

## **Nested Phase Interpretation and the PIC\***

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### **2.1 Against the PIC**

The theory of phases (from Chomsky 2001 onward), along with the long history in the literature supporting the cyclic derivational properties of language (ex. bracket erasure (Chomsky & Halle 1968), and ‘frozen’ lexical compounds (Uriagereka 1999)), includes the argument that some operation, which may be a limitation on language processing, provokes a derivational ‘flattening’.<sup>1</sup> Here ‘flattening’ entails that the internal hierarchical structure of syntactic objects that have undergone interpretation, or spell-out (at PF or LF) becomes unavailable; these structures behave as though they are monomorphemic, or ‘flat’. This flattening has implications for a cyclic theory of derivation, both in the syntax proper, and on its interpretive branches. On the phonological side, this involves the entailment that morpho-phonological operations should not have access to the morpho-syntactic features of linguistic objects that have undergone spell-out at a previous cycle (see Embick 2014). Going even further, Chomsky proposes that “[the phonological component] is greatly simplified if it can ‘forget about’ what has been transferred to it at earlier phases; otherwise, the advantages of cyclic

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<sup>1</sup> See Boeckx & Grohmann (2004) for a historical overview of theories of syntactic cyclic derivation.

computation are lost” (2004: 107). On the semantic side, it is unclear whether this type of ‘forgetting’ is active, as operations such as the interpretation of chains, pronominal binding, and NPI licensing, among others, must be able to operate across phases.<sup>2</sup> In this chapter I touch upon the semantic interpretive branch but briefly.

The Phase Impenetrability Condition (PIC) codifies the idea that, after undergoing the operation spell-out, the complements of phase heads become inaccessible to further operations. The domain of spell-out as put forth by Chomsky (2001) is as follows.<sup>3</sup>

- (1) The domain of H is not accessible to operations at ZP (the next strong phase); only H and its edge are accessible to such operations.

Notably, the argument for computational simplification through phase-based spell-out falls through if syntactic or phonological operations are shown to apply within the inaccessible domain in (1). Below I offer evidence that there is no PIC as such in either the Syntax or the Phonology. Phonological, Morphological, and Syntactic evidence is brought to bear on the argument that the structure built in both the syntactic and phonological modules is never ‘flattened’. Most of this evidence comes from word-internal operations.<sup>4</sup> Evidence from derivations including head movement, morphological

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<sup>2</sup> Thank you to Susi Wurmbrand for her comments to this effect at the Eastern Generative Grammar summer school, 2015.

<sup>3</sup> The exact domain of the PIC is still being debated in the literature.

<sup>4</sup> This work assumes a realizational approach to word formation, namely Distributed Morphology (Halle & Marantz 1994). Syntactic operations affect elements that, upon interpretation at the interfaces, may be smaller or larger than a phonological word.

late-adjunction and infixation are brought to bear, arguing both that word-internal derivations are subject to cyclic interpretation, and that they offer important evidence against the PIC. I present evidence below that;

- (2) a. The narrow syntax has access to the internal syntactic structure of phases that have undergone spell-out.
- b. The phonology has access to the phonological structure of phases that have undergone spell-out.
- c. Mismatches between Syntactic and Phonological phases may be due to post-spell-out alterations in either module.

While I argue against the PIC here, I also discuss how and why the phonology and syntax nonetheless appear to adhere to it. Importantly, a modular view of linguistic computation is assumed here, where the narrow syntactic and phonological components of the grammar work on different vocabularies and processes (e.g. phi features, merge vs. voicing, syllable structure) (Bobaljik 2000; Scheer 2012 and previous work). It is therefore argued here that the converging evidence for phase impenetrability is epiphenomenal and must be due to separate syntactic and phonological responses to cyclic derivation.

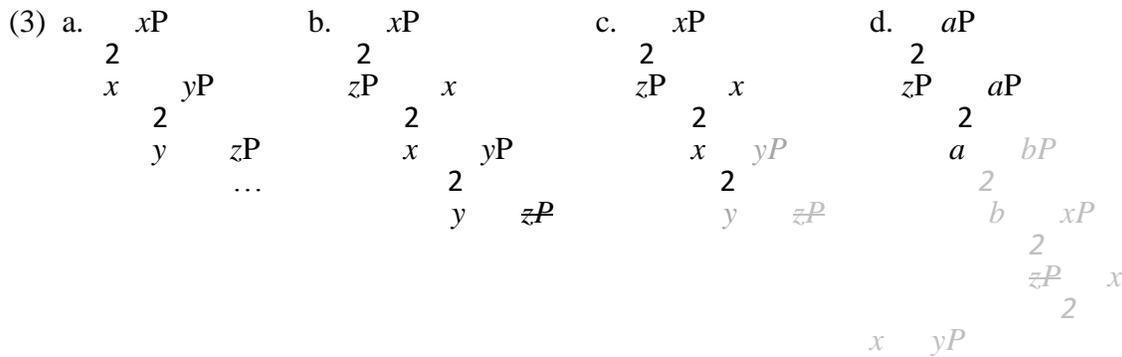
### **2.1.1 Phase Domains**

Variations on the mechanics of phase interpretation are abundant in the literature. Bobaljik & Wurmbrand (2013) propose that uninterpretable features in the syntax, and allomorphy at PF, may delay phase interpretation. Embick (2010) countenances an expansion of the spell-out domain for only the first phase interpreted in each derivation, regardless of the syntactic or morphophonological features involved. Svenonius (2004), and Skinner (2009), have argued that phase interpretation is not triggered by a phase head, but is delayed until an element is external-merged to the phase head's projection. Johnson's (2003) 'numerphology' argues for the separate interpretation of moved elements before remerger. Grohmann (2000, 2003) breaks the trunk of the tree into 'prolific domains' ( $\Omega$ -domain (CP),  $\Phi$ -domain (IP),  $\Theta$ -domain (VP)), and each of these can be equated with a phase. Uriagereka (1999) proposes that the trunk of the tree and each of its branches (each specifier and adjunct) is a phase. Many people working in the domain of word-level phases, those triggered by the merger of category-defining heads, have at some point argued for the spell-out of the phase head with its complement (e.g. Piggott and Newell 2014; Dobler et al. 2011; Newell 2008; Arad 2003; Marvin 2002; Marantz 2000; etc.) which goes counter the original proposal that it is the complement of a phase head that is interpreted at each phase (Chomsky 2000; Nissenbaum 2000).

