

THE CONSEQUENCES OF CYCLIC SPELL-OUT FOR VERBAL STEM-ALLOMORPHY*

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Under non-lexicalist morphologies (e.g. Distributed Morphology, Halle and Marantz 1993), complex word forms must be produced via narrow syntactic and post-syntactic transformational operations, rather than in a pre-syntactic generative lexicon (cf. Chomsky 1993, 1995, Lieber 1992). This has particularly important repercussions for paradigms of verbal inflection, in which the discrete tense and verb morphemes must somehow combine to produce an overtly complex form.¹ In this paper, I argue that a cross-linguistic analysis of tense-hopping languages, when combined with a theory of cyclic Spell-out to the PF interface, supports a specific model of morpho-phonology in English verb forms that display allomorphic variation, namely a morpho-phonological readjustment model like that originally proposed by Halle and Marantz, as opposed to a limited morphological look-ahead (e.g. Bobaljik 2000).

1. Stem-allomorphy in English Verbs

The table in (1) shows that regular inflected past tense verbs in English maintain separate, phonologically identifiable tense and stem/root morphemes. Crucially, note that the verb stem is phonologically identical to the uninflected form of the verb. However, the table in (2) shows that several verb stems in English surface with distinct allomorphy in their past tense forms.

(1) Regular English verb stems

Uninflected	Past tense	Morphological form
walk [wɔk]	walked [wɔkt]	[wɔk] _{STEM} + [t] _{PAST}
help [hɛlp]	helped [hɛlpt]	[hɛlp] _{STEM} + [t] _{PAST}
save [sɛv]	saved [sɛvd]	[sɛv] _{STEM} + [d] _{PAST}
study [stʌdi]	studied [stʌdid]	[stʌdi] _{STEM} + [d] _{PAST}

* Many thanks to my advisers Jon Nissenbaum, Glyne Piggott, and Lisa Travis for the helpful discussions we shared regarding the model of morphology presented here. All errors are my own.

¹ I will be following the model of DM here, under which morpho-syntactic feature bundles are assigned phonological features during the post-Spell-out process of Vocabulary Insertion. Therefore, the phonological form of complex verb forms is not determined until after Spell-out.

(2) Variable English verb stem-allomorphy

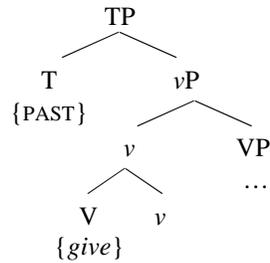
Uninflected	Past tense	Morphological form
drink [drɪŋk]	drank [dræŋk] *drinked [drɪŋkt]	[dræŋk] _{STEM} + [∅] _{PAST}
teach [titʃ]	taught [tɔt] *teached [titʃt]	[tɔt] _{STEM} + [∅] _{PAST}
give [gɪv]	gave [geɪv] *gived [gɪvd]	[geɪv] _{STEM} + [∅] _{PAST}
stand [stænd]	stood [stʊd] *standed [stændəd]	[stʊd] _{STEM} + [∅] _{PAST}

These patterns raise the question as to how the combination of two individual morphemes may derive bidirectional allomorphy. In particular, assuming that all inflected verbs are formed via syntactic and post-syntactic processes, and given that the inflectional affix attaches to the verb stem (i.e., as argued below, the inflectional affix is evaluated for phonology *after* the verb stem), how does this affixation produce changes in the overt form of the stem? In other words, why do we derive *gave* instead of **gived*? The main goal of this paper is to address whether the overt allomorphs of the stems in (2) are assigned when the verb is first given phonological form after Spell-out, or if these forms surface as the result of a re-analysis of phonological form that was already assigned before the affixation of finite past tense. For example, is the form *give* [gɪv] readjusted to [geɪv] after affixation of the past tense morpheme, or is it simply the case that this intermediate stage never occurs, and [geɪv] is assigned directly to the stem during the first (and perhaps only) mapping of phonological features to the stem's morpho-syntactic feature bundle? I will show that the interactions of cyclic Spell-out and tense-hopping constructions support a readjustment analysis for English verbal stem-allomorphy.

