Phasal syntax = cyclic phonology?

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Abstract

This paper addresses three central questions in the phonology-syntax interface: What does phonology know about syntax? Does phrasal phonology 'know' about syntax directly or indirectly (i.e., mediated by prosodic constituents like Intonation Phrase)? When does the phonology-syntax interaction take place? Most current phase-based theories of the interface assume a strict cyclic model of derivation, where the output of each spell-out domain directly feeds the phonology. We argue instead for an indirect model where phonology is mainly conditioned by phase edges and accesses syntax only when the syntactic derivation is complete. We motivate the model mainly with data from Bantu languages which have played a leading role in the development of current theories of the phonology-syntax interface.

Keywords: phonology-syntax interface, Bantu languages, spell-out domain, Edge-based alignment, prosodic phrasing

1   Introduction

The goal of this paper is to address a central question in the syntax-phonology interface, namely: what does phrasal phonology know about syntax (Chen 1990)? Work based on current syntactic models using phases often proposes that prosodic domains are identical to spell-out domains. We argue in this paper that spell-out domains are not adequate to define the domains necessary for phonological processes. Instead, it is phase edges which play a central role in accounting for the prosodic phrasing properties of the languages we discuss. This proposal raises, though, two other central and related questions. First, does phrasal phonology 'know' about syntax directly or indirectly? Second, when does the phonology-syntax interaction take place? Most current phase-based theories of the interface assume a strict cyclic model of derivation where the output of each spell-out domain directly feeds the phonology. We argue instead for a non-cyclic model where phonology has access to the syntax only indirectly, when the syntactic derivation is complete.

The paper is structured as follows. In section 2, we present data from Bantu languages that have played a central role in the development of theories of the syntax-phonology interface, and show that the domains motivated by the phrasal prosodic properties do not match the domains predicted by spell-out-based approaches for both simple sentences and restrictive relative clauses. In section 3, we take up the question of whether phase edges are referenced directly or indirectly by the phonology, arguing for an indirect approach which parses the syntactic string into phrasal domains by aligning prosodic constituent edges with phase edges. In section 4, we take up the question of when phonology accesses syntax and argue for a non-cyclic model where the string is parsed into prosodic domains only when the syntactic derivation is complete. We conclude in section 5.

2   What does phonology know about syntax?

The correlation between phonology and syntax has been investigated in the generative linguistic tradition beginning with *SPE* (Chomsky & Halle 1968). Phase-based syntax (Chomsky 2001) has provided new ways of formalizing the relation between syntactic and prosodic domains. In one current theory spell-out strips away a phonological string (the complement of a phase head) from the syntactic structure and maps it to the phonological component. (For a variety of proposals see, e.g., Adger 2007; Dobashi 2004, 2009, 2010; Ishihara 2007; Kahnemuyipour 2009; Kratzer & Selkirk 2007; Newell 2008; Pak 2008; Selkirk 2009, 2011.) In this section, we present data from selected Bantu languages illustrating that a spell-out domain analysis incorrectly predicts that subjects, verbs, and heads of restrictive relative clauses should all phrase separately from what follows. We argue that though phases play a central role in determining prosodic phrasing, it is not spell-out domains that matter, but phase edges.

2.1 Spell-out domains in Bantu languages

Basic word order in most Bantu languages is: (S) V (IO) (DO) (Bearth 2003, Heine 1976). This order is rather rigidly enforced in languages like Zulu, less rigidly in languages like Chicheŵa. In this section, we briefly discuss the relevant syntactic structures for the Bantu languages we discuss in a phase-based approach.

According to the syntactic theory of phases (Chomsky 2000, 2001), syntactic structure is sent out in chunks – phase by phase – for phonological (and semantic) interpretation. In particular, the operation Spell-out transfers a syntactic object to the phonological component, which is then interpreted by the phonological component. Chomsky (2001, p.5) states that "Spell-out is strongly cyclic … Furthermore, the phonological cycle is not a third independent cycle, but proceeds essentially in parallel." In this paper, we follow other work on the phonology-syntax interface – like Adger (2007), Chomsky (2000), Kahnemuyipour

(2009), Kratzer & Selkirk (2007), Legate (2003) and Pak (2008) – in adopting the version of Spell-out where a spell-out domain is the complement of a phase head, as indicated in (1):

(1) Phases   Equivalent spell-out domains

     vP and CP   VP and TP, respectively

We discuss in sections 2.2.2, and 2.2.4 the alternative version of Spell-out where the spell-out domain is identical to a phase.