All this variation, and the evidence provided in the vast literature on phases, makes determining the exact size of the inaccessible domain difficult to definitively pinpoint. This does not, however, make it impossible find evidence determining whether the proposed interpreted domains are indeed opaque.

Consider the derivation in (3). In (3a) all of the elements in a numeration combine by iterations of Merge to create the SO  $xP$ , where  $x$  is a phase head. Upon the merger of

$x$ , any elements within  $xP$  that must escape interpretation do so by satisfying the EPP feature on  $x$  and moving to its specifier(s) as in (3b)<sup>5</sup>. In (3c) the elements in grey, in the complement of  $x$ , undergo spell-out at Phonological Form (PF) and Logical Form (LF). This greyed domain is therefore proposed to be ‘inaccessible to operations outside  $x$ ’. According to the PIC, the domain of  $yP$  is therefore a ‘flattened’ opaque SO; a single indivisible node from this point on in the derivation. Upon merger of the next numeration nothing may be targeted (for Move, Agree) but the edge of  $x$  (3d), or  $yP$  as an indivisible unit. Spell out of  $aP$  in (3d), after the movement of  $zP$  once more, includes all elements in the complement of  $a$  (a phase head). The phonological output in (4) ideally mirrors the phases in (3), where elements in the outer brackets cannot affect or be affected by elements in the inner brackets.



(4)  $[b \ x \ [y]]^6$

<sup>5</sup> Note that Bošković (2007), among others, has argued for the EPP as an epiphenomenon. I will return to this below.

<sup>6</sup> Whether head movement (or post-syntactic Morphological Merger) is a necessary precursor to a string of morphemes being pronounced as a word is abstracted away from here. Most of the papers in this volume grapple with this problem.

An issue here is that it is not universally the case that the phonological output mirrors the syntactic derivation in this way. Chomsky proposes that this is due to the primacy of C-I over S-M conditions (2008), but recent literature, including but certainly not limited to Bošković (2007, 2014); Newell (2008); Bobaljik and Wurmbrand (2005); and Stepanov (2001), has argued that it is also the case that the PIC appears to not hold absolutely in the syntax proper, making it unclear whether any mismatch is due to phonological or syntactic factors. It is beyond the scope of this paper to review all of the arguments for and against the PIC, and therefore I will stick to a subset of examples that are relevant to the matter at hand. That matter is to argue for the epiphenomenality of the PIC, arguing that its effects, notably in the phonology, are independently motivated. The basic size of phonological domains are determined by syntactic phases, but the apparent opacity of phonological domains is caused by different principles than is the apparent opacity of syntactic domains. Phonological opacity must be caused by phenomena internal to the phonological module, while syntactic opacity must be due to restrictions on syntactic operations.

### **2.1.2 PIC evidence**

Phases, and hence the PIC, are primarily motivated in the syntactic literature by evidence that successive-cyclic movement exists and targets the edges of certain phrases. In fact, there is much more evidence for phases themselves than for the PIC. For example, the intermediate landing site in (5) allows for the attested binding relations.

(5) [CP[Which of the papers that he<sub>1</sub> gave Miss Brown<sub>2</sub>] did every student<sub>1</sub> [<sub>vP</sub> \_\_\_\_ask  
her<sub>2</sub> to read \_\_\_\_carefully?]]

(Fox 2000)

The WH-object must move through the intermediate landing site (Spec,<sub>vP</sub>), escaping interpretation in its initial-merger position. If the object were to be interpreted pre-movement, the R-expression ‘Miss Brown’ would not be free, disallowing the bound interpretation in (5). Movement to this intermediate position must occur, however, in order to allow for the bound reading of the pronoun ‘he’. It is argued that successive-cyclic movement is motivated by the need to avoid a PIC violation. As spell-out must occur at the <sub>vP</sub> phase, were the WH-object to not move, the PIC would cause the derivation to crash. Crucially, this type of argument rests on the proposal that this intermediate movement is not independently motivated.

If the movement to Spec,<sub>vP</sub> can be motivated featurally, however, intermediate landing sites become a much weaker argument for the PIC. Van Urk and Richards (2015) argue that, in Dinka (Nilotic), movement to the edge of <sub>vP</sub> and CP is both mandatory and featurally conditioned (by Case). Below we can see that positions of successive-cyclic movement must remain empty due to the movement of the WH-word through them. This can be compared to declarative sentences, where these phase-edge positions must be overtly filled. If the WH-element being moved is plural, each intermediate <sub>vP</sub> (case-checking) position is marked as plural, offering further evidence that intermediate landing sites target phase edges in the language, and that feature-checking occurs in these

positions. Movement in Dinka is therefore arguably not the reflex of the often-appealed-to yet dubiously-motivated EPP feature.

- (6) Yeyíŋà      yé      [vP \_\_\_\_ké      tâak, [ CP \_\_\_\_ cíi      Bôl      [vP \_\_\_\_ ké  
 Who.PL      HAB.2SG      PL      think      PRF.NS Bol.GEN      PL  
 see  
 tíŋ]?  
 'Who all do you think Bol saw?'