2. Two Competing Models of Stem-allomorphy

Halle and Marantz (1993) and Embick and Marantz (2006) propose that Vocabulary Insertion (VI) applies in a strict bottom-up fashion, and may not look ahead to higher morpho-syntactic feature bundles when determining the phonological form of lower morphemes. In this way, changes in the morpho-phonology of lower morphemes due to the presence of higher morphemes is the result of morpho-phonological readjustment rules that occur after the higher morphemes are evaluated in the Vocabulary Insertion process. This produces the following scenario for English stem-allomorphy (note that 'Λ' indicates a relation of string-adjacency and linear precedence in the morpho-phonological string; only relevant VI cycles are illustrated here):

(3) a.



- b.
- | | | |
|--------------|------------|--|
| VI Cycle 1: | [grv] | ← uninflected form of verb inserted |
| VI Cycle 2: | [grv ^ ∅] | ← null past tense allomorph concatenated with verb |
| VI Cycle 2': | [gerv ^ ∅] | ← phonology of stem morpheme readjusted |

Note that the null allomorphy of the past tense in Cycle 2 is unproblematic, since this morpheme scopes over the verb, and thus its allomorphy may be conditioned appropriately due to its selectional constraints.

Bobaljik (2000) argues that Vocabulary Insertion may indeed look ahead to morpho-syntactic features (but not phonological features) of structurally higher elements when determining the phonological form of structurally lower elements. Applying this model to English produces the following scenario, assuming a structure like that in (3a) at Spell-out:

- (4)
- | | | |
|-------------|------------|--|
| VI cycle 1: | [gerv] | ← allomorph inserted when V undergoes VI |
| VI cycle 2: | [gerv ^ ∅] | |

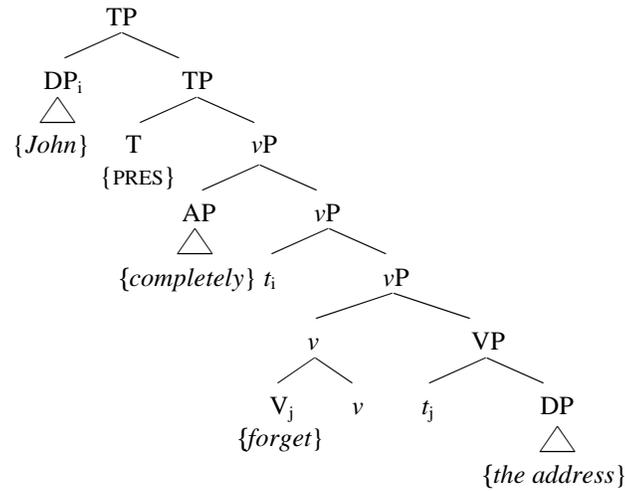
After the structure in (3a) is spelled out, Vocabulary Insertion applies cyclically from the bottom up. When VI targets the morpho-syntactic feature bundle of the verb root {give}, it may look ahead to the higher feature bundle to see that {give} is in the scope of {PAST}. Therefore, VI assigns the stem allomorph [gerv] at this point of the post-syntactic derivation (4). In this way, there is no need for a later readjustment of the phonological form of the stem.

3. Tense-hopping: Lowering or Local Dislocation?

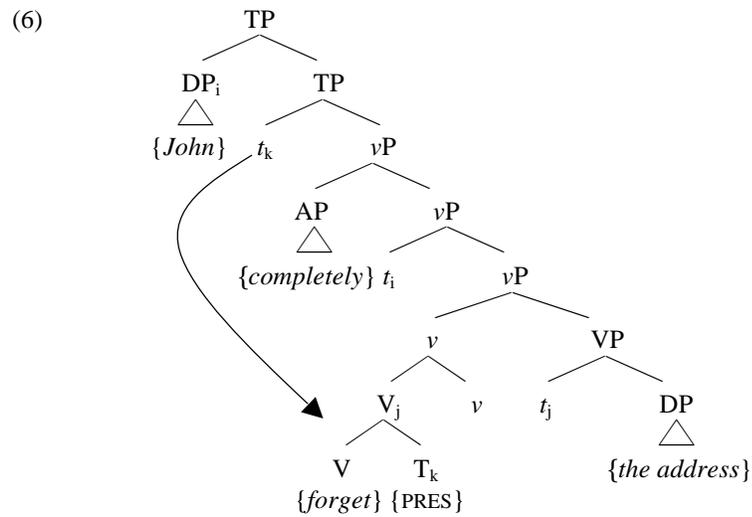
A step in resolving the debate between these two schools of thought on non-lexicalist verbal stem-allomorphy in English is determining how tense-hopping works. Again, there are two main, competing theories.