   To understand the Bantu data, we need to understand what is in VP and TP. Subjects must raise to SpecTP to trigger subject agreement with the verb (see Carstens 2005). The subject (agreement) marker is both an agreement marker and a pronominal (see Bresnan & Mchombo 1987). Following Julien (2002) (see also Buell 2005, 2006), we assume that the verb in Bantu languages undergoes movement to a position between T^0 and v^0, an X^0 (corresponding often to an inflectional final vowel, containing valency and modality information). Positioning the verb in between T^0 and v^0 can easily accommodate the subject marker and tense/aspectual prefixes as well as verbal suffixes such as applicative, causatives, etc.[1] We take Cheng & Downing's (2007, 2009) analyses of the syntactic structure of simple sentences and restrictive relative clauses for Bantu languages like Zulu and Chicheŵa as the basis for our analysis. The syntactic structure assumed for a simple sentence (S V IO DO) like the one in (2) is given in (3).[2,3]

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[1]   Note that even if the verb moves to T^0, it would not affect our analysis below.

[2]   The accent marks on vowels in the data indicate tone; long vowels are indicated by doubling the vowel. In the morpheme glosses, numbers indicate noun class agreement, following the standard Bantu system adopted in work like Mchombo (2004). The following abbreviations are used: CL = noun class marker; OBJ = object marker; SUBJ = subject marker; TAM=tense-aspect marker; NEG = negative; INF = infinitive; COP = copula; REL = relative; LOC = locative; DJ = disjoint verbal affix.

(2)   Zulu (Cheng & Downing 2009)

[$_{TP}$ Ú-Síph'   ú-phékél' [$_{vP}$ ú-Thánd'   in-kúukhu]]

        CL1-Sipho   1SUBJ-cooked.for   CL1-Thandi   CL9-chicken

    'Sipho cooked chicken for Thandi.'

(3)   CP
        ┌──────┴──────
        C^0 TP → Spell-out domain 2
            ┌──────┴──────
        Subject   T'
                ┌──────┴──────
                T^0 XP
                        ┌──────
                            X'
                    ┌──────┴──────
                    X^0 vP
                        ┌──────┴──────
                        v^0 VP → Spell-out domain 1
                            ┌──────┴──────
                            IO   V'
                                ┌──────┴──────
                                V^0 DO
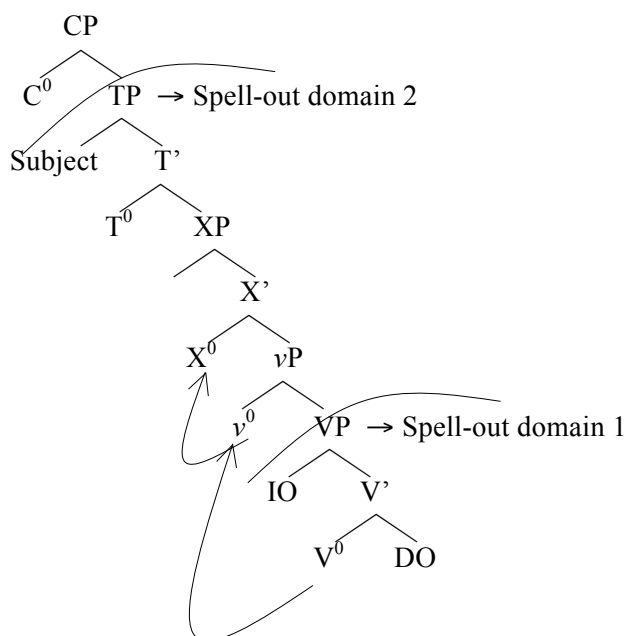
For a sentence containing a restrictive relative clause like the one in (4), the structure

assumed is the one consistent with a raising analysis (e.g., Kayne 1994), where the head noun

and the relative clause are contained in a CP phase, as shown in (5):[4]

(4) Zulu (Cheng and Downing 2007)

[$_{TP}$ [$_{DP}$ [$_{CP}$Ín-dod'   é-gqokê   ísí-gqooko]]   í-boné   ízi-vakáashi]

        CL9-man   REL.9SUBJ-wear   CL7-hat   9SUBJ-see   CL8-visitor

    'The man who is wearing a hat saw the visitors.'