(van Urk & Richards 2015)

If all movement is featurally-motivated, and the only elements left behind in the domain of spell-out are those that have not been attracted, then the PIC becomes a much more difficult concept to motivate. The rest of this chapter aims to support the argument that all apparent PIC effects are likewise independently motivated.

## 2.2 Evidence Against the PIC

It is not within the scope of this paper to offer reanalyses for all derivations that appeal to the PIC. The following sections aim to demonstrate that the PIC does not hold universally, and therefore cannot hold as formulated in (1). I discuss three arguments in the literature that offer evidence against the flattening of syntactic structure after phase-interpretation; late adjunction, the distinct locality domains for Agree and Move, and late

head-movement. This in turn sets up the discussion in the following sections of the implications of a PIC free system for the PF interpretive branch.

### 2.2.1 Late Adjunction

Many researchers (e.g. Lebeaux 1988; Bobaljik 1994; Torrego 1996; Ochi 1999; Stepanov 2001; Nissenbaum 2000; Newell 2005, 2008) have proposed that the operation of late-adjunction (acyclic merger) is possible and/or necessary. If this acyclic merger can target a domain that has already undergone interpretation, this would be a violation of the PIC. We find an argument for this type of derivation in the following example.

- (7) a. John Infl [VP leave] (cf. John left)  
b. John Infl not [VP leave] (cf. John did not leave)  
c. John Infl quickly [VP leave] (cf. John quickly left)

(Stepanov 2001)

(7) demonstrates that, as noted in Bobaljik (1994), there is a PF adjacency requirement between Infl and the verb. This adjacency is blocked by negation, but not by adverbial adjuncts. Neg must merge cyclically, as it projects syntactic features (projecting a NegP or Polarity Phrase). The adverbial phrase, being non-projecting, is a prime candidate for a-cyclic merger. If we accept that adverbial adjuncts are merged acyclically to *vP*, we

have evidence that this acyclic merger has recourse to the interior of an SO that has already undergone interpretation.<sup>7</sup> The derivation is as follows;

(8) 1) Create: [<sub>vP</sub> John [<sub>v</sub>leave]]

PF interpretation of the complement of  $v^0$  is vacuous

2) Attract *John*: [<sub>CP</sub>[<sub>TP</sub> John [<sub>T</sub> [PAST] [<sub>vP</sub> John [<sub>vP</sub> [<sub>v</sub>leave]]]]]

The complement of CP undergoes interpretation. PF adjacency of T and  $v$  is met.

3) Merge *quickly*: [<sub>CP</sub>[<sub>TP</sub> John [ <sub>T</sub> [PAST] [<sub>vP</sub> [<sub>aP</sub> quickly][<sub>vP</sub> John [<sub>vP</sub> [<sub>v</sub>leave]]]]]]]

PF interpretation of TP must re-occur to effect the linearization of *aP* and  $v$ .

If lowering of Tense onto the verb occurs at spell-out, and merger of *aP* is effected in the narrow-syntax, then (8) is licit only if the adverb is merged to  $vP$  after PF interpretation of TP. As such, the syntactic structure of TP must not have been flattened at spell-out. An SO can have access to the interior of TP in this derivation iff the PIC does not hold.

### 2.2.2 Agree and Move

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<sup>7</sup> Embick and Noyer's (2001) Lowering account of English tense avoids the issue of whether the adverb is late adjoined. But, it is argued in Skinner (2009) that Lowering cannot be the correct explanation for English tense. Rather, Tense hopping in English is Local Dislocation. Under the latter account, Late Adjunction must be assumed.

Bošković (2007) argues that, from a purely syntactic viewpoint, the PIC is not a true restriction on the derivation. He argues that having all elements with uninterpretable features move to the phase-edge before spell-out derives apparent PIC-effects. This movement is proposed to stem from elements with uninterpretable features needing to c-command the element that values said features (9). They will therefore always move to a position with wide-scope as a default. Like mentioned above, if all movement to a phase edge is independently-motivated, this movement is not evidence for an independent condition such as the PIC (or for a ‘movement feature’ like the EPP). This supports the position that phase domains appear to be opaque only because the elements that undergo spell-out are those that have no features left to check, and therefore have no motivation to move.

(9) Bošković’s Move vs. Agree

- a. Elements with an uF [uninterpretable feature] must function as probes. Probes must c-command their goals. Therefore elements with uFs that do not c-command their goal at Merge must move to check their features. If they are merged in a phase where their features cannot be checked, they will move to the edge of the phase to escape spell-out and increase their search space.
- b. Elements with interpretable features may be goals. These goals must be c-commanded by their probes. This c-command relation is not affected by phases.

(9a) applies to elements, like *what* in (10), generally thought of to have interpretable features in the system of Chomsky (2000).<sup>8</sup> Re-analyzing these elements as SOs with uFs (as probes) forces their movement, as they must escape being spelled-out with unvalued features.

(10) [CP What<sub>uF</sub> C<sub>iF</sub> did [IP John [vP what<sub>uF</sub> [vP John buy [vP what<sub>uF</sub> ] ] ] ] ]

In (10) it is the unvalued feature on ‘what’ that forces it to move to the edge of vP, and later to CP, so that it can c-command its goal; C. Its movement is therefore motivated independently, due to the requirements of feature-checking rather than the PIC.

(9b) is formulated to explain why Agree, but not Move, may occur across a phase edge.<sup>9</sup> Previously spelled-out items are available for syntactic operations such as Agree, which does not require movement. One piece of evidence that Agree is not subject to the PIC comes from Expletive constructions (under the assumption that passive and unaccusative vPs are phases; see Legate 2003) as in (11), and WH in-situ languages (12).

(11) [IP There<sub>i<sup>0</sup></sub> [vP seem to have [vP appeared two problems]]], (don’t there)?

