Minimalism and the syntax-phonology interface

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1 Introduction

Although the literature on the syntax-phonology interface is vast, there have been almost no attempts within this literature to explicitly apply Minimalist reasoning in pursuit of a general theory. Thus, rather than simply surveying existing work on the interface, we must take an atypical approach to this handbook chapter. In what follows, we attempt to characterize, in broadest strokes, what a Minimalist theory of the syntax-phonology interface should look like, emphasizing a set of design principles that we take to be essential for such a theory. In particular, we adopt the basic Minimalist principles that the architecture of grammar is modular and "feed-forward" (i.e., it is organized in an inverted Y-model), and that these distinct modules necessarily work with fundamentally different and mutually unintelligible alphabets (i.e., they obey Strict Modularity). When combined with the methodological and ontological economy that comes with the Strong Minimalist Thesis, these premises – often mentioned, but rarely applied seriously – impose strict conditions on what might qualify as a Minimalist interface theory. Weighed against this metric, we argue, even mainstream approaches to the interface come up short.

We begin by discussing these premises in more detail, before showing how various existing theories are incompatible with them. We cast a particularly critical eye on what is currently the dominant theory of the syntax-phonology interface – namely Prosodic Phonology (especially as implemented within Optimality Theory) – and argue that it does not meet the Minimalist standard as we define it. Our treatment of this previous literature is rather narrow, however, and readers seeking a traditional overview chapter would be better served elsewhere.[1] Rather, the bulk of the forthcoming discussion is dedicated to demonstrating the viability of Minimalist alternatives with a collection of disparate case studies on syntax-phonology interface phenomena, including ellipsis in Taiwanese, hiatus resolution in complex words in Ojibwe, and domains of tonal phenomena in Xitsonga and Kuria.

In a modular, feed-forward design like the one to be outlined below, the output of syntax provides the input to phonology. It is widely assumed that a host of operations and procedures take place in between NS and NΦ; this space is referred to as "PF", but the structure of this zone (including the crucial question of which, if any, module it belongs to) is subject to immense variation among theoreticians, even within the subdisciplines concerned with aspects of PF specifically (e.g. Distributed Morphology). This poses a serious and immediate problem, and yet we will try to set it aside somehow, at least for the moment, to think about the operations that this zone is thought to comprise.

Some of these operations are said to "prepare" the output of syntax for interpretation by the phonology (in modular terms, this would fall under the guise of *translation*: Scheer 2012:§29) (ex. Vocabulary Insertion, insertion of boundary markers, projection of prosodic domains), while others

[1] For particularly comprehensive surveys of the syntax-phonology interface literature, see Elordieta (2008) and Scheer (2011), along with Selkirk (2011), Elfner (2018), and Bennett and Elfner (2019).

– perhaps the majority – are situated in PF simply because they cannot be easily accommodated in either the NS or the NΦ (ex. Local Dislocation, Impoverishment, deletion of syntactic constituents at PF).[2] This leads to the impression that, although the workings of syntax are obviously relevant to the phonology, by the time the phonology has segments to work with, the output of syntax has been thoroughly manipulated, translated, and arguably distorted.

While this impression is accurate for some cases – those where syntactic and phonological domains are non-isomorphic – the impact of syntax on phonology is more often quite direct (as is amply noted in the literature cited throughout this chapter). We will attempt to illustrate this point using three case studies: one involving ellipsis, one involving vowel hiatus resolution in complex words, and one involving domains of tone spreading. We have chosen such disparate phenomena precisely because of their clear differences: ellipsis is regarded as a syntactic operation with a phonological consequence (silence), hiatus resolution is thought of as quintessentially phonological, and tone spreading is a non-local phonological process that appears to make reference to higher domains of the Prosodic Hierarchy (PH). Taken together, then, these phenomena provide especially diverse tools for evaluating (and sometimes challenging) the syntax-phonology interface from the Minimalist perspective (i.e. adopting MP-friendly assumptions such as those laid out below). The hope is that by working from these points inward, we can more effectively corner our quarry – the point of contact between these two modules – and get a better look at how it works.

2 Starting assumptions

We describe and briefly defend our starting assumptions here, each of which is fundamentally Minimalist, either in letter or in spirit. We adopt these assumptions for the remainder of the chapter, and do not attempt to justify them further.

As we will see, adopting these assumptions has significant consequences for the analysis of many phenomena—specifically, it demands reanalysis of a considerable portion of the patterns that compose the empirical base of the literature on prosodic phonology, intonation, external sandhi, cyclic phonology, etc. Obviously, we cannot hope to undertake such comprehensive reanalysis here. What we can do is sketch how to proceed from here, taking it for granted that a Minimalist theory of the syntax-phonology interface is a necessary and desirable goal, and thus justifies the effort such reanalysis will require.

The literature explicitly applying Minimalist reasoning to the phonological side of the syntax-phonology interface is quite small.[3] This might stem from the position in Chomsky (2014) that Minimalism aims to explain restrictions on syntactic structure and its viability at the interfaces, but that, at least for PF, interface considerations might override Minimalist design. Notably, Chomsky sends the reader to Bromberger and Halle's (1989) *Why phonology is different* for discussion of what is important to the final stages of the PF interface. Although phonology is unarguably different from syntax in its vocabulary, representations, and computation (see also Neeleman and van de Koot 2006, Heinz and Idsardi 2013, Idsardi 2018), it does not follow that the workings of the phonological module ought to be excluded from Minimalist inquiry—questions of economy, locality, and third

[2] There is a clear bias in the directionality of this practice of banishing operations to PF, as seen in the sorts of vocabularies that they make reference to: roughly all of them are syntactic in that sense, and not phonological; yet, as Scheer (2011) discusses at length, they have been exiled from NS for primarily aesthetic reasons, leading to what Scheer calls "clean syntax, dirty phonology" (§31). However, on this point Strict Modularity is clear: if any computation references syntactic vocabulary, then it is syntactic by definition; likewise, reference to the phonological vocabulary defines a phonological computation.

[3] See the references in §2.4 (especially Samuels 2009, 2011), the papers in Grohmann (2009), Dobashi (2020), and EXTERNALIZATION CHAPTER.

factors are all relevant, for example (again see Samuels 2011). We will therefore attempt here to examine certain data through a Minimalist lens.

The assumptions we adopt are:

(1) a. Strict Modularity
    b. Feed-forward Y-model of grammatical architecture
    c. Derivation by phase
    d. Late Insertion of Vocabulary Items

In addition to these concrete assumptions, we also adopt the general methodological heuristic (presumably common to all the chapters in this volume) sometimes referred to as the *Minimalist Critique*: in the quest for simplicity and conceptual necessity, if a component of the theory is not essential, it should be eliminated (e.g. by reduction to some other, necessary component). Elimination of theory-internal redundancy follows as an immediate consequence of this heuristic, and will play a role in some of our reasoning below.

2.1 Strict Modularity

A cornerstone of the Cognitive Revolution is the proposal that the human mind has a modular architecture (Chomsky 1965, 1980, Fodor 1983, 2000, Jackendoff 1997, 2002, among many others; see Scheer 2011:§586 for an overview). A *module* is a domain-specific cognitive system dedicated to carrying out a single narrowly-construed computation. As summarized in Segal (1996:145), a module takes input (formulated in a vocabulary specific to that module), performs its computation quickly, automatically, and without interruption, and outputs the result (which then requires translation if it is to be used as input for another module; see below). In the context of the language faculty, the number and nature of the modules involved is debated (see Scheer 2011:§622 for an overview, and Curtiss 2013 for extensive supporting evidence), but there is general agreement that at least (morpho)syntax and phonology each have modular status, exhibiting the properties described above. Two prototypical properties of cognitive modules are *Domain Specificity* and *Encapsulation*.[4] Domain Specificity refers to the property that each module can only understand its own proprietary vocabulary (a set of symbols, representations, etc.); one module cannot understand the vocabulary of another. Encapsulation refers to the property that modular computation is bounded by its own input, which is fixed for each iteration; once it has begun, a module's computation is shielded from the interference of other information.

As implemented in the linguistic modules, Domain Specificity dictates that the NS computation may read and write only terms from the syntactic vocabulary (formal features, categories, phrases, etc.), whereas the NΦ computation may read and write only terms from the phonological vocabulary (distinctive features, segments, x-slots, etc.). Indeed, the claim that syntax is phonology-free goes back to the earliest days of the generative enterprise (Zwicky 1969; see also Zwicky and Pullum 1986, inter alia), and follows straightforwardly if Domain Specificity renders the syntactic module incapable of understanding elements of the phonological vocabulary.[5] Concretely, a linguistic the-

[4] For Fodor (1983), neither Domain Specificity nor Encapsulation is strictly definitional of modules (rather than merely typical of them; see Coltheart 1999); however, in the wake of his highly influential monograph, two opposing positions have emerged along these lines (for Domain Specificity as the definitional property of modules, see Hirschfeld and Gelman 1994 and Coltheart 1999; for Encapsulation, see Gerrans 2002 and Clarke 2020).

[5] Note that Domain Specificity entails the existence of a logical counterpart of phonology-free syntax, namely syntax-free phonology: just as the phonological vocabulary is illegible to syntax, so should the syntactic vocabulary be illegible to phonology. To the extent that this entailment is discussed at all in the literature, it is usually regarded as being false *prima facie* (Zwicky 1969:411, Miller et al. 1997:68, among others), owing to the feed-forward design of grammar; however, see Scheer (2012:§61) and Breit (2019:17).

ory could be said to violate Domain Specificity if it allows or requires an operation from one module to read or write any term from another module's vocabulary. A hypothetical NS operation violating Domain Specificity would be, for example, a phi-probe that can only be valued by goals with [+bilabial] onsets. Conversely, such a process on the NΦ side would be e.g. a final-devoicing rule that only applies to case-licensing heads.

Encapsulation in a linguistic context ensures that no new information can be added to either the NS or NΦ computation once it has begun: derivations are bounded by their input. Under Minimalism, this modular property goes by another name: *Inclusiveness* (Chomsky 1995:228). As applied to NS, Inclusiveness prohibits e.g. the addition of binding indices to nominals, on the assumption that such indices are not inherent to nominals, and the need for them could only arise mid-derivation (i.e., a nominal finds itself in a binding configuration). More generally, this property can be thought to rule out "lookahead" in derivations, since such information is unlikely to be part of the derivation's input.[6] The relevance of Encapsulation (by any name) to NΦ has evidently received much less attention in the literature (but see Blaho 2008:7 and Iosad 2017: ch. 2). In the discussion that follows, we largely set aside Encapsulation, and focus on the boundary conditions imposed by Domain Specificity.[7]

Given the preceding discussion, then, the question immediately arises: how can the workings of one module ever be visible to another, given Domain Specificity? If modules are only able to read and write their own proprietary vocabulary, then there must be some means by which one module's output can be converted into a format that is legible to another; without this, the output of syntax would have no way of being passed to phonology, for example, and syntactic derivations would never be externalized. The answer is that there must be a mechanism of intermodular *translation* (sometimes referred to as *transduction*), which converts one module's output vocabulary into another's input vocabulary (see Scheer 2011:§649 for extensive discussion and references). In Prosodic Phonology, this is referred to as *mapping*: syntactic constituents are mapped onto various constituents of the Prosodic Hierarchy (see §3). However, the outcome of mapping in Prosodic Phonology is specified by a number of rules and/or constraints that are context-dependent (rather than being specified by its input alone); as such, mapping is computational in character. This conflicts with claims in both the linguistic literature and the general cognitive science literature that translation is formally distinct from computation (see Fodor 1983:41, Reiss 2007:§§2.3-4, Hale and Reiss 2008:§5.1.2, Scheer 2012:§160, and references therein).[8] A candidate for a non-computational alternative is Vocabulary Insertion, an operation that, unlike mapping, has independent justification (discussed in §2.3, below): see Scheer 2012:§160 for such an approach to translation.

[6] There is an obvious tension between this property and the interface-driven, "derive-and-crash" derivational system that is widely thought to underpin Minimalist syntax. See Preminger (2018) for critical remarks of the latter.

[7] It is unclear to us – at least with respect to the linguistic modules – what work Encapsulation might do that Domain Specificity cannot do already. For example, given that the NΦ is unable to interpret the NS vocabulary (and thus its computation) by Domain Specificity, it follows that its own computation could not be influenced by such information, thus vitiating Encapsulation (as distinct from Domain Specificity). See Fodor (2000:63) for general remarks along similar lines.

[8] To briefly summarize the argument in Scheer (2012:§169): if translation involves computation, then translation has the status of a module by definition; however, if translation has modular status, then it grossly violates Domain Specificity: to perform even its most basic task, it must be capable of reading one module's vocabulary and writing another. This paradox is avoided if translation does not involve any computation, but rather simply involves symbol conversion, as argued in the references above. This militates against one of the cornerstones of mainstream Prosodic Phonology; for additional challenges, see §3.

2.2 Feed-forward Y-model design

We also assume the traditional (inverted) Y-model architecture of the grammar, whose origins can be traced back to Chomsky (1965: ch. 1). The "feed forward" nature of this model means that information is passed between the modules only in one direction: for example, the syntax provides input to the phonology (indirectly, via translation), but the reverse is ruled out. Note that while this model of grammar respects modularity, it is not a consequence of modularity: other modular architectures are logically possible (see e.g. Jackendoff 1997, 2002). In other words, the Y-model must be justified on grounds at least partly independent of modularity, though we leave this aside here (but see Irurtzun 2009).