Embick and Noyer (2001) argue that the English tense-hopping transformation's insensitivity to intervening adjuncts entails that it is a downward head-to-head movement, just as narrow syntactic head-raising skips intervening adjoined material. To illustrate, consider the following pre-Spell-out structure:

(5) *John completely forgets the address*



According to Embick and Noyer, T in (5) lowers to the complex *v* head after Spell-out but before Vocabulary Insertion, forming a structure like the following before phonology is assigned:²



² Lowering, as it is a downward movement that violates the Extension Condition (Chomsky 1993), is, by hypothesis, prohibited from taking place in the narrow syntactic derivation, and so must occur after Spell-out on the PF branch (but see Skinner in prep for an alternative view).

Crucially, tense here is contained within the same complex head as the verb before Vocabulary Insertion. Because of this, they are both simultaneously visible to the phonological component when the overt form is determined, thus permitting a look-ahead VI scenario for stem-allomorphy. However, while this head-to-head Lowering account allows for a look-ahead model, it does not rule out a morpho-phonological readjustment model of the observed allomorphy.

Following the work of Lebeaux (1988) and Bobaljik (1995), Ochi (1999) argues that the possibility of merging adjuncts counter-cyclically allows us to analyze tense-hopping in English as a case of affixation under phonological adjacency, aka Local Dislocation. Under the theory of Local Dislocation (Embick and Noyer 2001, Embick 2006), two morpho-phonological elements that are string-adjacent after Vocabulary Insertion may undergo a process of morpho-phonological merger that may 1) invert their order and 2) create a single, morphologically complex word. Under Ochi's analysis, PF-adjacency of the finite tense morpheme and the verb is evaluated before any intervening adjunct is merged into the derivation, producing the following scenario after Spell-out and VI of the structure in (5) with late-merger of the adjunct:

- (7) a. Spell-out of CP:
[John ^ -s ^ forget ^ the ^ address]
- b. Local Dislocation of T and verb:
[John ^ forget+s ^ the ^ address]
- c. Late merger and Spell-out:
[John ^ completely ^ forget+s ^ the ^ address]

Under this model, tense-hopping is blocked when T is not phonologically adjacent to the verb after T undergoes Spell-out, but before the late merger of adjuncts. However, when T is string-adjacent to the verb after Spell-out, but before the merger of adjuncts, Local Dislocation occurs, thus deriving the apparent “transparency” of vP-adjuncts for tense-hopping. This analysis requires that the verb and the tense morpheme be assigned phonological features *before* the tense-hopping transformation occurs, which might appear to support a model in which the phonological form of the verb is readjusted after the tense-hopping Local Dislocation operation takes place. However, note that under this version of the Local Dislocation model of tense-hopping, it may still be possible to devise a scenario in which the phonological form that is initially mapped to the verb reflects the stem-allomorphy. That is, nothing prevents the formation of the phonological string in (8a) instead of the string in (8b) before Local Dislocation of the tense and verb morphemes, since it may still be possible for Vocabulary Insertion to look-ahead to the {PAST} feature bundle when determining the phonological form of the verb:

- (8) a. [John ^ ∅ ^ drank ^ some ^ wine]
 b. [John ^ -ed ^ drink ^ some ^ wine]

Nevertheless, a cross-linguistic comparison of tense-hopping languages, namely English and Swedish, shows that a Lowering analysis of English tense-hopping is highly improbable. Note that, though it is V2 in matrix clauses, the order of constituents in embedded clauses in Swedish is identical to that of English, where the inflected verb follows any *vP*-adjunct, showing that Swedish is also a tense-hopping language.