(Bošković 2007:615)

(12) John-ga [CP Peter-ga *nani-o* kat-ta to]  
 John-NOM Peter-NOM what-ACC buy-PAST COMP

<sup>8</sup> These SOs would also have an unvalued feature in Chomsky (2001) whose sole purpose is to render the SO a target for EPP feature-checking.

<sup>9</sup> Bobaljik and Wurmbrand (2005) also show that the domains for agree and move are not isomorphic in German (among other languages). The major, and complicating, distinction between their conclusion and that presented by Bošković, is that the domain for Agree is smaller than that for Move.

omotteiru no?

think Q

‘What does John think that Peter bought?’ (ibid. 616)

In (11) there is agreement between the matrix  $I^0$  and the VP-internal object across a phase boundary, and in (12) the WH-in-situ *nani-o* licenses the Q features in the matrix CP across the subordinate CP phase boundary. If Agree is still operative in these derivations between elements in a matrix and subordinate clause then it must be concluded that SOs that have already undergone spell-out cannot have been flattened.<sup>10</sup>

In other words, as argued in the discussion on Late Adjunction, the transparency of phases for Agree argues that SOs which have undergone interpretation at PF (and LF) are still available for syntactic operations. The unavailability of XP movement after spell-out is, following Bošković (2007), due to syntactic requirements that are independent of the proposed restrictions on phase impenetrability.

### 2.2.3 Post-spell-out movement

Malagasy causative constructions also offer evidence against the PIC. The data in this section from Dobler et al (2011) (see also Piggott & Travis this volume) argue for head

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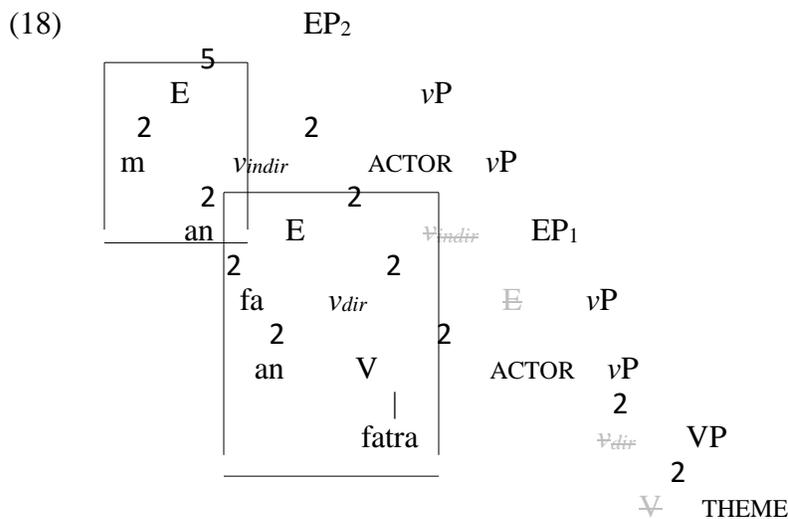
<sup>10</sup> Zeijlstra (2012) brings up some problems with Bošković’s proposal that need to be accounted for regarding WH-in-situ and Non-raising NOM DPs. Note that these problems are mechanical with regard to feature-valuation, and do not necessarily pose any problems for the conclusions made in Bošković regarding the PIC or EPP.







(see also Newell 2014, 2015, 2016). The phases assumed in (16) are depicted below in (18), where each EP is a phase (following Travis 2000). The morphemes in the lower EP<sub>1</sub>, although they move to the higher EP<sub>2</sub>, are interpreted before movement. Remember that Ojibwe gives evidence that head-movement can bleed PF interpretation (§4.1). The phonological output in Malagasy makes it obvious that this is not occurring here. Although all the heads in the verbal word move to EP<sub>2</sub>, /fa-an-fatra/ is interpreted within EP<sub>1</sub>. Coalescence across the phase boundary of the two phases is dispreferred as it would force a major alteration of the features of post-nasal consonants that have already undergone PF computation, a violation of (17).



(19) [ma<sup>m</sup>[pamaatra]<sub>Phase1</sub>]<sub>Phase2</sub>

The phonology therefore indicates that both the direct causative and the verb are spelled-out in EP<sub>1</sub>. If this is the case, the PIC predicts this portion of the SO to be inaccessible for movement. This is, as indicated by word-order in (13), not the case. We see there that the

verb in Malagasy causatives undergoes head movement to a position above the Agent. This data argues that in addition to Merge and Agree, Move can also violate the PIC.

### **2.3 Implications of the elimination of the PIC for the PF branch**

The above sections have demonstrated that syntactic domains are not rendered opaque by cyclic interpretation. The operations Merge, Agree, and Move may occur after spell-out. Let us turn now to the predictions this makes for interpretation at PF.

There seem to be two conflicting views in the syntactic literature as to what a mismatch between the syntax and the PF branch could mean with regard to phases/interpretation. The first view is that the PIC holds at PF, and therefore (possibly indirectly) affects the syntax. For example, along with his conclusion that the PIC and EPP (and the Activation Condition) are epiphenomena of the derivational system, Bošković (2007: 617) also comes to the following conclusion:

*'PIC effects are deduced: Y has to move to Spec,XP, XP a phase, in order not to get caught in a spell-out unit, which would lead to a PF violation. The freezing effect of phases, with the PIC as an escape hatch, follows. It is established via pronunciation (i.e., it holds for PF), but it has an effect on successive-cyclic movement; more precisely, it forces it to proceed via the Spec of phase heads. Stjepanović and Takahashi (2001), Fox and Pesetsky (2005), and I (Bošković 2003) all observe that given that the PIC effect is achieved via PF, it would be redundant to duplicate the phase/PIC effect in*

*the syntax, which would happen if we were also to assume, following Chomsky (2000), that only the edge of a phase is visible from outside the phase in the syntax (i.e., the PIC). We therefore argue that the PIC should be eliminated as a **syntactic** locality condition....' (bolding mine)*

The conclusion above is that the PIC applies only in the phonology, and that this phonological restriction can have an effect on the syntactic derivation.

