Head movement and PF Spell-out: a review[1]

In today's presentation, I will provide a simple overview of some previous proposals regarding head movement transformations and Spell-out. The goal will be to synthesize these proposals into a single overarching, organic model of linguistic computation.

We will be making the following assumptions, which have underlied all of our relevant previous research in this area:

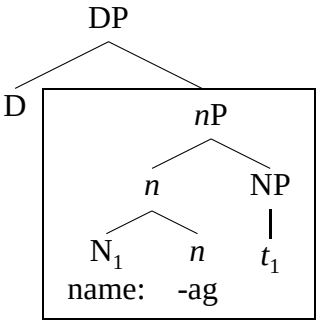
- Morphologically complex words are formed in the narrow syntactic or post-syntactic modules of computation; i.e. a non-lexicalist model such as Distributed Morphology (Halle and Marantz 1993).
- Phonological form is mapped to syntactic elements only on the PF branch (i.e. late insertion, aka Vocabulary Insertion under DM).
- All syntactic transformations are driven by a need to check uninterpretable features, following a strict version of the Minimalist Program (Chomsky 1993).
- Spell-out to the PF and LF components occurs in cycles, or phases (Chomsky 2001, Nissenbaum 2000, Svenonius 2001, and many others).

1 Head movement before and after Spell-out

1.1 Background

Recall that Piggott and Newell (2008) argue that vowel hiatus in Ojibwa (Algonquian) is resolved via *deletion* only when the offending morphemes are spelled out on the same phase cycle (boxed elements indicate a phase):[2]

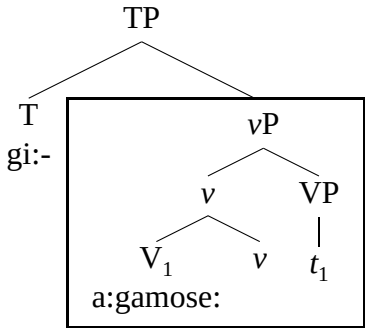
(1) a. name:-ag [name:g] V-deletion
sturgeon-PL
'sturgeons'



[1]This ongoing research is supported by a government grant from the *Fonds québécois de recherche sur la société et la culture* (FQRSC 2010-SE-130906).

[2]I am oversimplifying the structures here a bit for ease of exposition.

b. gi:-a:gamose: [gi:a:gamose:] no hiatus resolution
PAST-walk.in.snowshoes
's/he walked in snowshoes'



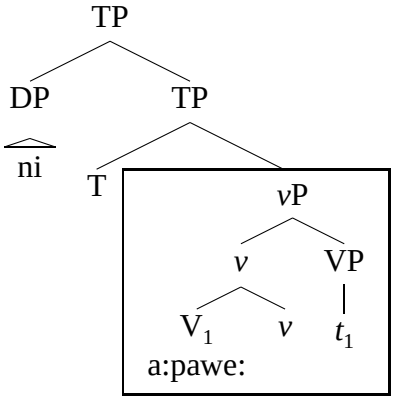
Deletion does not occur across a phase boundary. This is attributed to the following condition:

(2) *Phase Integrity* (Piggott and Newell 2008)
Conditions on the well-formedness of prosodic categories are imposed on all elements that emerge within a phase α, if the elements are solely within α.

Thus, hiatus only needs to be resolved *within* a phonological phase, not across a phase boundary.

However, vowel hiatus must sometimes be resolved across a phase boundary, but this is done via epenthesis rather than deletion; this occurs when elements in the higher phase do not meet a phonological phase minimality condition:

(3) ni-a:pawe: [ni**d**a:pawe:] C-epenthesis
1S-have.nightmares
'I have nightmares'



Here, because the morpheme *ni* does not meet a phonological phase minimality condition (i.e. it is a light syllable), it must merge *phonologically* to the adjacent phonological phase (via a process of string-vacuous Local Dislocation, or morpho-phonological merger; see below).

Because *ni* adjoins to the adjacent phonological phase, Phase Integrity now requires that vowel hiatus be resolved. However, it is crucial that this hiatus is resolved via epenthesis, not deletion. This analysis, in addition to other research, supports a generalization on phonological phases, which I summarize as follows:

(4) *Phonological Persistence*
In the computation of phonology, there is a tendency to retain the phonological form that has been previously mapped to each individual phase constituent during later computation; i.e., the phonology assigned to a phase will be maintained as much as possible during subsequent computation.

To understand this a bit better, let's consider ex. (1a) again. Both *name:* and *-ag* are assigned phonology on the same Spell-out cycle. We can assume that V-deletion occurs during this Spell-out cycle, as well. Note that VI occurs from the bottom-up (I will call each iteration of VI a 'stage'):

(5) Spell-out of *n*P
VI Stage 1: [name:]
VI Stage 2: [name: $^\wedge$ ag] → [name:g] (V-deletion)
End of *n*P Spell-out cycle; resulting phonological form: **[name:g]**

However, in the case of (3), there are two phonological phases, giving the following order of operations:

(6) Spell-out of *v*P
VI Stage 1: [a:pawe:]
End of *v*P Spell-out cycle; resulting phonological form: **[a:pawe:]**

Spell-out of CP
VI Stage 1: [ni]
End of CP Spell-out cycle; resulting phonological form: **[ni]**

Local Dislocation of **[ni]** to **[a:pawe:]** due to minimality violation:[3]
[**[ni]** $^\wedge$ **[a:pawe:]**] → [**ni+a:pawe:**]

Phase Integrity applies ([ni] has moved into the phonological phase of [a:pawe:]);
Epenthesis preferred to deletion as a result of Phonological Persistence:
[**ni+a:pawe:**] → [**nida:pawe:**]

In the final stage in (6), the features of the already spelled-out phonological phase **[ni]** are retained during the later process of hiatus resolution (i.e. deletion of phonological features does not occur).

This analysis captures the following related generalizations:

- The phonological boundary between string-adjacent morphemes that are contained in different phases is somehow *stronger* than the phonological boundary between tautophasal morphemes.
- Phonological processes occurring between non-tautophasal morphemes will alter the phonological form of those morphemes *relatively less* than similar processes occurring between tautophasal morphemes (or oftentimes not at all).

[3] A condition on phonological phase minimality can only be evaluated **after** VI on the entire phase is complete.

1.2 Phase heads and Spell-out

Keeping the above model in mind, consider the data in (7) from Timugon Murut (Austronesian: Malaysia). Here, the final nasal on the prefix /*maN*-/ can either undergo nasal assimilation to the root or trigger nasal substitution on the root:

(7) a. Nasal assimilation
/maN - buli/ → [ma**mb**uli] '*Topic/Subject* will keep *[Referent]*
/maN - tutu/ → [ma**nt**utu] '*Topic/Subject* will pound *[Object]*

b. Nasal substitution
/maN - buli/ → [ma**m**uli] '*Topic/Subject* will keep *[Referent]*
/maN - tutu/ → [ma**n**utu] '*Topic/Subject* will pound *[Object]*

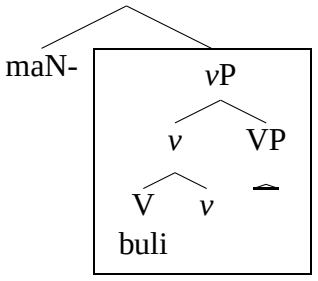
Note that the nasal assimilation examples in (7a) alter the phonological features of the individual morphemes to a lesser extent than the nasal substitution examples in (7b). In fact, assuming underspecification for place features in the prefix-final nasal, the process in (7a) is one of feature-sharing, whereas the process in (7b) is one of feature-deletion or de-linking.