- (9) Du vet att jag ofta läser tidningen.
 you know.PRES that I often read.PRES newspaper.DEF
 'You know that I often read the newspaper.'

I will assume that Swedish is also tense-hopping in matrix clauses, but that this movement is often obfuscated by later movement of the verb to V2 position (see Skinner in prep). I argue that English and Swedish do not derive their tense-to-verb movement via identical means. Consider the following asymmetry in fronted *vPs*:

- (10) a. He said he would play the piano, and [*vP* play the piano]_I he did *t*₁.
 b. *He said he would play the piano, and [*vP* played the piano]_I he (did) *t*₁.

- (11) [*vP* Läser boken] gör han nu.
 read.PRES book.DEF do.PRES he now
 'Reading the book he is now.' (Källgren and Prince 1989)

In English (10), the verb in the fronted *vP* is not inflected, whereas in Swedish (11) the verb in the fronted *vP* carries the present tense morpheme. This suggests that tense-hopping occurs in Swedish before *vP*-fronting, but is evaluated in English after *vP*-fronting. I argue that this points to an analysis in which the following hold:

- In Swedish, the tense morpheme undergoes head-to-head Lowering to the verb before *vP*-fronting.
- The dummy verb 'do' in Swedish *vP*-fronting is an overt realization of a trace copy of T that is left behind after head-to-head Lowering of tense; this copy no longer forms a chain with the overt tense morpheme on the verb in the fronted *vP*, and so must be rescued via 'do'-support (I will not address this in any detail here).
- The tense head in English does not undergo Lowering. Rather, tense-hopping in English occurs as Local Dislocation after narrow syntactic fronting of *vP* and Spell-out, but before the late-merger of

adjuncts, as in Ochi (1999). Note that tense in (10) is not phonologically adjacent to the verb after ν P-fronting, and so *do*-support is required.

4. The Timing and Domain of Cyclic Spell-out

The order of operations in Swedish ν P-fronting supports a model of cyclic Spell-out, or derivation by phase (e.g. Chomsky 2001, Svenonius 2001, Fox and Pesetsky 2005, among many others). Namely, Lowering of tense must occur on a Spell-out cycle that precedes the narrow syntactic operation of ν P-fronting.³ I here follow the standard assumption that Spell-out cycles, or phases, correspond to ν P and CP at the clausal level.

Crucially, Lowering of tense in Swedish may not occur on the CP Spell-out cycle, due to the fact that the ν P must be fronted before the CP is sent to Spell-out. If CP were spelled out with the ν P remaining *in situ*, then fronting of the ν P would be impossible due to the Phase Impenetrability Condition (PIC, Chomsky 2001), which prohibits movement of elements out of a spelled-out phase (perhaps modulo those found at the phase edge). Furthermore, if ν P-fronting in Swedish occurred before Lowering of tense (i.e. if ν P-fronting took place before Spell-out of CP, but Lowering of tense took place later during Spell-out of CP), then we would not expect the verb in the fronted ν P to be inflected, as the copy of the verb that will be realized overtly would no longer be found in the complement of T, but rather in SpecCP.

Taking this into consideration, it must be the case that T lowers to ν during the Spell-out cycle of ν P (i.e. before the fronting of ν P). Furthermore, since Lowering cannot occur in the narrow syntax, it cannot be the case that the verb itself is spelled out on the CP phase, contra Fox and Pesetsky (2005), but rather that the verb, which is the targeted landing site for tense-lowering, is found on the PF branch when the tense-hopping transformation occurs.⁴ That is, the phase head containing the verb is spelled out on the ν P phase cycle along with its complement. However, T must also be present during ν P Spell-out in order to be able to lower. This supports a triggering model of Spell-out under which ν P, including the phase head, is spelled out to PF once T merges into the derivation.⁵ Thus, in Swedish, T merges with ν P, sending ν P to PF. T then ‘piggybacks’ on the Spell-out cycle of ν P to check an uninterpretable feature (see the addendum ‘Why do heads lower?’). That is, T is re-merged to the structure on the PF branch as a last resort after the ν P has been transferred to PF, but before Vocabulary Insertion applies to that structure. The following

