPIs or PPIs instead of by category (Iatridou and Zeijlstra 2010, 2012, Homer in press)). However, for these authors, head movement must be able to affect LF scope. It might be, however, that NPI/PPI properties are required in addition to category.

local clause, merges under Functor First can only give the scope and linear order shown by '>' in (88b) (corresponding to c-command).

(88) a MS: Pol/V (obligatory polarity head)

MS: Pol/…Pol (high modal)

MS: V/…V (low modal)

b Pol/Pol > Pol/…V; Pol/…V > V/…V (no other orders of merge possible)

Note that if Pol is obligatory, there must be an entry for Pol POS as well as Pol NOT. In the absence of evidence to the contrary, the merge positions of the modals in relation to Pol POS are taken to be as for Pol NOT.

Now consider the position of Tense in relation to these heads. Assuming that, as in the Reichenbachian system, finite Tense is an operator rather than a binder, then abstracting away from the temporal c-selection, it will have category Pol/Pol. But this leaves Tense unordered with respect to a high modal, since again the MSyn features do not serve to order the heads. Where should the high modals be merged? There are two possible scenarios. First, Tense does indeed have a category with goal Pol. In this case, the position of the high modal might be free (subject to any scope effects desired). Second, Tense has a dedicated goal category (as we will argue in Chapter X), in which case a categorial choice between the high and the low merge position has to be made. Is a high modal merged below or above Tense? MSyn Tense features must always be assigned, and low epistemics must be merged below Pol, and hence below Tense, so there are no syntactic grounds for arguing that modals cannot bear Tense features, nor fall within the scope of Tense. The conservative option for the child learner is that these modals are in conformity with the scope with respect to Tense of other AUX. We thus take the correct position for the high modals to be below Tense (contra Cinque 1999b, 2006; see Homer in press). Additionally, if T licenses the subject, then we do not expect items to fall between Tense and the subject (see Ch 2, Ch X).

If the current array of relevant items is ordered at LF as in (89), where no item can fall between the subject and Tense, it is necessary to consider the scope of the high modals with respect to the subject, as well as with respect to Tense.

(89) subject > Tense > high modal > Pol > low modal > verb[77]

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[77] What is required for the low scope readings is rather that the subject may take lower scope under semantic reconstruction, equivalent to a low LF interpretation under a Raising analysis (Lee 2006, Wurmbrand and Bobaljik 1999). We see the need for this even with the low deontic modals. In particular, in (i), the most natural reading has the subject taking lower scope than deontic *MAY*, which is a low modal:

(i) All the boys may come in my car PERMISSION > ALL THE BOYS

It has been claimed that quantified subjects cannot scope over epistemic modals (e.g. von Fintel and Iatridou 2003), but Huitink 2008, Swanson (2010) argue otherwise. Swanson points out, for instance, that (90a) cannot be paraphrased as (90b).

(90) a Almost every square inch of the floor might have paint on it

b It might be that almost every square inch of the floor has paint on it

Thus the array in (89) is as is required.

With the exception of the quasi-modals such as *HAVE to*, the majority of verbs with modal meanings in English cannot appear in a non-finite form. Suppose we use the MSyn word class MODAL for items with this property; then all the English true modals have this word class, including the *BE* of *is+ for + to*.[78] Then because the items cannot be non-finite, each will need to have the MSyn feature <MODAL: α, TENSE: *u*>, rather than the default <MODAL: α, AUX: *u*>. Modals also assign bare inflection to the following V–EXT head, so that a second feature is required. The default specification for a MODAL item will then be constrained as in (91).

(91) Canonic MSyn.β = <MODAL: α> =>

MSyn.β = {<MODAL: α, TENSE: *u*>, <V-EXT: *u*, MODAL: α>}

The situation with respect to low modals appears to be straightforward. Since they have to bear Tense inflection, intervention effects will ensure that they are merged higher than other VERB items in the immediate clause. The quasi-modals will have the usual properties of VERB or AUX items.

There are however some restrictions on the occurrences of modals with various inflections, which might properly be encoded in MSyn features. One relates to Tense. It has been argued extensively that epistemic modals must fall under present tense (Stowell 2004 and others).[79] Examples are shown in (92 a, b). In English, the deontic versions of the high modals need the same restriction, as shown in (92c), so that for this, an MSyn

There is some doubt as to whether it is true for all speakers that epistemic modals must scope over quantified subjects; see Huitink 2008 for discussion. .

[78] This does not of course hold in those varieties of English, including Scottish English, Tyneside English, and some American English dialects where double modals are permitted (Miller and Brown 1982, McDonald and Beal 1987, Battistella 1991 and Cormack & Smith 2002b among others). In these dialects, the modals corresponding to MODALs in the majority dialect similarly fail to inflect for 3rd person singular even when finite.

[79] Many apparent exceptions are instances of Free Indirect Speech, where the apparent past tense is occasioned by the Sequence of Tense morphology arising from an elided past tense matrix clause of the utterance.

encoding is required. The examples in (92 b, c) are acceptable only as Free Indirect Speech.

(92) a *There was a gigantic meteor strike in Russia in the pre-Cambrian era, but that should not / ought not to affect Asia at the same time.

b (There was a massive extinction). #It must be due to some catastrophic event

c #In those days, a woman should / must / ought to wear a hat in church

This might be encoded for such modals using the MSyn features as in (93) for an item falling under MODAL.

(93) High MODAL: *α*

{<MODAL: *α*, TENSE: *PRES*>, <TENSE: *PRES*, COMP: *u*>, <V-EXT: *u*, MODAL: α>}

Here, the legitimacy of TENSE: *PRES* in the first feature must be obtained by opportunistic checking, using the second feature, since the first feature will not percolate. The third feature is the usual inflection-assigning one.

The low modal *NEED* cannot be interpreted as PAST tense in either its epistemic or deontic uses, as shown by the examples in (94 a, b) and (94c).

(94) a *There was a gigantic meteor strike in Russia in the pre-Cambrian era, but that need not affect Asia at the same time.

b (There was a massive extinction). *It need not be due to climate change

c *In those days, a woman need not wear a hat in church

The involvement of deontic NEED (NEED-D) precludes a semantic explanation based on properties of epistemics; and the falling together of NEED-EP and NEED-D is what is expected if MSyn features of *NEED* are involved. We may assign to MODAL: *NEED* features as in (93).

The same MSyn opportunistic feature could be launched by a modal item which is a VERB, but is not an AUX or a MODAL (failing to invert). Modal epistemic *HAVE to* and *NEED to* are VERBs, and at least in some dialects, require that the local Tense head is PRES (example (95a) is ungrammatical for those speakers). At the same time, the VERB is able to receive bare inflection from an intermediate item, as in (95b).

(95) a % John now agrees that there had to have been a flood in that period

b There might need to be two solutions to any such equation

We suggest that these epistemic items have an MSyn diploid requiring local inflection as usual, to account for (95b), but also one to check opportunistically for <TENSE: *PRES*> higher up the tree, as in (96). An MSyn feature like that in (96) will suffice.

(96) MSyn: {<VERB: β, AUX: *u*>, <TENSE: *PRES*, COMP: *u*>, <V-EXT: *u*, VERB: β>}

If the TENSE value is PAST, the derivation will correctly crash.