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3   As a reviewer points out, if the verb does not move out of the VP, the prosodic word would be
     split in two different syntactic phases.

4   With the traditional NP-adjunction analysis of restrictive relative clauses, the distinction between
     the prosodic phrasing of restrictive and non-restrictive relative clauses cannot easily be accounted
     for. See Cheng and Downing (2007) for more detailed discussion. And see section 3.3 below for a
     discussion of the prosodic phrasing of adjuncts.

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(5) Restrictive relative clause

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              DP
            /    \
         D⁰       CP → Spell-out domain 2
        /        /  \
   HEAD N       C'
              /    \
           C⁰       TP → Spell-out domain 1
```
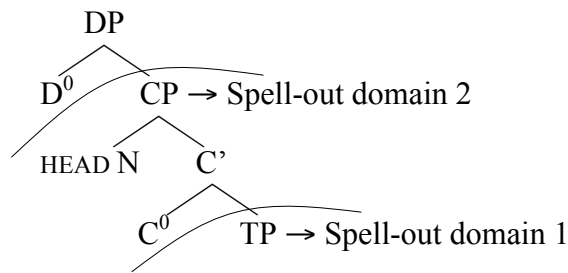
In a standard Kaynian analysis (Kayne 1994: 91; Bianchi 1999: 190-197), a restrictive relative clause is in the spell-out domain within the CP-phase (i.e., the TP in (5)), while the head and complementizer are outside this spell-out domain. If DP were also a phase, the CP selected by the D^0 would constitute another spell-out domain (spell-out domain 2 indicated in (5)). (We shall come back to the question of whether DP is a phase in Bantu languages in section 3.2 below.)

Given these assumptions about the relevant syntactic structures, a spell-out domain based approach to prosodic phrasing predicts the patterns for simple sentences and relative clauses summarized in (6).

(6) Relevant structures and spell-out domains (domain 1 is bolded; domain 2 bolded & underlined)
   a. *simple sentence* [$_{CP}$ [$_{TP}$ **<u>Sipho cooked</u>** [$_{vP}$ [$_{vP}$ **Thandi chicken**]]]]
   b. *restrictive relative clause*
      [$_{DP}$ the [$_{CP}$ **<u>man</u>** [$_{C'}$ **<u>who</u>** [$_{TP}$ **is wearing a hat**]]]] saw the visitors

For a simple sentence, since there are two phases (*v*P and CP), and thus two spell-out domains (VP, TP), we expect two prosodic domains, one per spell-out domain, with a phonological phrase break following the verb. For the DP containing a relative clause, we expect at least one prosodic domain (the relative TP) and if DP is a phase, a second prosodic domain (the material outside this TP). Crucially, the TP within the relative clause is in a

separate spell-out domain from the head of the relative clause, and thus, a prosodic phrase break is predicted to follow the relative complementizer/pronoun.

2.2 Testing the spell-out domain approach on four Bantu languages

In this section we look at four Bantu languages where previous work shows that there are systematic cues to prosodic phrasing: Chicheŵa, Kinyambo, Luganda and Zulu. As we shall see in section 2.2.1, the attested phrasing in these languages does not match the phrasing predicted in a spell-out domain account.

2.2.1 Phrasing in simple sentences

The phrasing patterns are illustrated first with data from Zulu and Chicheŵa. (Zulu is Bantu S40, spoken in South Africa; Chicheŵa is Bantu N30, spoken mainly in Malawi.) The salient cue to prosodic phrasing in Zulu and Chicheŵa is penultimate vowel lengthening.[5] Neither Zulu nor Chicheŵa has contrastive vowel length. However, certain penult vowels are lengthened as a correlate of phrasal stress. (See Downing & Pompino-Marschall 2013 for a recent overview of penult lengthening as a cue to stress in Bantu languages.) Following work like Kanerva (1990), Selkirk (2000), and Truckenbrodt (1995, 1999, 2007) we posit that each lengthened penult syllable is the metrical head of a prosodic phrase domain, and a prosodic phrase domain follows the word with the lengthened vowel. Using this criterion for prosodic parsing,[6] we can see that in (7) and (8), the verb always phrases with a following object, while adjuncts, such as the temporal adverbs in this data, phrase separately. Note in (7b, c) and (8b, c) that the phrasing of the subject is variable: sometimes it is phrased with the following verb and sometimes it is not. (We take up the phrasing of subjects in sec. 3.3.) The