Note that Timugon Murut is a verb-raising language. Therefore, the verb root will always adjoin syntactically to the /*maN*-/ prefix.

It has been argued (Gref 2008) that the distinction in (7) arises due to the possibility of raising the verb either before or after Spell-out of *v*P. Movement after Spell-out is illustrated as follows:[4]

(8) Movement after Spell-out

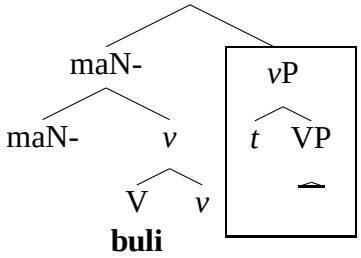
a. Verb is spelled out during *v*P Spell-out cycle:



Phonological form assigned to *v*P: **[buli]**

[4]Note that I am unsure of the category of the /*maN*-/ prefix and so I represent it generally. However, this is not crucial to the current discussion.

b. Verb is later raised to *maN*-:

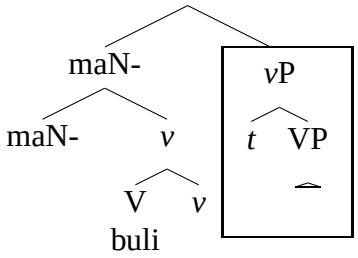


Spell-out of CP: [maN- ^ **buli**] → [mam**buli**]

In (8), the phonological form of the verb root is assigned on the *v*P Spell-out cycle. Thus, after verb movement and Spell-out of CP, Phonological Persistence applies to the root when phonology is mapped to /*maN*-/ – the already established phonological form of the root remains unchanged on this later Spell-out cycle. However, this is not true in the case of movement before Spell-out:

(9) Movement before Spell-out

a. Verb raises to *maN*- before *v*P Spell-out:



Phonological form assigned to *v*P: **[∅]**

b. Spell-out of CP: [maN- ^ buli] → [mamuli]

In (9), since the verb root escapes the Spell-out cycle of *v*P and is assigned phonology on the later CP Spell-out cycle, Phonological Persistence does not apply to the root; the prefix and root are assigned phonology on the same Spell-out cycle, and so deletion (of phonological features under coalescence/substitution) is possible, similar to vowel-deletion in Ojibwa.

1.3 Taking stock

The above analyses have some important implications for syntactic derivation and Spell-out:

- A phase head is included in the Spell-out domain of the phase, contra previous models under which only the complement of the phase head undergoes Spell-out (e.g. Chomsky 2001, Nissenbaum 2000). However, the head of phase *n* can escape Spell-out if it moves to phase *n+1* before Spell-out of *n*.
- Spell-out of a phase *n* must occur only after at least one element from phase *n+1* is merged into the narrow syntactic derivation, given the possibility that the head of phase *n* may move into phase *n+1* before Spell-out of *n*.

2 Lowering and Raising: a featural analysis

We will now change gears a bit and look at lowering vs. raising, but will return to the previous issues shortly.

2.1 Tense-hopping

As is well-known, some languages raise the verb out of *v*P into the INFL domain, whereas other languages move the inflectional morpheme downward to the verb in *v*P (Pollock 1989):

(10) *Verb-raising: French*

a. Jean oublie [$_{vP}$ **complètement** l'adresse].
Jean forget.3S.PRES completely DET.address
'Jean completely forgets the address.'

b. *Jean [$_{vP}$ **complètement** oublie l'adresse].
Jean completely forget.3S.PRES DET.address

(11) *Tense-hopping: English*

a. *John forgets [$_{vP}$ **completely** the address].
b. John [$_{vP}$ **completely** forgets the address].

(12) *Tense-hopping: Swedish*

a. Du vet att jag [$_{vP}$ **helt** glömde adressen].
you know.PAST that I completely forget.PAST address.DEF
'You know that I completely forgot the address.'

b. *Du vet att jag glömde [$_{vP}$ **helt** adressen].
you know.PRES that I forget.PAST completely address.DEF

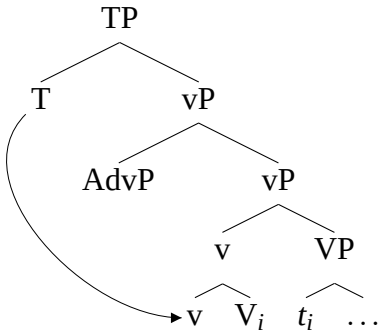
In (11) and (12), the finite tense morpheme in T must undergo a **downward** transformation to adjoin to the verb in *v*P.

Crucial factor: transparency of the *v*P-adjunct: Tense Adjunct Verb

How do we derive this basic pattern of tense-hopping? There have been (at least) two models proposed under DM.

2.1.1 Tense-hopping as Lowering

- Downward head-to-head movement; skips adjuncts just like upward head movement.



- According to Embick and Noyer (2001), takes place *after* Spell-out on the PF branch.
  This is to avoid a violation of the Extension Condition in the narrow syntax. We will return to this, time permitting, but note that I do not adopt the Extension Condition as an inviolable principle of syntactic derivation.

- Takes place *before* structure is linearized into a morpho-phonological string via VI.

- *Late Lowering Hypothesis* (LLH; Embick and Noyer 2001:567)
  All Lowering in Morphology follows all movement in syntax.
  Note that this cannot easily be incorporated into a model of cyclic Spell-out.

- Order of operations:
  All narrow syntactic derivation ≫ Spell-out to PF ≫ Lowering ≫ Linearization/VI
  ‖ PF branch ‖

2.1.2 Tense-hopping as Local Dislocation

Recall that, under Local Dislocation, two **string-adjacent** elements may undergo a process of morphological merger/inversion after VI (Embick and Noyer 2001):

[X ^Y ^ Z] → [Y+X ^ Z]

Problematic for tense-hopping?

[Tense ^ Adjunct ^ Verb] ↛ [Adjunct ^ Verb+Tense] ⇐ T and V not string-adjacent

According to Ochi (1999), string-adjacency of Tense and the Verb obtains under a theory of **late adjunction** (Lebeaux 1988, Stepanov 2001):

- Step 1: Derivation and Spell-out of pre-adjunction structure; PF string after VI:

  [Tense ^ Verb]

- Step 2: Local Dislocation of Tense and Verb (string-adjacency holds):

  [Tense ^ Verb] → [Verb+Tense]

- Step 3: Late merger and Spell-out of adjunct, forming:

  [Adjunct ^ Verb+Tense]

If adjuncts are merged late, they do not disrupt string-adjacency.