The low modal *NEED* may alternatively have these MSyn features rather than those in (93). Other low modals are deontic. (97b) on its required deontic reading is mildly archaic.

(97) a In those days, a woman could not politely go to church bare-headed

b In those days, a married woman might not be wealthy in her own right

Here, we seem to have genuine PAST tense modals. The setting given in (93) will then be too restrictive. The underdetermined MSyn feature in (98), where γ is some low deontic modal, will serve, and will percolate to check for some TENSE feature.

(98) MSyn: {<MODAL: *γ*, TENSE: *u*>}

We now have three classes of modals, distributed by these MSyn features. The simplest is that in (98), which we have cast most generally, corresponding to the first (deontic) modals learned by the child. The settings for the high MODALs in (93) are a restricted version of this, requiring <TENSE: *PRES*>; the settings for the rest of the epistemics, whether modal or verb, are given in (96).

In this section, we have sketched some of the MSyn features required specifically to model the behaviour of modals in standard English, and shown that the feature system set up is adequate.

8 Polarity items

8.1 High polarity

There are good reasons to suppose that there is in many languages, including English, a polarity head above Pol at LF. We argue here for a negation position below Tense but above Pol NOT. The strongest argument would come from languages where there are two phonologically distinct negation operators, one plausibly Pol NOT, and the other in a higher position, or negation appearing in two distinct positions. Typically, but not necessarily, the higher negation is used for ‘echoic’ or ‘metalinguistic’ negation, and as in our earlier work, we will use ‘Echo’ informally for this position (Cormack & Smith 2000a, 2002b), and <ECHO: *NEG*> for the canonic MSyn of the item. Korean has overtly distinct positions for negation which we would characterise as Echo and Pol positions (see Carston and Noh (1996), as does Swedish (see below). The Italian dialects of Piedmontese (Zanuttini (1997) and Modena (Rita Manzini p.c.) use obligatory negation-related particles, which are distinct for echoic vs. non-echoic uses of negation. In Cormack & Smith 2000a we argued for distinct negation position for the Echo and Pol heads in those dialects, and also for standard Italian, Catalan (Picallo 1990), and Basque (Laka 1994).[80] Interesting corroboration of this position comes from Drozd's (1995) reinterpretation of utterance-initial negation in child language. Following Horn (1989:462) he suggests that examples of pre-sentential negation in child English such as *No Nathaniel a king* are characteristically "an early form of metalinguistic negation" and are in contrast with (typically non-echoic) internal negation. Moreover, although there is considerable variation, such external negation is usually signalled by the use of *no*, while internal negation is usually signalled by *not* or *n't*.

We consider here arguments for a higher negation position based on English. Scottish English (Brown 1991, §8.3) has distinct negation items which correspond to Pol NOT and Adv NOT items, *-nae*, and *no*, respectively. However, the stressed Pol NOT may also be realised in the free form *no*.

(99) a She couldnae have told him NOT > POSS

b She could no have told him POS > NOT (unless stressed: NOT > POSS)

Additionally, *-n't* occurs, almost exclusively in tags, but also occasionally in root questions (see Millar and Brown 1979 for Edinburgh Scots tags). Otherwise, tags and yes/no questions use *no*. The Scottish English examples in (101) are from Bresnan 2001.

(100) a He's coming, isn't he? b He's coming, is he no?

(101) a. Am I no your friend? b. *Couldnae he have been working?

c. Amn't I your friend? d *I amn't your friend.

We suggest then that in these Scottish English dialects *no* may realise either isolate Pol NOT or Echo NOT, as well as Adv NOT, but that the *–n't* forms are exclusively Echo NOT.

For standard English, an old argument for a high negation was that it was needed to obtain scope over the subject, but the possible use of semantic reconstruction means that in the simplest examples, such as (102), the argument is no longer cogent. Suitable type-

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[80] Kiparsky and Condoravdi (2006) discuss Jespersen's cycle in Greek dialects over three millennia, associating 'emphatic negation' with what we would call echoic negation (see the discussion of English examples in their (5) to (8)), and suggesting that all languages can express this in some way that contrasts with the non-emphatic version. Whether this negation corresponds to high, Echo negation seems likely.

lifting at the position of the up-arrow will force the subject to reconstruct semantically to this position, so that it may now fall under Pol NOT.

(102) Three students have **not** (↑) [failed the test] — only two failed.

A more useful argument for a second, high, polarity head, can be offered, concerning negation scoping over high modals (Cormack & Smith 2000a, 2002b). We discuss these briefly.

Consider the exchange in (103a). The mother's utterance, in both main clause and tag, may have the falling final intonation of an assertion. It is to be interpreted as having the scope shown in (103b), consistent with the high position of the modal with respect to Pol NOT at LF.

(103) a Teenager: I'm going out

Mother: You shouldn't go until you have done your homework, should you.

b SHOULD > NOT

Now consider the following exchange, where the mother casts her comment as a diffident proposition, using the intonation of a question but with declarative syntax.[81]

(104) a Teenager: I'm going out

Mother: You shouldn't do your homework first, should you?

b NOT > SHOULD

This makes sense only if the LF of the mother's utterance has the scope shown in (104b), and only if the intonation is questioning. This contrasts with (103), where either intonation is possible. Similarly, the questions in (105) and (106) most naturally contrast in the scope of the modal and the negation, having the paraphrases shown, where '?' indicates the scope of the question (see Ladd 1981 for the intonation and context appropriate for the two distinct interpretations of questions containing negation).

(105) (to friend who must lose weight) Shouldn't you eat **fish** (instead of lamb)?

'Is it **not** the case that you **should** eat fish?' ? > NOT > SHOULD

(106) (to friend who talks about over-fishing) Shouldn't we **eat** fish (any more)?

'Is it the case that we **should not** eat fish?' ? > SHOULD > NOT

Note that in (106), *fish* might be replaced by *any fish*, which includes an NPI item, but this is not possible in (105). We conclude that Echo NOT may reverse tag polarity (cf. (104)) but that it does not licence NPIs (in line with Ladd 1981).[82, 83]

[81] We refer here to the main clause; the tag for a declarative has the syntax of a question.

The scope of Echo vs. Pol NOT in relation to modals such as MUST is relevant to a different scope argument for a high LF negation position, which we have to reject. Repp (2009: section 4.2), discussing the wide-scope negation reading in Gapping, argues that when the gapped version of a sentence like (107a) has the reading in (107b), the negation ("illocutionary negation") scopes syntactically over both conjuncts.

(107) a John can't eat caviar and Mary (eat) beans

b It is not permissible that [John eats caviar and Mary eats beans]

Repp's discussion does not deal with the English modals in detail; most of her examples are from German, where she does discuss modals. However, on the basis of (108a), with the reading in (108b), it follows that the negation must, surprisingly, be Pol NEG, at least in English.

(108) a Your new baby must not get all your attention and your toddler none

b OBLIG [NOT [your new baby gets all your attention and your toddler none]]

This is consistent with Carston and Noh's demonstration that Korean 'short negation', corresponding to our Pol NOT, can be used in echoic contexts. We discuss the structure required to give the correct LF for this Gapping in Ch Z.