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[5]   In Chicheŵa, some tonal processes are conditioned by the same phrasal domain as penult lengthening. See Kanerva (1990) for detailed discussion.

[6]   Throughout the paper, parentheses indicate prosodic phrasing. The phrasing indicated in this section is motivated in detail in section 3, below.

lengthened penults that justify the phrasing are bolded in these examples. (Note that

morpheme concatenation can lead to sequences of identical vowels in Chicheŵa, as in (8c),

below):

(7) Zulu (Cheng & Downing 2007, 2009)

    a. (bá-níké   ú-Síphó   íí-m**aa**li)

        2SUBJ-give CL1-Sipho CL9-money

        'They gave Sipho money.'

    b. (ú-Síph'   ú-phékél'   ú-Thánd'   in-k**úu**khu)

        CL1-Sipho 1SUBJ-cooked.for CL1-Thandi CL9-chicken

        'Sipho cooked chicken for Thandi.'

    c. (ín-kósík**aa**zi) (í-théngel'   ábá-fán'   ízím-b**aa**tho)

        CL9-woman   9SUBJ-buy.for CL2-boy CL10-clothes

        'The woman is buying clothes for the boys.'

    d. ((bá-ník'   ú-Síph'   í-bhayisék**ii**li)   namhl**áa**nje)

          2SUBJ-gave CL1-Sipho CL5-bicycle   today

        'They gave Sipho a bicycle today.'

(8) Chicheŵa (Downing & Mtenje 2011a, b; Kanerva 1990: 98, fig. (101a))

    a. (A-na-ményá nyumbá ndí   mw-**áá**la)

        s/he-TAM-hit CL9.house   with   CL3-rock

        'S/he hit a house with a rock.'

    b. (Ma-kóló a-na-pátsíra   mwaná   ndalámá   zá   mú-longo w**áa**ke)

        CL6-parent 6SUBJ-TAM-give CL1.child CL10.money 10.of   CL1-sister 1.her

        'The parents gave the child money for her sister.'

    c. (M-f**úu**mu) (i-na-pátsá   mwaná   zó-óv**áa**la)

        CL9-chief   9SUBJ-TAM-give CL1.child CL10-clothes

        'The chief gave the child clothes.'

    d. (B**áa**nda)   ((a-ná-wá-ona   a-le**é**ndó) dz**uu**lo)

        CL1.Banda   1SUBJ-PST2-2OBJ-see CL2-visitor yesterday

        'Banda saw the visitors yesterday.'

We next turn to prosodic phrasing in Kinyambo (Bantu J20, spoken in Tanzania). In this language, the cue to prosodic phrasing is High Tone Deletion (HTD):

(9) Kinyambo High Tone Deletion (HTD) (Bickmore 1990: 9)
    H tone is deleted if followed by a H tone in the following word in the phrase.

The sentence in (10a) illustrates that in Kinyambo, as in Zulu and Chicheŵa, the verb plus following (non-modified) complements phrase together. Postverbal adjuncts are included in the same prosodic phrase as preceding objects. The evidence for this phrasing is that only the final word in the phrase maintains its input penult High tone; the penult High tones on the preceding words are deleted in the context defined for HTD. (A phrasal High tone is inserted on the initial vowel of phrase-medial nouns.) The sentences in (10b, c) illustrate the variation in the phrasing of the subject, which depends on whether a (subject) DP is modified (branching in Bickmore's analysis), while (10d) illustrates that the branching effect also conditions the phrasing of verbal complements. Notice that /aba-kózi/ loses its underlying High tone due to HTD in (10b, c), when it is phrase-medial, but retains it in (10d), where it is phrase-final. The vowels that lose their High tone due to HTD are underlined. Note that the prosodic phrasing indicated follows the bracketing conventions of the original source:

(10)   Kinyambo (Bickmore 1990)

   a.   /Nejákúha   omutáhi   ebitóoke /   → (Nejákuh' ómutah' ébitóoke)

        s/he.will.give   CL1.friend   CL8.bananas

        'He will give the friend bananas.'

   b.   /aba-kózi   bá-ka-júna /   →   (abakozi bákajúna)