Given just the basic facts in (11) and (12), it is impossible to determine whether tense-hopping results from Lowering (as argued by Embick and Noyer) or Local Dislocation (as argued by Ochi).

2.2 Asymmetries in tense-hopping

A default assumption might be that tense-hopping –however it is derived– works identically in both English and Swedish. However, the following patterns of *v*P-fronting (to SpecCP) indicate that this is not the case (Swedish data from Källgren and Prince 1989; ignore *göra*-support for now):[5]

(13) *English*

a. He said he would play the piano, and [$_{vP}$ play the piano]$_1$ he did t_1.
b. *He said he would play the piano, and [$_{vP}$ played the piano]$_1$ he (did) t_1.

(14) *Swedish*

[$_{vP}$ Läser read.PRES boken book.DEF]$_1$ gör do.PRES han he t_1 nu now

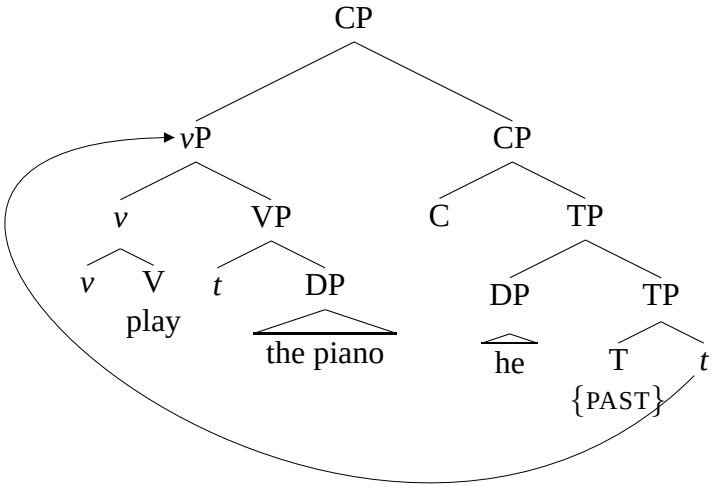
'Reading the book he is now.'

[5]The English *v*P-fronting judgments hold in the absence of any focus effects; see Embick and Noyer (2001).

Observation: Tense adjoins to the verb *before* *v*P-fronting in Swedish, but not in English.

Both Lowering and Local Dislocation, as defined above, could account for the absence of tense-hopping in English *v*P-fronting:

- Lowering on the PF branch (the Late Lowering Hypothesis): Narrow syntactic *v*P-fronting bleeds the environment in which T takes *v*P as its complement after Spell-out:



- Local Dislocation on the PF branch: Narrow syntactic *v*P-fronting bleeds the environment in which Tense and the Verb are string-adjacent in the PF representation:

  [play ^ the ^ piano ^ he ^ PAST]

⋆Neither Lowering nor Local Dislocation, as defined above, can account for the presence of tense-hopping in Swedish *v*P-fronting for the exact same reasons just stated.

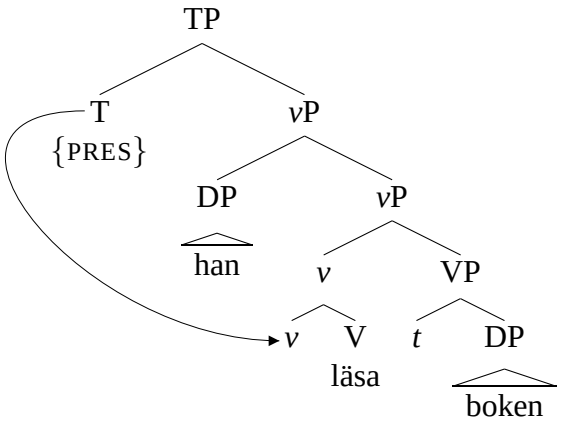
Solution: Narrow syntactic Lowering.

Just like (many argue) is the case for upward head movement, I propose that downward head movement is operative in the narrow syntax *and* is subject to the Earliness Principle (Pesetsky 1989). Roughly:

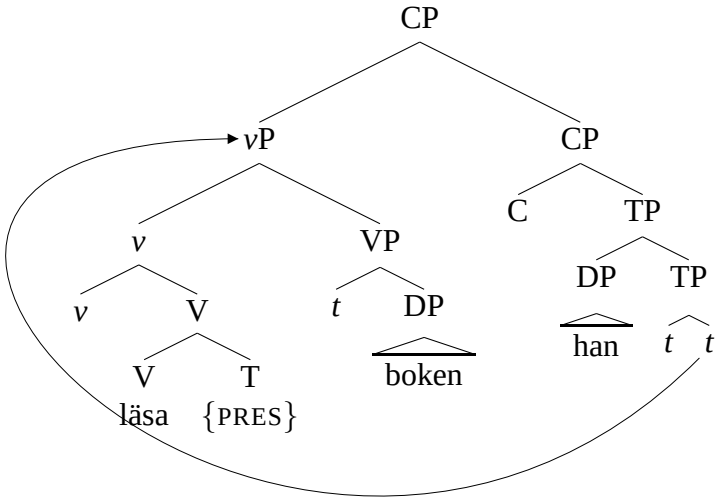
syntactic derivation (including Lowering) ≫ Spell-out to PF ≫ Linearization/VI
‖ PF branch ‖

Swedish: T lowers to the verb in the narrow syntax before *v*P-fronting:

(15) a. *T merges and lowers to v*



b. *C merges and targets vP for movement*



Result: since the tense morpheme is adjoined to the verb before narrow syntactic *v*P-fronting takes place, the verb in the fronted *v*P is inflected for tense.

Assuming that all head-to-head Lowering operations work similarly (i.e., take place in the narrow syntactic structure and are subject to Earliness), tense-hopping in English cannot be derived via Lowering. Rather, it must be a case of Local Dislocation. This accounts for the observed asymmetry in *v*P-fronting.

Swedish tense-hopping: **Lowering** (pre-Spell-out/syntactic)[6]

English tense-hopping: **Local Dislocation** (post-Spell-out/morpho-phonological)

There are some additional advantages to this transformational asymmetry:

Interrogatives and V2

(16) *English*: simplex T moves to C (with *do*-support):
Did he walk?

(17) *Swedish*: Verb+Tense moves to C:
Gick han?
walk.PAST he
'Did he walk?'

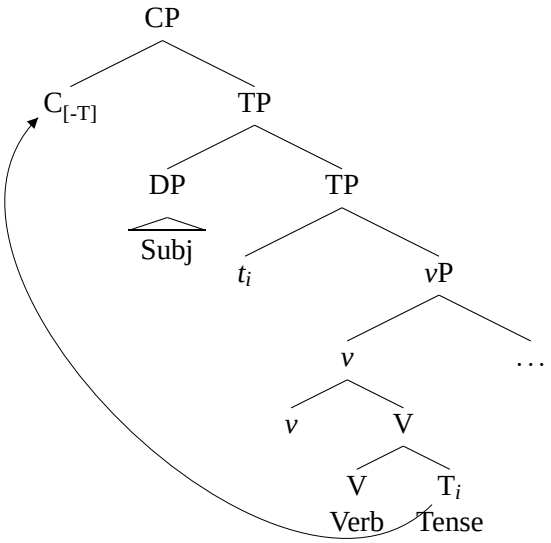
This interrogative asymmetry can be explained in a straightforward manner –from the perspective of feature-driven movement– in the following way:

- Interrogative C carries an uninterpretable T-feature (i.e. $C_{[-T]}$).
- T in Swedish –in both matrix and embedded clauses– lowers to *v* in the narrow syntax, forming a complex Verb+Tense head. The verb does not independently raise to T.
- T in English remains *in situ* in the narrow syntax, only later undergoing Local Dislocation with the verb on the PF branch if string-adjacency obtains (to satisfy the stray affix filter).