[82] This is separate from the question whether Metalinguistic use of negation (MLN) licenses NPIs (see Carston 1996a for discussion of MLN). Carston and Noh (1996) cite (i) from Seuren (1990, 451-2). If we use quote marks to indicate the content to be treated metalinguistically, as in (ii), we make explicit the fact that the NPI [*at all*] does not fall within this (where it would indeed be insulated from licensing by the clausal negation). But nothing forces us to take the negation here as Echo NEG rather than Pol NEG. We find Seuren's example infelicitous, but (iii) makes the same point.

(i) That car isn't (pretty) old at all. It's antique.

(ii) That car isn't "(pretty) old" at all. It's "antique".

(iii) There aren't any "old people" any more, there are only "senior citizens"

MLN is said to indicate that the metalinguistically marked item is mentioned but not used (Sperber & Wilson 1981, Carston 1996a); but this gives at best only a very partial account of the compositional semantics and explicature of sentences like those above. Note that without MLN, a metalinguistically marked item is used as well as mentioned:

(iv) So you (don't) want a "tomaido", today?

We leave many interesting loose ends here.

[83] Pol NEG does both; Adv NEG licenses NPIs but fails to reverse tag polarity.

Finally, some clauses with negative quantifiers have a 'split scope' reading. This is well-known in German, but occurs also in English.[84] Here, the negation may have widest scope.

(109) Zu dieser Feier musst du keine Krawatte anziehen (Abels and Marti 2010)
to this party must you no tie wear
'To this party you don't have to wear a tie' NOT > OBLIG > ∃

(110) a None of the people on the list **must** be sent invitations, but invite them anyway

b The baby **must** eat **nothing**, but variety is important

c NOT > OBLIG > ∃

For such readings, an analysis is required where the negation is above the modal at LF, but an existential ('some/any of the people', 'some/any thing') is reconstructed below the modal.

What does need to be determined is whether Echo NOT and Pol NOT may co-occur in a clause. Consider the dialogue in (111). In B's response, is it possible for the first negation to be Echo NOT, and the second, Pol NOT? A's statement with unmarked intonation includes Pol NOT, the modal scope is SHOULD > NOT since there is contraction (not available with constituent negation).

(111) A: Jemima shouldn't make fun of her brother

B: Jemima should **not** not make fun of her brother: he needs a bit of teasing.

In B's response, the modal scope is NOT > SHOULD > NOT, plausibly with both Echo NOT and Pol NOT occurring. But equally, the lower one could now be Adv NOT. When we discuss auxiliary inversion across negation in the next section, we argue that this is indeed correct.

We have not yet determined the LF position of Echo NOT. At PF, in English, it appears below a modal over which it has scope, so this is no help. There are however suggestive examples. We have already mentioned child English above, where Echo NEG appears before the subject. Consider next the following:

(112) a Tony must leave soon, but not Rachel

b Fred may leave now, but not anyone else.

[84] For recent discussion and references, see Zeijlstra 2011. We expect that an MSyn checking account of the relation between the existential and the indefinite will be viable and lead to an account of the PF (see op.cit. §4.1).

In (112a), for the second clause, there is available a reading “but it is **not** the case that Rachel **must** leave soon”, suggesting that the position of Echo is above the subject. The negation in (112b) must be Pol *NEG*, since Echo does not licence NPIs. We argue in section 8.2 that this is consistent with Pol *NEG* being merged below the subject at LF (being realised at a higher position at PF), and argue further for the availability of an Echo *NEG* position above C. Echo Negation above the subject appears again with adjunct *whether or not*. In (113), the reading is Echo *NEG*.

(113) Johnny must go to school, whether or not his sister should

There are however data from other languages that indicate more directly that the Echo position is potentially above the subject, consistent with a T/T selection or C/C selection.[85] Swedish shows both these selections, as well as selections for lower positions.

In a Swedish clause with a modal, there are four possible positions for negation.[86] With low modals, for each position of negation including the lowest, only the scope NOT > MODAL is possible, as exemplified in (114).

(114) … att Johan får inte ha frack NOT > PERMIT * PERMIT > NOT
... that Johan may not have tails

‘... that Johan may not wear tails’

We therefore assume that as in English, the low modals have category V/V, or V/D/V, while the negation has a category Pol/V (or some higher category for Echo *NEG* readings). It must then be possible for the low modal optionally to be displaced at PF to some higher position. There is no Adv negation of category V/V (Holmberg 2012). High modals show different results, as exemplified in (115) to (118). The scope order in bold is the one predicted by the PF positions assuming no relevant displacement. The unmarked position is that in (116).

(115)	… att Johan skall **inte** ha frack that Johan must not wear tails	NOT > OBLIG	**OBLIG > NOT**
(116)	… att Johan **inte** skall ha frack	**NOT > OBLIG**	OBLIG > NOT
(117)	… att **inte** Johan skall ha frack	**NOT > OBLIG**	?OBLIG > NOT
(118)	**Inte** skall Johan ha frack	**NOT > OBLIG**	*OBLIG > NOT

We assume that as in English, the high modals have category Pol/Pol, so that they scope above Pol *NEG*. We will not attempt here to account for the intermediate negation

[85] See also Déchaine & Wiltschko (2003).
[86] We are indebted to Anders Holmberg for the information here.

positions and the possible positions of the modal. Assuming V to C displacement for (118), there is in evidence a high *NEG* with category C/C, which unambiguously has scope over a high modal. We take it that the C/C *NEG* is the Swedish equivalent of our Echo *NEG*, and hence that this highest position is the locus of Echo.

A further argument for a high polarity position is that this is a natural locus for the root question equivalent of a *wh*-word. Following Hausser and Zaefferer 1979, Hausser 1983 §4.2, Krifka 2001, the semantic value for *wh*-questions is obtained by treating the *wh*-item as a lambda abstraction operator. That is, the question in (119a) has the meaning that is indicated as a first approximation in (119b). Given our variable-free LF, and taking PERSON as a restrictor on a two-place lambda abstraction operator, we propose an LoT representation as in (119c), where the brackets are for perspicuity only (see also Holmberg 2003, 2012). The symbol shown on the left in (119c) is the capital lambda, where the likeness to the conjunction operator is fortuitous but convenient: its interpretation is identical to type-shifted conjunction. Then the NL operator WHO is subject to the Meaning Postulate in (119d).

(119) a Who left?

b λx [(PERSON x) $\wedge$ (LEFT x)]

c [Λ. PERSON]. LEFT

d WHO $=_{df}$ Λ. PERSON Type: <<e, t>, <e, t>>

Comparably, *Which student read Ulysses?* will have the LF and LoT representation at least as in (120),[87]

(120) [Λ. STUDENT] [COMP$_{ROOT}$ [$\uparrow$ ULYSSES] READ]]

The idea is that if such a representation is presented by the speaker to a hearer, with appropriate questioning intonation, the speaker is expected to supply a pragmatically more useful characterisation of the same one-place predicate. So for (120), an appropriate answer might be ‘Paddy’, or ‘the same person as took *Finnegan’s Wake* out of the library’ or ‘None of us’.[88] Now, assuming that some such representation is appropriate for all questions, some polarity head needs to be able to host a ‘*wh* operator’ in the form of a lambda operator of the appropriate type.[89] This operator will replace the ‘?’ in (105)

[87] It is necessary that in the explicature, the set of students is restricted to one available pragmatically, and that it is presupposed that there is only one such student. Pragmatic processing of the LF, or rather of its LoT congener, is responsible for these additions.