2.3 Late insertion of vocabulary items

We also adopt a realizational approach to morphology rooted in late insertion: phonological information is entirely absent from the items manipulated by the syntactic computation, and is not added until a given cycle has undergone Transfer. We adopt standard assumptions from Distributed Morphology about how this mechanism, Vocabulary Insertion, works (see Embick 2015: ch. 4 for an overview), though see below for some discussion (and LATE INSERTION CHAPTER for detailed treatment).

2.4 Derivation by phase and domain delimiters

Derivation by phase (Chomsky 2001; see also Uriagereka 1999) is generally thought of simply as a constraint on syntactic derivations; however, when combined with the preceding architectural assumptions, it should be clear that bottom-up cyclic spell-out also has significant consequences for what comes "downstream", especially the phonology. Specifically, cyclic spell-out ensures that the input to NΦ is not the final syntactic representation (the root node and all it dominates); rather, the input to NΦ is parceled out into phase-sized *chunks* (to use Scheer's 2012:§99 term). The phonology receives these chunks piecemeal, and operates on each one successively as it receives them (via translation). As such, the phonology is utterly dependent on syntax to define the size of the chunks it computes.[9] We therefore expect to see phonological consequences of derivation by phase—for example, phonological operations which are restricted to working on phase-sized strings.[10] This is exactly what we find, as we discuss further below (and see Marvin 2002, Newell 2008, Pak 2008, Samuels 2009: ch. 5, Samuels 2011, Scheer 2012:§307, and references therein).

Prosodic Phonology is concerned with (among other things) phonological processes that apply within *domains* at and above the word level. A pivotal question facing this literature (one which goes back a very long way: see Part I of Scheer 2011 for a comprehensive history) lies in identifying the means by which these domains are defined—a quintessential interface problem. Proposals range from the insertion of boundary markers at certain morphosyntactic junctures in order to delimit domains (as in SPE: Chomsky and Halle 1968), to the mapping of syntactic constituents onto prosodic constituents which themselves serve as the domains (as in Prosodic Hierarchy-based approaches: Selkirk 1986). We discuss such approaches in more detail in §3, below; we mention them here simply because phase theory offers a straightforward and independently (i.e., syntactically) motivated solution to this domain-delimiting question: if syntax already requires the derivation to

[9] To the extent that phasehood is a property of particular heads (*qua* List 1 items: see below), then phonology is dependent on both the syntax and the lexicon for chunk definition. We leave this detail aside (but see D'Alessandro and Scheer 2015 for relevant discussion).

[10] What precisely constitutes a 'phase-sized string' – and, indeed, what precisely constitutes a phase – is still a live issue in the literature (see PHASES chapter). We mostly leave this aside, stating our assumptions about e.g. phasal categories where necessary.

be broken up into chunks of varying sizes, then perhaps phonological domains are just an epiphenomenon of this. Thus, to the extent that phonological domains correspond to syntactic phases, the need for a distinct domain-defining mechanism (mapping, etc.) can be eliminated from the grammar (see references cited in the previous paragraph)—clearly a desirable result for a Minimalist theory of the interface. We therefore adopt this assumption in the discussion to follow, recognizing that it is ultimately an empirical question that remains to be answered.

2.5 Summary

The four assumptions in (1) are taken to underlie a Minimalist point of view with regard to the investigation of the Syntax-Phonology interface. Syntactic cycles determine what is sent to PF. There is a translation process that transforms syntactic features into phonological strings. Phonological operations will then operate over these strings, but may make no reference directly to the syntax. Before going on to apply these to specific test cases, a more detailed discussion of the Prosodic Hierarchy and its motivation within a theory of the interface is warranted.

3 The predominant theory of the interface: Prosodic Phonology

Many discussions of the syntax-phonology interface begin (and end) with Prosodic Phonology, the collection of theories intended to deal with phonological phenomena at and above the word level—roughly, those whose domains of application seem to be directly influenced by syntax, rather than being determined strictly by e.g. segmental phonology (see Elordieta 2008 for an overview of segmental phenomena and their interaction with prosodic domains).

For a handbook chapter on the syntax-phonology interface, this one is atypical in its treatment of Prosodic Phonology. Rather than surveying the considerable literature on this topic,[11] our discussion of Prosodic Phonology is instead rather brief, and mostly critical. This is because, as we argue below, the mainstream theories comprising this subdiscipline do not meet the Modular standard we laid out above.[12]

We divide theories of Prosodic Phonology according to whether they make crucial reference to *constituency*—either syntactic or phonological. The most influential theories rely on constituency; yet, as we argue below, any phonological theory with this property will run afoul of the assumptions we laid out above (especially Strict Modularity and/or the injunction against inter-modular redundancy). Non-constituency-based theories are more promising in this respect, but are conversely much less popular.

[11] For more traditional comprehensive surveys of the Prosodic Phonology literature, see e.g. Elordieta (2008), Selkirk (2011), Wagner (2015), Elfner (2018) and Bennett and Elfner (2019).

[12] The vast majority of Modularity-violating interface theories in the literature are intended, fundamentally, as theories of phonology, albeit ones requiring some syntactic vocabulary to leak through (in the form of sisterhood relations, constituency, categories, etc.). This is likely due to the lasting influence of the *Principle of Phonology-Free Syntax* (Zwicky 1969, Zwicky and Pullum 1986), which is rarely questioned. There are exceptions to this, however: see e.g. the Contiguity Theory of Richards (2010, 2016), which places certain kinds of phonological information (e.g. metrical structure) in the narrow syntax, triggering operations there; and, see Kayne (2016:§§15-19), who suggests that all phonological concatenation might be the product of Merge. These syntactic theories violate Domain Specificity just as the phonological theories we discuss here do, but we do not treat the former any further here.

3.1 Constituency-based approaches

Almost all theories of Prosodic Phonology over the past 40 years have relied on constituency in some form, and come in roughly two flavors: *Direct Syntax* approaches[13] vs. *Indirect Reference* approaches. What distinguishes the two is the nature of the constituents involved: whereas Direct Syntax allows NΦ to refer directly to syntactic constituency (and c-command relations, branchingness, etc.), Indirect Reference restricts NΦ to referencing only the constituents of the Prosodic Hierarchy, a collection of principally phonological objects.

Early on, Direct Syntax approaches (Kaisse 1985, Odden 1987, 1990, and more recently Seidl 2001, Pak 2008, and Samuels 2009) were rightly criticized for being anti-modular: Domain Specificity (§2.1) must be abandoned if Direct Syntax is adopted. To preserve the modular divide between syntax and phonology, Indirect Reference was developed (Selkirk 1986): as part of the regular inter-modular translation procedure, syntactic constituents are mapped onto broadly isomorphic phonological constituents defined by the Prosodic Hierarchy (Selkirk 1986). The constituents[14] of the Prosodic Hierarchy relevant to the phonology-syntax interface include (but are not always limited to) the Prosodic Word, Prosodic Phrase, Clitic Group, and Intonational Phrase. As phonological objects, these constituents can be freely referenced by phonological rules without flouting Domain Specificity (but see Scheer 2008 for arguments that prosodic constituents are not truly phonological objects). Moreover, this mapping procedure is assumed to be imperfect, leading to non-isomorphisms between syntactic constituents and their prosodic counterparts; this predicts that prosodic phenomena ought to show the effects of such non-isomorphisms, a prediction that Selkirk (1986, inter alia) takes to be correct (see §3.3).

Despite that the Prosodic Hierarchy was proposed as a Modularity-respecting competitor of Direct Syntax, the rise of Optimality Theory (OT) saw that founding principle all but abandoned: it is now commonplace to find OT analyses that require simultaneous evaluation of both prosodic constituency and syntactic (and even semantic) information, thereby obliterating the modular divide that motivated the turn toward Indirect Reference in the first place (Scheer 2011:§525, Newell 2018).

Specifically, OT-based approaches to Prosodic Phonology introduced various interface contraints (WRAP: Truckenbrodt 1999; ALIGN: McCarthy and Prince 1993; MATCH: Selkirk 2009, 2011) to achieve the mapping (*qua* translation) from syntax to phonology. These contraints are tacitly assumed or explicitly described as maintaining the Indirect Reference standard that was introduced in the 80s; however, in most cases, such constraints in fact involve direct reference to (or evaluation alongside) syntactic information, in clear violation of Strict Modularity. Indeed, this fact has recently been acknowledged even by traditional proponents of these constraints. For instance, Bermúdez-Otero (2012) notes the modularity-violating nature of Alignment constraints (but argues in support of them nonetheless), whereas Elordieta and Selkirk (to appear) and Lee and Selkirk (to appear) propose formal separation of the subgrammar responsible for evaluating interface constraints from the one responsible for evaluating strictly phonological (NΦ) constraints, going as far as to refer to these subgrammars as distinct *modules*. The former, however, does not qualify as a module in any standard sense of the term: as Lee and Selkirk (to appear:§4) admit, it "necessarily exploits a mixed

[13] The term *Direct Reference* is sometimes used for this family of approaches as well (for obvious reasons), but see Scheer (2012:§20) for possible confusion arising from this term. For that reason, we use *Direct Syntax* here. Note also that, as Pak (2008:51) and Elordieta (2008:225) point out, there are Direct Syntax analyses that define phonological domains based on syntactic notions other than constituency *per se* (e.g. c-command), as in Kaisse (1985). While true, such analyses do still rely on syntactic constituency in some fashion (e.g. in defining the notion of "edge", which one of the c-commanding members must occupy: see the Branch Condition of Kaisse 1985:175, for instance). We therefore treat Direct Syntax approaches as constituency-based.

[14] Syntacticians will not recognize these objects as constituents in any familiar sense of the term: for example, they violate the basic phrase-structural property of Endocentricity, in that they are not projections of anything. See Pak (2008), Samuels (2009) and Scheer (2011:§406) for discussion.

syntactic and phonological vocabulary", in violation of Domain Specificity.

As an illustration of the problem, consider a typical definition for one of the popular MATCH family of interface constraints (Elfner 2018:6):

(2) MATCH-PHRASE
For every syntactic phrase (XP) in the syntactic representation that exhaustively dominates a set of one or more terminal nodes α, there must be a prosodic domain in the phonological representation that exhaustively dominates all and only the phonological exponents of the terminal nodes in α.

Plainly, this contraint references syntactic and phonological information simultaneously: it ensures construction of a phonological object (a prosodic phrase) based on a comparison of sets of phonological exponents to sets of syntactic dominance relations.

The problem is further compounded in traditional OT-based approaches (i.e., those that do not draw the above "modular" distinction between interface constraints and purely phonological constraints). It is commonplace to find interface contraints like MATCH or ALIGN ranked in the constraint hierarchy alongside contraints that reference purely phonological information (e.g. *LOW, ONSET, OCP). Consider the following tableau from a popular OT textbook (Kager 1999:113), in which an interface constraint (ALIGN-R, which aligns the right edge of a particular syntactic constituent with that of a syllable) is ranked among purely phonological constraints (e.g. *COMPLEX, which constrains complex codas within syllables):

(3)

Input: /ark-ark/	ALIGN-R	*COMPLEX	DEP-IO	NO-CODA
a. ar.gark^h		*!		**
b. ☞ ar.ga.rik^h			*	**
c. ar.gar.gi	*!		*	**
d. a.ri.ga.rik^h			**!	*
e. a.ri.ga.ri.gi	*!		***	

By erasing the modular divide that separates NS from NΦ – both in general constraint rankings, as in (3), and in constraint-internal definitions, as in (2) – OT-based implementations of Prosodic Phonology represent a radical departure from the original guiding principles that motivated the development of Indirect Reference. Indeed, they represent a return to Direct Syntax (Scheer 2011:§525), which the founders of Indirect Reference approaches rightly condemned for being anti-modular.

Thus, we conclude that the overwhelming majority of constituency-based approaches to Prosodic Phonology – both classical Direct Syntax, as well as its resuscitation in OT implementations of the Prosodic Hierarchy – are incompatible with Strict Modularity. As such, they are incompatible with a Minimalist approach to the syntax-phonology interface.

3.2 Non-constituency-based alternatives

A number of criticisms of the Prosodic Hierarchy (independent of those arising from OT-based implementations, as discussed above) have recently led to the development of alternatives. For example, Neeleman and van de Koot (2006) argue at length that phonological representations in fact show none of the telltale signs of hierarchy, and that endowing the phonology with hierarchical structures leads to simultaneous under- and over-generation. They conclude that all phonological

representations must be entirely flat, and thus not based on constituency as the Prosodic Hierarchy is (see also Raimy 2000 and Idsardi and Raimy 2013). A related argument is raised by both Pak (2008) and Samuels (2009): Merge is the only structure-building operation, but the constituents of the Prosodic Hierarchy are clearly not the product of Merge; thus, generating the Prosodic Hierarchy requires endowing the phonology with its own structure-generating mechanism (*mapping*, in Prosodic Hierarchy terms). Applying the Minimalist Critique (§2), this is an intolerable architectural redundancy. Given Neeleman and van de Koot's (2006) conclusions that phonology is flat, the phonological hierarchy-generating mechanism can (and therefore must) be done away with.