        CL2-workers   2SUBJ-TAM-help

        'The workers helped.'

   c.   /aba-kózi   bakúru   bá-ka-júna /   →   (abakozi bakúru) (bákajúna)

        CL2-workers   2.mature   2SUBJ-TAM-help

        'The mature workers helped.'

   d.   /Nejákwórecha omukáma   w'ábakózi   émbwa /

        s/he.will.show   CL1.chief   1.of.CL2.worker CL9.dog

        → (Nejákworech' ómukama w'ábakózi) (émbwa)

        'S/he will show the chief of the workers the dog.'

   e.   /Nejákúha   omukózi   ekitébe   mpóra /

        s/he.will.give   CL1.worker CL7.chair slowly

        → (Nejákuh' ómukoz' ékitebe mpóra)

        'S/he will give the worker a chair slowly.'

The final language that we present is Luganda (Bantu J10, spoken in Uganda), where the cue

to prosodic phrasing is High Tone Anticipation (HTA):[7]

(11)   High Tone Anticipation (HTA):
       A H tone spreads leftward through toneless moras onto preceding words within the
       domain. It must cross a prosodic word boundary, and it must stop short of the first
       mora in the domain. (Hyman & Katamba 1993: 45; 2010; Pak 2008: 134).

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[7]   The tone system of Luganda is extremely complex, and so we present here only the essentials of
      HTA necessary to follow the analysis. The interested reader should consult Pak (2008) and
      especially Hyman & Katamba (1993, 2010), Hyman, Katamba & Walusimbi (1987) and
      references therein for more detailed discussion.

The sentences in (12a, b) illustrate that the verb plus following complements, as well as right dislocated elements phrase together. The sentences in (12c, d) illustrate that the subject and left-dislocated elements phrase separately from the verb phrase, while the verb, following objects and following right-dislocated elements phrase together:

(12)   Luganda (Hyman & Katamba 2010; Pak 2008: 135); underlining indicates HTA
         domain

    a.   (nj-ógérá kú   bítábó   by-á   Mùkàsà)

        I-talk   LOC CL8.book CL8-POSS CL1.Mukasa

        'I'm talking about Mukasa's books.'

    b.   (tè-bá-lì-lù-yìmbá   á-bá-límí   ó-lú-yîmbá)

        NEG-2SBJ-FUT-11OBJ-sing AUG-CL2-farmer   AUG-CL11-song

        'They will not sing it, the farmers, the song.'

    c.   (òmùlènzì) (à-gúlírá   Múkásá   kááwà)

        CL1.boy   1SBJ-buy.for CL1.Mukasa   coffee

        'The boy is buying Mukasa some coffee.'

    d.   (òmùlènzì) (Mùkàsà)   (à-mú-gúlírá   kááwà)

        CL1.boy   CL1.Mukasa 1SBJ-1OBJ-buy.for coffee

        'The boy, Mukasa, [he] is buying him some coffee.'

We summarize the generalizations about the phrasing patterns to be accounted for in (13):

(13)   Phrasing patterns

    (a) In all four languages, verbs phrase together with object complements for the phonological processes discussed.

    (b) There is cross-language variability in the phrasing of elements which follow the objects:

        In Zulu and Chicheŵa, adjuncts such as temporal adjuncts (and right dislocated constituents) phrase separately. In Luganda, right dislocated constituents phrase with what precedes.

    (c) There is cross-language and language-internal variability in the phrasing of the subject: In Chicheŵa, Kinyambo and Zulu, the subject sometimes phrases with the following verb and sometimes does not. In Luganda, the subject always phrases separately from the following verb.

2.2.2 Problems for a spell-out domain account - Simple sentences

The phrasing of simple sentences expected under the spell-out domain approach is repeated below from (6a):

(14)   Relevant structures and spell-out domains

    simple sentence [$_{CP}$ [$_{TP}$ **subject verb** [$_{vP}$ [$_{VP}$ **IO DO**]]]]

As we can ascertain in the generalizations about the patterns summarized in (13), the actual phrasing of simple sentences found in the data presented is quite different. The verb plus IO and DO are phrased together in all four Bantu languages. In Chicheŵa, Kinyambo and Zulu, the subject only variably phrases with the verb.