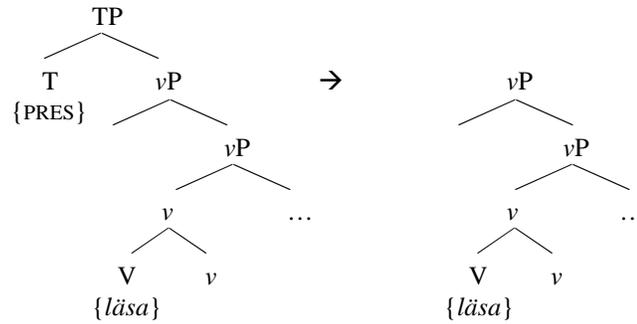
³ That is, Lowering, which must occur to an element on the PF branch, and thus after (or during) a Spell-out operation, occurs before a narrow syntactic phrasal movement. Therefore, Spell-out operations must be interleaved with narrow syntactic operations.

⁴ In other words, since it is the copy of tense ultimately contained on the verb that reflects the *downward* tense-lowering operation, the verb itself must be located on the PF branch before that operation occurs.

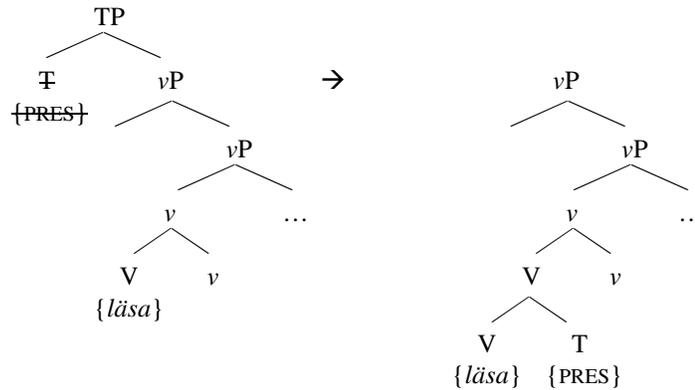
⁵ See Svenonius (2004) for a similar proposal. See also Skinner (in prep) for further investigation into this model of derivation and Spell-out.

illustrates the proposed order of operations in Swedish (note that I will not address the Spell-out status of specifiers here):

- (12) a. T merges and sends vP to PF:
Narrow syntax



- b. T piggybacks on Spell-out cycle of vP (~~struckthrough~~ indicates a trace copy):
Narrow syntax



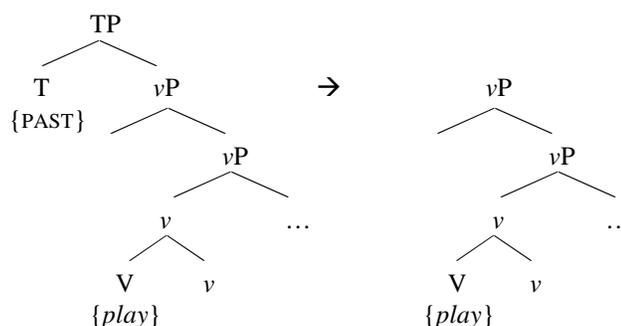
- c. Phonological form is mapped to the resulting PF vP structure:
[läser ^ ...]

When C later merges and targets the (entire) vP phase for vP-fronting, the vP contains an inflected verb. Crucially, this suggests that the phonological form of all constituents contained within the vP is determined during the Spell-out cycle of vP (i.e. the inflected form of the Swedish verb is assigned before vP moves). Additionally, due to the movement of vP, the narrow syntactic trace of T must be realized overtly for the reasons stated previously, deriving the tense-doubling effect in vP-fronting constructions.

5. Back to Stem-allomorphy in English

Assuming that the Spell-out domains of English and Swedish are identical, there is one crucial difference that must be noted. Namely, T in English remains *in situ* during the Spell-out cycle of *vP*, as illustrated by the following:

- (13) a. T merges and sends *vP* to PF:
Narrow syntax



- b. T remains *in situ*; phonological form mapped to *vP* structure at PF:
[play ^ ...]