Moreover, as mentioned previously, Scheer (2008) argues that the Prosodic Hierarchy is intrinsically anti-modular, because its constituents are not phonological objects in any familiar sense. For example, no prosodic constituent reliably associates with fortition or lenition, nor directly triggers voicing, palatalization, or any other assimilatory operation; moreover, prosodic constituents allow external sandhi processes to selectively breach or respect their boundaries. In short, the constituents of the Prosodic Hierarchy exhibit none of the properties that typical phonological objects have (nor do they have the properties of syntactic constituents: see fn. 14).

Ironically, these criticisms were among those that originally motivated the turn toward the Prosodic Hierarchy, and away from early interface approaches which did not rely on constituency. The most influential among these non-constituency-based approaches was that of Chomsky and Halle (1968), whose theory of the interface involved the insertion of a diacritic symbol, #, at major morphosyntactic junctures during the translation procedure. Importantly, this boundary-based approach of SPE was entirely flat on the phonological side, trading strictly in linear sequences of symbols (including #) rather than constituents. Beginning in the 1980s, early proponents of the Prosodic Hierarchy criticized # for being phonological in name only, arguing that it lacked the usual hallmarks of phonological objects (see above); however, in this regard the Prosodic Hierarchy seems to fare no better than #, as we just mentioned (and again see Scheer 2008).

The question now arises: is there an alternative approach to the interface that is compatible with our assumptions? Given that the representations it produces will necessarily be phonological, such a theory could not directly reference syntactic constituents (or categories, etc.); however, it could plausibly reference the edges of *strings* corresponding to spelled-out cycles passed from the syntax (via translation). If some symbol were inserted at these edges, then phonological rules could freely reference those devices; this would give the rough appearance of phonological sensitivity to syntactic constituency, but without actually allowing phonology to have any access to the syntactic vocabulary whatsoever. Crucially, though, the edge-marking device in question must itself have independent status as a phonological object; if its sole function is to mark edges, then it is simply a diacritic, and thus subject to all the drawbacks of the SPE # marker just mentioned. What, then, could such a device be?

A promising candidate is *empty syllabic space*—an empty CV unit. This idea grows out of work on CVCV Phonology, an extension of Government Phonology (Lowenstamm 1996, Scheer 2004). These theories hold that phonology is strictly flat and linear; it neither builds nor interprets hierarchical structures, consistent with Neeleman and van de Koot's (2006) observations. Under the CVCV-based approach to the interface proposed in Scheer (2004, 2012), and D'Alessandro and Scheer (2015), insertion of empty CV units at important junctures can capture boundary effects without recourse to a diacritic like #. Crucially, each component of the theory is intrinsically phonological. In particular, CV units are an independently-necessary item of the phonological vocabulary, and are canonically associated with a host of phonological processes (fortition, lengthening, blocking, etc.), unlike prosodic constituents or #. Moreover, they are inserted at the start of the phonological computation, upon its receipt of a phonological string following translation. In other words, this CVCV-based approach to the interface avoids all of the modular shortcomings of both

the Prosodic Hierarchy and SPE-style boundary insertion (see especially Scheer 2012:§188), and thus qualifies as a flavor of Indirect Reference; however, unlike the Prosodic Hierarchy, its phonological mechanisms make no reference to constituency of any kind. As a result, to the extent that such an approach is successful, it would render the Prosodic Hierarchy superfluous.

When combined with a phase-based derivation, such an approach is able to capture domain-like effects arising at the left edge of a cycle (see the next subsection, and §4.2.3). D'Alessandro and Scheer (2015) develop this idea further, proposing to essentially parameterize insertion of CV units on a phase-by-phase basis, thereby allowing for both intra- and inter-language variation regarding which phases exhibit phonological domain effects. A recent reply by Bonet et al. (2019) counters that this approach lacks the empirical coverage of the Prosodic Hierarchy, and thus is not a licit replacement for it (though it offers no arguments against the theoretical machinery, especially that of the CV-as-replacement for the PH, that D'Alessandro and Scheer 2015 propose, as far as we can see). Though we leave the details of this debate aside, we take it as a sign that a Minimalist approach to the syntax-phonology interface is a growing concern within the field. Questions of modularity and domain definition are once again pushing the field to refine its tools.

3.3 Phonological evidence for phases? The (non-)isomorphism question

Let us return for a moment to cyclic spell-out domains, or phases. In the literature, diagnostics for phasehood are mostly limited to morphosyntactic and semantic (scope/reconstruction) evidence (Gallego 2010, Abels 2012, van Urk 2020, among others). As mentioned in §2.4, the phonological reflexes of phases are the subject of a growing literature on the interface, but these phonological-domain effects are not generally taken as evidence for phasal domains in their own right.[15] That is, evidence for phonological domains without accompanying syntactic evidence is not taken to be a reliable indicator of phasehood in the literature (see Wagner 2015 on phonology as evidence for syntax more generally). We believe this is a mistake, and suspect it is due to two factors: one sociological, and one theoretical.

The sociological obstacle is simply a lack of communication between phonologists and syntacticians, reflected in the surprising shortage of collaborative work between the two.[16] If one accepts that cyclicity in syntax automatically imposes cyclicity on phonology (see the previous section), and that the sole cyclic interface operation is phase-based spell-out/Transfer, then it follows that phonological domains should be just as informative about phasehood as evidence from, say, movement. More cross-modular collaborative work (like this chapter) can help to bring parallel evidence for cycles in the morphosyntax and the phonology to the fore.

The second, more theory-based reason that evidence for phasehood tends not to come from phonology is that it would conflict with one of the core assumptions underlying all work on the Prosodic Hierarchy (Selkirk 1984, 2011, Nespor and Vogel 1986), namely that phonological domains and syntactic structures are often non-isomorphic (see e.g. Wagner 2015:§2.3 for an overview). A clarification on this front is in order. First, much of the work done on this non-isomorphism suffers from the problem described in the previous paragraph: a lack of collaborative work between (morpho)phonologists and (morpho)syntacticians. Thus, even properly specifying the domains to

[15] Ironically, certain morphophonological patterns in fact provided some of the earliest evidence for successive-cyclic movement (now understood as a by-product of the phase-based derivation), namely *wanna*-contraction (Chomsky and Lasnik 1977). See Thoms and Sailor (2018) for similar cliticization-based evidence for movement through the *v*P phase edge.

[16] We can think of distressingly few prominent examples of phonologist-syntactician collaborations, particularly given that interface questions have been a going concern since the earliest days of the generative enterprise. Some examples include Chomsky and Halle (1968), D'Alessandro and Scheer (2015), Cheng and Downing (2016), Arnhold et al. (2018), Bennett et al. (2019), Fábregas and Krämer (2020), and Clemens and Bickmore (2020). It is noteworthy that most examples we can think of are quite recent—cause for optimism, perhaps.

be compared for (non-)isomorphism is potentially fraught: it requires sophisticated understanding of both the syntax and phonology of the language under consideration.

A related challenge faces prior work on the topic, as well: syntactic theory has advanced sufficiently since the era when the foundations of Prosodic Phonology were first developed (the mid-1980s to the mid-1990s) that the structures posited then would no longer be considered valid under our present understanding of syntax, thus seriously confounding the original arguments for non-isomorphism. For instance, virtually all putative examples of non-isomorphism from Nespor and Vogel's (1986) seminal work on the topic are based on phenomena involving the attachment of adjuncts, relative clauses, etc. that would receive radically different syntactic analyses today (see Bennett and Elfner 2019: fn. 3 for a similar point). As such, the original empirical arguments for non-isomorphism should be looked upon with skepticism until the underlying syntactic analyses can be reassessed and updated. For additional arguments against the premise that syntactic and phonological domains are non-isomorphic, see Pak (2008:§2.2.1), Samuels (2009:§5.4.1), Scheer (2011:§416), and Wagner (2015), among others. We do not mean to suggest that phonological processes are incapable of disrupting isomorphism; rather, we follow the references just cited in suspecting that the conditions under which such disruptions arise form natural classes that can be generalized over, and thus do not motivate a theory of the interface in which a general mechanism for generating non-isomorphisms is 'baked in' (as it is with mainstream Prosodic Phonology, where non-isomorphisms simply reflect violations of a MATCH constraint, e.g.).

4 Three case studies in syntax-phonology interface phenomena

This section describes three phenomena that each involve some interaction between syntax and phonology, albeit in very different ways. Our goal is to show that each phenomenon can be analyzed in a way that is consistent with the assumptions we laid out above; namely, in a way that respects Strict Modularity, and does not require inter-modular redundancy. Our hope is that our analysis of these three narrow case studies will help to demonstrate the plausibility of a more general research program—a Minimalist approach to syntax-phonology interface phenomena. This of course does not adequately represent all of the various details of the large and important body of work on the Phonology-Syntax interface. Our goal here is to employ particular examples as tools that allow for a discussion of a modular, Minimalist interface framework.

4.1 Case study 1: Ellipsis

Our first case study involves ellipsis, a phenomenon widely regarded as involving "deletion at PF" of a syntactically-defined constituent. Any theory of the syntax-phonology interface has to explain how a given syntactic object can remain phonologically unrealised, even though under normal circumstances it is associated with Vocabulary Items that contain phonologically overt material. The challenge lies in finding an explanation that respects core Minimalist assumptions such as Strict Modularity.

We begin the discussion of ellipsis with a brief background on its treatment in the literature, in particular its status as involving "deletion at PF". After describing the fundamental challenges to this approach posed by Strict Modularity, we lay out alternatives that are consistent with the Minimalist assumptions we laid out above.

4.1.1 Ellipsis is not "deletion at PF"

Ellipsis refers to one particular sort of *interpretable silence* in natural language (among many others) in which a syntactic constituent may go unpronounced when it appears in a certain syntactic configuration and its meaning is recoverable from the discourse (see Merchant 2018 for an overview). Since Ross (1969), evidence has accrued suggesting that ellipsis sites are more or less regular, internally-structured syntactic constituents, albeit ones that are somehow rendered silent (and are subjected to various interpretational well-formedness conditions, left aside entirely here; see references in Merchant 2018). A Minimalist formalization of this idea was made particularly prominent by the work of Jason Merchant (Merchant 2001, 2004, 2008, inter alia), whose [E] feature delegates most of the tasks of generating the salient properties of ellipsis (its silence, its interpretive effects, etc.) to the interfaces. Aside from syntactic licensing (determined simply by the set of heads able to bear [E]),[17] [E] is conceived as a set of instructions for LF and PF. This now widely-held view of ellipsis – that its syntax is essentially mundane, and that its silence is imposed post-syntactically – is commonly summarized with the following expression: ellipsis is "deletion at PF". Despite the popularity of this assumption, however, few attempts have been made to identify the PF mechanism(s) responsible for the silence of the ellipsis site.

While Merchant is clear that this question is orthogonal to his main interests (i.e., the syntax and semantics of ellipsis), he does provide some suggestions. For example, in describing clausal (TP) ellipsis contexts, Merchant (2004) characterizes the silencing mechanism triggered by [E] as (emphasis ours):

> "...a familiar kind of **morphologically triggered syncope**: here the morphological trigger is [E] and the syncopated element is TP...The non-pronunciation is entirely controlled by the actual phonology (that component which takes a PF structure as its input), in ways familiar from studies of morphologically determined syncope phenomena, here merely applied to a larger prosodic unit" (Merchant 2004:671).

While these suggestions for how to achieve "deletion at PF" are clearly preliminary, they have also been highly influential, with much of the subsequent ellipsis literature either tacitly assuming something along these lines, or developing it explicitly (recent examples of the latter include Griffiths 2019, An 2019, Erschler *to appear*, among many others).

This family of PF-deletion approaches (including those sketched in Merchant 2001:60 and Merchant 2008:134) is incompatible with Strict Modularity, and thus a non-starter for a Minimalist theory of the interface. For example, the above quote includes a suggestion that syncope – a phonological rule whose structural description is defined over phonological structures – could be applied to a prosodic constituent corresponding to an entire clause; however, 'clause' (and/or the categories TP/CP/IP) is not part of the phonological vocabulary. Thus, no phonological rule can make reference to such an object in order to delete it (or, indeed, to wrap it in a phonological phrase first and then delete that; see §3, above). More generally, phonological processes simply do not work with strings of anything approaching the size of a clause.[18] As Scheer (2011:616) puts it, "No phonological theory is suited for the manipulation of this kind of object, which phonologists look at like an ant looks at a jumbo jet."

[17] We discuss only cases of *head-licensed* ellipsis here, i.e. what have traditionally been described as NP ellipsis, *v*P ellipsis, and TP ellipsis (e.g. sluicing): see Hankamer (2018) for recent discussion of this classification, though the observation that certain types of ellipsis are head-licensed goes back to Bresnan (1976), Sag (1976), and Zagona (1982), and was given a uniform analysis in Lobeck (1995).

[18] At this point the reader might wonder about intonation, which (i) seems phonological, and (ii) seems to work on clause-sized strings. We defer discussion of intonation to the chapter's conclusion. In any case, intonation clearly does not engage in deletion, and thus is not responsible for the silence of ellipsis (but see Tancredi 1992 on the ellipsis-deaccenting connection).

Even overlooking such details, it becomes clear that any PF-deletion approach will fail on grounds of Modularity, because a more general problem looms. If we take "deletion" to mean "removal of phonological material",[19] then whatever rule we are proposing must necessarily be a *phonological* rule: manipulation of the phonological vocabulary can only happen within that module (Domain Specificity). However, there is no phonologically-formulable operation that can apply to syntactic constituents of potentially unbounded size. To demonstrate this, we sketch a few hypothetical attempts below, and show how each fails in turn.