[88] A quantified noun-phrase reply such as ‘None of us’ requires that the one-place predicate be of, or be raised to, type <<<e, t>, t>, t>, rather than the simple <e, t>.

[89] We take it that embedded questions, which may differ semantically and structurally from root questions, have additional structure.

and (106) above, for instance. It follows that it should be possible to have a polarity head above *COMP* in a clause.

(121) a Is it raining? $[_C\ \Lambda\ \ [_C\ \mathrm{ID_{COMP}}\ [\mathrm{IT_{WEATHER}}\ \mathrm{ID_{POL}}\ \mathrm{ID}_{\mathit{BE}}\ \mathrm{PROG\ RAIN}]]$

b Isn't it raining? $[_C\ \Lambda\ [_C\ \mathrm{NOT}\ [_C\ \mathrm{ID_{COMP}}\ [\mathrm{IT}\ \mathrm{ID_{POL}}\ \mathrm{ID}_{\mathit{BE}}\ \mathrm{PROG\ RAIN}]]$

We assume then that there are polarity items whose category is C/C, and whose LF content may be NOT (Echo NOT) or Λ (the root question operator).[90] Echo *NEG* and *wh*-polarity can occur simultaneously in polar questions, as we saw in (105) above, but this is unproblematic if the category is C/C. However, Echo NOT will correctly not be able to iterate because of its MSyn features, as set out in the next section.

8.2 The morphosyntax of Polarity heads

The main matters discussed in this section concern MSyn features responsible for auxiliary inversion across Pol NOT, together with the related or contrasting properties of Pol POS. We also discuss the MSyn features required for Echo NOT.

In discussing auxiliary inversion across Pol NOT, we first note that English has several distinct items realised at PF as *not* (Cormack & Smith 2000a, 2002b), all of which have LF NOT. We are concerned in this section with Echo negation and Polarity negation, not with what we called 'adverbial negation' (here, ADV: *NOT*), an adjunct to a V projection.[91] The first two, unlike adverbial negation, must occur in a tensed clause. This suggests that they check for a Tense element, and hence are V-EXT items.[92] We capitalise on this. We begin by discussing auxiliary inversion across Pol.

English has the well-known property that in a finite clause with Pol NOT, some auxiliary or modal must precede Pol NOT, at PF — with the further consequence that *do*-support (i.e. DO in LF) is required in the absence of such a head in the LoT array. In standard English, *do*-support is required with Pol POS mainly when Pol POS is contrastive; it is not required in general. The examples in (122) illustrate these facts. The complement in the desiderative example in (122d) does not show *do*-support, and hence must be non-finite, lacking Pol.

(122) a (i) *The dog not barked (ii) The dog did not bark

[90] In Belfast English, *whether* is the only *wh*-item which may not be followed by *that* in embedded clauses. Henry (1995: 88, 107) argues that it is merged in the Comp position. A Google search produces numerous instances of *whether that …*, some of which are quotations from older English, but some apparently contemporary. The correct category here might be C/C, but evidence is so far lacking.

[91] For further arguments for this adverbial head, see Kim and Sag 2002.

[92] Negation is classified as an auxiliary for 47 languages in Dryer & Haspelmath 2011.

(iii) *The dog barked not

b (i) The dog barked (ii) The dog **did** bark

c (i) The dog sometimes/**sometimes** barked

(ii) The dog did **sometimes** bark

d It is essential that the dog not bark

We first consider how the grammar can encode this distribution, initially for the Pol items requiring or allowing *do*-support in the absence of a local AUX item. Then we consider the Echo items, and finally, positive polarity in clauses without *do*-support in the absence of an overt AUX, as in (122) b (i) or c (i)). The relevant heads will be characterised initially as Pol *NEG*, Pol *POS* (requiring *do*-support), and Pol *ID* (not requiring *do*-support).

The first thing to note is that dummy *DO* without local contrastive stress is by no means impossible, as witness (123).

(123) Your intervention, Mr Speaker, does unfortunately remind me of Churchill's famous observation…

There is no doubt that the *do*-support here has some rhetorical effect, perhaps of softening the rudeness, and also prosodic affects which may be desirable.[93]

We will consider then Pol *NEG*, which always requires *do*-support, and expect a very similar lexical entry for the *do*-support Pol *POS*. Given that Pol items seem to be V-EXT items, we might assign to them a Raising category, Pol/D/V, or an operator category Pol/V. We opt here for the simpler operator category, treating Pol as a Functional rather than Relational head.

In English, the traditional 'NICE' properties delimit the class of items which can serve inter alia to precede Pol NOT in a finite clause. We assigned all these to the word-class AUX, where MODALs too fall under AUX. The auxiliary–negation sequence is realised in various ways, for example, *isn't*, *won't*, *can't*, *cannot*, *could not*, *must not*, et cetera. We consider first the non-contracted forms, for sentences with a high modal, and a high modal plus an auxiliary, and low modal.

(124) a i Alice **must not** watch TV after nine o'clock

ii PRES [[MUST [NOT …]

b i Graham **should not have** drunk so much brandy (, should he)

ii PRES [SHOULD [NOT [HAVE …]

c i John **could not** beat his brother at Scrabble

[93] There are dialects where dummy *DO* is available more generally (Schütze 2004).

ii [PAST [NOT [COULD …]]

Examples such as those in (125) can be used to demonstrate that the *not* in (124b) really must be Pol *NEG*:

(125) a A puppy should not be often left alone, should it

b A puppy should be not often left alone, (#should it/shouldn't it) [94]

With the same non-interrogative intonation as required by (125a), the positive tag in (125b) is unacceptable, while the negative tag is fine, indicating that Pol *NEG* is not available in non-finite clauses, and that Adv *NOT* does not switch tags as Pol *NEG* does. Example (124a) has Pol *NEG*.

Displacement of a lower AUX item is required only in the absence of a high modal, with the natural implication that the locus of displacement in this instance is the high modal position. We suggest then that the high modal position is obligatory, and that there is a high modal without its own root, which may attract a V-EXT item.[95] Since we are suppressing the types for possible worlds, we will just assume a lexical item with canonic MSyn <MODAL: *ID*>. We give the high modals the category Modal/Pol, and Tense the category T/Modal. This makes a high modal item obligatory in a finite clause. We will informally refer to the position of high modals as 'Modal'. For Pol *POS* and *NEG*, the null modal will attract an AUX; for Pol *ID*, it is to attract an AUX or a VERB.

Assuming such an analysis, what is required is that the relevant item have MSyn features capable of attracting a V-EXT item, where this item has TENSE inflection. The modal must thus attract the V-EXT item without assigning the default bare inflection, and must check for Tense, but without utilising the inflection-assigning property of TENSE. This allows the attracted V-EXT item to receive inflection from TENSE, as required. This

[94] Tag polarity is by default the inverse of matrix Pol or Echo polarity, so that (125b) is also ungrammatical if the *not* is adverbial negation. Examples (i) and (ii) show tags with Pol POS and NEG respectively. Example (iii) shows a reverse tag with Echo NEG. In examples (iv) and (v), the clause is echoed, and the tag indicates the speaker's implicit Echo NEG valuation (for (iv)) and POS (for (v)).