In an English *vP*-fronting construction (e.g. 10a), when C merges and targets the *vP* for narrow syntactic movement, the *vP* contains an uninflected verb. As T has remained *in situ*, it will not be assigned phonological form until the Spell-out cycle of CP, i.e. after *vP*-fronting has taken place. Thus, if *vP* has been fronted before Spell-out of CP, the verb in the *vP* will not be phonologically adjacent to tense, and *do*-support will occur. If, however, both T and *vP* remain *in situ* by the time CP Spell-out takes place (e.g. *vP*-fronting does not take place), T will undergo Local Dislocation with the verb before the late-merger of any adjuncts.⁶

The fact that T remains *in situ* during the Spell-out of *vP* strongly suggests that the verb in English is assigned uninflected phonological form during the Spell-out cycle of *vP*. That is, as T is not present on the PF branch during the Spell-out cycle of *vP*, the process of Vocabulary Insertion may not “look-ahead” to higher inflectional features when determining the initial phonological form of the verb stem, as these features are not found on the PF branch when the *vP* undergoes mapping to phonological features.

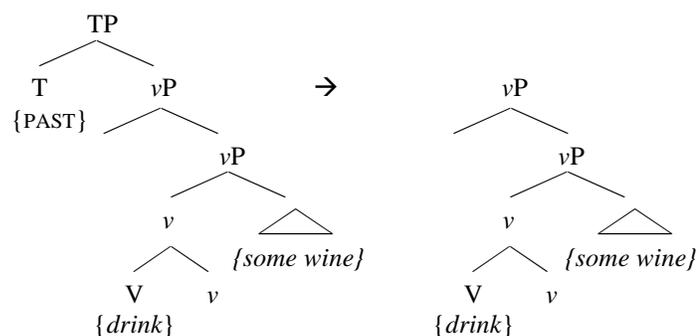
Assuming that all morpho-syntactic feature bundles that undergo Spell-out to PF are evaluated by Vocabulary Insertion, and that only those

⁶ Note that T-to-C movement in e.g. interrogative constructions also disrupts the phonological adjacency requirement for Local Dislocation of tense and the verb before Spell-out of CP: *Does Vinny play the cello?*

feature bundles that have been spelled out are visible to the Vocabulary Insertion process, I propose the following order of operations for a simple English declarative construction containing a verb with variable stem-allomorphy:

(14) *John drank some wine.*

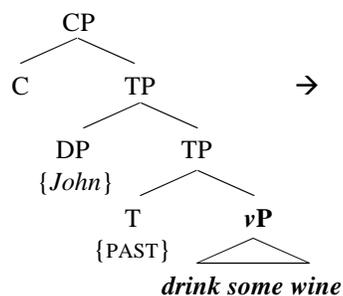
- a. T merges and sends vP to PF:
Narrow syntax



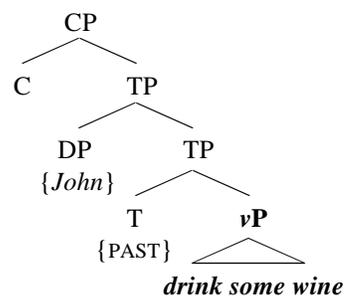
- b. T remains *in situ*; phonological form mapped to vP structure at PF:
[drink ^ some ^ wine]

- c. C merges, end of derivation reached, and CP is spelled out (**bold** indicates a phase that has already undergone Spell-out):

Narrow syntax



PF



- d. Phonological form is mapped to the CP structure at PF and concatenated with the morpho-phonological structure of the previously spelled out ν P:⁷
- i) [John ^ - \emptyset ^ **drink** ^ **some** ^ **wine**]
 - ii) Local Dislocation of tense and verb:
[John ^ **drink**- \emptyset ^ **some** ^ **wine**]
 - iii) Morpho-phonological readjustment:
[John ^ **drank**- \emptyset ^ **some** ^ **wine**]

6. Discussion

Note that it is only under morpho-phonological adjacency that stem-allomorphy of English verbs arises. E.g.:

- (15) a. Did John drink some wine?
b. *Did John drank some wine?