This is at odds with the second view, exemplified by the quote from Chomsky (2008);

*“..we might discover that SMT is satisfied by phonological systems that violate otherwise valid principles of computational efficiency, while doing the best it can to satisfy the problem it faces: to map to the S-M interface syntactic objects generated by computations that are “well-designed” to satisfy C-I conditions.”*

Chomsky’s view takes the PIC to hold in the syntax, and that any mismatch between the syntax and PF (ex. a PIC violation or the appearance of phonological cycles that are not motivated syntactically) is a demonstration of how the PIC does not hold at PF.

What I argue here is that, although non-isomorphic mapping may occur, there is no PIC constraint at all in the grammar. Each module of the grammar must work with the SO it is provided with (or with its translation into phonological elements), and the

different vocabularies within each module of the grammar may cause divergences in apparent output domains.

We have seen above that there are empirical reasons to question that the PIC holds in the syntax. There are also empirical reasons not to place the application of a PIC at any point along the PF interpretive branch of the derivation. The morpho-phonology is argued in the following sections to have access to repair strategies that apply when a previously determined linearization is confounded by morpho-syntactic operations. This evidence argues against the proposal that linearization at PF is inalterable and causes certain syntactic derivations to crash (cf. Fox and Pesetsky 2005).

### **2.3.1 Late Adjunction revisited**

Newell (2008, 2005) argues that, when linearization is confounded by Late Adjunction, PF will re-organize a previous output to accommodate the newly adjoined SO. The data point to the operations of vocabulary insertion and linearization having the ability to reassess a domain that has previously undergone spell-out. There are morphology-internal and phonology-internal requirements that indicate a reticence to modify previously interpreted domains (i.e. that are PIC-like), but as in Bošković's syntactic argument, the effects of these requirements are not *caused* by the PIC, they are deduced from more basic principles.

As noted in §2.1, an SO may be late adjoined into an already interpreted domain. In the case of *vP* adverbs, PF linearizes the late-adjoined element inside of a phase that has already undergone spell out with no obvious effect on the surrounding phonological

elements. Some instances of Late Adjunction, however, cause a re-assessment (and re-interpretation) of an SO at PF/Morphology due to a linearization paradox. Consider the following construction:<sup>13</sup>

(20) Bounty, the quicker **picker upper**.

The bolded double affixation in (20) can be explained if we assume that particles are late adjoined (Nissenbaum 2000; expanded upon in Newell 2008). Note that the nominalizing affix *er* is doubled phonologically, but is interpreted only once semantically. This indicates that *er* is only merged once in the syntax. The late adjunction derivation is argued to proceed as follows:

(21) a. 
$$\begin{array}{ccc} & & n \\ & & 2 \\ & v & er \\ \sqrt{2} & & \\ \text{pick} & v & \\ & \emptyset & \end{array}$$

b. 
$$\begin{array}{ccc} & & n \\ & & 2 \\ & v & er \\ \sqrt{2} & & \\ 2 & \emptyset & v \\ \text{pick} & \text{up}^{14} & \end{array}$$

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<sup>13</sup> In the adverbial example in section 2.1 the final linear relation determined on the PF branch is not the one indicated by the morpho-syntax, namely PF [John>quickly>leave>Infl] vs. Syntax [John>Infl >quickly>leave]. That there is no repair strategy here may be due to Infl not being a possible affix on the adverb. Other instances of late adjunction that do not cause a PF reanalysis are those where the adjunct is linearized at an edge. This is argued to be the case for Bracketing Paradoxes in Nissenbaum (2000), and in Newell (2008), where, for example, *un* in *unhappier* is a Late Adjunct. As *un* is a prefix, it causes no PF ordering paradox when recomputation of the phase *happier* occurs.

<sup>14</sup> Newell 2008 actually argues that the particle is adjoined to a null Aspectual head, following Vinka (1999). This argument explains the aspectual distinctions among particle verbs and their non-particle counterparts, but has no affect on the PF arguments herein. For simplicity the AspP has been omitted.

In (21a) there are two phases, one triggered by *v*, the other by *n*. Note that there is no motivation for head movement within the nominal, so none is assumed. At the PF interpretation of *n*, the nominal morpheme *er* is phonologically merged to the output of the *v* phase, giving *picker.up* is then late adjoined in (21b). When the phase in which *up* is sent to PF is interpreted, we have an ordering conundrum. The phonology has already determined *er* to be immediately following *pick*, while the syntactic ordering is one where *er* immediately follows *up*. As the phonology displays strong tendencies against altering previously spelled-out material, the final output conforms to both the previously determined and newly derived orderings, giving *picker upper*.

What this tells us is that PF must examine each SO in its entirety each time the operation of spell-out is invoked, including the syntactic structure of all phases that have previously undergone phonological interpretation. Failure to do so would lead to *up* not being linearized (or perhaps to be linearized incorrectly), as its merger site would not be visible anywhere along the PF interpretive branch.

Another example of the same phenomenon is the plural diminutive construction found in Breton (22) and Yiddish (23).

(22)a. bag-ou-ig-ouí  
boat-PL-DIM-PL  
'little boats'

(Breton: Stump 1989)

b. dern-er-l-ex  
 thorn-PL-DIM-PL  
 ‘little thorns’

(Yiddish: Bochner 1984)

(23)a.           num  
           2  
           n    num  
            $\sqrt{2}$     n  
           dern     $\emptyset$

b.                   num  
                   2  
                   n    num  
                    $\sqrt{2}$     n  
                   2     $\emptyset$   
           dern    1<sup>15</sup>

Note again that the doubled plural affix is only interpreted once at LF. Breton nouns may take a double plural that is interpreted twice, but note the semantic contrast to the purely phonological double plurals in (22).