    Note that alternative proposals treating the spell-out domain to be the same as a phase such as Chomsky (2001), Fox and Pesetsky (2005) and Ishihara (2007) do not yield a different result, as the vP phase is spelled-out first, predicting also a prosodic break between the verb and its complements (this can also be easily seen in (14)).

Work like Dobashi (2004, 2009, 2010) notices this "Mismatch Problem" and relates it to what he calls the "Assembly Problem". Based on a structure like the one in (3), he notes that given Multiple Spell-out, the units of Spell-out sent to phonology in a cyclic fashion are:

(15)   a.   one object: $(C^0)_{\varphi 3}$ (Subject T^0 $V^0)_{\varphi 2}$ $(DO)_{\varphi 1}$
　　　b.   two objects: $(C^0)_{\varphi 3}$ (Subject T^0 $V^0)_{\varphi 2}$ (IO DO)$_{\varphi 1}$

Since linearization is dependent on c-command, in (15), $\varphi 2$ cannot be linearized with respect to $\varphi 1$ because $\varphi 1$ is already spelled-out in the phonological component. Similarly $\varphi 3$ cannot be linearized with respect to $\varphi 2$.

To solve this Assembly Problem, he proposes that the leftmost element in each unit of spell-out is left behind for the next spell-out. Given the structure in (3), the following revised phrasing is predicted (adapted, Dobashi 2010: 245):

(16)   a.   one object: (C Subj)$_{\varphi 3}$ $(T^0$ $V^0)_{\varphi 2}$ $(DO)_{\varphi 1}$
　　　b.   two objects: (C Subj)$_{\varphi 3}$ $(T^0$ V^0 IO)$_{\varphi 2}$ $(DO)_{\varphi 1}$

However, the proposal still has two problems, to be discussed in turn. First, the subject is predicted always to be phrased separately from the verb. Second, the verb phrase is not parsed into a single prosodic phrase. Instead, a single object is predicted to be phrased separately from the verb (16a); in the case of two objects, the two objects are predicted to be parsed in two different prosodic phrases (16b). To account for cases in which the subject phrases with the verb, Dobashi (2004, 2010) proposes that rephrasing is allowed, but only in the phonological component and only for prosodic reasons, e.g., to satisfy a minimal size constraint requiring a phonological phrase to have at least two phonological words:[8]

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[8]   See work like Inkelas & Zec (1995), Nespor & Vogel (1986) and Selkirk (2000, 2011) for examples of languages where phonological phrasing is subject to a minimality constraint. And see

(17)   Minimal size constraint (Dobashi 2010: 249)

(ω ω)$_\varphi$

An example of how rephrasing works is provided by Dobashi's (2004, 2010) account of the phrasing of subjects in Kinyambo, illustrated in (10b, c), repeated here as (18a, b):

(18)   a.   /aba-kózi   bá-ka-júna /   →   (abakozi bákajúna)
             CL2-workers   2SUBJ-TAM-help
             'The workers helped.'
       b.   /aba-kózi   bakúru   bá-ka-júna / → (abakozi bakúru) (bákajúna)
             CL2-workers   CL 2.mature   2SUBJ-TAM-help
             'The mature workers helped.'

For (18a), the syntactic derivation yields the phrasing in (19a), since the subject is phrased separately from the verb. Because the subject (the leftward constituent) violates the minimal size constraint stated in (17), rightward phonological rephrasing applies, which yields (19b):[9]

(19)   a.   (abakózi) (bá-ka-júna)
       b.   (abakozi bákajúna)   (result of phonological rephrasing)

For (18b), the syntactic derivation yields the phrasing indicated in (18b). Because the subject satisfies the minimal size constraint (17), no rephrasing applies. Even though the verb is subminimal (one word), rephrasing cannot apply because there is nothing to the right of the verb for it to rephrase with. Rephrasing in the case of a sentence with a single object would

