

## Intermodular argumentation: morpheme-specific phonologies are out of business in a phase-based architecture

### 1 Setting the scene: interactionism, selective spell-out and modification-inhibiting no look-back (PIC)

The minimalist focus on the interface has afforded a radical change in generative interface architecture. Since the 60s (Chomsky 1965:15ff), the inverted T model stands unchallenged (the generative semantics interlude lain aside): a concatenative device (morpho-syntax) feeds two interpretative devices, PF and LF. This architecture was supplemented with a proviso which requires that all concatenation be done before any interpretation. That is, the morpho-syntactic derivation is completed before the result (S-structure) is sent to PF and LF in one go.

An alternative view of the communication between morpho-syntax and LF/PF was formulated in phonology in the early 80s: the backbone of Lexical Phonology (Pesetsky 1979, Kiparsky 1982a,b), so-called interactionism, holds that concatenation and interpretation are intertwined. That is, first some pieces are merged, the result is interpreted, then some more pieces are concatenated, the result is again interpreted and so on.

While GB-syntax of that time hardly produced any echo, generative orthodoxy in phonology reacted on this violation of "all concatenation before all interpretation": Halle & Vergnaud (1987) proposed a non-interactionist version of Lexical Phonology that restores the interface landscape of SPE to a large extent. Halle & Vergnaud (1987) also promote a new idea: selective spell-out. Since cyclic derivation was introduced by Chomsky et al. (1956:75) and formalized in Chomsky & Halle (1968:15ff), interpretation was held to run through the bracketed string (that is inherited from S-structure) from inside out; (roughly<sup>1</sup>) every morpheme break defined a cycle. Halle & Vergnaud dispense with this definition of what an interpretational unit is: they propose to grant cyclic status only to a subset of morpho-syntactic divisions. That is, some nodes trigger interpretation, others do not.<sup>2</sup>

Halle & Vergnaud's (1987) selective spell-out is exactly what modern (syntactic) phase theory is about: in more familiar terminology, nodes may or may not be phase heads, hence their material may or may not be an interpretational unit. As far as I can see, the phonological heritage is left unmentioned in the syntactic literature since derivation by phase was introduced by Epstein et al. (1998), Uriagereka (1999) and Chomsky (2000,2001 et passim).

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<sup>1</sup> In actual fact, SPE holds that all morphemic and syntactic divisions are cycles, except for sequences of morphemes that belong to the same major category: these cohabit in the same cycle (hence [[[theatr]<sub>N</sub> ic + al]<sub>A</sub> i + ty]<sub>N</sub>, Chomsky & Halle 1968:88f).

<sup>2</sup> Of course the question associated to selective spell-out is how to decide just which subset of nodes is spelled out. The phonological take of Halle & Vergnaud (and of all other phonologists who practise selective spell-out) is that this depends on a lexical property of the piece (the affix) that is merged. In Halle & Vergnaud's terminology, there are cyclic (interpretation-triggering) and non-cyclic (interpretation-neutral) affixes. Under the header of phasehood, this is a top-ranked question on the agenda in current syntactic phase theory (den Dikken 2007 for example provides an overview of the large body of literature). Unlike in phonology where phasehood depends on a lexical property of affixes, the syntactic take is that it depends on the label of nodes (which of course is also a projection of a lexical property, but in a different sense): I call the two options node-driven vs. piece-driven phase (Scheer 2008, forth). This question, and an eventual unification of both options, cannot be discussed in the frame of this article.

This is also true for interactionism: multiple spell-out and derivation by phase make the generative interface architecture interactionist, exactly along the lines that Lexical Phonology had laid out: first you do some concatenation, then some interpretation, then some more concatenation etc. For (extra-linguistic) reasons of computational economy regarding the limited availability of active memory, a costly cognitive resource (e.g. Chomsky 2000:101, 2001:15), modern phase theory applies the interactionist world view. Here again, the phonological origin of the idea has gone unnoticed as far as I can see (let alone the anti-interactionist reaction of generative orthodoxy in the 80s).

On the pages below, I examine a question that is closely related to selective spell-out and interactionism: critical for current syntactic phase theory is a device which guarantees that previously interpreted strings do not burden further computation – in Chomsky's terms, strings that are returned from interpretation are "frozen" and "forgotten" when concatenation resumes. I discuss the history of no look-back devices in generative theory, which begins with Chomsky's (1973) Conditions on Transformations, and whose offspring – until its recent revival in the coat of the Phase Impenetrability Condition (PIC) – was essentially phonological. No look-back devices are designed in order to prevent computation to consider "old" strings. Depending on their precise formulation, however, they have very different empirical effects, which correspond to the thing that the analyst wants the computation to be unable to do. I show that here again, Chomsky's PIC has a phonological precedent: unlike all other no look-back devices that the literature has accumulated since 1973, Kaye's (1992,1995) mechanism inhibits the modification of previously interpreted strings – which are thus "frozen".

Modification-inhibiting no look-back is absolutely critical for current syntactic theory: it is a headstone of the interface-oriented minimalist programme. In contrast to GB where the completed morpho-syntactic derivation was merely dumped into PF and (LF) with a "good bye and don't come back", phase theory establishes a two-way pipe between the morpho-syntactic and the phonological (and semantic) module. Actors on both ends are not free anymore to do what they want: their theories and analyses may make predictions on the other end. The intermodular potential of phase theory, however, has not received much attention thus far. Syntacticians use Phase Impenetrability for syntax-internal purposes, and phase theory evolves at high speed without taking into account what happens when the parcel spends time on the phonological side. On the other hand, phonologists have barely acknowledged the existence of phase theory, let alone taken into account the predictions that it makes on the phonological side.