(i) John is coming, isn't he?

(ii) John isn't coming, is he?

(iii) We don't eat /tomeidos/ here, do we?

(iv) John is coming, is he — so where is he?

(v) John isn't coming, isn't he — so who's that?

[95] Given that in many languages, only epistemic modals take scope over Pol, we speculate that this null element is (in the absence of a lower epistemic modal) an epistemic operator, one which instead of giving quantificational binding over worlds, supplies something more like a proper name picking out this world. Probably, a range of such items would be required, some more like bound variable pronouns.

somewhat strange set of requirements is parallel to what was required of the *WANT* permitting a parasitic supine, discussed in section 6.1. The solution, then, is to give MODAL *ID* an opportunistic MSyn feature for TENSE, and a transparent feature to attract an AUX. The opportunistic MSyn feature relating to TENSE will check not for the inflection-assigning feature under Tense, but for the second feature, related to COMP (see (48) in §4.2.3. The diploids in (126) will be needed.

(126) Default high modal, <MODAL: *ID*>, LF: ID, category: Modal/Pol;

MSyn: {<TENSE: *u*, COMP: *FIN* >, <V-EXT : *u*, AUX: *u* >}

For Pol requiring *do* support, the V-EXT in question must not be the closest V-EXT head, the polarity head itself; it follows that these Pol items do not have an inflection-seeking feature. To avoid the feature being assigned by default, they must not fall under VERB.[96] We assign them a separate word-class POL, with POL ⊂ V-EXT. The items POL *POS* and POL *NEG* allow an AUX but not a VERB to be attracted to the Modal ID position, so the 'transparent' MSyn feature which will unify with the high modal item's MSyn TENSE assigning feature must act as a filter here. Again, a Pol item does need to check that it falls under local Tense, so we give it the same opportunistic feature as for MODAL *ID* (an additional feature for the items will be added below).

(127) LF: NOT, category: Pol/V; (interim)

MSyn: {<POL: *NEG*>, <COMP: *FIN*, TENSE: *u* >, < AUX: *u*, AUX: *u*>}

The final underdetermined MSyn feature here will unify under sisterhood with the inflection-seeking MSyn feature from an immediately lower AUX, say α, giving <AUX: α, AUX: *u*>. This is still not fully valued, so will percolate as usual, eventually to be valued after unification with features from some high modal (perhaps ID) and then Tense. The features for Pol *POS* will be very similar.

In the absence of a low AUX item, the final feature will percolate to be sister to the Modal item. If a non-null high modal is present, it will have an inflection-seeking MSyn feature with which the final *NEG* feature may unify. In the absence of any low or high AUX item, the derivation would fail, as required, because of the final MSyn feature on Pol *NEG*. In the case where the desired LF contains no local AUX, some AUX with identity semantics must be provided. It must necessarily receive inflection from Tense, and assign inflection to the verb; for this reason, the identity <AUX: *BE*> will not serve the purpose (it does not assign inflection — see (36) above). The required AUX is always <AUX: *DO*>; it

[96] In earlier papers, we suggested the word-class VERB.

will be merged at LF below Pol but above the verb, and assigns PF-null inflection to the verb (see also section 4.2.4).[97]

(128) Rupert PRES [$_{\text{Modal}}$ does] not [$_{\text{Aux}}$] like honey

The same AUX will serve for Pol POS in examples with local stress, such as those from (122): *The dog **did** bark*, and *The dog did **sometimes** bark*, and the 'rhetorical' use of the dummy in (123). Dummy AUX *DO* has the usual default properties of an AUX item, and in particular, must assign inflection to a V-EXT item — it assigns bare inflection. Provided AUX *DO* is an identity item, it can be merged freely to obviate this problem, but for economy reasons, it will not be inserted if it has no necessary or desirable effects..

What remains to be checked is that the displacement of an AUX to the high modal position has no untoward scope effects. Only the case of a low modal being displaced to the high modal position could show any such effects. There will be scope effects with OFTEN and modal NEED. The bullets mark potential high adverb positions.

(129) a Tense • Modal • Pol • Aux • …..

b PRES Ø NOT NEED …..

What we see is that there is a potential position for the adverb above both the LF and the PF positions associated with NEED and NOT, and also such a position below both positions. This means that a speaker will chose the one of these if it gives the right scope. The problematic case is illustrated by example (129) where the modal is required to have scope between NOT and NEED. But this is simply solved by inserting dummy DO at the Aux position and using the NEED associated with a Raising verb MSyn (*does not need to*…). Similarly, the LF order NOT ALWAYS CAN may be reformulated as SOMETIMES NOT CAN, which retains the scope of the adverb with respect to the modal. The upshot is that the surface position of the adverb with respect to both modal and negation may, and stylistically preferentially will, respect correct LF scope. Because of this, some speakers will not detect ambiguity in (130a), assuming that if the speaker intended (130a ii) he would have used (130b).

(130) a Lulu can't always climb the tree (i) NOT > CAN > ALWAYS

(ii) NOT > ALWAYS > CAN

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[97] We reject the view put forward in Hagstrom (1996), and there ascribed also to Chomsky (1957), Halle & Marantz (1993), Bobaljik (1994, 1995), Lasnik (1993)) that *do*-support is an entirely morphophonological matter, with no *DO* in the syntax. Here we agree with Gonzáles Escribano (2012).

b Lulu sometimes can't climb that tree   (i) SOMETIMES > NOT > CAN

≡ NOT > ALWAYS > CAN

We can deal summarily with the non-*do*-support version of Pol, POL ID. The MSyn features for Pol ID must differ from those of the Pol POS or NEG items, since no *do*-support is required. Suppose the only MSyn feature the item has is its canonic MSyn specification, <POL: *ID*>. Then it is not restricted by MSyn features to appearing in finite clauses. However, because it is an ID item, it will only be merged where necessary — exactly, in finite clauses, where the now obligatory high modal selects Pol. In effect, it is transparent, as one might expect. This will allow any V-EXT item to be attracted to the high modal position, as required. The MSyn is then so far as in (131), allowing simple clauses as in (132).

(131) LF: ID, category: Pol/V;   MSyn: {<POL: *ID*>}   (interim)

MS→PF. <POL: *ID*> = Ø

(132)

	Tense	Modal	Pol	Verb
↑JOHN	PAST	ID	ID	LEAVE
John	*Ø*	*left*	*Ø*	~~*left*~~

Next, we need to provide for Echo *NEG*. We argued that this item is optional, with category T/T. We observe that Echo NEG is apparently realised at PF in the position otherwise occupied by Pol NEG. The simplest assumption is that this is literally correct.

(133) Mother: You should go to bed

Child: No I should **not**: it is Saturday tomorrow   NOT > SHOULD

It follows that the two are not compatible. For this reason, we assign to both regular Pol items and Echo items a feature checking for the value of the other (this does not apply to the lambda operator for root questions). The idea is that each will acquire a feature <POL: α, ECHO: β> after percolation and unification, for some value of α and β. If α = NEG and β = NEG, the MS→PF mapping is to fail.[98] It follows that Echo: POS must be merged in a phrase with Pol. The MS→PF mapping rules will be as in (134).