Perhaps the most commonly-held view of how "deletion at PF" ought to be implemented appeals to the Prosodic Hierarchy: the ellipsis site is wrapped in a prosodic constituent that the phonology can then operate on directly, silencing/deleting it (following the instructions it receives from [E], for instance). Given the discussion above in §3, such an option is ruled out in frameworks such as CVCV phonology, along with the rest of the Prosodic Hierarchy: under Minimalist assumptions, phonology cannot be in the hierarchy-building business, particularly when that hierarchy essentially duplicates work from another module (but without the logical underpinnings: see esp. the projection problem discussed in §3). If a syntactically-defined ellipsis site cannot be mapped onto phonological object of equal size, then there is no single object for the phonology to syncopate (or otherwise render silent). The only other alternative along these lines – adopting a Direct Syntax-like approach in which a phonological rule can make direct reference to e.g. syntactic category – is straightforwardly ruled out under Domain Specificity.

We can imagine alternatives, however. For instance, one might concede that the silence of ellipsis is not the effect of a single application of some phonological rule – one-fell-swoop deletion, as it were – but rather the iterated application of a rule applying to much smaller objects than (the prosodic constituent corresponding to) an entire syntactic constituent. That is, perhaps there is successive syncope (e.g.) of phonological material below the prosodic word level, until the entire ellipsis site has been exhausted. While this could potentially be stated in such a way as to avoid reference to the Prosodic Hierarchy, it would surely fall short on other grounds. First, such a rule would need instructions – where to start and where to end – without referencing non-phonological vocabulary. Given that ellipsis is licensed in the syntax (and the size of the ellipsis site defined as a consequence of such licensing), that would seem to require these instructions to be passed to the phonology from the syntax. However, down this path another Domain Specificity violation is lurking: such an approach would require the syntax to mark terminals with "delete me" diacritics only legible within the phonology.[20] Simply put, diacritics violate Domain Specificity by definition, since their job is to smuggle bits of one module's vocabulary into another: see Scheer (2012:§95) for extensive discussion. Yet again, a "deletion at PF" approach to the silence of ellipsis is ruled out by standard Minimalist assumptions.

Challenges for the "deletion at PF" approach posed by the theory – specifically, by Strict Modularity – are compounded by empirical arguments as well. For example, as Sailor (to appear) argues in detail, the silence of ellipsis is relevant for allomorph selection.[21] We briefly review the argument

[19] We could of course take "deletion" to mean "removal of structure (which then can't be pronounced)"; this is the tack taken in Murphy and Müller (to appear), for instance, resuscitating some of the earliest generative ideas about ellipsis. Along similar lines is Banerjee (2020), who argues that ellipsis leads to obliteration (terminal removal) in the morphological component prior to Late Insertion. We return to some of these issues below.

[20] One way around this is to claim that "deletion applies for free", and then leave the job of filtering out ill-formed ellipses to some other part of grammar. This is the approach taken in Ott and Struckmeier (2018), who imply that over-application of freely-applying ellipsis will lead to unrecoverable deletions, which they imply are ruled out on grounds of discourse infelicity (i.e., the grammar generates such over-applications, but we don't use them because it wouldn't be Gricean of us). Aside from the fact that this kind of approach ignores all the findings relating to the *licensing question* (see §4.1.1 above) since Bresnan (1976), it also predicts no interactions between ellipsis and other syntactic processes, contrary to fact.

[21] To our knowledge, this claim was first made by Kornfeld and Saab 2004, in their discussion of Spanish determiner

below; but, if correct, the challenge this poses should be clear: if allomorph selection occurs post-syntactically, then the silence of ellipsis has to arise no later than at Vocabulary Insertion as well (see below). This straightforwardly precludes a "deletion at PF" account: by definition, any phonological deletion rule would be unable to apply until after Vocabulary Insertion has taken place. In other words, a "deletion at PF" account predicts that the silence of ellipsis should be irrelevant for allomorph selection, since phonological deletion would have to wait until allomorphy has already been determined, and the relevant forms inserted. If Sailor's argument is sound, this prediction is refuted.

The argument comes from the interaction of ellipsis and tone sandhi in Taiwanese (Southern Min / Min Nan), a lexical tone language. Taiwanese (and its close relative, Xiamen) has a complex tone sandhi system that has received a great deal of attention in the phonological literature.[22] Very roughly, a syllable bearing an underlying lexical ("citation") tone undergoes a predictable tonal alternation if it occurs in what appears to be a non-XP-final position.[23] An example is below, adapted from Simpson and Wu (2002:74); syllables in **bold** have undergone tone sandhi:

(4) **na**-**si** **A**-sin **m**-khi, **A**-hui **ma** **b**-**e** khi.
if A-Sin NEG-go A-Hui also NEG-IMPF go
'If A-Sin doesn't go, then A-Hui also won't be going.'

The non-bold syllables arise in what appear to be XP-final configurations, and thus fail to undergo tone sandhi, in line with the rough structural description given above for the Taiwanese tone sandhi "rule". However, as Sailor argues (building on earlier work by Tsay and Myers 1996), this system is highly unlikely to be the product of any phonological rule(s). Experimental results from Zhang et al. (2006) and Chen et al. (2010) show that Taiwanese tone sandhi is unproductive: in brief, speakers fail to apply sandhi in nonce-word environments, suggesting that their grammars lack the generalized rules necessary to produce the expected patterns. Given that tone sandhi is normally exceptionless in Taiwanese, these authors conclude that it must be the product of allomorphy, instead: each tone-bearing morpheme has a citation-tone allomorph and a sandhi-tone allomorph (which explains why speakers overwhelmingly fail to apply tone sandhi of any kind in nonce-word conditions: novel items cannot have associated allomorphs).

This sets the stage for a look at how ellipsis and this system of allomorphy interact. Sailor (to appear) shows that ellipsis seems to create new XP-final configurations as far as this sandhi "rule" is concerned. He shows this with data from both predicate ellipsis and nominal ellipsis:

(5) a. **A**-Ying chang **b**-**o** **khi** **hak**-hau, **tan**-**si** **A**-Ha **u** **khi** **hak**-hau.
A-Ying yesterday NEG-PERF go school but A-Ha PERF go school
'A-Ying didn't go to school yesterday, but A-Ha did go to school.'

allomorphy in the context of NP ellipsis.

[22] Taiwanese and Xiamen tone sandhi involves circular chain shift, a type of counterfeeding opacity that is notoriously difficult to capture in both rule-based and OT-style frameworks. Neither this property nor the actual tones involved (citation or sandhi) bear on the present discussion, which is only concerned with where and when sandhi takes place. See Chen (1987, 2000) and Zhang et al. (2006), among others, for further details on the phenomenon and its relevance for phonological theory.

[23] If tone sandhi is a phonological process, then this characterization of its domain of application is incompatible with our assumptions: a phonological rule cannot make direct reference to syntactic information such as "XP", assuming Domain Specificity. However, as Sailor (to appear) argues, tone sandhi in Taiwanese is the product of allomorphy, not phonology (i.e. NΦ). Regardless, "non-XP-final" is an oversimplification in any case, since adjunction introduces exceptions: see Chen (2000: ch. 10) for extensive discussion. While we can imagine an MP-friendly analysis of Taiwanese tone sandhi that accords with the assumptions we adopt here (taking seriously the arguments Chen 1987:143 and Tsay and Myers 1996:399 against a purely prosodic approach), we leave this for future work, focusing only on its interaction with ellipsis here.

b. **A**-Ying chang **b**-**o** **khi hak**-hau, **tan**-**si** **A**-Ha { u / ***u** } ~~[khi hak-hau]~~.
A-Ying yesterday NEG-PERF go school but A-Ha PERF
'A-Ying didn't go to school yesterday, but A-Ha did.'

(6) a. **Chi**-Beng **beh sann pun** chhe, **A**-Ying **beh si** **pun** chhe.
Chi-Beng buy three CL books, A-Ying buy four CL book
'Chi-Beng bought three books, and A-Ying bought four books.'

b. **Chi**-Beng **beh sann pun** chhe, **A**-Ying **beh si** { pun / ***pun** } ~~[chhe]~~.
Chi-Beng buy three CL books, A-Ying buy four CL
'Chi-Beng bought three books, and A-Ying bought four.'

In both cases, the material stranded adjacent to the ellipsis site – i.e., the perfect marker *u* in (5), and the classifier *pun* in (6) – cannot undergo tone sandhi; they surface with their citation tone instead, as though they were in XP-final position. Crucially, this contrasts with the unelided representations in the (a) examples above, in which both *u* and *pun* undergo tone sandhi obligatorily.

Taking all these facts together, Sailor concludes that the silence of ellipsis is directly relevant for allomorph selection, meaning it cannot be the product of the application of a rule in NΦ; this silence must arise before or during Late Insertion, where allomorphy is determined. In other words, ellipsis cannot be "deletion at PF". The question immediately arises: what is responsible for the silence of ellipsis, if not phonological deletion? In what remains of this subsection, we review the analytical options that accord with our premises in §2.

4.1.2 Modularity-friendly alternatives to the silence of ellipsis

We discuss two potential sources for the silence of ellipsis, both of which comply with the premises we laid out in §2. In particular, both seem fully compatible with Strict Modularity, and thus either is preferable to a "deletion at PF" account (and see Sailor *in progress* for further discussion).

The first possibility – to our knowledge, initially proposed in Wilder (1997:§6.5) and developed in Bartos (2000, 2001) – is that the silence of ellipsis reflects non-application of Vocabulary Insertion to the contents of the ellipsis site. Under this view, ellipsis somehow instructs Vocabulary Insertion to bypass the terminals (and/or the constituents that dominate them, if non-terminal insertion is allowed; see below and LATE INSERTION CHAPTER for discussion) that comprise the ellipsis site, meaning there is never any phonological material within the ellipsis site to undergo deletion in the first place. We refer to this as the Non-Insertion Hypothesis (NIH). Compared to the "deletion at PF" view, the NIH remains a minority position within the ellipsis literature. It has been explicitly developed in much work by Andrés Saab (see Kornfeld and Saab 2004, Saab 2008, Saab and Lipták 2016, and Saab *to appear*, i.a.), while various other works have adopted it without much comment (see e.g. Aelbrecht 2010, Merchant 2015:207, among others; but see Murphy 2016 and Sailor *to appear* for some discussion of non-insertion in the context of ellipsis).

One immediate advantage of the NIH over "deletion at PF" is that no special phonological deletion operation is required (nor, indeed, is any component of the Prosodic Hierarchy): it makes use only of the independently-needed machinery of Vocabulary Insertion. Likewise, it offers a straightforward explanation of the facts reviewed above from Sailor (to appear): plainly, the silence of ellipsis can affect allomorphy if it arises in the same component of the grammar where allomorphy is implemented.

Whether the NIH meets the Modularity standard is a separate question, and the answer depends on the details of its implementation. One option is to assume that ellipsis licensing (which unambiguously takes place in the syntax: see Aelbrecht 2010, Sailor *to appear*, among others) has the effect of marking terminals internal to the ellipsis site with "don't insert on me" features, such that Vocabulary Insertion will ignore them (see Saab 2008 for such a proposal). Since Vocabulary Inser-

tion requires access to the syntax anyway, there is no Domain Specificity violation in this model. However, the addition of arbitrarily-many "don't insert on me" features mid-computation is a clear violation of *Inclusiveness* (Saab *to appear*:§3.1), which is the MP name for Encapsulation, as defined above in 2.1. Thus, while the NIH seems promising, this particular implementation still runs afoul of Strict Modularity.

A refined implementation of the NIH is developed in Saab (to appear), who proposes a return to one of the earliest views of Vocabulary Insertion – that of Halle (1990) – in which Vocabulary Insertion is *replacive*, not *additive*: rather than *adding* a List 2 (vocabulary) item L onto a suitable terminal T, Vocabulary Insertion actually *replaces* a placeholder variable on T with L (see also Embick 2015:§4.2 on this distinction). This technical solution entirely circumvents the Encapsulation problem for the NIH: under Saab's view, ellipsis results in the deletion of this placeholder variable within the syntax; nothing new is added mid-comptuation.[24] Thus, the terminals inside an ellipsis site do not meet the structural description for replacive Vocabulary Insertion to apply, and therefore remain silent.[25] This alternative to "deletion at PF" is therefore Modularity-compliant (see Saab *to appear* and Sailor *in progress* for further discussion).

A different approach (discussed in greater detail in Sailor *in progress*) also takes Vocabulary Insertion as the general mechanism responsible for the silence of ellipsis, but makes crucial use of insertion at non-terminal nodes (see Radkevich 2010, Starke 2009, Caha 2018, Baunaz and Lander 2018:§1.3.3.2, and NANOSYNTAX CHAPTER). Under this approach, ellipsis sites are regular constituents in the syntax, but are spelled out as null proforms at Vocabulary Insertion. The following independently-motivated assumptions are necessary to make this work: Vocabulary Insertion proceeds inside-out/bottom-up as usual, but must be able to operate on non-terminal nodes, and must be capable of overwriting (or "overriding") its own earlier output when a node is reached with a more suitable matching lexical entry than what was inserted lower in the structure (see previous references).