When interrogative $C_{[-T]}$ merges and probes its c-command domain, the following are the basic structures for Swedish and English:

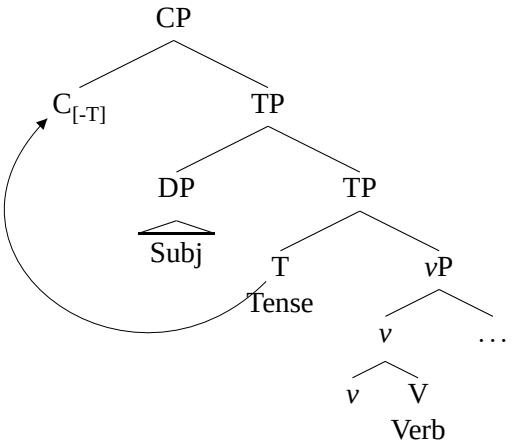
[6]We will make a slight revision to this definition later.

(18) a. *Swedish*
V will be pied-piped with T



PF string after Spell-out:
[Verb+Tense ^ Subj]

b. *English*
T moves alone



PF string after Spell-out:
[Tense ^ Subj ^ Verb]

This holds for V2-type phenomena, as well; head movement to C checks a [-T] feature on C:

(19) *English neg-inversion*: verb is not pied-piped
a. (In all my travels), never did I find a more loathsome place.
b. *(In all my travels), never found I a more loathsome place.

(20) *Swedish V2*: verb is pied-piped
a. Boken läser han.
book.DEF read.PRES he
'He reads the book.'

b. Han läser boken.
he read.PRES DEF
'He reads the book.'

c. *Han gör läsa boken.
he do.PRES read.INF book.DEF

Summary: In tense-hopping languages, $C_{[-T]}$ will pied-pipe the verb only when T has undergone a previous morpho-syntactic transformation with the verb (Lowering); otherwise, the verb remains in *v*P (English).[7,8]

[7]Not surprisingly, $C_{[-T]}$ will also raise the verb in languages that have independent *v*-to-T movement; see Schwartz and Vikner (1996) for an argument that German is such a language.

[8]I will not discuss *göra*-support in Swedish *v*P-fronting today, but see the appendix to this handout.

2.3 Movement of and to phase heads

My research thus far (see Skinner 2008, in prep) suggests that phase heads are the only possible landing sites for Lowering operations; e.g. T-to-*v* (Swedish tense-hopping), Asp-to-*v* (reduplication in Tagalog and Ndebele, progressive in English), Top-to-C (Turkish agreement markers), D-to-*n* (determiner-hopping), etc. Additionally, these movements only take place when the Lowering head takes the phase as its complement. This has led me to postulate the following:

(21) *Head-lowering Generalization*
Lowering only ever occurs locally across a phase boundary; i.e. only heads that take phases as their complements are candidates for Lowering.

Thus, in terms of narrow syntactic operations involving phase heads, we currently have the following three-way distinction:[9]

1. Raising of a phase head after Spell-out
2. Raising of a phase head before Spell-out
3. Lowering to a phase head

We will first address the Raising vs. Lowering distinction generally.

Recall that we earlier claimed that 1) a phase head is included in the Spell-out domain of the phase and 2) at least one head from phase *n+1* must be merged before Spell-out of phase *n*, given the possibility of moving a head from phase *n* to phase *n+1* before Spell-out of phase *n*.

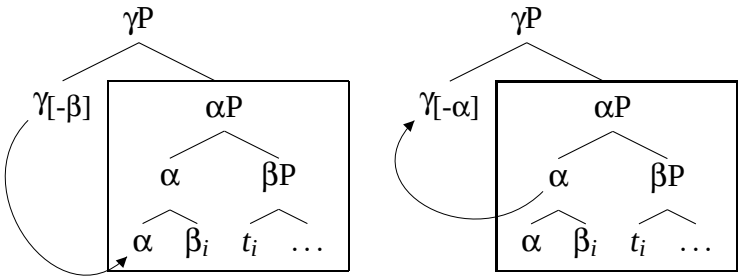
Thus assuming that a phase head is spelled out along with its complement, I argue that Lowering occurs due to the following extension to the Phase Impenetrability Condition:

(22) *Phase Head Impenetrability Condition* (PHIC)
Features embedded within a complex phase head α become unavailable for further narrow syntactic feature-checking transformations as a result of Spell-out of αP. Only the features of α itself and its specifier(s) will be visible after Spell-out.

This gives us the following general scenario:

[9]Of course, there is also raising to a phase head, as in V-to-*v* movement, but we will not discuss this today, as we are concerned primarily with operations that take place across a phase boundary.

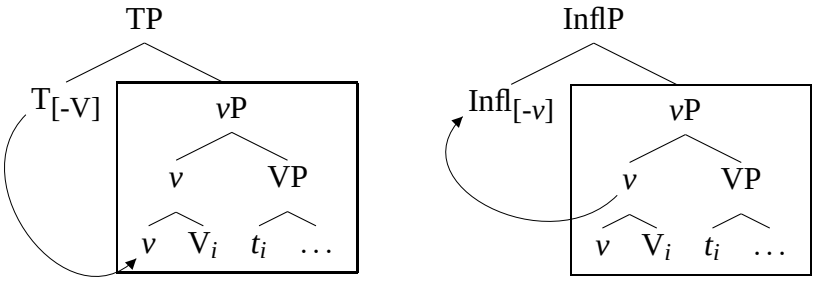
(23) a. Lowering b. Raising



Lowering occurs when a head probes a feature embedded in the head of its phase complement; i.e. when the head probes an impenetrable feature of the phase head (PHIC).

Raising of a phase head occurs when a head probes the topmost (i.e. non-embedded, and thus non-impenetrable) feature of the phase head; i.e. when the feature of the phase head itself is targeted in the probe-goal operation.[10]

(24) a. Tense-lowering (e.g. Swedish) b. Verb-raising (e.g. French)



2.4 Triggered Spell-out

However, the model in (23) does not account for the possibility of raising a phase head either before or after Spell-out, nor does it specify the timing of Lowering operations wrt Spell-out. A possible answer to both of these problems lies in a theory of triggered Spell-out.

Recall that Swedish T must lower to *v* before $C_{[-T]}$ merges. Otherwise, Earliness predicts that T would raise to C before Lowering is evaluated, thus disrupting the head-complement relation (between T and *v*P) necessary for Lowering.