(24)   bugal-e-où                   ‘several groups of children’                   (Stump 1989)  
           child-PL-PL

An important additional item to note about the doubling seen in (20-24) is that it is not, in actuality, phonological. By this I mean that it is not an operation like reduplication, where a phonological string is copied. As can be seen in (23b) the exponent of each plural morpheme is different. This indicates that the diminutive morpheme in Yiddish induces allomorphic selection of the Number vocabulary item in

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<sup>15</sup> The exact syntactic position of the diminutive morpheme is unimportant here. It must be below the plural, and above the root.

the morphology. This is additional evidence that the PIC is epiphenomenal. The above doubling operations are not purely phonological repairs. The PF branch, including the morphology, has access to the syntactic structure inside the nominal phase twice.<sup>16</sup>

### 2.3.2 Lower-copy spell-out

Franks (2010) also argues that linearization can be repaired in the phonology. He notes that Bulgarian, which allows multiple WH-movement (25), does not allow two homophonous WH-words to occupy Spec(s),CP (26).

- (25) a. Koj kakvo kupi?  
          who what bought  
          ‘Who bought what?’  
      b. \*Koj kupi kakvo?

- (26) a. Kakvo obuslavja kakvo?  
          ‘What conditions what?’  
      b. \*Kakvo kakvo obuslavja?

Franks argues that because of a ban on homophonous linear items in the language, the phonology must spell-out a lower copy of (one of) the WH-words. Note that this repair is, as in the last section, not purely phonological. If the derivation still has access to

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<sup>16</sup> This process of morpho-phonological doubling may also be a good account for Swedish modified double definites, as seen in Embick and Noyer (2001).

syntactic information like copies/chain formation, then this operation has to be effected in the morphology, it being the only module in the derivation to have simultaneous access to syntactic structure and vocabulary insertion. I assume here, following Scheer (2011), that purely phonological processes cannot reference syntactic vocabulary. (27) demonstrates that the above relinearization does not appeal to anything like a Phonological Word (ex. move to the edge of a following PWd), but rather to a lower syntactic position. Both the initial merger site and the periphery of the embedded clause are licit pronunciation positions for the doubled WH word.

(27) Kakvo (\*kakvo) misli (\*kakvo) Ivan (%kakvo) če (kakvo) obuslavja (kakvo)?  
 What \*what think \*what Ivan %what that what conditions what ?  
 ‘What does Ivan think conditions what?’

(Franks 2010. fn.10, word-by-word gloss added)

This data points to the above not being a truly phonological repair, as Franks proposes, but rather resulting from a ban on a sequence of VIs with identical features. Regardless of the repair-strategy’s morpho-phonological nature, the fact that (27) has access to the initial-merger site of the WH-word indicates that previously interpreted domains are syntactically accessible and therefore not subject to a PIC. The violation on linear homophony (or homomorphy) cannot be determined until the higher CP undergoes spell-out, and the repair position is inside a subordinate tensed CP.

## 2.4 Pure Phonology and the PIC

§2 and §3 contain data that offer syntactic and morpho-phonological evidence that the syntax is unaffected by the operation spell-out, and that the PIC is not a condition on linguistic derivation. We have seen that the syntax is available all-the-way-down throughout the derivation, and that this allows for alterations/operations to span phase boundaries.

Now we turn to evidence that purely phonological domains, although they parallel the morpho-syntax, also offer evidence against the proposal that previously spelled out domains are inaccessible to further operations. The data below all demonstrate processes that (1) only use phonological vocabulary and are never influenced by morpho-syntactic structure or features and (2) violate the PIC.

The default assumption here, as with any example of the literature on phases and PF-spell-out, is that phonological cycles are phase based (e.g. Marantz 2001; Marvin 2002; Kratzer and Selkirk 2007). This means that syntax determines which elements undergo spell-out, reaching morphology and then phonology. The trigger of a cycle is the phase-head. The literature on which heads trigger interpretation is vast and growing, and the proposed domains of spell-out are multiple and shrinking. They go from the extremes of Chomsky (2000) where only (transitive) *v*P and CP are phases (with some other possibilities admitted to but not investigated), to Epstein *et al.*'s (1998) spell-out-as-you-Merge and Starke's (2011) Nanosyntax, where every instance of merger triggers interpretation. Regardless of which phases turn out to be correct, the conclusion that PF phases should mirror syntactic phases remains. It follows that domain restrictions on the

syntax should also either apply (or not apply) in the phonology. If the PIC is inoperative in the syntax, it cannot be expected to be operative in the phonology.

### 2.4.1 Phono-Syntactic Mismatches in Ojibwe

As phases trigger interpretation, and PF receives and acts on the structure the syntax has sent, then we can expect phonological domains to be influenced by phases. Consider the following data from Ojibwe.