With this in place, a fully-structured ellipsis site of category XP can undergo Vocabulary Insertion to be realized as a null proform, essentially as an allomorph of XP conditioned by its licensing head:[26] that is, when [$Y_{[E]}$ XP] undergoes Transfer, $Y_{[E]}$ conditions allomorphy of XP, with *pro* inserted for the elided XP:[27]

(7) XP $\Leftrightarrow$ *pro* / $Y_{[E]}$ __

In a certain sense, this approach resuscitates the core intuition from Lobeck (1995) that ellipsis

[24] This of course requires the placeholder variables to be present in the input to the syntactic module, suggesting that they are part of List 1 entries; see Embick (2015:§4.2) for some relevant discussion.

[25] Any NIH-style approach rooted in Late Insertion faces a potential lookahead problem (see Murphy 2016:§2.2.3): it would seem to require previously spelled-out cycles inside an ellipsis site to have known in advance that they needed to remain silent in anticipation of eventually finding themselves inside an ellipsis site, or to require Late Insertion to have the ability to undo its own output from previous cycles (see below); however, see Saab (to appear:fn. 6) for a solution that avoids both of these problems.

[26] See Aelbrecht (2010: ch. 3) for a refined theory of ellipsis licensing, which may take place at a distance via Agree. Importantly, in Aelbrecht's system, the licensor need not be adjacent to the ellipsis site, but must Agree with the [E]-bearing head Y that takes the elided XP as its complement. This also yields the right configuration to condition allomorphy of the sort proposed here.

[27] Another possibility is that the target for insertion of *pro* is the node immediately dominating both the elided XP and its licensor, i.e. [$_{YP}$ $Y_{[E]}$ XP], making this look more like a case of portmanteau suppletion rather than simple contextual allomorphy. This would also have the counterintuitive effect of imposing silence on a constituent larger than the so-called ellipsis site (and there may be reasons to exclude this; see Aelbrecht 2010: ch. 3). Then again, if both these options for insertion of *pro* were possible, it would predict minor fluctuations in the size of the silenced constituent for a given ellipsis type, a prediction that may well be correct: see Sailor (2014) and Bošković (2014) on predicate ellipsis, for example. Another advantage of this proposal is that null allomorphs need not be proposed for every morpheme in the lexicon of a speaker, but only for the set of elidable XPs in the language (e.g. NP, VP, and CP).

sites share distributional similarities with little-*pro* and other atomic empty categories, but with one critical difference: in the approach advocated here, ellipsis sites are still internally complex in the syntax; their status as atomic silent elements does not arise until Vocabulary Insertion. In other words, this approach is fully compatible with all of the evidence that has accrued in the last few decades showing that ellipsis sites are internally-structured syntactic objects (see Merchant 2018:§2.3 for an overview): for example, elements may freely move out of the ellipsis site in the syntax as normal, a fact that Lobeck's original approach explicitly ruled out.

4.1.3 Summary

As one case study in the syntax-phonology interface, the foregoing discussion of ellipsis is intended to show how even contemporary, widely-held assumptions – e.g., that ellipsis is "deletion at PF" – can be shown to be incompatible with Minimalist premises (among them Strict Modularity). In this case, the problem arises because the syntax appears to instruct the NΦ to delete a constituent of an arbitrarily-large size, a demand the phonology is simply not equipped to carry out. We argued above (following very recent suggestions in the literature) that the silence of ellipsis is better understood not as the product of a phonological rule, but of Vocabulary Insertion: such a mechanism may freely take instructions from the syntax without violating Domain Specificity, and has the means to effect the characteristic silence of ellipsis without making recourse to elements of the Prosodic Hierarchy.

In the next subsection, we explore a different case study in the syntax-phonology interface—one on the other side of the "aisle", so to speak, in the form of vowel hiatus resolution. As we will see, this process is directly constrained by the options provided by the syntactic derivation, despite its appearances as a quintessentially phonological operation in nature.

4.2 Case study 2: hiatus resolution in Ojibwe

We turn now to a case study involving vowel hiatus resolution in Ojibwe (Algonquian). We have chosen this phenomenon because it bears all the characteristics that would normally invite a Prosodic Hierarchy (PH)-based analysis in the literature; in particular, it is characterized by apparent non-isomorphisms between the syntactic output vs. the domain that phonology seems to work with (recall that such apparent non-isomorphisms are regarded as *prima facie* arguments for PH-based approaches: §3). Since the PH is incompatible with our assumptions, such (apparent) non-isomorphisms must be explained by other means. Thus, to the extent that we can provide a credible alternative analysis that is consistent with our assumptions, we will have provided a template for approaching other such phenomena in a Minimalist way.

After describing the core data involving apparent non-isomorphisms in how hiatus is resolved in Ojibwe, we sketch the PH-based analysis put forth in Newell and Piggott (2014). Then, we lay out a competing analysis found in Newell and Scheer (2017) that eschews reference to the PH entirely, and instead relies only on what is already required independently: the cyclic derivation determined by syntax, and a particular phonological object that marks cyclic domains (namely, the empty syllabic space, or CV, referenced in §3.2). In so doing, we hope to provide a blueprint for how similar phenomena might be reanalyzed without reference to the PH, in keeping with the Minimalist agenda we laid out above.

4.2.1 Deriving Non-Isomorphism

Ojibwe repairs vowel hiatus in one of two ways – either by deletion (8) or by epenthesis (9) – but, interestingly, it can also leave hiatus unresolved (10). (Throughout, vowels in hiatus appear in boldface, examples are taken from Newell and Piggott (2014))

(8) *name:g*
nam**e:**-**a**g
sturgeon-PL
'sturgeons'

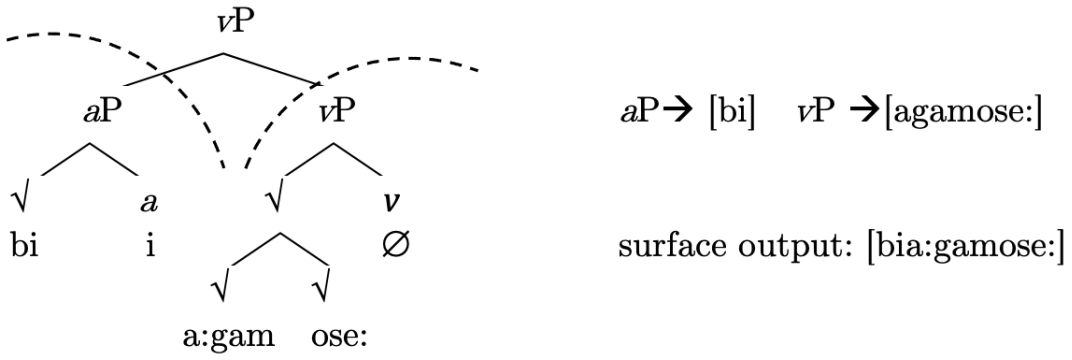
(9) *nidakwe:m*
n**i**-**a**kwe:-im
1S-wife-POSS
'my wife'

(10) *b**ia:**gamose:*
Ø-b**i**-**i**-**a:**gam-ose:-Ø
3S-TO.SPKR-*a*-snowshoe-walk-*v*
'He/She walks here in snowshoes.'

Newell and Piggott (2014) argue that these different hiatus resolution strategies track differences in the underlying syntax. For instance, they argue that the deletion strategy is only available when the hiatus-inducing vowels undergo Vocabulary Insertion in the same cycle; i.e., they are not separated by a cyclic domain boundary. Thus, the hiatus in (8) is resolved via deletion because the two morphemes responsible for the hiatus occupy the same spell-out domain (DP).

Leaving aside the epenthesis strategy for the moment, we turn instead to (10), where hiatus goes unresolved. Newell and Piggott note that /bi-i-/ is a deictic adverbial modifier, adjoined to the *v*P. Crucially, as an adjunct (labeled here *a*P) it is spelled out separately from its host (see Uriagereka (1999), Johnson (2003), Newell (2008), Sato (2009), among others. As a result, hiatus is resolved within the *a*P (by deletion: /b**i**-**i**/ → [bi]), but not across *a*P and *v*P (/b**i**-**a:**gamose:/), since the hiatus-inducing vowels do not share a cycle:

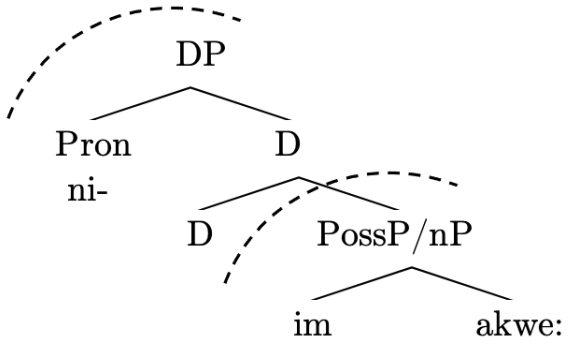
(11)



Thus, VV-sequences that are due to the linearization of separate workspaces remain unresolved in the language, as in (10)-(11). Moreover, for (8) and (10) we see surface isomorphism of syntactic and phonological domains.

Turning now to the epenthesis strategy in (9), however, we see an instance of what is called non-isomorphism in the literature: hiatus is resolved between morphemes that are spelled out in separate cycles ([n**i**-**a**kwe:m] → /ni-**d**-akwe:m/), contrary to what we just saw. The structure of this possessive DP is illustrated below (Newell et al. 2018). The possessor /ni-/ is merged in the Specifier of DP; as such, it is spelled out in a separate cycle from the complement of D:

(12)



DP→ [ni] PossP/*n*P → [akwe:m]

surface output: [nidakwe:m]

The crucial difference between (11) and (12) – the one responsible for these distinct treatments of hiatus – is that only the latter derivation allows for re-footing of the prefix with the material in its complement. Newell and Piggott (2014) argue that this refooting in Ojibwe is licensed by a kind of cliticization they refer to as Phonological Merger:[28]

(13) Phonological Merger (Newell and Piggott 2014:353)
(X (.....)) → (~~X~~ (X.....))

In brief, Phonological Merger applies to /ni-/ in (12), but not to /bi-/ in (11), leading to the distinct treatments of hiatus. Both derivations involve a morpheme that is too small to be footed on its own, namely /ni-/ and /bi-/, which are monomoraic morphemes containing just a single short vowel (after resolution of hiatus in the case of the *a*P); the crucial difference lies in the derivational history leading up to spell-out of each morpheme. Let us briefly see how this works.

In (12), /ni-/ is spelled-out adjacent to a previously-computed cyclic domain (the phase complement of D^0), to which it is therefore able to cliticize via (13), despite the cyclic boundary separating them. Note that this incorporation of /ni-/ can only occur once /ni-/ has undergone a stage of phonological computation: only after failing to construct a foot around this Vocabulary Item will the phonology deem /ni-/ too small to stand on its own,[29] allowing it to find a host in another, locally-computed cycle. This cliticization is what leads to refooting, which in turn leads to hiatus resolution via epenthesis. An example derivation is illustrated below:

(14) a. /akw**e:**-**i**m/ → [akwe:m] → (akwe:m) *Deletion, footing*
b. /ni-/ → [ni-] → *ni *Footing fails*
c. [n**i**-**a**kwe:m] → (nida)(kwe:m) *Phonological Merger, refooting, epenthesis*

This option is unavailable to /bi-/ in (11): when /bi-/ is spelled-out, it finds no previously spelled-out material to cliticize to, and thus has no chance of being refooted. Subsequent Merger of *a*P and *v*P is of no help either, since by that point cliticization can no longer apply:[30] Phonological Merger in Ojibwe is limited to occuring within the cycle in which a vocabulary item is first inserted and interpreted. The result is that the phonology must employ its general last-resort strategy for any final unfooted/degenerate syllable containing short vowel; namely, it builds a degenerate foot around /bi-/.

Note that if this approach is on track, it gives us valuable insight into the construction of phonological domains and the visibility of previously spelled-out domains at later steps in a derivation.

[28] Newell and Piggott (2014:353) define Phonological Merger as refooting into another PWd, which we do not assume here (note that the (non-)existence of the Prosodic Hierarchy was orthogonal to their analysis). Direct evidence for feet in Ojibwe comes from the alternating stress patterns of the language, whereas direct evidence for nested PWds is not clearly available.

[29] Ojibwe footing is iambic, constructed from left-to-right (Piggott 1980, 1983).

[30] The relevant relation among the cycles involved is one of *containment*: a morpheme can only undergo this cliticization if its cyclic domain contains another. In (11), the *a*P does not contain the *v*P; they form separate command chains (Uriagereka 1999), and are therefore spelled-out independently before they are Merged together.

Specifically, the operation in (13) requires previously spelled-out cycles to be visible to phonological processes (under the right structural configuration: see fn. 30). In other words, at the spell-out of DP in (12), the entire domain of DP is visible to NΦ. This clearly requires that the Phase Impenetrability Condition (Chomsky 2000) be inactive in the phonology—a point that we return to briefly in the next section, where we look more closely at phonological domain construction.

4.2.2 Phonological domains, Modularity, and the PIC

Let us use these data to compare theories of phonological domain-building with an eye toward evaluating their compatibility with Minimalism, modularity, and a feed-forward cyclic interface.

Traditional phonological domain construction – i.e., the mapping procedure generating the Prosodic Hierarchy – is unarguably the most popular tool used by phonologists to delimit phonological domains. Let us look at how it fares with the Ojibwe test-case. Below, we discuss the PH-based analysis of the hiatus patterns seen above, before arguing for an alternative.