(134) a MS→PF.{<POL: *POS*, ECHO: *POS*>} = Ø

b MS→PF.{<POL: *POS*, ECHO: *NEG*>} = *not*

c MS→PF.{<POL: *NEG*, ECHO: *POS*>} = *not*

d MS→PF.{<POL: *NEG*, ECHO: *NEG*>} **crashes**

[98] The required LF may be obtained by using Adv *NOT* instead of Pol *NEG*.

e MS→PF.{<POL: *ID*, ECHO: *POS*>} = Ø

f MS→PF.{<POL: *ID*, ECHO: *NEG*>} = *not*

These diploids are to be spelled out overtly at Pol, but not at Echo. For this reason, we assign a simple MSyn feature to the Echo items. The features for Echo *NEG* will be as in (135). Those for Echo *POS* will be similar.

(135) LF: NOT; category: T/T; Canonic MSyn: <**ECHO: *NEG***>,

MSyn: {<ECHO: *NEG*>, <POL: *u*, ECHO: *NEG*>}

Because Echo items select for goal T, unlike Pol items, they do not need to check for TENSE. The new MSyn feature must now be incorporated in to Pol *NEG* and Pol *POS*:

(136) Pol <POL: *NEG*> LF: NOT, category: Pol/V;

MSyn: {<POL: *NEG*>, <COMP: *FIN*, TENSE: *u* >, < AUX: *u*, AUX: *u*>, <POL: *NEG*, ECHO: *u*>}

(137) Pol <POL: *POS*> LF: ID; category: Pol/V;

MSyn: {<POL: *POS*>, <COMP: *FIN*, TENSE: *u* >, < AUX: *u*, AUX: *u*>, <POL: *POS*, ECHO: *u*>}[99]

(138) Pol <POL: *ID*> LF: ID, category: Pol/V;

MSyn: {<POL: *ID*> <POL: *ID*, ECHO: *u*>}

These specifications, along with the MS→PF rules in (134), will, with one exception, correctly determine the appropriate PFs for the various combinations of Echo and Pol *POS* and *NEG*.

In the light of this, consider (139) and (140).

(139) a Fred may leave now, but not anyone else

b Fred may leave now, but not anyone else ~~POS may leave now~~

(140) a Is Gerald coming this afternoon, or not?

b Is Gerald coming this afternoon, or not ~~is Gerald IS POS coming this afternoon~~?

Both these are plausibly treated as ellipsis, as indicated. The hypothesis is that because the lower Pol position has been elided, the Echo *NEG* is exceptionally realised in situ. The position of the Echo *NEG* in (140b) indicates that its merge position is above C.

Finally, consider (141a).

[99] The alert reader will see that the feature relating to Echo has the indirect effect of verifying that Tense is present. However, this can only be deduced if categories are referred to, in a manner which is not compatible with the MSyn checking system. Further, we speculate that in '*NEG*-raising', Echo in the lower clause is absent.

(141) a Should not Maria be invited too?

b *Not should Maria be invited too?

c ↑ MARIA [**<u>B</u>** NOT [**<u>B</u>** SHOULD POS]] ID$_{BE}$ PASS INVITE

How does the negation in (141a) reach this position? We suggest that it has been displaced as a phrase, along with the modal, where the phrase is constructed as indicated in (141c); within this phrase, Echo *NEG* is realised at PF at the Pol position. This naturally accounts for the absence of the order in (141b). Phrasal fronting of verbal constituents is shown also in questions such as those in (142).

(142) a Should or shouldn't the man resign?

b What should or shouldn't Joey eat for supper?

There are still some loose ends. We need to account for the properties of a contrastive Pol, and for contracted negation. And we promised an overall explanation.

The reason that contrastive or focussed Pol is interesting is that it cannot be realised simply on the Pol head except in the case of Pol NEG. It also seems that it cannot occur at all with Pol *ID*, though it can with Pol POS. Consider (143), where A is a visitor to B's house, and the dog is supposed to be a watchdog.

(143) A: The dog never barks when I come in.

B1: #But it **barks** if there is a stranger here.

B2: But it **does (**bark) if there is a stranger here.

B3: But it (usually) **does** (usually) (bark) if there is a stranger here

A2: And it **should** bark if there is a stranger here.

The response B1, with stress on *barks* and without *do*-support, is marginal: it gives contrast to BARK, not Pol ID. The reply in B2, with *do*-support, and hence Pol or Echo POS, is fine, and *usually* may be added as in B3. A's continuation in A2 may arguably be interpreted as showing confirmatory Echo POS. Here there is an AUX item, the modal, so it is syntactically fine. We assume then that contrastive Pol excludes Pol ID. A formal discussion of the discourse component of the language system would take us too far afield, so we do not specify the mechanism, but take it to operate on the MSyn features associated with a Pol or Echo item, such as that shown in (144).

(144) MSyn: {<AUX: *u*, TENSE: *u*>, <POL: *u*, ECHO: *u*>}

We will consider emphatic stress on Pol or Echo items along with contracted negation. It has long been argued that the forms appearing in contracted negation are not synchronically due to cliticisation of a reduced *not* under adjacency (Zwicky and Pullum 1983). Among other things, the forms are frequently irregular. We may exclude the hypothesis that they are entered separately in the lexicon as varieties of AUX, because of the ramifications then required of Echo and Pol features. This still leaves two options: that they arise from a MSyn specifications, via an alternative MS→PF mapping, or each such form arises from a composed POL and AUX phrase via a special MS→PF mapping for the phrase. But as there may be an adverb between the POL and AUX phrases, as in (130a ii) above, a phrasal explanation is incorrect,

The question that needs to be asked then is: How could MSyn features relating to negation be present at the node where the tensed AUX item is spelled out? The answer is straightforward: the MSyn features must include the <POL: *u*, ECHO: *u*> diploid introduced for Echo *NEG*. Thus in addition to the default MSyn entry for an AUX α in (145a), there is an additional item with MSyn features, given in (145b):

(145) For item LF= β with canonic MSyn <**AUX: α**>:

a MSyn.β = {<AUX: α, V-EXT: *u*>, <V-EXT: *u*, AUX: α>}

b MSyn.β = {<AUX: α, TENSE: *u*>, <V-EXT: *u*, AUX: α>, <POL: *u*, ECHO: *u*>}

c MSyn.β = {<AUX: α, TENSE: *u*>, <V-EXT: *u*, AUX: α>} =>

MSyn.β = {<AUX: α, TENSE: *u*>, <V-EXT: *u*, AUX: α>, <POL: *u*, ECHO: *u*>}

We suggest that the MSyn in (145b) is derived by the rule in (145c) applying whenever the first diploid (0a) acquires a <TENSE: *u*> value.[100] Accordingly, the presence or absence of contracted negation for appropriate <POL: *u*, ECHO: *u*> diploids is due to the MF→PF mapping and Prune. In informal speech, the pair {<AUX: α, TENSE: *u*>, <POL: *NEG*, ECHO: *u*>} from (145b) may be spelled out as one PF item, such as *won't*. In formal speech, no such possibility is acceptable: the AUX diploid may and must be spelled out alone, leaving the <POL: *NEG*, ECHO: *u*> diploid for later. The pronunciation of an item is often subject to register variation, so the placing of the formal vs. informal choice in the MS→PF mapping is plausible.