But it cannot be the case that *v*P undergoes Spell-out before T merges, since, as we have argued, at least one head from phase *n+1* must merge before Spell-out of phase *n*. Since T must take *v*P as its complement –in order for T-to-*v* Lowering to be possible– it must therefore be the

[10]This assumes an edge condition –similar to Fox and Pesetsky (2005)– under which features at the edge of a phase are targetable by higher elements.

case that T merges to *v*P before Spell-out of *v*P.

Additionally, if Lowering results from the PHIC, this means that *v*P must at least begin the Spell-out process (in order for the PHIC to apply) before C merges but necessarily after T merges.

In sum: *v*P in Swedish cannot undergo the process of Spell-out until after T merges to *v*P, but it must do so before $C_{[-T]}$ merges with TP.

I propose that this condition is met if the Spell-out operation on a phase is "triggered" when that phase merges with a non-tautophasal head:

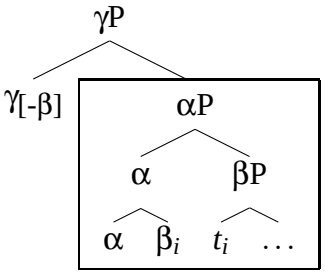
(25) *Triggered Spell-out*
A phase *n* begins the Spell-out process upon merger of a head from phase *n+1*.[11]

I suggest that both Lowering and Raising-before-Spell-out actually occur *after* Spell-out has been triggered but *before* **Transfer** of the phase to PF. The following is the proposed order of operations of the Spell-out process:

Triggering ≫ Lowering-of-trigger/Raising-to-trigger ≫ Transfer of syntax to PF ≫ VI

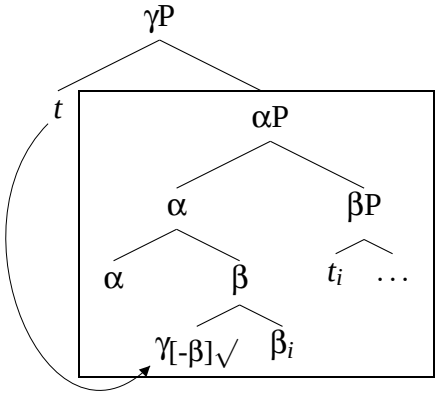
Phonological form is mapped to any constituents found in the transferred phase.

(26) Lowering
a. Non-tautophasal head merges;
Spell-out is triggered (i.e. the phase is marked for Spell-out):



[11] Svenonius (2004) also proposes a triggering model of cyclic Spell-out. Though there are some differences between our models, it's possible that, with some modification, they can be made compatible. However, I will not address this here.

b. Triggering head lowers in the narrow syntax before phase is transferred to PF; PHIC applies between γ and β (i.e. PHIC applies once Spell-out is triggered); Lowering head "piggybacks" on the lower phase's Spell-out cycle in order to check its uninterpretable feature:

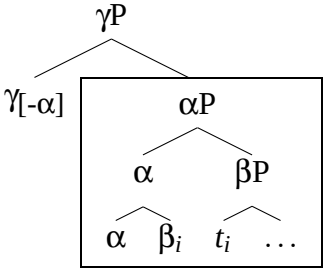


PF output of αP after Transfer and VI: [α ^ γ ^ β]

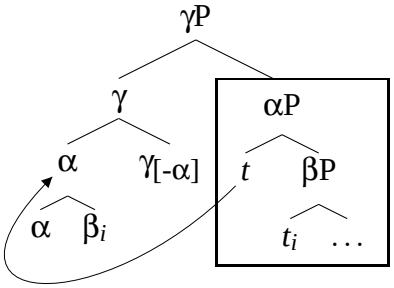
NOTE: The feature-driven "piggybacking" operation of Lowering is only available to heads that trigger Spell-out of their phase complements, since only these heads may lower *before* Transfer of the phase to PF. This correctly predicts that higher heads may not lower (i.e. iterative head-lowering, following the HMC), since Transfer (and thus complete phase impenetrability) will have taken place before these heads merge.

(27) Raising "before" Spell-out (i.e. Raising before Transfer)

a. Non-tautophasal head merges; Spell-out is triggered



b. Triggering head raises phase head before Transfer; PHIC does not apply between γ and α:

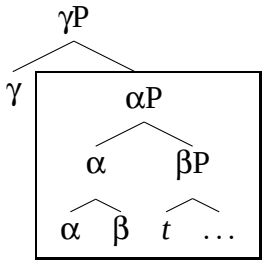


PF output of αP after Transfer: [∅]

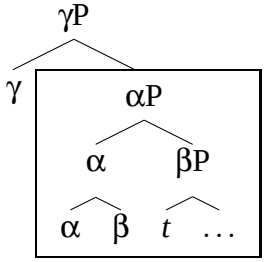
Following this model, I propose that Raising after Spell-out occurs when a higher, non-triggering head targets the phase head for movement:

(28) Raising after Spell-out

a. Non-tautophasal head merges; Spell-out is triggered

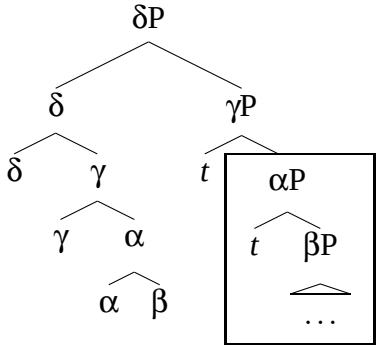


b. Triggering head has no uninterpretable feature;
Neither Raising nor Lowering occur before Transfer:



PF output of αP after Transfer: [α ^ β]

c. A higher head δ merges and targets phase head for movement;
PHIC does not apply between δ and α:

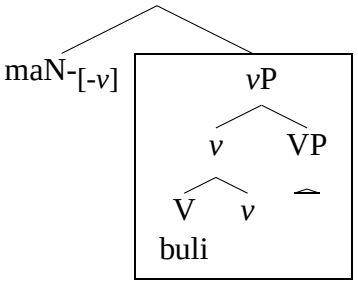


PF output of δP after Transfer: [δ ^ γ^ <u>α ^ β</u>]

In (28), phonological form is mapped to [α ^ β] during Spell-out of αP –i.e., before movement of α to δ– and so Phonological Persistence applies to these elements during Spell-out of δP.