(28) a. name:g

[name:-ag<sub>nP</sub>]

sturgeon-PL

'sturgeons'

b. gi:a:gamose:

[gi:-[a:gam-ose:<sub>vP</sub>]TP]

PAST-snowshoe-walk

'he walked in snowshoes'

c. nida:gamose:

[ni-[a:gam-ose:<sub>vP</sub>]CP]

1P-snowshoe-walk

'I walk in snowshoes'

d. **bížà:**

[[**bi**<sub>nP</sub>][**-ižà**:<sub>vP</sub>]<sub>vP</sub>]

here-go

'He comes'

e. **nidížà**

[[**ni**-[**ižà**:<sub>vP</sub>]<sub>TP</sub>]

1P-go

'I go'

Newell & Piggott (2006, 2014), argue that hiatus resolution in Ojibwe is sensitive to syntactic phases. (28a) shows a derivation where a VV sequence arises. Both morphemes in the word are spelled-out in the same phase (*nP*), and hiatus is resolved by deletion. (28b) gives evidence that hiatus is not resolved across a phase boundary. The Tense morpheme is outside *vP* (a phase), the verb is within *vP*, and therefore both vowels surface.<sup>17</sup> These first two examples would be consistent with a phonological PIC, where in (b) the first phase is invisible to computation of the second phase. (28c, d, and e) introduce complications to this perfect mirroring. In (28c) hiatus between the pronominal morpheme (which sits in Spec, CP) and the verb (*vP*) is resolved through epenthesis. This

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<sup>17</sup> Piggott and Travis (this volume) argue that the verb in Ojibwe raises out of *vP*. We have seen this kind of post-spell-out movement in section 2. Nonetheless, in both accounts the verb is interpreted in a separate phase from the tense morpheme.

is argued to be due to the deficient size of the pronominal morpheme. *ni-* undergoes Phonological Merger in order to be contained in a licit PWd. Phonological Merger moves a vocabulary item from an external position to the inside of a prosodic word. The reason that hiatus is resolved by epenthesis rather than deletion after Phonological Merger is that Phonological Persistence (PP) (17) applies.

Upon spell-out, the elements within the  $\nu$ P phase project prosodic structure (syllables, feet, PWds). Therefore, anything from segments to PWds that have already been interpreted by the phonological derivational system will (in the default scenario) persist. In the CP phase, the pronominal marker has also been interpreted and has projected syllable structure. If this were not the case then the phonology would have no notion of it being *too small* (not a licit foot). Therefore PP applies to *ni-* as well. Phonological Merger therefore absorbs the illicit output of the CP phase into the PWd output of the  $\nu$ P phase for reasons of phonological well-formedness. The syllable *ni-* needs to be part of a PWd, and hiatus is resolved in agreement with PP.

Now consider (28d vs. e). (28e) can be accounted for by the explanation just given, but (28d) does not have a parallel output (despite its identical phonological input in all relevant respects). The differences in syntactic derivation allow the phonological repair described above in (28d) but not in (28e).

The relevant distinction is that (28e) is a nested structure, while (28d) is not. When *ni-* in (28e) is interpreted the derivational system has in its memory the complement of TP.

(29) Computational Memory (CM): At each point of interpretation (spell out) in a

derivation the entire constituent under consideration is visible and accessible to syntactic, morphological, and phonological operations.

As this is the case, the output of  $vP$  is visible to the output of CP and Phonological Merger can apply. (28d) shows an adjunction structure. As argued in Uriagereka (1999), adjuncts are interpreted before syntactic merger. Therefore, when the  $aP$  adjunct undergoes interpretation there is no complement domain in the derivational memory space (CM). Phonological Merger is therefore illicit and *bi* projects a defective PWD. This procedural restriction on PF derivation is codified as follows in Newell & Piggott (2014):

(30) Phase Integrity/PF

An element  $X$  cannot contribute to the well-formedness of a prosodic word that realizes a phase  $\alpha$  if  $X$  is phonologically realized in the interpretation of another phase  $\beta$

Syntactic Merger of the  $aP$  to  $vP$  cannot ‘save’ this construction, as the defective PWD projected in the  $aP$  domain is subject to PP. The Ojibwe data therefore presents an argument for phono-syntactic isomorphism, except in the case of phonological repair due to phonological deficiency. Phonological Merger has access to the (phonological) structure of a previously interpreted phase in its domain; previously interpreted domains are interpretable and accessible for derivational operations. In other words, the PIC does not apply at PF.

## 2.4.2 Infixation

Further evidence against the PIC at PF comes from infixation. The target of infixation (ex. the first segment, edge of a syllable/foot (see Yu 2003) must assume phonological interpretation of the target previous to affixation, including suprasegmental projection. Expletive infixation in English targets the left edge of the syllable/foot that carries main stress.<sup>18</sup>

(31) a. fan**fuck**intáctic

b. rig**oddamn**dículous<sup>19</sup>

In (31) both the morpho-syntax and the semantics of these words indicate that the infixes are structurally peripheral to the words at hand. Note that both expletives can be pronounced as independent words with exactly the same semantic interpretation as the infixed examples.

(32) a. That's fucking fantastic!

b. You're being goddamn ridiculous.

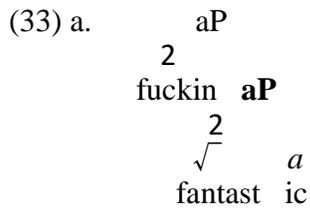
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<sup>18</sup> This can be confounded by prefixation, e.g. *unfuckinbelievable/unbefuckinlievable*.

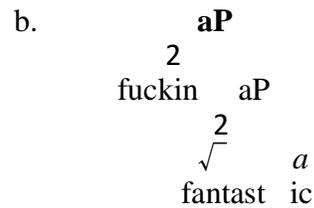
<sup>19</sup> Attributed to a drunken John Wayne, in an address to graduating ROTC cadets, also used in the movies *Anchorman: The Legend of Ron Burgundy*, *Austin Powers: The Spy Who Shagged Me* and *Haggard*.