The argument that is made below builds on the fact that the chunks which are designated by the spell-out mechanism for computation at PF (interpretational units) must be the same on the syntactic and on the phonological side. Also, the phonological and syntactic computation of these identical portions of the string must be restricted by the PIC in the same way. A particular syntactic analysis thus makes precise predictions on the phonological side, and vice-versa. A situation where a no look-back device restricts the computation of "old" strings in syntax, but not in phonology, or where it restricts them in different ways on both sides, is inconsistent.<sup>3</sup> Chomsky (2001:12f, see the quote under (10)) is actually explicit on the fact that the economy of active memory concerns phonological as much as syntactic computation.

On these grounds, competing phonological analyses of affix class-based phenomena are compared. Since Lexical Phonology, the most popular solution are morpheme-specific phonologies, i.e. distinct computational systems that apply to strings according to their morphological composition (class 1 vs. class 2 affixes). The modern offspring of this

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<sup>3</sup> This issue is further examined in Scheer (in press a).

approach has been adapted to OT, where it runs under the banners of Stratal OT, DOT, co-phonologies and indexed constraints. Halle & Vergnaud's (1987) aforementioned system that is based on selective spell-out proposes an alternative that works with only one computational system. Kaye (1992,1995) has supplemented this approach with the aforementioned "freezing" no look-back device that is known as the PIC today.

It is shown that the PIC and morpheme-specific phonologies do the same labour in the analysis of affix class-based phenomena: they organize underapplication. Therefore, I argue, no theory can afford to accommodate both devices: this would be redundant. If syntactic phase theory is on the right track, then, present and past solutions that rely on morpheme-specific phonologies do not qualify: the PIC must exist in phonology. In other words, a core property of current syntactic theory, the PIC, is found to act as a referee for competing phonological theories.

I submit that intermodular argumentation provides stronger evidence than what can be produced by modular-internal reasoning: it offers the maximal degree of independent assessment that linguists can expect without leaving their discipline. Be it only for that reason, the new interactionist architecture that the minimalist orientation has installed is a good thing to have: after a long period of quasi-silence, syntacticians and phonologists can talk again about things that are unrelated to the weather and to job openings.

Finally, it is worthwhile making explicit that this article is not empirically oriented: while some contrasting empirical predictions that are made by competing theories are mentioned (namely in section 3.4), this is not what the argument relies on. No doubt the empirical record is important, no doubt theories need to be assessed according to empirical coverage, and also, of course, affix class-based phenomena are not the only phenomena that inform the interface and cyclic derivation. All this needs to be pondered elsewhere, and typically is. The ambition of the following pages is merely to draw attention to the fact that the phase-based architecture offers a new opportunity for refereeing competing theories that is not explored in the discussion thus far. This opportunity is intermodular in kind, and its discussion is based on a phenomenon that is surely not alone to be able to inform the interface, but which represents a core piece of the phonological evidence for cyclic derivation, and played a key role in the historical development of the debate: morpheme-specific phonologies, and more generally speaking the idea that there are several distinct computational systems in phonology, are around today because of affix class-based phenomena (in English).

The roadmap is as follows. Section 2 introduces the approach that relies on morpheme-specific phonologies, as well as the variation that is afforded by different older and modern brands thereof. Section 3 presents the alternative account that builds on selective spell-out and just one computational system. The two representatives, Halle & Vergnaud (1987) and Kaye (1992,1995), are shown to be different in that only the latter uses the PIC. Through a historical survey of the various no look-back devices that have been proposed in the generative literature, section 4 shows that the PIC ("freezing" no look-back) is unprecedented. Finally, section 5 gathers the strands and makes the argument: morpheme-specific phonologies have to go if derivation by phase is on the right track.

## 2 Morpheme-specific phonologies (two engines)

Let us start by introducing the relevant evidence regarding affix class-based phenomena in English. Data and analyses have been extensively discussed in the literature. I therefore only introduce aspects that are critical for the argumentation. A more complete review appears in Scheer (forth), of which the present article is a piece.

## 2.1 Morpheme-specific phonologies: the basic analysis of Lexical Phonology

Affix classes are best studied in English (see Booij 2000:297 for an overview of literature regarding other languages). Their existence was identified in SPE (Chomsky & Halle 1968:84ff); since then, the basic diagnostic for class membership is the behaviour of affixes with respect to stress: they may be stress-shifting (class 1) or stress-neutral (class 2). While the former roughly correspond to the Romance stock of lexical material (e.g. *-ity*, *-ic*, *-ion*, *-ary*, *-al<sub>adj</sub>*), the latter typically are of Germanic origin (e.g. *-ness*, *-less*, *-hood*, *-ship*, *-ful*). Relevant overview literature includes Kaisse & Shaw (1985), Giegerich (1999), McMahon (2000) and Bermúdez-Otero (forth).

For example, a root such as *párent* appears with regular penultimate stress when it occurs in isolation; adding the stress-shifting affix *-al* produces *parént-al*, while the stress-neutral item *-hood* yields *párent-hood*. Another way of looking at the same facts is that both *párent* and *parént-al* bear transparent penultimate stress, while *párent-hood* illustrates an opaque non-penultimate pattern where stress behaves as if the suffix were not there. In other words, stress has been reassigned when *-al* has been added (stress-shifting), but reassignment was blocked upon the merger of *-hood*. The task for the analyst is thus to organize underapplication of the stress rule, which must somehow be prevented from reapplying to strings that are headed by class 2 affixes.

Table (1) below shows the solution that is proposed by Lexical Phonology.

### (1) *párent* - *parént-al* vs. *párent-hood* in Lexical Phonology

		parent	parént-al	párent-hood
lexicon		parent	parent	parent
level 1	concatenation	—	parent-al	—
	stress assignment	párent	parént-al	párent
level 2	concatenation	—	—	párent-hood
	rule application	—	—	—

The spine of Lexical Phonology is its stratal architecture: lexical entries contain underived roots, all class 1 affixes are concatenated at stratum 1 (level 1), while class 2 affixes join in at stratum 2 (level 2). After the concatenation is complete at each stratum, a stratum-specific phonology applies to the string as it stands. Rules are assigned to specific strata: in our example, the stress-assigning rule is a level 1 rule, which means that it is active at level 1, but absent from level 2. Another ground rule is that the derivation is strictly serial: given the order lexical entries → level 1 → level 2 (result: words), strings that are present at some point in this algorithm must run through all subsequent levels on their way to the surface. This means that they experience the computation that these levels.