This analysis implies that in Timugon Murut nasal substitution vs. nasal assimilation, the prefix /*maN-*/ is the Spell-out trigger for *v*P in cases of nasal substitution (i.e. Raising before Transfer; *ma**m**uli*), and that there is an additional, phonologically null syntactic head between /*maN-*/ and the verb in cases of nasal assimilation (i.e. Raising after Spell-out/Transfer; *ma**mb**uli*). The following are the respective derivations:

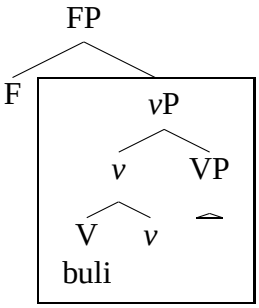
(29) a. Raising before Transfer; nasal substitution: *ma**m**uli*



Prefix will raise *v* before Transfer of *v*P

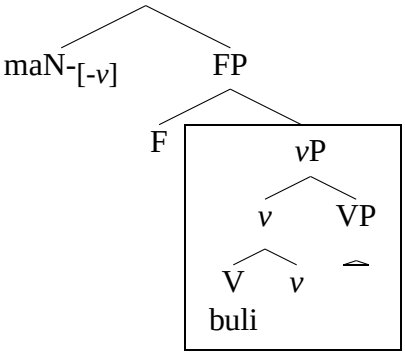
b. Raising after Spell-out/Transfer; nasal assimilation: *ma**mb**uli*

(i) Merger of phonologically null Spell-out trigger



PF output after Transfer of *v*P: **[buli]**

(ii) Merger of prefix



Prefix raises *v* after Transfer of *v*P;
Phonological Persistence applies to **[buli]**

Only a Spell-out trigger (i.e. a head that merges directly with a phase) may undergo Lowering to the phase head or raise the phase head before Transfer. The prefix /*maN*-/$_{[-v]}$ is the Spell-out trigger in (29a) but not in (29b). In (29b), the phonological form of the verb root is assigned after merger of the trigger F and Transfer of *v*P; *v* is only raised to the prefix after this process is complete, and so Phonological Persistence applies to the verb root.

3 Interim conclusion

3.1 Summary

- Phases are triggered for Spell-out upon merger of a non-tautophasal head. Certain narrow syntactic operations may occur after Triggering but before Transfer of the phase to the PF branch.
- A head that undergoes Lowering or targets the phase head for Raising-before-Transfer:
    1. Must be a Spell-out trigger; i.e. it must adhere to a strict locality condition under which it takes a phase as its complement;
    2. Must carry an uninterpretable feature; in the case of Raising-before-Transfer, the head must target the "topmost" feature of the phase head; in the case of Lowering, the head must target a feature embedded in the phase head (the PHIC);
    3. Is not required to obey Phonological Persistence, since the Spell-out trigger and phase head will ultimately be assigned phonology on the same Spell-out cycle – i.e., on the lower phase cycle in the case of Lowering and on the higher phase cycle in the case of Raising before Transfer.
- Any other heads (i.e. non-local heads) that target the phase head for a feature-checking movement operation:
    1. May only raise the phase head (since Lowering/"piggybacking" is unavailable after Transfer), and
    2. Must obey Phonological Persistence of the phase head.

3.2 Questions

- Is it just the case that TP is the phase, not *v*P, and simply spells out its complement?

    Evidence from other Lowering operations suggests that *v*P is spelled out when it merges with *any* non-tautophasal category (e.g. Asp, Σ). It is thus not the case that T always spells out its complement. See Skinner (in prep) for more.

- What about the Extension Condition? Doesn't narrow syntactic Lowering violate it?

  There are several operations that appear to violate the Extension Condition; e.g. Richards's (2001) 'tucking in' and head movement, in general (contra Matushansky 2006). Might it be the case that the Extension Condition is violable under certain last resort conditions?

- How does LF interpret a syntactic structure that contains a lowered head? Total syntactic reconstruction (i.e. deletion of all but the first-merged copy; Fox and Nissenbaum 2004)?

- Others?

4 Supplementary section: English auxiliaries

4.1 Deriving Aux-raising

I have argued that T-to-*v* Lowering and *v*-to-T raising occur due to (different) uninterpretable features on finite T. But what about English, which derives its tense-hopping pattern via morpho-phonological, rather than morpho-syntactic, means? Does finite T simply lack any uninterpretable feature, since tense does not lower and main verbs do not raise? Auxiliary constructions suggest this is not the case.

(30)
a. Bill did **not** eat cabbage.
b. *Bill eats **not** cabbage. ← *main verb does not raise to T*
c. Bill has **not** eaten cabbage.
d. Bill is **not** eating cabbage.
e. *Bill does **not** have eaten cabbage. ← *auxiliary must raise to finite T here*
f. *Bill does **not** be eating cabbage. ← *auxiliary must raise to finite T here*
g. *Bill **not** has eaten cabbage.
h. *Bill **not** is eating cabbage.

Aux obligatorily raises to finite T, but Aux does not always raise to T:

(31) Bill would **not** have eaten.

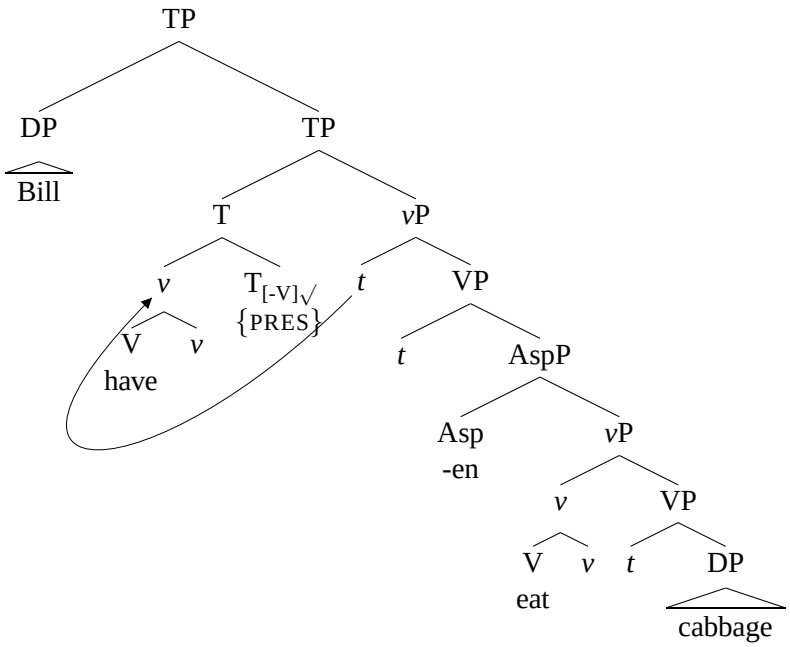
Lasnik (1995) proposes that each auxiliary has **two** lexical entries: one that has an uninterpretable feature and is merged in Aux-raising environments, and another that has no uninterpretable features and is merged in non-raising environments.

I argue that we can use the proposed model of derivation and Spell-out to develop a simpler system under which each morpheme has only **one** lexical entry; namely, auxiliaries consistently lack any uninterpretable features and finite T (i.e. present and past) consistently has an uninterpretable feature, which will be checked via Aux-raising when an auxiliary is present.

The feature on finite T cannot be [-*v*], as this has been argued to induce raising of main verbs (e.g. in French).