The MF→ PF mapping does not show any effect for a <POL: *POS*, ECHO: *POS*> diploid, unless Pol POS is emphatic. In this instance, the emphasis can and must be spelled out at the Aux head, whereas for emphatic Pol NOT or Echo NOT, the spelling out may be at the Aux position (contraction), or at the Pol position (*not*). This suggests that discourse information about contrastive focus at least must be encoded in the MSyn system (see Gundel and Fretheim 2004 for discussion, and Steedman 2000b for a CCG analysis).

[100] This rule, like (91) in section 7, is a generalisation over the lexicon, which applies to the MSyn features of an item whether it is a simple item or a phrasal item. The grammar does not distinguish between the two.

Irregularity of PF forms, such as *can't*, is accounted for by specific MS→PF mappings such as that in (147) over-ruling the general ones supplied in (146 a to c).

(146) a MS→PF.{<POL: NEG, *ECHO*: *u*>, <AUX: *β*, TENSE: *PRES*> } =

MS→PF.{<AUX: *β*, TENSE: *PRES*> } + -*n't*

b MS→PF.{<POL: *u* , *ECHO*: NEG>, <AUX: *β*, TENSE: *PRES*> } =

MS→PF.{<AUX: *β*, TENSE: *PRES*> } + -*n't*

c MS→PF.{< POL: *u*:, ECHO: *u*>, <AUX: *β*, TENSE: *PRES*> =

MS→PF.{<AUX: *β*, TENSE: *PRES*> }

(147) MS→PF.{ <POL: NEG, *ECHO*: *u*>, <AUX: *CAN*, TENSE: *PRES*>} = *can't*

These new entries will be spelled out as usual at the first position where the MSyn features of a head are encountered; and if the Pol and Echo MSyn are spelled out at the LF position of AUX (under Modal), they will be ignored later at the Pol position.

The same features as in (145b), also occur for POS values of Echo and Pol. For these, we assume that spelling out at the high position is always possible, with the <*u*, *POS*> diploid contributing nothing. For emphatic *POS* or *NEG* values of Pol or Echo, the required stress necessitates that some diacritic be visible on the POS feature — say, a new value POS-EMPH. In this case, spelling out at the low Pol position is impossible (the MF→PF mapping rejects the features). The item <POL: *ID*> can only be spelled out in situ, and cannot be emphatic.

We have now accounted for the possibility of the displacement connected with the Pol items, and the dummy *DO*. The rules provide the minimum. But there is as yet no explanation of this peculiar English phenomenon. Ultimately, the explanation probably lies in the changes in English through a 'Jespersen cycle', where reanalysis conflicts with conservative tendencies. Alternatively, part of the explanation is that requiring an AUX above negation has the effect of supplying overt tense information (in the form of the inflection) in the usual place, immediately after the Tense node. Similarly, serialising languages with SVO typically mark only the first of a series of verbs with an overt tense/aspect morpheme, but those with SOV typically mark only the last of the series (see Ch Z). The effect is to put the overt tense/aspect marking in the same position as where it occurs in a clause with a single verb.

There is one loose end. Consider the following examples with Adverbial negation of category V/V, (examples a and b from Han (2000)):

(148) a *John often not eats his vegetables

b John **does** often not eat his vegetables c John could not eat any vegetables

d *John often eats not his vegetables

We have argued above that POL: *POS* is a simple identity element, and that the high MODAL *ID* attracts the tensed verb (see (132) above). This entails that the offending output will be (148d), rather than (148a); but then it is still not clear why *do*-support is required for ADV *NOT*. We suggest that since Pol is always present in a finite clause, the expectation is that any local negation will be POL *NEG*. For (148 b or c), with or without the *often*, disambiguation in favour of ADV *NOT* rather than POL *NEG* can be achieved in speech by setting off ADV *NOT* and its complement with an intonation break. But for (148d), this is not permitted, because the phrase headed by ADV *NOT* is not a well-formed LF domain in the sense of section 4.2.5[101] (the LF EAT in the clause-final position has no associated PF within the phrase). Inserting dummy *DO* will remedy this, giving (148b). The necessity for stress on the dummy arises from the fact that unless POL *POS* is being contrastively focussed, there is no reason not to use POL *NEG*.

Examples with embedding under a verb, such as that in (149), are simpler.

(149) I promise not to be late

Here, ADV *NOT* and its complement do form an LF domain, so there is no problem with intonation at Spell Out.

9 Summary and conclusions

The main point of the sections above has been to begin to explore how certain LF-preserving displacements can be accounted for without the potentially LF-changing operations of 'Move', or 'Internal Merge'. We reject 'PF' displacement as such, on the grounds that PF does not, at least in general, contain enough information correctly to describe the required displacements: it does not even encode word-class. We established the need for both categories and a set of morphosyntactic (MSyn) features ('syntactic features'), allied with morphophonological rules of spellout, to mediate between LF and PF. These syntactic features do not required the postulation of another level of representation; the combination of an LF with categorial and MSyn features constitutes a lexeme (a lexical entry), consistent with the requirement that all generalisations be captured in the lexicon. As usual, lexemes are merged to give phrases, clauses or sentences, where each such structure has both LF and syntactic properties.

[101] The implication is that there is a connection between intonational phrases and LF domains, but we cannot pursue this here.

One of our most important tactics has been to maintain consistently a sharp distinction between LF items and PF units on the one hand (interpretable at the interfaces), and syntactic features (MSyn and categorial features), which are wholly uninterpretable.[102]

Primitive MSyn features are based on word class and, and MSyn 'word-name' and are formed of <attribute: value> pairs. They are used to formalise relations of agreement and 'displacement', subsuming much of 'Agree'. In these functions we argue that they characteristically occur in pairs of such pairs, dubbed 'diploids', exemplified by <<VERB: *WANT*>, <TENSE: *PAST*>>. We do not find the use of single attribute value pairs as usually deployed in the Minimalist literature to be adequate. We have supplied Merge rules for these features, which require no reference to c-command, or 'probe' vs. 'goal' asymmetry, and do not require any unnatural procedure such as a head with unvalued features 'searching' its c-command domain to locate a value (Chomsky 2000a: 135) .[103]

Adger 2010: example (29) suggests feature structures for inflection consisting of what we would describe as an **un**ordered diploid. However he later rejects such feature on the grounds that embedding should be confined to syntax (merge). We see no reason why feature structure should not be as complex as LoT structure, provided that it is LoT structure that is learnable or known very early — that is, early enough for the acquisition of Natural Language syntax. At any stage, the child can only deploy feature structures as complex as the LoT structures it is capable of using at that stage. A simple feature consisting of an attribute-value pair, which is no more complex than 'BARK.FIDO' is certainly possible at the earliest stage of LoT. A diploid has a fixed structure, so does not involve recursion, and is no more complex than the LoT '[BITE.TEDDY]. [BAD.FIDO]', with

[102] One interesting consequence of this absence of LF content of MSyn features is exhibited in Latin deponent verbs, which are semantically and (usually) syntactically active, but morphologically passive. All that is required for the correct PF to appear is that in Latin, *loquor* 'to speak', with LF SPEAK, be assigned the MSyn <VERB: *LOQUOR*, AUX: *PASS*>, which will be input to the MS→PF mapping. This will supply passive morphology at PF without the LF PASS being introduced in the derivation, in both simple and allegedly 'periphrastic' structures (the passive morphology always appears on the verb itself). This tactic defangs the argument of Börjars et al 1997, discussed in Stump (2001: 15), that paradigms may contain periphrastic forms. Of course, more needs to be said, but we hope to have shown that the strategy of doing without the notion periphrastic constructions is viable. See Kiparsky 2005 for a wider-ranging discussion.