Both fn. 19 and 20 are taken from <http://worldfullofidiots.com/special-report-expletive-infixation-or-merry-mc-fuckin-christmas/>

Let us assume that the infixated derivations in (31) are structurally identical to (32). In line with recent theories on word internal phases, the adjectives *fantastic* and *ridiculous* in (32) must constitute phases (Marantz 2001; Marvin 2002; Arad 2003; Newell 2008; Newell & Piggott 2014; Piggott & Travis this volume). The stress-shifting affixes *ic* and *ous* must be interpreted in the same phase as the roots they attach to in order to attract stress away from the first syllables (*fántasy*, *rídicule*) (33a). This phonological structure building feeds the environment for expletive infixation. In (33b) the higher *aP* is sent to spell-out, but no syntactic or morphological operation can place the expletive correctly. It must wait until phonology to be inserted inside the domain interpreted at the previous phase



PF output – [fantástic]



PF output– [fuckin [fanfuckintástic]]

This is therefore another example of Phonological Merger violating the PIC. Note that there is, predictably, no syntactic limit on operations such as Phonological Merger. The standard hypothesis in work on word-internal phases is that non-stress-shifting affixes (like *ly* and *tion*) are those that merge outside a domain that has already undergone interpretation. The examples in (34) therefore show two phases intervening between the infix and its host.

- (34) a. It's [bloody [<sub>advP</sub>[<sub>aP</sub> absolute-*a*] ly]] perfect!      **absobloody**lútely  
 b. Will you pay [bloody [<sub>nP</sub>[<sub>vP</sub> attend-*v*] tion]]?      **abloody**ttention<sup>20</sup>

Again, this gives evidence that previously spelled out domains remain accessible for phonological operations. Additionally, we can see that these modifications are not limited to occurring at an edge, but rather may target any (phonologically licit) position in the string.

### 2.4.3 Phonological Conclusions

§4 has demonstrated that, although syntactic phases determine phonological domain formation, elements in these phonological domains can sometimes undergo operations that make them appear to be non-isomorphic with the syntactic phases that caused them to come into existence in the first place. This is unsurprising given that morphological and syntactic phenomena may also cross phase-boundaries in non PIC-sanctioned ways. There seems to be reason to doubt the existence of the PIC at every step in the derivation. Interestingly though, the phonology seems nonetheless loath to alter elements that have been previously spelled out. This is proposed here to be caused by a phonological inertia effect that has been noted in the literature from SPE to today (bracket erasure, no-look-back, PIC, now PP). Of note is that this is proposed not to be due to a flattening operation in the grammar. There is no 'rule' that disallows look-back into previous structural domains. The derivation contains previously spelled out complement domains in memory, but CM and the PP together conspire to disallow

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<sup>20</sup> "Pay a-bloody-ttention!" (from *Dressed to Kill* by Eddie Izzard)

multiple iterations of VI and phonological interpretation on the same node except when absolutely necessary.

## 2.5 Conclusion

In §2 we saw data that demonstrate the fallibility of the PIC in the syntax, relating to Merge, Agree, and Move. The non-adherence to the PIC in the syntax was argued to be due to Bošković's proposal that movement is triggered by the need for feature valuation to occur in a specific c-command relation. In §3 and §4 we saw word-internal evidence that morphological and phonological domains may be non-isomorphic with the syntactic domains that trigger them. This can be either due to alterations of the syntactic structure after spell-out (e.g. Late Adjunction), or through post-syntactic morphological and phonological operations (Vocabulary Insertion, Phonological Merger). Nonetheless, each mismatch left visible (or rather audible) cues that it had occurred (coalescence vs. prenasalization in Malagasy, doubling in Breton and English, epenthesis in Ojibwe, targeting of feet by English infixes).

To explain the word-internal morpho-phonological effects normally attributed to the PIC, I proposed two restrictions on derivations. One was Computational Memory, the other the previously proposed Phonological Persistence. CM determines which syntactic nodes can be accessed at the point in the derivation where Vocabulary Insertion applies. PP regulates the phonology and allows changes to previously interpreted structure only when forced to meet language specific phonological requirements. Note that these separate devices are not a complication of the system; each device is necessary to

implement derivation-by-phase in a system without the PIC. Interestingly, even if PP may be argued to reduce the computational burden, CM may be argued to increase it. This runs counter to the proposal that desirable devices like the PIC increase computational efficiency. If there is no PIC, we must rethink whether computational efficiency is at issue within the grammar.

Much work has been done on and by the PIC. If it is truly the case that it is epiphenomenal then something else needs to explain its effect. Taking into account the work done in the papers cited herein, and more, we have a beginning to this solution, but more work defining the exact domains that trigger spell out needs to be done. The major elements in recent work on cyclic domains that remain controversial seem to be the phase-heads themselves. The phase-heads in the literature do not form a cohesive syntactic class. Little *xP* phases, *vP* and *CP* all offer evidence for cyclicity, but have different syntactic characteristics. Notably, *aP*, *nP*, and perhaps some instantiations of *vP* appear to be purely phonological phases. By phonological phases, I am referring to those phases that have not been diagnosed as reconstruction/edge movement sites. Note that this is not an argument against them being syntactically defined phase-heads. Movement most likely does not (or does not often) target the specifiers of *xPs* because they are not targets for feature valuation (which is more naturally a property of the functional domains they are encapsulated in, like *DP*). Also, moving through a *Spec,xP* would most often yield no perceptible semantic difference, and therefore be virtually impossible to detect. Work like Noonan (this volume) and Leu (this volume) that looks at movement at the sub-word level may be a fruitful domain for syntactic evidence for these phases.

A further result of the loss of the PIC would be that the notion of an uninterpreted phase edge is no longer syntactically necessary. If syntactic structure is not flattened after interpretation, then having its edge interpreted at the interfaces will not prevent syntactic structure building or further movement. For example, even if a head  $x$  is spelled out with its complement  $yP$ , Merge can target the projection of that head (or the head itself); spell-out has no effect on the syntax. This, along with a feature-valuation view of phases may lead to an explanation for the conflicting views in the literature on spell-out domains (only the complement vs. the head and the complement). Whether a head spells out with its complement may be predictable from whether its features are valued. In any case, the evidence here argues for our looking elsewhere than the PIC to syntactic and phonological freezing effects. The PIC is predicted to be fully derivable by independent means.

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