Looking back at the deletion strategy in (8), we might assume that when a DP is spelled out, it gets mapped to a phonological domain—say, a Prosodic Word (PWd).[31] Then, we could simply assume that hiatus is resolved by deletion within a PWd in Ojibwe:

(15) $[_{\text{DP}}$ nam**e:**-**a**g$] \rightarrow (_{\text{PWd}}$ nam**e:a**g$) \rightarrow (_{\text{PWd}}$ name:g$)$

However, things are more complicated for the other two resolution strategies for hiatus in Objibwe.

First, consider the epenthesis strategy involving [nidakwe:m] from (9). Let us assume that the derivation of the innermost cycle (PossP/*n*P, which involves deletion) mirrors that of (15):

(16) $[_{\text{PossP}/n\text{P}}$ akw**e:**-**i**m$] \rightarrow (_{\text{PWd}}$ akw**e:i**m$) \rightarrow (_{\text{PWd}}$ akwe:m$)$

Subequently, /ni-/ must undergo spell-out as part of the edge of DP. We might simply adopt the same basic scenario as in (14) above, but swapping out the well-formedness of feet for that of PWds. That is, we could assume that /ni-/ is too small to project a PWd itself, and must project only a syllable; as such, no prosodic domain would be matched with the DP spell-out domain. This would then lead to incorporation of /ni-/ into the PWd following it, in much the same way as we saw previously with Phonological Merger:[32]

(17) ni- $(_{\text{PWd}}$ akwe:m$) \rightarrow (_{\text{PWd}}$ n**ia**kwe:m$) \rightarrow (_{\text{PWd}}$ ni**d**akwe:m$)$

We could see this incorporation as the consequence of a constraint in OT like STRONG-START (Selkirk 2011), which requires that a prosodic domain at a left edge not be lower in the PH than the domain to its right. Thus, a syllable preceeding a PWd violates STRONG-START, leading to selection of a candidate in which /ni-/ is part of the same PWd as the stem.

However, if this PH-based derivation is on track, a familiar problem arises: we cannot maintain our assumption that hiatus within the PWd is resolved by deletion, given that the output of (17) includes an epenthetic consonant (cf. (16)). It is clear that the derivational history of the prefix or suffix is what determins the hiatus resolution strategy employed, independently of the prosodic structure attributed to the output.

[31] For the sake of argument, we are setting aside the known problems with mapping phasal domains to prosodic constituents, especially in highly synthetic languages (as in Ojibwe) where there is clearly no match between X^0s/PWds and XPs/PPhs (Compton and Pittman 2010, among others).

[32] This derivation involving PWds (rather than, say, one in which the prefix is incorporated as part of a larger prosodic constituent such as the Clitic Group) is supported by evidence from stress patterns in the language suggesting that the prefix is footed with the following syllable (see Piggott 1980, 1983 and Newell and Piggott 2014).

Turning now to the case of unresolved hiatus seen above in (10), a distinction must clearly be made between the phonological behavior of /bi-/ and /ni-/. Within a MATCH-style Prosodic Hierarchy analysis, this distinction can made in one of two ways: either by appealing to syntactic cycles, or by appealing to the lexical vs. functional nature of the morphemes involved. We discuss each of these options in turn in the remainder of this subsection.

The first analytical option is similar to the derivation discussed above, appealing to the complement vs. adjunct status of the morphemes. Here we must say that an adjunct like /bi-/, despite its monomoraic size, projects a PWd. The structure of /bi-a:gamose:/ would therefore be as follows:

(18) $(_{\text{PWd}}$ b**i**-$)$ $(_{\text{PWd}}$ **a:**gamose:$)$

Note that in each of (17) and (18), we have two cycles of phonological interpretation. Somehow, the derivation must be sensitive to whether the phonological material to the right of the prefix originated in the syntactic complement of that prefix. Given Strict Modularity, this information must be obtained derivationally; it cannot be marked on the phonological structure, since *complement* is not an item of the phonological vocabulary (by Domain Specificity).

One way to accomplish this would be to relax the what is generally taken to be a Phase Impenetrability Condition (PIC) effect in the phonology (see CHAPTER ??? in this volume). In Multiple Spell-Out (Uriagereka 1999) and Derivation by Phase (Chomsky 2001), it is proposed that elements that undergo Spell-Out become frozen and inaccesible to further syntactic operations. The PIC is sometimes taken to apply in the NΦ as well as in the NS (Lowenstamm 2014 and D'Alessandro and Scheer 2015, among others), but as noted above (and argued in greater detail in Embick 2014 and Newell 2017a), there are compelling reasons to assume that the PIC does not actually hold for phonological derivations. If we assume that previously spelled-out domains remain accessible for phonological processes on subsequent cycles, then we have a way to approach the problem seen above in (12). At the spell-out of /ni-/ in [Spec, DP], /akwe:m/ will be visible and available for cliticization.[33] On the other hand, at the spell-out of the *a*P phase in (18), *bi-* is alone in its cycle: /a:gamose:/ is not within its complement and so is not visible inside the spell-out domain of *a*P. Hiatus is therefore not resolved in this derivation, as it is not visible upon spell-out of the morphemes involved.

This type of analysis will need an additional tool to account for the distinct resolution strategies within a single cycle, as in (8), and after refooting, as in (9): namely, faithfulness to previously-computed structure. For this to work, we must assume that undergoing cycle of NΦ fundamentally alters the vowels inside that cycle, such that they are no longer licit targets for deletion. One possible alteration of this sort might be syllabification: the standard assumption in the literature is that lexical items are not stored with syllabic structure; this structure is added during phonological computation. A vowel that has undergone a full cycle of computation would be structurally different from a vowel that has not yet undergone a full cycle of computation, and phonological rules simply need to be sensitive to this difference (see Newell 2017b for a detailed analysis of this distinction). The result would be that syllabified vowels would be retained, since vowels would only be deleted if hiatus occurs prior to syllabification in the NΦ. In other words, sensitivity to earlier cycles could simply be implemented as involving a familiar sensitivity to faithfulness, so long as we assume that a cycle of phonological computation renders its output fundamentally distinct from its input.[34]

The second analytical option mentioned above relies not on the adjunct/argument divide, but

[33] See Cheng and Downing (2016) and Dobashi 2020 for a different view on the visibility of syntactic structure in phonology: for them, syntactic structure is directly mapped to prosodic structure in one fell swoop at the end of a derivation, eschewing an appeal to phases altogether.

[34] Note that this relaxation of the PIC has no ties to any specific phonological theory of the interface in the literature.

rather on the lexical/functional divide. In mainstream (PH-based) prosodic phonology, patterns like those seen above involving the different behavior of /ni-/ vs. /bi-/ are often analyzed by assuming distinct phonologies for functional vs. lexical items (Inkelas and Zec 1993, Selkirk 1972, 1996, Hall 1999, Shih 2018). For instance, whereas /bi-/ contains a lexical root, /ni-/ does not.[35] If phonology is sensitive to the lexical vs. functional distinction, then it could simply instruct lexical items to always project a PWd, while functional items will only do so if they are large enough, i.e. bi-moraic or bi-syllabic (Selkirk 1996).

While this sort of approach can easily capture the differing behavior of /ni-/ vs. /bi-/ with respect to hiatus, it also blatantly violates Strict Modularity: the phonology cannot reference terms like *functional* or *lexical*, which are syntactic notions, to the extent that they have any status whatsoever (Svenonius 2014). Similarly, recent work by Newell and Scheer (2021) aims at deriving the dependent nature of so-called functional items from a combination of their underlying phonological representations and the cyclic derivations that they emerge from (for example, see Cardinaletti and Starke 1999 for discussion of the different syntactic positions of strong vs. weak pronouns). We will not discuss this further here due to lack of space, but we reject the possibility that phonology is sensitive to the lexical/functional distinction on the grounds that it violates our initial assumptions in §2. Minimalism requires that a modular solution be found (otherwise Strict Modularity as a hypothesis must be rejected entirely). We must therefore conclude that, within the options given to us here, the one in which the PIC is relaxed, and a derivational sensitivity to syntactic constituency is in evidence, is preferable.

We can see that an account of the Ojibwe pattern that appeals to the PH is possible. Let us now turn to an alternative analysis that captures all that the PH account does, but without violating modularity.

4.2.3 A modular alternative: empty syllabic space

The above analysis of Ojibwe vowel hiatus can account for the facts; however, it appeals to elements of the Prosodic Hierarchy, a device we take to be at odds with basic Minimalist principles (see §3). Recall that the drawback of the PH is that it introduces intolerable redundancy into the architecture of grammar: phonology must replicate (at times imperfectly) the hierarchical structures that syntax has already generated. However, the obvious alternative – sidestepping this redundancy by simply letting phonology reference syntax directly (as in Direct Syntax) – is anti-modular, and thus a non-starter for us. An alternative is required.

Recall from §3.2 that insertion of empty syllabic space provides a promising alternative to the Prosodic Hierarchy, especially when viewed through the lens of the Minimalist assumptions we adopt. Newell and Scheer (2017) offer a CV-based analysis of the Ojibwe vowel hiatus facts, outlined below, in the hopes that it demonstrates the general viability of this sort of approach to syntax-phonology interface phenomena (see also Scheer 2004, 2012, and D'Alessandro and Scheer 2015).

Before delving into the Ojibwe analysis, let us begin by briefly comparing a hierarchical (i.e. PH-based) vs. linear (i.e. CV-based) account of a particular derivation. Consider a hypothetical language that resolves hiatus via deletion. This language must define the phonological environment within which deletion will apply. Under a PH-based account, prosodic constituents are built via mapping; these could then be referenced by a deletion rule such as the following: *in a sequence V1-V2, do not realize V1* iff *V1 and V2 are within the same PWd.* This would yield patterns of the following sort:

(19) a. [[$_{\text{PWd}}$ d**a**] [$_{\text{PWd}}$ **i**bi]] → d**ai**bi *No hiatus resolution*

[35] But see Leu 2015 on the lexical base of functional items.

b. [$_{PWd}$ d**a**-**i**bi] → dibi *Hiatus resolved via deletion*

A strictly linear approach to the same set of facts would make no appeal to domains of any sort (PWds or otherwise), but would rely on linear boundary definition instead, using CV units to demarcate such boundaries. Specifically, the phonology might simply insert an empty CV unit at the left edge of the string corresponding to a completed cycle passed to it from the syntax. Such insertion would require no reference to hierarchy of any sort—it would operate strictly linearly, applying to strings, not structures.

With this in place, a deletion rule could be defined simply according to locality on the CV tier. The rule above could be rewritten as follows: *if two vocalic segments V1 and V2 are local on the CV tier, then delete V1* (where *local* means that no V intervenes between the V-positions associated to each segment). This would yield the same result as above. Note the presence of empty CV units at the left edge of each putative cyclic domain (i.e., the chunks previously identified as PWds):

(20) a. **C V** C V **C V** C V C V → da ibi
d a i b i

b. **C V** C V C V C V → dibi
d a i b i

In essence, the insertion of empty CV units only at the left edges of cyclic domains has the effect of disrupting locality between two adjacent Vs just in case they are separated by a cycle. This ensures that hiatus is resolved *within* a cycle, but not *across* cycles in this hypothetical language.

Returning to Ojibwe, we can note that this sort of approach allows Newell and Scheer (2017) to capture Left-edge/Right-edge asymmetries not discussed in Newell and Piggott (2014). Consider the following.

In addition to hiatus being resolved by deletion within a phase, hiatus may be resolved by deletion between a base and any suffix, even those that are arguably outside the phase that contains their base of attachment, as in the following (from Newell and Piggott 2014:333):

(21) nigi:we:ʔa:
[$_{CP}$ ni- [$_{vP}$ [$_{vP}$ gi:w**e:**] -**i**ʔ -a:]]
1SG go.home CAUS 3SG
'I make him go home.'

Here we see a typical 'high' causative, characterized by a causative morpheme introduced outside the internal *v*P phase. Even though the causative suffix is introduced after the internal *v*P undergoes spellout, hiatus is not resolved via epenthesis, contrary to what we expect (see discussion of (16)-(17), above); instead, it is resolved via deletion. Newell and Scheer (2017) propose that this is due to the fact that empty CV units are inserted only at the *left* edges of spell-out domains, and not at the right. Thus, when /-iʔ/ is linearized to the right of /gi:we:/, no vocalic syllabic space intervenes between the overt vowels; as such, they are in a local relation on the CV tier, and thus the second V is deleted by the rule defined above in (20):

(22) **C V** C V C V C V C V C V C V → gi:we:ʔ
g i w e i ʔ

We turn now to the epenthesis resolution strategy we saw above for /nidakwe:m/ in (17). In such

cases, an empty CV is inserted at the left edge of /akwe:m/ upon spell-out of the *v*P phase. When Phonological Merger applies, the presence of this empty CV triggers epenthesis. The intricacies of the phonological analysis of this epenthesis are omitted here, but what is clear here is that the phonologcial structures in (22) and (23) are distinct.[36] Here there is an empty V-slot that intervenes between the V-slots linked to the vowels, meaning the deletion rule does not apply (the vowels are not sufficiently local). In this environment a distinct operation is triggered: epenthesis.