The feature must be [-V]:

(32)

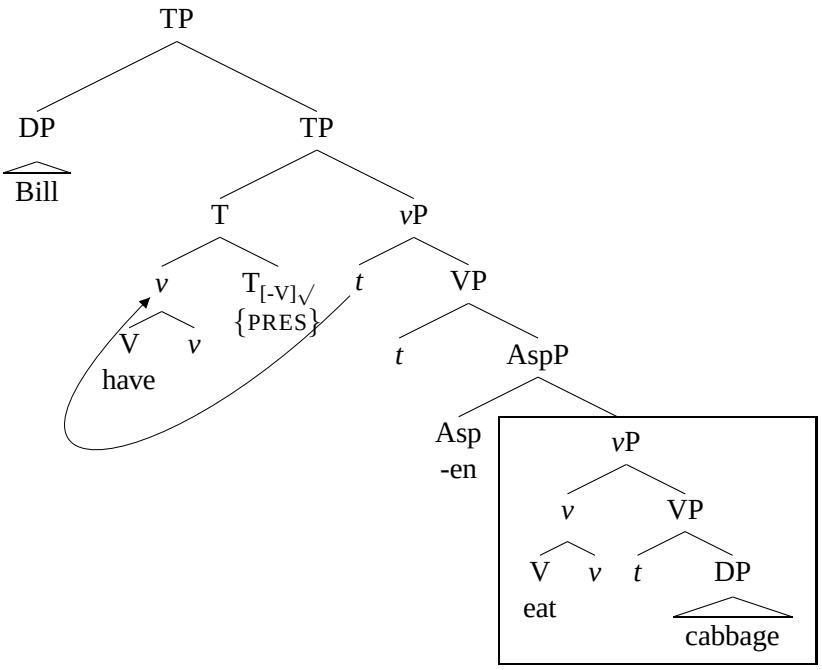


But isn't this the exact scenario in which I predict tense-lowering? T takes the auxiliary *v*P as a complement and probes a feature embedded in *v* (i.e. the V-feature)…

Recall that Lowering occurs as a result of the PHIC; Lowering only ever takes place across a phase boundary. Raising is otherwise the default feature-checking transformation.

Claim: Auxiliary verbs in English, unlike main verbs, are merged in the same phase as finite T; the PHIC therefore does not apply between finite T and an auxiliary verb.

(33)



I adopt Grohmann's (2003) *prolific domains*, under which syntactic elements are divided and grouped into lexical, functional, and discourse-related categories.

We can extend this notion to phases: each prolific domain constitutes a phase (i.e. lexical phases, functional phases, and discourse phases).

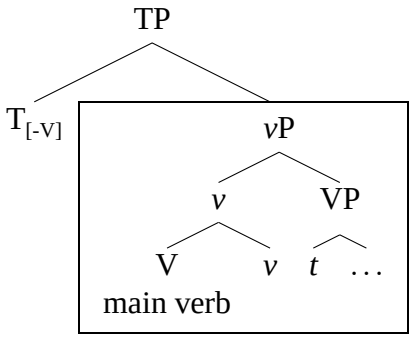
Auxiliary verbs and tense are functional, and so are merged in the same phase; main verbs are lexical, and so are merged in a lower phase.

⋆Feature-checking movements *within* a phase will always be upward; feature-checking movements *across* a phase boundary may result in Lowering, in accordance with the PHIC.

4.2 The absence of tense-lowering in English main verb constructions

What about main verb constructions in English? If the following, which was argued to be the structure for Swedish, is the same in English, why doesn't $T_{[-V]}$ also lower to the verb in English?

(34)



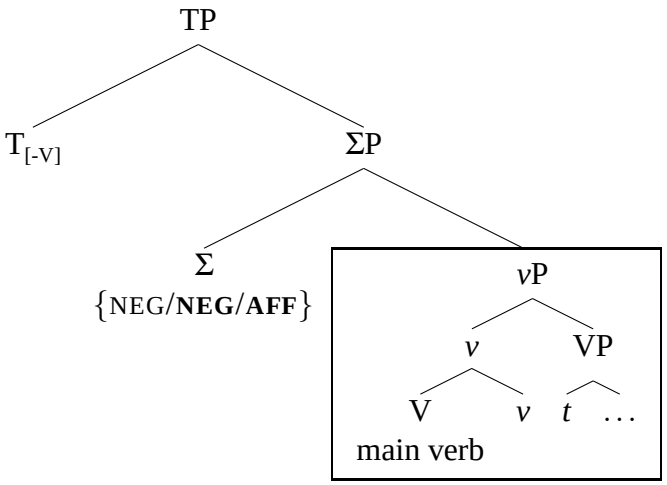
Short answer: (34) is not the structure of English main verb constructions.

Laka (1990) notes that negation, emphatic negation, and emphatic affirmation all block tense-hopping in English:

(35) a. Bill *does* not eat cabbage.
b. Bill *does* **not** eat cabbage.
c. Bill ***does*** eat cabbage.

She argues that all three are generated in the same syntactic projection, namely ΣP.

(36)



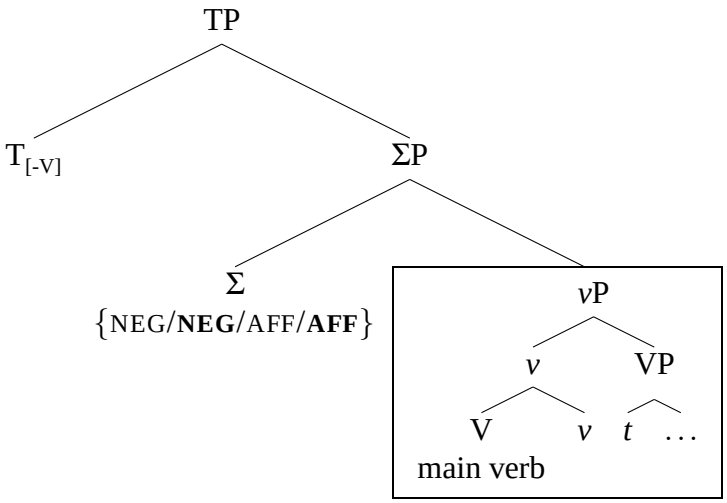
Such a syntactic scenario correctly predicts that $T_{[-V]}$ cannot lower to the verb, given the Head-lowering Generalization; i.e., finite T does not take the *v*P phase as its complement, and so is not the Spell-out trigger.

However, I argue that (syntactic) tense-lowering **never** occurs in English; rather, tense-hopping is derived via (morpho-phonological) Local Dislocation.

Claim: *non*-emphatic affirmation is also projected in a Σ head; ΣP is present in **all** clauses.

Non-emphatic affirmation, however, is phonologically null, and so does not disrupt string-adjacency of finite tense and the main verb:

(37)



a. NEG = [Bill ^ -s ^ not ^ eat ^ cabbage]
b. **NEG** = [Bill ^ -s ^ not.**FOCUS** ^ eat ^ cabbage]
c. AFF = [Bill ^ -s ^ ∅ ^ eat ^ cabbage] = [Bill ^ -s ^ eat ^ cabbage]
d. **AFF** = [Bill ^ -s ^ ∅.**FOCUS** ^ eat ^ cabbage]

Summary: An intervening ΣP correctly rules out tense-lowering in English, but a phonologically null Σ does not disrupt string-adjacency of finite tense and the verb for Local Dislocation.

But what about the [-V] feature on finite T in English? It will not be checked in the narrow syntax in the absence of aux-raising. Finite $T_{[-V]}$ is not a Spell-out trigger in English, and so it may not lower to the verb; it also may not raise the main verb due to the PHIC.

I argue that strong uninterpretable features may be checked on the PF branch (e.g. via Local Dislocation or *do*-support) when feature-checking is unavailable in the narrow syntax.