Under (1), then, /parent/ in isolation receives stress at level 1 where stress assignment is active. This is also true for /parent-al/ since *-al* has been concatenated in time. Stress assignment to /parent-hood/, however, concerns only /parent/ since *-hood* has not yet joined in at level 1. After its concatenation at level 2, stress does not move since the stress rule is absent from this stratum. Note that this is critical: otherwise *\*parént-hood* would be produced.

Underapplication of stress assignment at level 2 is thus achieved by the split of phonological computation into two morpheme-specific mini-grammars: one that assesses class 1 strings (where the stress rule is present), another that takes care of class 2 strings (where the stress rule is absent). The set of rules that applies at level 1 is thus necessarily distinct from the set of rules that applies at level 2 – both phonologies specifically apply to a certain class of morphemes.

## 2.2 Modern implementations of the morpheme-specific strategy

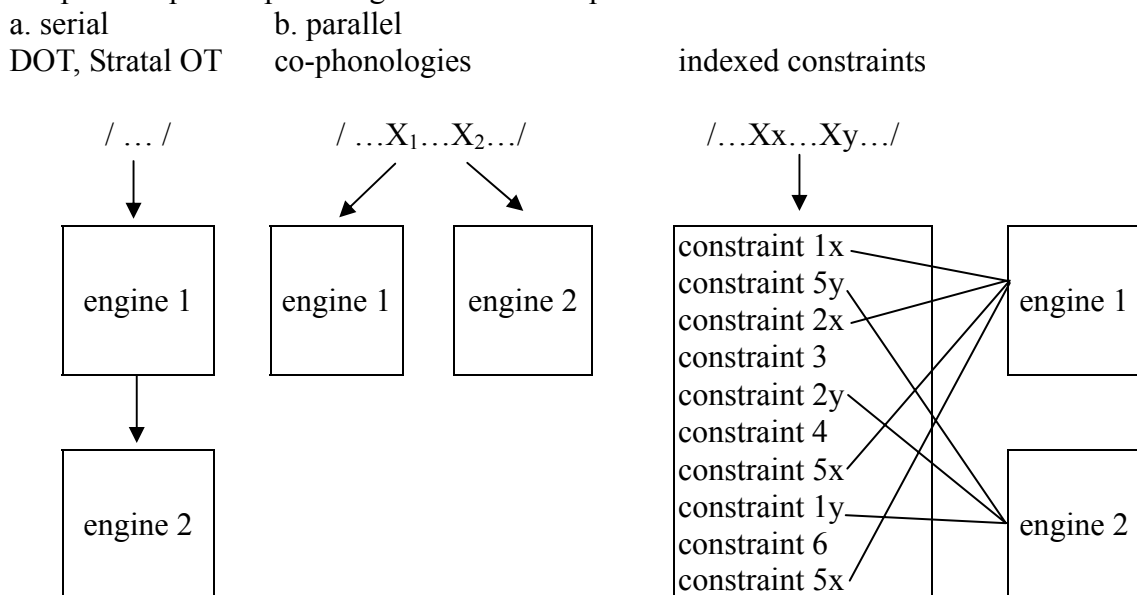
Morpheme-specific phonologies have been carried over from Lexical Phonology into the environment of OT – they are actually the only type of analysis that is practised in this theory (i.e., there are no OT-incarnations of the alternative approach that is discussed in section 3).

Within OT, the two-engine approach falls into two varieties, serial and parallel. On the one hand, Stratal OT (Kiparsky 2000,2003 Bermúdez-Otero forth) and DOT (Rubach 1997 et passim) faithfully continue the stratal architecture of Lexical Phonology: strata are serially ordered, and any string that was present at stratum n-1 must run through stratum n and all subsequent strata. In OT, differences among grammars are expressed by means of a different ranking of the same universal constraint set. Morpheme-specific phonologies therefore incarnate as different constraint rankings. That is, constraints are reranked between strata.

The alternative implementation of the two engine approach is parallel: class 1 strings are assessed by a computational system X, which is different from the computational system Y which applies to class 2 strings. In contrast to the serial solution, however, class 1 strings never meet class 2 computation, and vice-versa: nothing is serially ordered, and hence strings that are headed by a class-specific affix do not run through other "strata" (there are no strata in this approach) on their way to the surface. There are two competing representatives of this solution, co-phonologies (e.g. Itô & Mester 1995, Inkelas 1998, Anttila 2002) and indexed constraints. The latter were originally introduced by Prince & Smolensky (1993) for the purpose of alignment, but the idea was then generalised to other constraints (both faithfulness and markedness). This direction is represented by, among others, Itô & Mester (1999) and Pater (2000,forth).

Table (2) below depicts the three approaches discussed.

### (2) morpheme-specific phonologies: different implementations in OT



The difference between the two parallel solutions, co-phonologies and indexed constraints, is the number of constraint hierarchies that are involved. While the former provide for the existence of two independent rankings, the latter couch two (or more) computational systems in one single hierarchy. This is done by means of indices: the same constraint may appear several times, but with different indices that specify which type of string it exclusively considers. Strings are also indexed, and when EVAL assesses a candidate only those

constraints are active that match this lexical index. All constraints continue to be freely interspersed across indices and with non-indexed constraints. The two distinct computational systems are thus made of two blocks of constraints, the x- and the y-family under (2).