(23)

The important point here for the Minimalist discussion is that, in the linear CVCV derivations, the behavior of the extra syllabic space is consistent with predictions of the theory that are independent of the questions of spell-out domains. The C in which the epenthetic consonant is inserted in (23) is predicted by CVCV phonology to be a strong position; where consonants undergo fortition, or resist lenition processes, cross-linguistically (the *Coda Mirror*: Scheer and Ségéral 2008, Scheer and Ziková 2010). It is a predictable candidate for epenthesis. In (22), however, the C position between vowels is in a weak (intervocalic) position on the melodic and syllabic levels. In a language that differentiates weak and strong consonant positions, this is a less likely position to host epenthesis (although epenthesis is not impossible here cross-linguistically).[37] Cs and Vs (or syllables, or morae) are independently motivated objects within NΦ regardless of one's theory of the interface. The addition of the Prosodic Hierarchy to the phonological toolbox in the Ojibwe analysis is superfluous when such purely phonological objects are appealed to, and on such grounds must therefore be excluded from a Minimalist analysis of the phenomenon. To the extent that this reflects a more general possibility – i.e., that prosodic phenomena can be reanalyzed without reference to the Prosodic Hierarchy – then the Prosodic Hierarchy can be excluded entirely from a Minimalist theory of the syntax-phonology interface (see also Pak 2008 and Samuels 2009).

4.2.4 Summary

In the preceding discussion of vowel hiatus in Ojibwe, we hope to have shown that while a PH-based approach is able to capture the relevant facts well enough, it ought to be discarded for an alternative that does not require endowing the phonological module with the ability to build and interpret hierarchical structure. We presented one possible replacement for prosodic constituency – essentially, a return to a boundary "symbol" (cf. # from SPE), albeit one with irreducibly phonological status in the form of an empty CV unit – and we demonstrated how it might be fruitfully deployed.

The sketch of the CVCV analysis in Newell and Scheer (2017) establishes its general plausibility (and its advantages over the PH-based alternative, when viewed through a Minimalist lens), in the hopes that it might provide a template for future work undertaking a Minimalist approach to the syntax-phonology interface.

In the next subsection, we turn to our third and final case study in syntax-phonology interface phenomena, involving domains of tonal phenomena in two Bantu languages. As with the

[36] For clarity, the details of the analysis in Newell and Scheer (2017) have been simplified here (particularly regarding the more technical aspects of CVCV phonology).

[37] If we compare such a derivation to one that appeals to prosodic constituents, as the Prosodic Hierarchy does, we find that the prosodic constituents are proposed to be stronger initially and weaker finally, in a accordance with the cross-linguistic data, but that there is no independent motivation for this pattern; it could have just as easily been the opposite, where final position is strong and initial position is weak. Therefore, in addition to causing problems for Modularity (and therefore for Minimalist theorizing), the PH analysis lacks independent motivation for its phonological effects. This is true also of the boundary symbols used in SPE (and Selkirk's early work): see Scheer (2008) for a discussion of the phonological predications made by different boundary markers on the market.

Ojibwe data, we will see that syntax plays a crucial role in producing the observed effects; thus, a Minimalist-friendly analysis (i.e., one not built from elements of the PH) is required. We lay out a plausible path toward this goal below.

4.3 Case study 3: Tone and the Prosodic Hierarchy

A persistent topic in the interface literature is how to account for the realization of tone patterns such as spreading and deletion.[38] Tone spreads selectively in these langauges, and it is debated whether the domains in which it spreads are non-isomorphic with the syntactic structure or with syntactic phases. For example, Cheng and Downing (2016) propose that phases cannot account for the tone patterns seen in languages such as Kinyambo, while Sato (2009) suggests that a Multiple Spell-Out/phase account does in fact offer insight into the same data. In §4.3.1, we summarize Sande et al.'s (2020) Optimality Theoretic account of tone placement in Kuria, a North-East Bantu langauge, as it is the most modular account of tone we have seen in the OT literature, extending our discussion of modularity as a central tenet of Minimalist investigations. In §4.3.2, we will discuss Lee and Selkirk's (To appear) account of tone spreading in Xitsonga, a Southern Bantu language. They also treat the issue of modularity, and offer some seemingly problematic data for theories that seek to account for phonological domain effects without the PH (as we have advocated here).

This subsection serves to demonstrate that the same questions that were pertinent for the analysis of segmental patterns, such as the hiatus resolution in §4.2, are relevant for the suprasegmental domain of tone (and intonation). This is additionally pertinent as tone spreading crosses phrasal boundaries more readily than segmental processes appear to, allowing us to broaden the scope of the discussion of the interface to larger phonological domains. These larger domains of application seem to pose particluarly difficult challenges for any theory that does not make use of the Prosodic Hierarchy; thus, the discussion below serves as both a demonstration of how current analyses violate Minimalist premises, as well as a blueprint for how these challenges might be met. It also serves to highlight a trend in the tone literature toward considerations of modularity, suggesting that even the traditionally modularity-violating Optimality Theoretic work that dominates the analytical landscape of suprasegmental phenomena is leaning toward what can be considered Minimalist and Modularist phonology.

4.3.1 Kuria high tone placement

In Kuria, tone spreading crosses syntactic phrasal boundaries. In this subsection, we discuss how Sande et al.'s (2020) analysis of this fact demonstrates that an OT-based approach can be consistent with a Minimalist approach to phonology. We also point out that, although Sande et al.'s analysis invokes the PH, it does not appear to do any real work for them.

Kuria verbal conjugations are marked with a segmental prefix, as well as being marked by a High tone that docks according to morpheme-specific instructions. For example, the tense-aspect prefixes /o-/ and /ra-/ each come with a lexical High tone, but the former's H is linked to the immediately following mora (or V on the CV-tier, if translated into CVCV terms), while the latter's H is linked to the fourth mora following the prefix (other affixes have other lexically-specified tone attachment sites). Tone spreading then applies up to the penultimate mora (Sande et al. 2020:1212). (The initial site of tone linking is underlined.)

(24) Mora-counting H assignment in Kuria verb stems (Marlo et al. 2015:252-253)

[38] Unlike the tone sandhi phenomenon discussed in §4.1, the tone spreading and deletion patterns generally seen in Bantu languages discussed in the interface literature do not appear to be allomorphic (see Downing 2011 and references therein).

μ1 n-to-o-[hóótóótér-a]
FOC-1PL-TA-[reassure-FV]
'We have reassured.'
μ4 to-ra-[hootoótér-a]
1PL-TA-[reassure-FV]
'We are about to reassure.'

Interesting for a discussion of the interface is that the H introduced by /ra-/ may link to a mora outside of the verbal complex, i.e. on the object, when the verb is sufficiently short (Sande et al. 2020:1213):

(25) μ4 to-ra-[rom-a eɣétɔ́ɔ́kɛ]
1PL-TA-[bite-FV banana]
'We are about to bite a banana.'
μ4 to-ra-[ry-a eɣétɔ́ɔ́kɛ]
1PL-TA-[eat-FV banana]
'We are about to eat a banana.'

Sande et al. offer an analysis of the availability of the object as a target for High tone linking within a phase-based realizational framework, just as the verbal word is a target for Phonological Merger in Newell and Piggott (2014). The authors discuss how such an account eliminates the need for constraints that violate modularity, such as interface MATCH constraints. Recall that a standard MATCH constraint would be along the lines of the following:

(26) MATCH(XP, φ)
The domain of XP must match a φ (Prosodic Phrase) in the phonological representation.

The constraint in (26) (found in standard OT analyses: see §3) violates modularity when ranked among purely phonological constraints, as it references morphosyntactic information. Sande et al.'s solution is to relegate phonological structure-building to the NΦ, just as in the non-OT account in §4.2. The phonological string sent to PF by the syntax will undergo phonological computation, which includes, as a default, building a phonological domain around the entire string. The following constraint is proposed to capture this analysis:

(27) MAXIMIZE PROSODIC DOMAINS (Sande et al. 2020:1222)
All phonological content should be parsed into a single prosodic domain (e.g. word, prosodic phrase, intonational phrase)

Note that this constraint applies to a string that has been sent to PF via the mechanism of spell-out; it does not require any reference to XPs or X^0s (or to lexical or functional diacritics, also to be discussed below). It could be argued that it does not actually require the construction of prosodic domains like the PWd or PPh at all. In essence, it says "compute phonology over the entire phonological string received". This strikes us as entirely Minimalist and consistent with the linear approach to phonology presented in the discussion of Ojibwe in §4.2.

For example, consider the data we saw above in (25). There, the nominal objects are contained within a DP, presumed here following much work in the literature to be a phase.

(28) $[_{DP}$ eɣetɔɔkɛ] → /eɣetɔɔkɛ/

As far as we can tell, nothing forces us to adopt Sande et al.'s proposal that prosodic structure is built

here (a PWd), or even that a left-edge CV be inserted.[39] Let us assume no extra structure building unless we have clear evidence for it.

Turning to the next phase, the *v*P contains the verb and its complement DP. At spell-out of *v*P, phonology will again consider the entire string. As there is no tone to spread from the verb stem, nothing relevant happens at this step. Sande et al. propose that a PWd is built around the verb stem, but again, the construction of prosodic structure does not appear to be required here, so we will omit it.

(29) $[_{vP}$ rom-a $[_{DP}$ eɣetɔɔkɛ]] → /romaeɣetɔɔkɛ/

Finally, the CP phase will be interpreted. Since the *v*P and DP are in the spell-out domain (the complement) of C^0, the entire string will be visible.

(30) $[_{CP}$ to-ra $[_{vP}$ rom-a $[_{DP}$ eɣetɔɔkɛ]]] → /toraHromaeɣetɔɔkɛ/ → [toraromaeɣétɔ́ɔ́kɛ]

In (30), the phonology sees the linear string that is contained within the spell-out domain, and phonological rules (here of tone placement) have access to everything within this domain. Note once again that, as with the Ojibwe analysis, it is important that the PIC plays no role on the phonological side: the phonology is able to manipulate the content of earlier cycles it has already operated on. Here, tone spreads onto the string to its right in Kuria, just as sub-minimal prefixes cliticize to the string to their right in Ojibwe.

This section serves to demonstrate that Optimality Theoretic analyses, though often non-modular due to the presence of MATCH-type constraints ranked in the NΦ, are not incompatible with a modular, minimalist account. Regardless of whether the Prosodic Hierarchy is required, diacritic (and therefore not a possible phonological object, as argued in Scheer 2008) or simply unnecessary, the account in Sande et al. (2020) avoids constraints that reference syntactic and phonological information simultaneously, while accounting for how Tone spreading crosses phonological phrase boundaries—an important goal from the perspective of Modularity-minded theorists. Clearly there is abundant argumentation in the literature that the PH is indeed necessary to account for domain delimitation in phonology. As mentioned in the introduction to this chapter, it would be impossible to survey all of the evidence for or against it. The point we want to make here is simply that Minimalism requires us to take seriously the idea that it may not be necessary for both the NS and the NΦ to independently determine the size of phonological domains.

A different proposal that does include MATCH constraints while simultaneously targeting a modular grammatical system is discussed in the following section.

4.3.2 Derivation versus representation: Xitsonga tone spreading and penultimate lengthening

Another analysis of tone spreading that can be counted among those interface analyses concerned with Modularity is that of Lee and Selkirk (To appear). Following Kratzer and Selkirk (2020:§6.1), they break the PF branch into two separate stages: Vocabulary Insertion and Phonology (see also Idsardi and Raimy 2013). According to Kratzer and Selkirk (2020:§6.1) and Lee and Selkirk (To appear), there is a first step of spell-out from the *Morphosyntactic Output* (MSO) to the *Phonological Input* (PI), and a second step from the PI to the *Phonological Output* (PO). This latter mapping is referred to as the 'phonology *per se*' (akin to our NΦ).

One element of Vocabulary Insertion in Kratzer & Selkirk's and Lee & Selkirk's accounts is the insertion of prosodic structure, mediated by MATCH constraints. This gives us a system whereby OT

[39] Note that whether or not the left edge is marked with empty syllable space as seen in section §4.2 is proposed to be parametrized cross-linguistically (see Scheer (2004) and D'Alessandro and Scheer (2015)), while the PH is proposed to be universal.

constraints are computed in two cycles.[40] Now, as mentioned in the introduction to this chapter, all frameworks must have a stage in the derivation where the output of the syntactic module is translated into vocabulary that is parsable in the phonological module. This is consistent with Strict Modularity *iff* the translation is a pure mapping with no computation involved. As a module can only work with a single vocabulary (either phonology or morphosyntax), a MATCH constraint like the following cannot be involved in any computation as such:

(31) MATCHPHRASE (Kratzer and Selkirk 2020:19, Lee and Selkirk *to appear*)
For every instance of a Phrase in MSO there is exactly one instance of a phonological phrase φ that spells it out phonologically in PI.

If MATCH constraints are pure mapping instructions, and the relationship between the MSO and PI is uniformly isomorphic (non-isomorphism being derived subsequently in the computation of the phonology *per se*), then it would be unnecessary formulate these in the same fashion as standard OT contraints. A group of inviolable MATCH Constraints would not need to be ranked or undergo EVAL: such a computation would be superfluous (in addition to being anti-modular). The separation of MATCH constraints from the NΦ could be seen as tantamount to removing MATCH contraints from the phonological computation entirely, as proposed by Sande et al. (2020). Yet, this is not the proposal in Kratzer and Selkirk (2020) and Lee and Selkirk (to appear). Their proposal involves a computation of ranked constraints between MSO and PI, where, for example, MATCHPHRASE can be ranked alongside a contraint that destresses given material (cf. DESTRESSGIVEN: Féry and Samek-Lodovici 2006), a decidedly non-phonological notion:

(32) [G] = No-φ (DEPHRASEGIVEN) (Kratzer and Selkirk 2020:29)
A [G]-marked constituent in MSO corresponds to a prosodic constituent in PI which is not a φ and contains no φ.