Under a strong Minimalist Hypothesis, uninterpretable features must be checked before one of the two interfaces; the articulatory-perceptual (A-P; i.e. pronunciation) and the conceptual-intentional (C-I; i.e. interpretation) interfaces. I summarize this as follows:

(38) *Strong Minimalist Feature-checking Hypothesis* (SMFH)
The interpretability of morpho-syntactic features is evaluated only at the interfaces; strong features at the articulatory-perceptual interface and weak features at the conceptual-intentional interface.

In terms of PF Spell-out, several operations occur between Spell-out triggering/Transfer and pronunciation (e.g. Lowering, Vocabulary Insertion, Local Dislocation). Thus, feature-checking should be possible at any point on the PF branch before the ultimate PF representation is derived (i.e. the representation that interfaces with the A-P component).

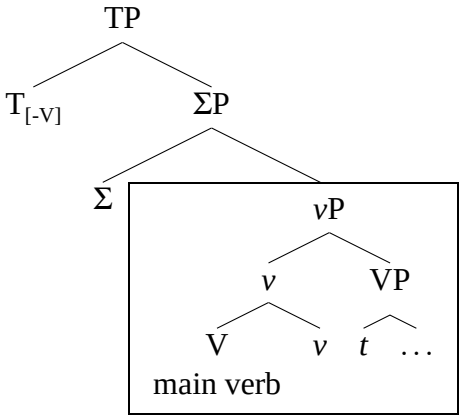
Therefore, when narrow syntactic feature-checking is impossible (e.g. due to the PHIC), operations on the PF branch may check any remaining uninterpretable features, when possible. For example, Local Dislocation of a finite tense morpheme on the PF branch will check the [-V] feature on T against the interpretable V-feature of the verb in English:

(39) *John walked.*
[John $^\wedge$ -ed$_{[-V]}$ $^\wedge$ walk$_{[+v,\ +V]}$] → [John $^\wedge$ walk$_{[+v,\ +V]}$+-ed$_{[-V]\surd}$]

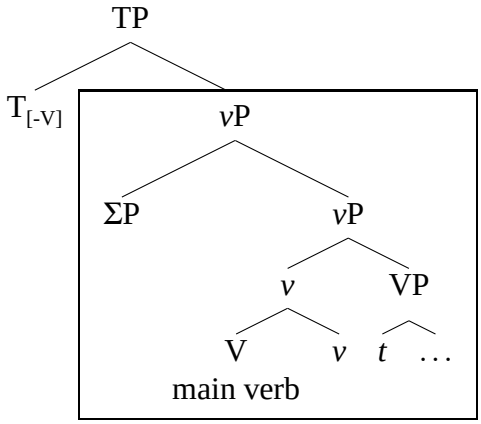
There are clearly several issues that arise with this analysis, but we will leave them for later.

Finally, following standard accounts of the distinction (e.g. Holmberg 1993), I assume that ΣP is an adjunct in Swedish, unlike in English, and so does not disrupt the head-complement relation necessary for tense-lowering:

(40) a. *English*



b. *Swedish*



Thus, finite T always takes *v*P as its complement in Swedish, and so Lowering occurs consistently:

(41) Du vet att jag **inte** *läser* tidningen.
you know.PRES that I not read.PRES newspaper.DEF
'You know that I do not read the newspaper.'

5 Conclusion

The following summarizes the main points of this presentation:

- Phonological Persistence: after Spell-out of a phase, there is a strong tendency to maintain the phonological form of that phase during later computation.
- The patterns of Raising before Spell-out, Raising after Spell-out, and Lowering can be accounted for via a combination of locality conditions, timing of Spell-out triggering and Transfer, and the effects of phase impenetrability.
- Tense-hopping is not uniform cross-linguistically.
- Finite T and auxiliary verbs are merged in the same phase (the functional phase) in English, and so finite $T_{[-V]}$ may target the auxiliary for raising. However, main verbs are merged in a separate phase (the lexical phase) and so the PHIC prevents raising of main verbs. Rather, T's [-V] feature in this case is checked on the PF branch via Local Dislocation or *do*-support. Thus, the aux-raising vs. tense-hopping asymmetry in English is not due to multiple lexical entries or different feature specifications, but rather to considerations of syntactic derivation.
- Most importantly, all types of syntactic head movement operations that we have seen today can be explained as cases of *predictable* feature-driven movement.

Appendix: *göra*-support

In Swedish *v*P-fronting, the dummy verb *göra* 'to do' appears in V2 position and must match the tense on the verb in the fronted *v*P:

(42) a. [$_{vP}$ Läser read.PRES boken book.DEF] gör do.PRES han he
'Reading the book he is.'

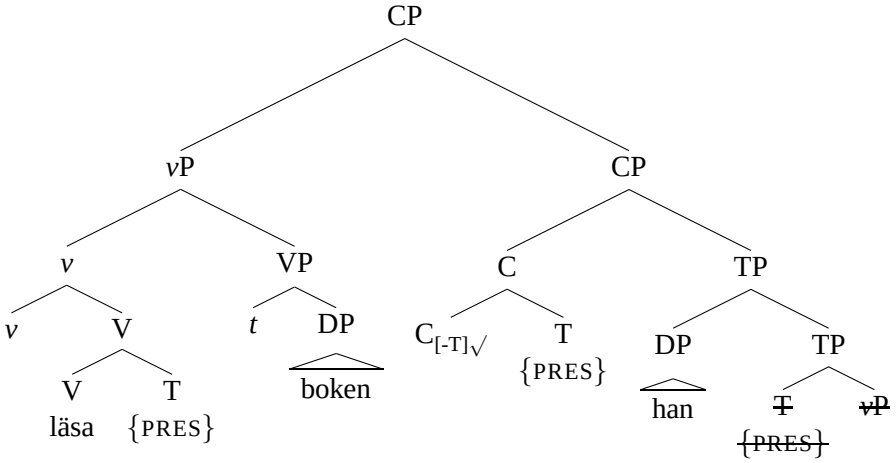
b. [$_{vP}$ Läste read.PAST boken book.DEF] gjorde do.PAST han he
'Read the book he did.'

c. *[$_{vP}$ Läste read.PAST boken book.DEF] gör do.PRES han he

Briefly, I argue that this is due to the following order of operations in Swedish *v*P-fronting constructions:

1. T merges and lowers into *v*P;
2. C merges and moves *v*P to SpecCP;
3. C then probes for head movement (NB: phrasal movement to C occurs before head movement to C, contra Matushansky 2006);
4. Since the most recent copy of T is not in C's c-command domain at this point of the derivation –it is in SpecCP– C targets a trace copy of T for feature-checking;
5. Upon Spell-out, the trace copy of T found in the C head does not c-command, nor is it c-commanded by, the copy of T embedded in the fronted *v*P, and so both are pronounced at PF; i.e. each chain of T is assigned phonological features.

The following is the tree interpreted at PF (~~strikethrough~~ denotes an unpronounced trace copy):



In sum, I argue that *göra* in Swedish *v*P-fronting is the resumptive pronunciation of a trace copy of T.

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