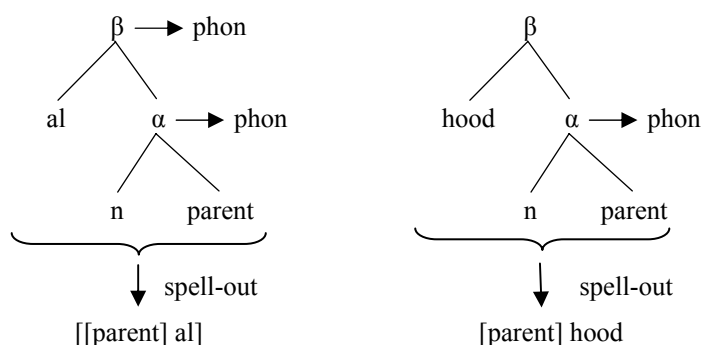
### 3 Selective spell-out and only one computational system (one engine)

#### 3.1 Halle & Vergnaud (1987): selective spell-out

In one way or another, all systems that have been discussed so far are based on morpheme-specific mini-phonologies. In all cases, this is the instrument that assures underapplication in the analysis of affix class-based phenomena. Halle & Vergnaud (1987) have introduced an alternative that works with only one computational system.<sup>4</sup> The heart of their mechanism is selective spell-out. The idea has already been introduced in section 1: only some nodes of the morpho-syntactic tree trigger spell-out. Whether or not a node dominates an interpretational unit (i.e., is a phase head or not) is decided by its head: affixes are lexically specified as interpretation-triggering (cyclic affixes in Halle & Vergnaud's terms) or interpretation-neutral (non-cyclic in their vocabulary). This property is then inherited by the node that they project, and the spell-out mechanism does or does not send off nodes to PF/LF according to this characteristic.

Under (3a) below,  $\beta$  triggers spell-out because it is projected by the class 1 affix *-al*; by contrast under (3b), the stress-neutral class 2 affix *-hood* does not provoke the interpretation of its node.

- (3) Halle & Vergnaud (1987): analysis of affix class-based stress  
 a. *parént-al*                      b. *párent-hood*



An additional proviso is that all roots are interpretational units by themselves (Halle & Vergnaud 1987:78). This is integrated into (3) by the fact that the root node  $\alpha$  is always spelled out. The difference between *parént-al* and *párent-hood*, then, is one of cyclic structure: in addition to the root, the former is subject to interpretation as a whole, while the latter is not. The input that enters phonology is thus /[[parent] al]/ vs. /[parent] hood/.<sup>5</sup>

<sup>4</sup> Halle & Vergnaud (1987) is a book about stress, not about the interface. The interface theory that it contains has only really emerged in subsequent work: Halle et al. (1991), Halle & Kenstowicz (1991), Odden (1993). Modern offspring includes Halle (1997), Halle & Matushansky (2006) and Halle & Nevins (forth). I use Halle & Vergnaud (1987) as a cover term that refers to the entire line of thought, in recognition of the fact that this book appears to be the first source in print (except a manuscript of Halle's 1986 which to date I was unable to hunt down: Morris Halle does not have a copy, and a call on Linguist List also remained fruitless).

<sup>5</sup> Recall that Halle & Vergnaud are anti-interactionist, i.e. need to complete the morpho-syntactic derivation before the full string, augmented with cycle-defining brackets, is sent to PF for interpretation.

Penultimate stress assignment then applies to each cycle: while the derivation ends for the latter item when [párent] has received stress (there is no further cycle), it reapplies to [párent al]; that is, stress is shifted to the right, and the result is *parént-al* vs. *párent-hood* ([parent] in isolation of course comes out as *párent*).

This analysis achieves underapplication by selective spell-out: class 2 affixes do not trigger interpretation, which prevents the stress rule from reapplying. Two more ingredients, however, need to be made explicit: for one thing, it was already mentioned that roots are always spelled out by themselves – this is nothing that selective spell-out enforces per se. Also, class 1, rather than class 2 affixes, are interpretation-triggering – this additional choice is not a property of the model either.

In sum, then, Halle & Vergnaud achieve the same affix class-based effect as Lexical Phonology (and modern incarnations thereof), but without recurring to morpheme-specific phonologies: there is only one computational system that assesses all strings.<sup>6</sup>

### 3.2 Kaye (1995): a different implementation of selective spell-out

Kaye (1992,1995) adopts selective spell-out and, like Halle & Vergnaud, rejects morpheme-specific phonologies. The implementation of selective spell-out, however, is significantly different given the "secondary" choices that Kaye makes. A comparison appears under (4) below.<sup>7</sup>

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<sup>6</sup> For the sake of completeness, it needs to be mentioned that the single computational system at hand only refers to the contrast with morpheme-specific multiple phonologies. We are not talking about chunk-specific phonologies, which apply only to a certain size of pieces and are a separate issue. The literature works with two well-identified chunk sizes for which specific computation has been proposed: word-level phonology (as opposed to smaller chunks) and sentence-level phonology (which assesses sequences of words, as opposed to sequences of morphemes). The former was introduced by SPE (in English for example, vowel reduction within a word is calculated with reference to main stress, which however is only determined after the last morpheme has been added), and is also provided for by Halle & Vergnaud (1987) (under the label of non-cyclic rules). The latter goes back to the Praguian distinction between word- and sentence-phonology, which has become a hallmark of Lexical Phonology (as far as I can see, the idea was introduced by Rubach 1981) where the set of lexical rules is distinct from the set of postlexical rules. Halle & Vergnaud (1987) reject this distinction.

<sup>7</sup> A formal property of Kaye's system that cannot be addressed in this article is the ability of terminal elements to be spelled out in isolation. This contrasts with regular spell-out procedures (and with Halle & Vergnaud), which can only spell out nodes. Hence [[prefix] [root]] is a possible (actually: a necessary) structure in Kaye's system, which requires the prefix to be interpreted prior to its being merged. This is known as counter-cyclic merger (or late adjunction) in syntax (e.g. Stepanov 2001), a non-standard mechanism. Interestingly, though, a property of counter-cyclic merger in syntax is precisely that the item at hand is spelled out before being merged – exactly what Kaye's system requires. This parallel is further discussed in Newell & Scheer (2007) and Scheer (forth).