Clearly, a mapping algorithm that involves computing ranked contraints referencing both syntax and phonology requires the elimination of Strict Modularity. Ultimately, a Minimalist alternative should be pursued—one that does not require blending the syntactic and phonological vocabularies within a single comptuation. While we do not attempt this here, we wish to highlight what we see as a positive trend developing in the OT literature: namely, that Strict Modularity seems once again to be a going concern for mainstream theories of prosodic phonology, after seemingly having falling off the research agenda for some time (with limited exceptions, e.g. work by Ricardo Bermúdez-Otero, Tobias Scheer, Jochen Trommer, and Eva Zimmerman; see Scheer 2011:§406 on the historical role played by Modularity in the development of Prosodic Phonology).

Independently of concerns of modularity, Lee and Selkirk (to appear) discuss a pattern that appears problematic for an analysis based solely on cyclic spell-out. They argue that an account of Xitsonga tone spreading and penultimate lengthening must crucially make reference to phonological domain formation via the PH. If this is correct, then our endeavor to seek Minimalist alternatives to the PH is in jeopardy. We briefly describe the data and their analysis before suggesting an alternative that accords with our premises, again with the broader goal of demonstrating that alternative approaches eschewing the PH can and should be pursued.

In Xitsonga, lexical tone spreads from left to right, up until the penultimate vowel within its domain (as was the case above for Kuria). For example, comparing the PI to the PO in (33), we see that the underlying H from the applicative object (AO) *hosi* 'chief', indicated with $^{/\mathrm{H}\backslash}$, spreads to the penultimate syllable of the direct object (DO) *hlambeto* 'cooking pot'. Interestingly, though, Lee

[40] This is much like the multiple strata proposed in Stratal OT, but where mapping itself is considered a Stratum. See Kiparsky (2015) and Bermúdez-Otero (2017) for overviews of Stratal OT.

and Selkirk demonstrate that this regular spreading process is disrupted when a potential target is modified. Consider (34), whose PI differs from that of (33) only in that its DO contains a "modifier", *yin'we* 'one':

(33) verb [$_{NP1}$ *noun*] [$_{NP2}$ *noun*]
PI: ni hlawulela hosí$^{/H\}$ hlambeto
1SG select chief cooking.pot
PO: ni hlawulela hosí$^{/H}$ hlámbé:$^{H\}$to
'I select for the chief a cooking pot.'

(34) *verb* [$_{NP1}$ *noun*] [$_{NP2}$ *noun* [$_{MP}$ *mod*]]
PI: ni hlawulela hosí$^{/H\}$ hlambeto yin'we
1SG select chief cooking.pot one
PO: ni hlawulela hosí$^{/H\}$ hlambeto yi:n'we
'I select for the chief one cooking pot.'

Lee and Selkirk argue that this spreading pattern cannot be captured with a derivational/spell-out approach of the sort we are advocating here, as modification of the DO does not change its syntactic relationship with the AO.

Relevantly, if we look at the position of long vowels in the above examples, we can see that there is only one in each sentence, in the penultimate syllable of the entire string. This lenthening is proposed to indicate phonological domains, specifically the right edge of Intonational Phrases, mapped from CPs, and therefore demonstrates that even when the DO is modified, it still belongs to the same domain as the verb and the AO. In contrast, right-dislocated arguments will show independent penultimate lengthening, while remaining subject to the same tone spreading restrictions as in (33)-(34). For example, tone spreads onto *dokodela* 'doctor' in (35a), even though it constitues a separate domain for final lengthening; by contrast, it does not spread in (35b), where the right-dislocated nominal is modified by *ntshwá* 'new', even though the domains for penultimate lengthening are not affected (adapted from Lee and Selkirk *to appear*:(20)):

(35) a. ú-vóná ho:$^{\downarrow}$sí, dókódé:la
3SG-see chief doctor
's/he sees the chief, the doctor.'
b. ú-vóná ho:sí, dokodela $^{\downarrow}$ló:-ntshwá
3SG-see chief doctor CL1-new
's/he sees the chief, the new doctor.'

The question then becomes how to account for this effect of syntactic modification on tone spreading.

Lee and Selkirk propose that the relevant effect here is not due to modification as such, but rather the binary prosodic structures that arise as the result of such modification. *Binarity* is a property commonly invoked in prosodic phonology; it refers to the apparent preference exhibited by phonological phrases (PPhs) for comprising two prosodic words. In this case, the claim is that an unmodified noun maps to a unary PWd, which would be an unsuitable PPh under Binarity. On the other hand, a modifier-noun pair will map to a PWd-PWd pair, and this resulting binarity qualifies it for containment within a PPh. With this in place, Lee and Selkirk simply claim that tone spreading in Xitsonga cannot cross the left edge of a PPh—this yields the effect that tone spreading is blocked on modified nouns, as seen above. The prosodic output structures they propose for (35) are below (based on Lee and Selkirk *to appear*:(21)-(22)):

(36) a. ($_{\text{IntP}}$ ($_{\text{IntP}}$ ($_{\text{PPh}}$ ú-vóná ho:$^{\downarrow}$sí)), dókódé:la)
's/he sees the chief, the doctor.'
b. ($_{\text{IntP}}$ ($_{\text{IntP}}$ ($_{\text{PPh}}$ ú-vóná ho:sí)), ($_{\text{PPh}}$ dokodela $^{\downarrow}$ló:-ntshwá))
'sh/e sees the chief, the new doctor.'

Note that patterns of this general sort have received alternative analyses in both Pak (2008) and Sato (2009). They propose that the timing of linearization or Spell-Out (respectively) is affected by whether a node is modified or not. Either of their accounts could capture the effect of modification in delimiting tone spreading in Xitsonga. Briefly, they propose that single/simplex phrases are spelled out with, or directly linearized in relation to, the phrase they attach to. Complex, multi-word phrases, are spelled out as separate domains, and/or linearized internally before being linearized in relation to the phrase they modify/merge with. This can allow for a distinction in spell-out domain determination where tone spreading only applies inside a spell-out domain, or between words that are directly linearized.[41] The challenge for these approaches lies in accounting for the right-dislocated phrases in (35): namely, the fact that they vary as to whether they are separate spell-out domains for the purposes of tone spreading but are always separate spell-out domains for the purposes of penultimate lengthening.

Scheer (2011:§4) and Newell and Scheer (2017) call phase/spell-out accounts of domain formation 'procedural' in that the derivation itself is proposed to interact with the timing of the application of phonological rules/contraints in a way that explains a pattern. What Lee and Selkirk (to appear) are arguing in their work is that a strictly procedural account will not be able to capture all the data, and therefore the representational PH is additionally required.

Lee and Selkirk do not, however, compare their PH account to other representational accounts. A representational account of domain formation is one that inserts phonological structure that blocks (or triggers) the application of phonological rules/constraints. The PH is a representational account of domain formation, as is the CV-insertion account in §4.2 (albeit one based on boundaries rather than constituents). The Xitsonga pattern can be fairly easily captured in a combined phasal / linear CVCV cyclic spell-out account, where spell-out domains define the application of penultimate lengthening, but only modified phrases insert an empty CV at their left edge, blocking tone spreading. Specifically, the translation algorithm would insert a left-edge CV at the spell-out of any phasal category composed of more than one segment (Kayne 1994). A similar kind of selective CV-insertion is proposed in Scheer (2012:§310) and D'Alessandro and Scheer (2015). In (37), square brackets indicate phases (not phonological structure), and a CV is inserted the left edge of only modified phrases:

(37) a. [ú-vóná ho:$^{\downarrow}$sí]$_{,}$ [dókódé:la]
ú-vóná ho:$^{\downarrow}$sí dókódé:la
's/he sees the chief, the doctor.'
b. [$_{\text{CP}}$ ú-vóná ho:sí]$_{,}$ [$_{\text{DP}}$ dokodela [$_{\text{DP}}$ $^{\downarrow}$ló:-ntshwá]]
ú-vóná ho:sí CV dokodela $^{\downarrow}$ló:-ntshwá
'sh/e sees the chief, the new doctor.'

How an empty CV blocks tone spreading is not inherently a more complicated question than how a prosdic boundary does. What is important to note here is that representational domain-delimiting apparatii are an important area of agreement between proponents of the PH and proponents of linear boundary markers, such as in CVCV Phonology. We see no knock-down argument that one representational tool in (36) and (37) fares better than the other at explaining the Xitsonga data.

[41] This is clearly similar to the distinction made between the modifier *bi-* and the person-marker *ni-* in the discussion of Ojibwe.

Where these theory do differ, however, are important to a minimalist programme for the investigation of the syntax-phonology interface. The types of arguments that will distinguish the two may be theoretical or empirical. An example of a theoretical argument would be if one puts forward that hierarchical structure is a product of Merge, and Merge is not a phonological operation (as do Neeleman van de Koot 2006), then phonological representation must be linear. If, on the other hand, one argues that linear boundary markers are excluded from the possible phonological tool-kit, then hierarchical domains are a relevant alternative.[42] An empirical argument would be that the PH does not predict the operations that it triggers. As noted in Scheer (2008, 2012), a Prosodic Word edge does not inherently predict either fortition or lenition, while the presence of an empty CV does predict fortition of a following consonant, the pattern attested at the left edge of strings. Alternatively, proponents of the Prosodic Hierarchy may argue, as do Bonet et al. (2019), that analyses that do not appeal to the PH are too strict or too permissive. It is of note in this latter case that Bonet et al. argue against D'Alessandro and Scheer (2015), an article that proposes two main tools for explaining patterns at the syntax-phonology interface; phases, and initial CVs that are inserted selectively at certain phase edges. The arguement in Bonet et al. uniquely criticizes D'Alessandro and Scheer of the basis of the procedural part of their analysis (claiming that phases cannot delimit the correct domains), but do not even mention the alternative representational part of the account; the empty CV. More work clearly needs to be done on the different predictions made on the representational side of PF interface analyses. This section has served as an initial foray into this kind of comparison, keeping in mind that, all else being equal, the simpler and more explanatory representational tools should be appealed to within a Minimalist phonological framework.

5 Conclusion

We have attempted to lay out the standards that any theory of the syntax-phonology interface must meet to qualify as Minimalist, under our current understanding of that term. The most restrictive of these standards are Strict Modularity and the elimination of architectural redundancy imposed by what we called the Minimalist Critique. We take both of these to be non-negotiable for any Minimalist interface theory; as such, various approaches to the syntax-phonology interface – including some highly popular and influential ones, such as the Indirect Reference approaches to Prosodic Phonology – were only given relatively brief treatments here, as they were found not to meet these standards. In that sense, this chapter is programmatic rather than comprehensive, and readers seeking the latter will have to look elsewhere (e.g. Elordieta 2008, Elfner 2018, Bennett and Elfner 2019). What we have done here, is to lay out a list of benchmarks that a minimalist theory of the phonology-syntax interface must meet. We have argued that Ellipsis cannot be deletion at PF. Concomitantly, we have been forced to the conclusion that the projection of the Prosodic Hierarchy poses many problems for a modular theory of the interfaces. If it is to be maintained, must be effected at translation, and cannot be part of the phonological computation. We agree with Sande et al. (2020) that Match constraints can be profitably removed from the phonological grammar. That said, we have also discussed a linear alternative to the PH; the empty CV (or empty syllabic space). The advantages of such a theory within a minimalist theory of the PF interface are clear. The empty CV makes phonological predictions that the PH does not. And if it is not present, then it cannot be referenced in the computation of Ellipsis. Seemingly disparate interface patterns: ellipsis, hiatus resolution, and tone spreading, are all more parsimoniously explained without the PH. Our insis-

[42] Scheer (2011) discusses how early work on the Prosodic Hierarchy did argue against lineary boundary markers. Importantly, the argument was against the non-phonological diacritics found in SPE (-,+,#). He notes that boundary markers built from independently necessary phonological objects, such as syllabic space (CV structure), were not considered at the time, and therefore no argument againt them has ever been levied in the phonological literature.

tance on subjecting theories of the syntax-phonology interface to the Minimalist Critique and a strictly-modular standard creates many new challenges—many more than we were able to address in this chapter. Among the relevant phenomena that we were not able to discuss, but which will nevertheless contribute an essential part of any truly Minimalist theory of the syntax-phonology interface, include the following; intonation, infixation, linearization, ...

We hope that this chapter serves as a tool for future investigations of these interface issues, with a goal of probing how far we can push a minimalist, modular explanation for the cross-linguistic patterns we see. We would like to close on a brief methodological note. To the extent that the foregoing discussion has been valuable to readers interested in what a Minimalist approach to the syntax-phonology interface might look like, we would like to credit a collaborative process which brought together two linguists with very different backgrounds: one a phonologist with syntactic inclinations, the other a syntactician with phonological leanings. Inter-modular communication is essential in interface derivations and collaborations alike.

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