[103] "Feature checking, then, resolves to pairs of heads <H, H' > [. . .]. For optimal computation, one member of the pair must be available with no search. It must, therefore, be the head H of the construction α under consideration, α = {H, XP}. Call H a *probe* P, which seeks a *goal* G within XP;. . . " (Chomsky, 2004: 113).

ordering induced by Functor First.[104] If the child can handle this in LoT, with types for syntax, then the step to categorial features and then the features needed for displacement and agreement should not be out of reach. The behaviour of the features under Merge is parasitic on syntactic (categorial) merge, and itself requires only unification.

MSyn features are subject to Merge under unification. Aside from unification, we need to postulate just two well-formedness constraints on MS-CH features:

(i) a constraint on possible diploids — the 'No twins' rule

(ii) a constraint on Merge for diploids — the 'Now or Never' rule

The Prune rule selects which MSyn features are input to the MS→PF mapping at each terminal node in turn, from left to right.

As the reader may have observed, the Agree system as posited above does not derive the 'Head Movement Constraint' (Travis 1984), but rather a variety of 'Relativised Minimality' (Rizzi 1990), where the feature intervention is relativised to the word-classes of a diploid. A partially unvalued diploid δ is sensitive to another MSyn diploid γ only if the two have the same pair of attributes (word-classes), or have pairs of attributes which will unify. So for the V-EXT heads we have been considering, heads such as adverbs without diploid features, or determiners without V-EXT values in their MSyn features, cannot act as interveners in the V-EXT system.[105] Despite the lack of any c-command requirement, this seems to give a system with sufficient restrictiveness for inflectional and related properties of NL. Extensions to phrasal displacement, and the related intervention effects, are discussed in Chapter X.

Morphosyntactic regularities in the lexicon are captured by rules stated over the features of lexemes. Such rules are typically defeasible. Additionally, there are morpho-phonological rules which, inter alia, capture the regularities found in traditional paradigms. These act as generalisations over and constraints on the MS→PF mapping. These two together provide a subset of the interesting parameters of the language.

Using 'Functor-first' to give the order of two items merged, we deployed the postulated MSyn to provide an account of the basic structure of the English clause, concentrating on the TAMP heads (Tense, Aspect, Mood and Polarity).

On the way we were led to:

extend the analysis to the MSyn properties of complementisers

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[104] It now seems that even pigeons can 'count' (Scarf, Hayne and Columbo 2011), so that the equivalent of mental representation of sets of sets is plausibly available to humans before overt language is.

[105] Thus at least for 'head movement', no ad hoc devices such as assuming that adverbs and specifiers are merged later in the derivation are required (as in Ochi 1999).

refine and revise our earlier analyses of modals, negation and quasi-serials

give a principled basis for distinguishing AUX and VERB

provide a novel account of dummy auxiliaries

identify fine-grained intervention effects in head movement as due to the Merge rules operating on diploids (rather than on single features);

For the structures discussed here, we were able to dispense with movement by internal merge, rules invoking c-command, probe-goal asymmetry, a numeration, interpretable vs. uninterpretable syntactic features, feature deletion, and a number of stipulations.

A consistent feature of the argumentation has been the appeal to considerations of learnability and processing by speaker or hearer.

10 Appendix: Paradigm dimensions: subjunctive, conditional, and SoT

In discussing the MSyn system for English, we initially abstracted away from the morphology associated with each of the subjunctive, the conditional, and Sequence of Tense. This simplified the discussion, since without these, no root bears inflection relating to more than one V-EXT head. We have treated paradigms as having two dimensions, corresponding to the two features in a V-EXT related diploid. There are two issues to be considered.

First, even in English, <V-EXT: α, TENSE: *PRES*> cannot be realised on a head α without information about person and number. There is no reason to suppose that these features should appear in all instances, so we propose that the <TENSE: *PRES*> paradigm is separate, and that it has four dimensions (V-EXT (root), AUX (for inflection), PERSON, NUMBER). It must then be the Tense head PRES that demands this, adding the diploid.

(150) LF: PRES/PAST; category: T/Pol,

MSyn: <V-EXT: *u*, TENSE: *PRES*/*PAST*>, <DET: *u*, PHI: *u*>}

Here, <DET: *u*, PHI: *u*> is an abbreviation for the set of phi-features associated with a noun-phrase, which arguably accrue on the determiner, or perhaps just the number and person features. The only determiner whose features are accessible to Tense will be that of the subject, as we show in chapter X.[106]

[106] Phi-feature agreement for the surface subject in an ergative language will have to be determined earlier in the derivation, probably by the content of Ev.

The second issue is that certain embedding structures relate a single root not only to its local V-EXT inflection-providing head, but to a higher V-EXT item, which contributes inflectional features. Such secondary inflection is induced in English by the two-place operator *if*. Consider (151).

(151) If John were here, he would hate it

Tense must be present, because Pol NEG may appear, as witness the contracted forms:

(152) a If John weren’t here, Mary would be annoyed.

b If John were here, he wouldn’t be enjoying it.

The effect of the subjunctive in the first clause and of the conditional in the second clause is manifest. However, we propose that it is not necessary to add an extra paradigm dimension to accommodate this.

In English, neither the conditional nor the subjunctive can show any Tense contrast. The mapping for V-EXT items which have been assigned inflection by these heads can be obtained from a two-dimensional paradigm as usual, by appeal to rules like that in (153):

(153) MS→PF.{<VERB: *u*, TENSE: PRES>, <VERB: *u*, COND: *u*>}

= MS→PF.{<VERB: *u*, COND: *u*>}

Similar remarks apply to Sequence of Tense realisation. In *John said that he was busy today/yesterday*, ‘*was*’ is the PF corresponding to BE with inflection from Tense (PRES/PAST) plus the SoT effect; but the realisation is uniformly as if simply PAST. That is, where a clause is embedded under Tense, PAST, and SoT is operative in the embedded clause, any Tense contrast in the embedded clause is effectively suppressed by the MS→PF mapping. Matrix PRES acts as an identity operator with respect to the realisation of the SoT verb. Thus in neither instance is it required to address more than the usual two V-EXT dimensions.

The generalisation that no paradigm needs more that one diploid of the form <V–EXT: *u*, AUX: *u*> to address a cell remains valid. We suppose that this restriction is a fact about the language (English), but it is unclear whether it should be or indeed if could be expressed anywhere in the morphological systems of the grammar.

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