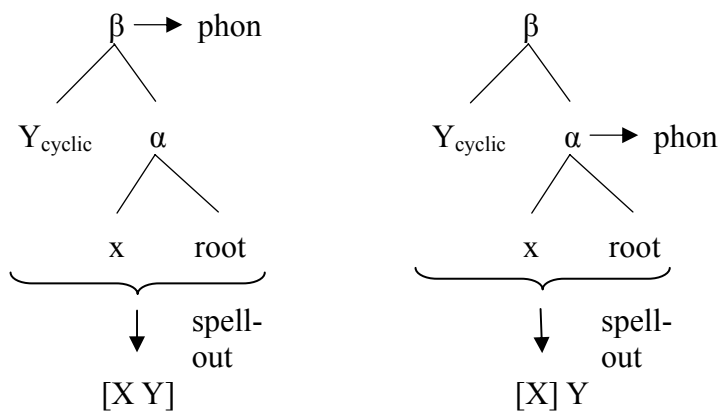
(4) differences between Halle & Vergnaud (1987) and Kaye (1995)

	Halle & Vergnaud	Kaye
a. the root is an interpretational unit	yes	no
b. the word is an interpretational unit	no	yes
c. interpretation-triggering affixes trigger the spell-out of	their own node	their sister
d. type of English affix-classes that triggers interpretation	class 1	class 2
e. underapplication is achieved by	cycles	cycles and no look-back

Unlike with Halle & Vergnaud, the root is not an interpretational unit (i.e. a cycle) per se in Kaye's system. By contrast, the word is always an interpretational unit (while it is not with Halle & Vergnaud: /[[parent] hood/). A third contrast is that with Kaye class 2 affixes are interpretation-triggering, whereas this privilege was granted to class 1 affixes by Halle & Vergnaud. Finally, another important difference is that with Kaye the sister of the interpretation-triggering affix, rather than the node that dominates the affix itself, is spelled out.<sup>8</sup> Table (5) below depicts this difference.

(5) interpretation-triggering affixes: what exactly is spelled out

- a. Halle & Vergnaud (1987): cyclic affixes trigger the spell-out of their own constituent  $\beta$
- b. Kaye (1995): cyclic affixes trigger the spell-out of their sister  $\alpha$



Given an interpretation-triggering (i.e. cyclic) affix  $Y$  and a root, two significantly distinct results are produced: /[[root]  $Y$ ]/ vs. /[[root]  $Y$ ]/. Note that this is only the isolated result of the action of the affix, which needs to be supplemented with the computation-independent provisos (4a,b): the root is always a cycle with Halle & Vergnaud, the word is always an interpretational unit in Kaye's system. This leaves us with identical structures: /[[root]  $Y$ ]/ is produced on both sides.

It is not true, however, that the two different spell-out strategies return identical results. This is shown under (6) below where interpretation-neutral affixes are included.

<sup>8</sup> It will be mentioned in the conclusion that this is relevant when comparing the phonological mechanism with syntactic phase theory: spelling out the sister is the phonological version of Chomsky's phase edge.



(6) given that

X = interpretation-neutral affix    Y = interpretation-triggering affix

	Halle & Vergnaud	Kaye
a. root-X	[root] X	[root X]
b. root-Y	[[root] Y]	[[root] Y]

The contrast between Halle & Vergnaud and Kaye thus concerns strings that bear an interpretation-neutral affix, and it is the result of the combined choices under (4a-c). These choices are hard-wired in the two systems, i.e. independent of the situation in particular languages. That is, the analyst must still identify which are the interpretation-triggering and which are the interpretation-neutral affixes in the particular language under study – theory will not help. The English situation is discussed in the following section.

### 3.3 Modification-inhibiting ("freezing") no look-back and the English situation

It was already mentioned that Halle & Vergnaud and Kaye have made opposite choices for English: while class 1, but not class 2 affixes trigger interpretation for the former, the reverse distribution is assumed by the latter. Table (7) below shows the configurations that are produced. It also mentions a set of data that was not considered thus far, i.e. processes that require the underapplication to class 1 strings (rather than to class 2 strings). In Lexical Phonology, this type of process is called a level 2 rule (against stress assignment, which is a level 1 rule).

(7) English affix classes: comparison

		monomorphemic situation	root + class 1 affix	root + class 2 affix
a. level 1 rule	H&V	[parent]	[[parent] al]	[parent] hood
	Kaye	[parent]	[parent al]	[[parent] hood]
b. level 2 rule	H&V	[sign]	[[sign] ature]	[sign] ing
	Kaye	[sign]	[sign ature]	[[sign] ing]

As may be seen, the additional factor regarding the (opposite) choice of interpretation-triggering affix classes produces structures on both sides that are systematically distinct.

Let us now look at how Kaye's system actually works. It was mentioned in (4e) that Kaye uses a specific no look-back device in addition to selective spell-out (while Halle & Vergnaud do not). Kaye's basic line of attack is to follow the observation that morpho-syntactic boundaries may or may not be visible for phonological processes. We know that they are if a morphologically complex string shows a different behaviour with respect to a monomorphemic item. This is the case of *párent-hood*<sub>2</sub>, which deviates from the monomorphemic penultimate pattern (*párent*). By contrast, penultimate *parént-al*<sub>1</sub> is indistinguishable from monomorphemic *párent*. The opacity (underapplication) of a process is thus indicative of the process being "disturbed" by a morphological boundary. By contrast, phonological transparency witnesses that the boundary is invisible in phonology. Hence [parent al] vs. [[parent] hood].