In (15a), under the current analysis, T-to-C movement displaces T from a morpho-phonological position in which it would be string-adjacent to the verb at PF. For the sake of argument, let's assume that the verb in the PF structure in (14a) can look back to the tense morpheme in the narrow syntax during the mapping of phonology to the morpho-syntactic feature bundle of the verb. That is, when Vocabulary Insertion first applies to $\{drink\}$, it may see the feature bundle $\{PAST\}$ that has not been spelled out yet, but rather remains in the narrow syntax during Spell-out of ν P. If this were possible, then Vocabulary Insertion could assign the phonological form [drank] to $\{drink\}$ during the Spell-out cycle of ν P, and later morpho-phonological readjustment would be unnecessary.

However, as shown in (15a), T-to-C movement requires that the uninflected form [drink] be assigned to $\{drink\}$. Therefore, if Vocabulary Insertion can "look back" to the narrow syntactic position of T during the Spell-out of ν P, this would require that T-to-C movement precede Spell-out of ν P. That is, the phonological form of the verb contained within the ν P could not be determined until after T-to-C movement. Otherwise, if the phonological form of the verb is determined before T-to-C movement, and VI can "look back" to the narrow syntax to see the *in situ* $\{PAST\}$ feature bundle to determine stem-allomorphy (i.e. before it has moved to C), then we would expect the past tense allomorph of verbs like *drink* to surface in both interrogatives and declaratives, contrary to fact. For example, we would expect (15b) to surface, in

⁷ Note again that when Vocabulary Insertion applies to $\{PAST\}$, the selectional requirements of tense allomorphy may be evaluated –that is, the null allomorph is assigned–, since the form and adjacent morpho-phonological position of *drink* are visible to VI.

which the past tense stem-allomorph [drank] is assigned to {*drink*} before T-to-C movement.

This “look-back” scenario would require that C merge before Spell-out of ν P, thus displacing T to C in English before phonology is assigned to the constituents in ν P. However, as we saw in Swedish, movement to C (e.g. ν P-fronting) must occur after Spell-out of ν P (i.e. after Lowering of T). This then suggests that no movement occurs in the CP domain before Spell-out of ν P. Therefore, since T-to-C movement may not occur before Spell-out of ν P under this analysis, it cannot be the case that Vocabulary Insertion may “look back” to the tense feature bundle that remains in the narrow syntax during the Spell-out of ν P in English, as this would then predict the wrong verb stem allomorphy for interrogative constructions.

Note, however, that if the model presented in this paper is correct, the phonological form initially assigned to the verb in constructions like (15a) will always be the uninflected form. This correctly predicts that when tense is spelled out in a position in which it is not morpho-phonologically string-adjacent to the verb, thus precluding Local Dislocation and morpho-phonological readjustment of the overt form of the verb, this default, uninflected form of the verb will surface. I thus maintain the following:

- T does not lower to the verb in English, but rather remains *in situ* during Spell-out of ν P.
- Vocabulary Insertion may only see those constituents that have been sent to the PF branch.
- As a result of this, when phonology is mapped to an English verb, VI can only assign the uninflected phonological form.
- The form of the verb may later be readjusted only if the tense morpheme is phonologically adjacent to the verb after the Spell-out of CP, but before the late merger and Spell-out of adjuncts.

7. Conclusion

I have here argued that stem-allomorphy in English verb paradigms must be due to morpho-phonological readjustment rules (as in Halle and Marantz 1993) rather than look-ahead to morpho-syntactic features (as would be the case under Bobaljik 2000). This claim is primarily based on an analysis of the cyclic Spell-out of inflected English verbs in which the morpho-syntactic feature bundles of the verb and tense morphemes are first analyzed by the phonological component on separate Spell-out cycles. Namely, the verb is first evaluated for phonology during the Spell-out of the ν P phase and tense is only later assigned phonology on the subsequent Spell-out of the CP phase. The tense morpheme then undergoes Local Dislocation with the verb if the two are string-adjacent at **this** point of the post-syntactic derivation. It is only under this Local Dislocation

operation that morpho-phonological readjustment rules may take effect.⁸ The model of derivation and Spell-out suggested by these patterns will have far-reaching repercussions for other areas of linguistic analysis, which I hope will be explored further in future work.

Addendum: Why do heads lower?

Within the non-lexicalist morphology literature, it is fairly uncontroversial that some syntactic heads raise, while others lower. As a first step in accounting for this distinction, I make the following assumptions (adapted from Skinner 2008):

- All pre-Vocabulary Insertion movement (both Raising and Lowering) is feature-driven.
- Narrow syntactic head-raising is preferred over Lowering on the PF branch.
- Head-lowering is therefore a last resort feature-checking operation.

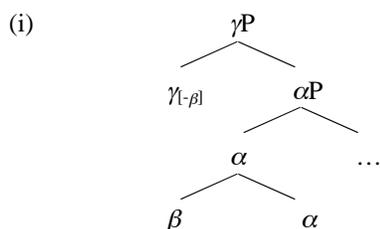
Curiously, most, if not all, heads that lower are base-generated in positions that are commonly assumed to be structurally adjacent to a phase boundary; that is, Lowering heads often, if not always, take phases as their complements (Skinner in prep). I argue that the following are the conditions that derive Lowering of a head:

- ① A phase head (e.g. v) must undergo Spell-out/linearization along with its complement; a phase undergoes Spell-out when the next highest head is merged (i.e. the triggering model of Spell-out).
- ② Spell-out/linearization of a complex head deletes all intermediate hierarchical structure, and retains only the category feature of the topmost node, i.e. embedded syntactic category features X, Y, and Z of a complex

⁸ Note, however, that the analysis presented here only disallows morpho-syntactic look-ahead for stem-allomorphy in English verbal paradigms. That is, it may still be possible that Vocabulary Insertion can look ahead to higher morpho-syntactic features that are present on the PF branch when phonology is mapped to a lower constituent. For example, given that tense in Swedish lowers to the complex v head before Vocabulary Insertion applies to either head (e.g. 12b), it may be the case that VI can see that the verb is within the scope of a tense morpheme when first assigning phonology to the verb, as under Bobaljik's model. While it is true that Swedish contains stem-allomorphy similar to English (e.g. *springa* 'to run' → *sprang*/**springa-de* 'ran'; cf. *laga* 'to prepare' → *laga-de* 'prepared'), I can think of no empirical or theoretical way to determine whether this stem-allomorphy is the result of either readjustment or look-ahead, since, due to Lowering, the inflectional tense morpheme invariably forms part of a complex syntactic head with the verb stem. That is, these two morphemes are never separated via narrow syntactic operations, unlike tense and the verb in English, and so are always assigned phonology on the same cycle. I therefore leave this as a question for future research.

head will ‘disappear’ at Spell-out (perhaps due to phase impenetrability; Chomsky’s 2001 PIC).

- ③ A Lowering head contains an uninterpretable feature X, Y, or Z. This head must therefore lower (if possible) before linearization of the complex head of its complement and the subsequent disappearance of its embedded features.



Taking into account the skeletal structure in (i), where α is a phase head and γ carries an uninterpretable β -feature, αP will undergo Spell-out when γ merges, and thus the β -feature embedded in the complex α head will become invisible for subsequent narrow syntactic feature-checking due to Spell-out of αP . Therefore, γ may lower to α before α is linearized (i.e. during the Spell-out process of αP) as a last resort operation to check its uninterpretable β -feature. Note that, crucially, if α were not a phase head, then narrow syntactic head-raising of α to γ could occur to check the $[-\beta]$ feature on γ , since the β -feature within α would not become invisible due to Spell-out.

In terms of tense-hopping in English vs. Swedish, we may assume that T in Swedish carries an uninterpretable V-feature, and so must lower to the v phase head to check this feature during the Spell-out cycle of vP , whereas T in English carries no such uninterpretable feature (but see Skinner in prep for a more detailed analysis).

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