Stress assignment, then, is straightforward for [parent] and [parent al]: in both cases, the penultimate vowel is made tonic. The no look-back device only enters the scene when embedded domains need to be computed in [[parent] hood]. Cycles are processed from inside out. The inner cycle thus receives regular penultimate stress on this pass: [párent]. On the outer cycle, the penultimate stress rule must be prevented from reapplying – otherwise \*[parént hood] is produced. In Kaye's system, this is assured by the proviso that strings which

have already been subject to interpretation cannot be modified by further computation on later cycles. That is, the previously assigned main stress of the first vowel of [párent] is "frozen" on the outer cycle. Syntacticians will have recognized Chomsky's Phase Impenetrability (on which more shortly).

### 3.4 English processes that require underapplication to class 1 strings (level 2 rules)

Let us now turn to the other type of affix class-sensitive processes in English, which are known as level 2 rules from Lexical Phonology. Abstracting away from theory-specific vocabulary that muddies waters, the empirical fact is that English features affix class-based phenomena of two types: one that requires underapplication to class 2 strings (i.e. [root + class 2]: *párent-hood*<sub>2</sub>, level 1 rules in LP), another where the process underapplies to class 1 strings (i.e. [root + class 1], *si[g]n-ature*<sub>1</sub>, level 2 rules in LP).

The latter is represented by a process that simplifies root-final clusters which involve a nasal. The phenomenon is well-known and amply discussed in the literature (e.g. Mohanan 1986). It comes in several brands: /gN/ → [N] (*sign*, *sign-ing*<sub>2</sub> vs. *si[g]n-ature*<sub>1</sub>), /mn/ → [m] (*dam*, *dam-ing*<sub>2</sub> vs. *dam[n]-ation*<sub>1</sub>), /mb/, /ŋg/ → [m], [ŋ] (*sing*, *sing-ing*<sub>2</sub> vs. *lon[g]-er*<sub>1</sub> (comparative of *long*), *bomb*, *bomb-ing*<sub>2</sub> vs. *bom[b]-ard*<sub>1</sub>).<sup>9</sup>

Chomsky & Halle (1968:85) have observed that "the inflectional affixes which are neutral with respect to stress also characteristically affect final clusters in the same way as word boundary does". That is, clusters before class 2 affixes systematically behave as if they were word-final. That being final is a necessary condition for the application of the process is also shown by the fact that the clusters in question survive morpheme-internally: *i[g]nore*, *am[n]esia*, *fin[g]er*, *Ham[b]urg*.<sup>10</sup>

It is this additional condition on finality that makes the difference between processes that require underapplication to class 1 strings and those that underapply to class 2 strings. In any event, it may be seen under (7) that Kaye's (as much as Halle & Vergnaud's) system attributes identical cyclic patterns to all strings that have the same affix class-structure. Did the process itself not introduce an additional condition, Kaye's system would be unable to distinguish the two patterns.

Given the final condition, then, nasal clusters simplify under Kaye's analysis iff they are string-final upon phonological computation. "Upon phonological computation" is an explicit formulation of "cycle-final" (or phase-final in modern terms, domain-final in Kaye's terminology). Given this process, the cluster in [sign] and [[sign] ing] is simplified since at some point in the derivation it is string-final when phonological interpretation occurs. By contrast, the cluster in [sign ature] is never string-final when computation applies and therefore survives (the same goes for [ignore]).

We are now in a position to compare the empirical coverage of Halle & Vergnaud's and Kaye's implementation of selective spell-out – at least regarding the English pattern. As a matter of fact, Halle & Vergnaud's system coupled with the language-specific choice that class 1, rather than class 2 affixes are interpretation-triggering, is unable to account for processes that require underapplication to class 1 strings (i.e. level 2 rules, nasal cluster simplification). Given the cyclic structures /[[sign] ing<sub>2</sub>]/ and /[[sign] ature<sub>1</sub>]/ (see (7)) it is impossible to formulate a rule that simplifies the cluster in the two former, but not in the

<sup>9</sup> The latter process, postnasal plosive deletion, suffers from a number of exceptions (Bermúdez-Otero 2008) and is therefore not the best witness of the pattern.

<sup>10</sup> Note that this fact has got nothing to do with derived environments: *sign* is just as underived as *i[g]nore*, but eliminates the cluster. What decides whether the cluster simplifies or not is its being root-final (in addition of the affix class-conditioning of course).

latter case. This is because of Halle & Vergnaud's specific choice according to which the root is always an interpretational unit (see (4a)): if cluster simplification applies to [sign] (i.e. *sign*), it will also apply to /[sign] ing<sub>2</sub>/ (which is fine), and to /[[sign] ature<sub>1</sub>]/ (which is counterfactual).

The literature that has worked out Halle & Vergnaud's system (see note 4) tacitly confesses that LP's level 2 rules cannot be covered: while it is explained at length how level 1 rules are analyzed, as far as I can see there is no mention of the level 2 pattern at all.<sup>11</sup>

#### 4. A short history of no look-back devices since Chomsky (1973)

We have seen that modification-inhibiting ("freezing") no look-back is a critical ingredient of Kaye's system. This section shows that Kaye's version of no look-back is unlike all others that have been proposed since Chomsky (1973), and that Chomsky's modern Phase Impenetrability has actually been invented by Kaye (1992,1995).

There is quite some confusion in the literature when it comes to the discussion of no look-back devices. The most deeply rooted misconception is due to Kiparsky (1982a,b), who has scrambled derived environment effects with Chomsky's original requirement to use newly introduced material – while presenting his significantly modified package as a *version* of Chomsky's Strict Cyclicity.

The ancestor of all no look-back devices is Chomsky's (1973) Strict Cycle Condition, which prevents rules from applying if they do not use material that has been introduced on the current cycle. The original formulation appears under (8) below.

##### (8) Strict Cycle Condition (SCC)

"No rule can apply to a domain dominated by a cyclic node A in such a way as to affect solely a proper subdomain of A dominated by a node B which is also a cyclic node."  
Chomsky (1973:243)

The effect is that rules are blocked whose structural description is met by a string which is made exclusively of material that belongs to previous cycles. That is, given  $[[AB]_i C]_j$ , a rule that is triggered by AB can apply at cycle i, but not at cycle j. Or, in other words, multiple application of rules is prohibited.

Kean (1974) and Mascaró (1976) have applied Chomsky's SCC to phonology. Mascaró's (1976:7) formulation talks about the "proper" application of a rule, which means that "improper" applications are blocked: "for a cyclic rule to apply properly in any given cycle j, it must make specific use of information proper to (i.e. introduced by virtue of) cycle j."

A derived environment effect is a phenomenon whereby a rule only applies to morphologically complex strings.<sup>12</sup> Paul Kiparsky has been on the track of this pattern since

<sup>11</sup> Another empirical issue are so-called bracketing paradoxes, i.e. cases where – contrary to the affix ordering generalization (Siegel 1974) that was a headstone of Lexical Phonology – class 2 affixes occur closer to the root than class 1 affixes. Examples are *govern-ment<sub>2</sub>-al<sub>1</sub>*, *organ-ize<sub>2</sub>-ation<sub>1</sub>* and the celebrated *un<sub>2</sub>-grammatic-al<sub>1</sub>-ity<sub>1</sub>* (which must be  $[[un_2 [grammatical_1]] ity_1]$ ) (see Aronoff & Sridhar 1983,1987). The bankruptcy of affix ordering is an argument that Halle & Kenstowicz (1991:459) and Halle et al. (1991:142) make in order to dismiss the stratal architecture of Lexical Phonology. Unlike the stratal system, bracketing paradoxes are not an obstacle for their model. Discussion regarding the reaction of Kaye's system cannot be provided in the frame of this article. The issue is considered at greater length in Scheer (forth).

<sup>12</sup> Or to monomorphemic strings which however are the result of the application of a previous rule (phonologically derived environments).

Kiparsky (1968-1973). It is for sure that Chomsky's (and Kean's and Mascaró's) condition on the applicability of rules is entirely irrelevant for derived environment effects: it will not prevent rules from applying to monomorphemic strings since these have necessarily been introduced on the latest (the only) cycle. Thus Trisyllabic Shortening (*s[ej]ne* - *s[æ]n-ity*), a famous example, will happily apply to *n[aj]tingale* and *[aj]vory* under Chomsky's SCC.

Nonetheless, Kiparsky (1982a,b) introduces his version of the SCC as if it were just a restatement of Mascaró's.

"With some simplification, his [Mascaró's] proposal was:

(47) Strict Cycle Condition (SSC):

- a. Cyclic rules apply only to derived representations.
- b. Def.: A representation  $\phi$  is derived w.r.t. rule R in cycle j iff  $\phi$  meets the structural analysis of R by virtue of a combination of morphemes introduced in cycle j or the application of a phonological rule in cycle j."

Kiparsky (1982b:153f)

Derived environments have thus appeared over night in what Kiparsky sells as Mascaró's slightly "simplified" Strict Cycle Condition. Also, the notion of phonologically derived environment has joined in where Chomsky and Mascaró were only talking about morphological conditions.

Kiparsky's attempt to kill two birds ("use new material!" and derived environment effects) with one stone (his scrambled SCC<sup>13</sup>) was considered an important achievement in the 80s, but has turned out to lead into a dead end: ten years later, Kiparsky (1993) himself declares the bankruptcy of his version of the SCC.<sup>14</sup>

Another (anecdotal) aspect of this dossier is that the combination of Chomsky's SCC with derived environment effects was actually not done by Kiparsky (1982a,b), which is always given credit in the literature, but by Halle (1978) in an article that nobody quotes.<sup>15</sup> Unlike Kiparsky, Halle (1978:131) is explicit on the fact that "the version of the constraint on cyclic rule application that I propose below is a combination of certain suggestions made by Kiparsky (1973:60), with others due to Mascaró (1976:9)." His formulation is as under (9) below.

(9) "A cyclic rule R applies properly on cycle j only if either a) or b) is satisfied:

- a) R makes specific use of information, part of which is available on a prior pass through the cyclic rules, and part of which becomes first available on cycle j. [...]
- b) R makes specific use of information assigned on cycle j by a rule applying before R."

Halle (1978:131)

<sup>13</sup> Cole (1995:72) is also explicit on the fact that what Kiparsky's SCC actually does is to combine two very different patterns.

<sup>14</sup> From a post-hoc perspective, Bermúdez-Otero's (forth) interpretation is that all the adornment that the practitioners of the 80s were inveigled to add to the basic stratal idea – namely Kiparsky's SCC (together with structure preservation and brackets) – lured Lexical Phonology on to decline. Stratal OT is now about to reinitialize the motion on the grounds of the original setup, which is freed from the disastrous patches of the 80s.

<sup>15</sup> I am aware of two exceptions: Rubach (1981:18ff) and Szpyra (1989:17). Halle (1978) is absent from Kiparsky (1982b); it is mentioned in the reference section of Kiparsky (1982a), but does not appear in the text (or the notes) of this article.

Halle's version of the SCC does exactly the same labour as Kiparsky's. The critical modification with respect to Chomsky's SCC is that instead of imposing only new material to be used by rules, Halle requires that new *and* old material be accessed.

The historical survey of the question notwithstanding, the goal of this section is not historiographic; rather, what I intend to show is that (the significant confusion regarding the various versions of the SCC laid aside) Kaye's no look-back device is unlike all others that have been proposed since Chomsky (1973). What Kaye introduces is the idea that previously interpreted strings cannot be modified by computation on subsequent cycles: modification-inhibiting no look-back.<sup>16</sup>

Chomsky's (2000,2001 et passim) Phase Impenetrability does exactly the same thing: previously interpreted phases are "frozen in place" (Chomsky 2001:6). It was mentioned in section 1 that Chomsky's PIC is the instrument which frees active memory from the unnecessary burden of old strings. This extra-linguistic motivation is reflected in the quote below, which is also explicit on the fact that the economy effect is supposed to apply to phonological as much as to syntactic memory.

(10) "The whole phase is 'handed over' to the phonological component. The deleted features then disappear from the narrow syntax. [...Uninterpretable features] have been assigned values (checked); these are removed from the narrow syntax as the syntactic object is transferred to the phonology. The valued uninterpretable features can be detected with only limited inspection of the derivation if earlier stages of the cycle can be 'forgotten' – in phase terms, if earlier phases need not be inspected. The computational burden is further reduced if the phonological component too can 'forget' earlier stages of derivation. These results follow from the Phase-Impenetrability Condition (PIC) (MI [Minimalist Inquiries, i.e. Chomsky 2000], (21)), for strong phase HP with head H,

(7) The domain of H is not accessible to operations outside HP; only H and its edge are accessible to such operations."  
Chomsky (2001:12f)

The current syntactic literature on phase theory in general and Chomsky (2000,2001 et passim) himself in particular are not very historically oriented. Of course there is nothing

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<sup>16</sup> Due to space restrictions, two issues need to be rejected into this footnote. For one thing, Kaye (1992:142, 1995:307) makes explicit reference to Chomsky (1973), Kean (1974) and Mascaró (1976) when he introduces his no look-back mechanism, which is supposed to do the same job. His actual practice, however, is different: Kaye applies modification-inhibiting no look-back, which has got nothing to do with Chomsky's SCC: "when phonology is done on the external domain, an empty onset is available for the *n*. However, the principle of *strict cyclicity* states that the association created in the inner domain cannot be undone in an external domain. The association remains and the *n* also links to the available onset" Kaye (1995:307, emphasis in original). Like other voices around the SCC, Kaye was thus confused, and "freezing" no look-back was introduced incognito, as it were.

The other thing that needs to be mentioned for the sake of completeness is a no look-back device which has not been discussed in the main text because it does not interfere with the SCC. In order to account for level 2 rules (underapplication to class 1 strings), Lexical Phonology uses brackets and bracket erasure, which are due to Mohanan (1982,1986). On this count, all morphemes are enclosed by brackets upon concatenation, and rules can make reference to these brackets, which are however erased at the end of each stratum. Hence *si[g]n-ature*<sub>1</sub> is [[sign][ature]<sub>1</sub>] at stratum 1, but enters stratum 2 as [sign ature] after bracket erasure. G-deletion then is a level 2 rule and sensitive to brackets (*g* → ∅ / \_\_n); it therefore does not apply to [sign ature] (but simplifies the cluster of [[sign][ing]<sub>2</sub>], which has "fresh" brackets).

wrong with that – it is strange to see, though, that Chomsky makes no reference at all to previous no look-back devices that the generative literature has produced, and actually not even to his own 1973 paper where the idea was launched. That the syntactic literature does not mention the fact that modification-inhibiting no look-back was introduced by Kaye (1992,1995) is less surprising: Kaye's work is in phonology, and on top of that does not belong to the phonological mainstream.

## 5. Conclusion

Given the preceding, the argument now is quite simple: if current phase theory is on the right track, "freezing" (i.e. modification-inhibiting) no look-back must also be in place in phonology – exactly what Kaye (1992,1995) proposes. This is an intermodular argument: the PIC exists for extra-linguistic and syntax-internal reasons, but the new interactionist architecture of grammar makes a prediction to the end that it restricts phonological as much as syntactic computation. Otherwise the global architecture is inconsistent.

The necessary presence of the PIC in phonology, then, discriminates between competing theories of PF which are based on phonology-internal evidence only. This has a direct impact in the area of affix class-based phenomena, for which two families of competing analyses exist: on the one hand, those that are based on morpheme-specific computational systems (Lexical Phonology and its serial or parallel offspring in present-day OT); on the other hand, those that rely on selective spell-out and have strings of whatever morphological composition assessed by the same computational system at PF. Among the latter, Kaye's system uses the PIC, while Halle & Vergnaud's does not (nor does it use any other no look-back device for the analysis of affix class-based phenomena). Kaye's approach is thus selected: it is the only one that implements the syntactically warranted PIC.

Now it could be argued that this does not disqualify the other theories: the intermodular argument only requires that the PIC be active somewhere in phonology – not specifically in the analysis of affix classes. That is, approaches that are based on morpheme-specific phonologies could still be correct: the PIC restricts phonological computation, but happens not to be responsible for affix class-based phenomena. This argument, however, is flawed: the simultaneous presence of morpheme-specific phonologies and the PIC is not an option because both devices do the same job. It was shown that underapplication is achieved by morpheme-specific phonologies on the one hand, and by the combined action of selective spell-out and the PIC on the other. No theory can thus afford to accommodate both devices – that would be redundant. Either morpheme-specific phonologies or selective spell-out and the PIC are correct. Syntactic phase theory then referees: the former has to go.

A last word on Kaye's visionary skills. It was mentioned under (4c) that what the merger of an interpretation-triggering affix actually triggers is the spell-out of its sister, rather than of its own node. This is exactly what is called the phase edge in current syntactic theory: given a phase head XP, spell-out of XP only triggers the interpretation of the complement; the head and Spec, XP (the edge of the phase) are spelled out only at the next higher phase (see the quote under (10), also Chomsky 2000:108; this parallel is discussed at length in Scheer in press b) . The same trans-modular logic holds as before: since the definition of interpretational units is done only once upon spell-out of morpho-syntactic structure, syntax is as much engaged as phonology. A situation where phonological and syntactic evidence requires the definition of different interpretational chunks would call the entire architecture into question. Rather, it is expected that phonology and syntax single out the same interpretational units and require the same spell-out mechanism. This is what Kaye's system offers with respect to current syntactic phase theory.

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