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Selkirk (2011) and Wagner (2005, 2010) for other spell-out domain-based approaches which allow prosodic factors to condition prosodic domain formation.

[9]   In Bickmore's (1990) original analysis of the Kinyambo data, the phrasing in (19b) is the default one. Thus, a branchingness constraint, not a minimality constraint, accounts for why modified DPs, like the subject DP in (18b), are followed by a prosodic phrase break. We return to the problem of how branchingness and/or a minimality condition(s) prosodic phrasing in section 3.5.2, below.

presumably work the same way as for subjects: the verb's spell-out domain is one phonological word (see (16a) above), thus rightward phonological rephrasing with the object(s) is triggered. This is illustrated schematically in (20).[10] The syntactic derivation yields the phrasing in (20a). Because the verb (the leftward constituent) violates the minimal size constraint (17), rightward phonological rephrasing applies, which yields (20b):

(20) a. $(T^0 \, V^0)_{\varphi 2} \, (DO)_{\varphi 1}$
      b. $(T^0 \, V^0 \, DO)_{\varphi}$ (result of phonological rephrasing)

Phonological rephrasing can therefore yield a prosodic phrasing with the verb and object in one prosodic domain. However, there are still problems with Dobashi's (2004, 2009, 2010) phrasing proposal for the Bantu languages discussed in the preceding section. Recall from the generalizations in (13) that in Chicheŵa and Zulu, subminimal subjects are only variably phrased with the verb (see (7b, c) and (8b, c), above). Under Dobashi's account, variability in phrasing should be linked to the minimal size constraint (17). However, the variability in these languages has nothing to do with prosodic size; instead, when the subject is phrased separately, it is a topic, showing anaphoric agreement with the subject prefix on the verb. We discuss this further in section 3.3.

An additional problem under Dobashi's account concerns cases involving an indirect object. In all four of the languages, the entire verb phrase, including cases where there are two objects, phrase together. However, this is not possible in Dobashi's approach, as rephrasing is not applicable to the second object in the configuration in (16b). A subminimal DO cannot be phrased with the preceding verb and IO, as only rightward rephrasing (from a subminimal phrase to another phrase) is permitted. Dobashi (2004) allows an additional mechanism aside from phonological rephrasing to accommodate the fact that in Chicheŵa the

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[10] T^0 in (20) is the head of T(ense)P where tense morphemes can appear.

verb phrases with the object. In particular, the object can move to Spec vP (to check a certain feature) and the verb moves above v^0. If the object is moved out of the vP spell-out domain (i.e., VP), it will not be phrased separately from the verb (as shown in (21)).

(21) $[_{TP}$ subject verb$_k$ $[_{vP}$ object$_i$ t$_k$ $[_{VP}$ t$_k$ t$_i$ $]]]$

However, this proposal faces a number of problems: (a) in the case of two objects, the IO and DO order has to be maintained; (b) in Luganda and Zulu, any movement of an object out of a verb phrase requires object marking on the verb, and in a neutral S V IO DO sentence, no object markers are present; (c) there is no independent evidence for movement to vP (see also Cheng & Downing 2012 on immediately after the verb position in Zulu). Dobashi's rephrasing proposal also faces a crucial problem in accounting for why in Chicheŵa the phrasing of objects depends on whether or not they are modified. We take up this particular problem in section 3.5.2 below.

2.2.3 Phrasing in restrictive relative clauses

For restrictive relative clauses, we find a similar phrasing pattern in Zulu, Chicheŵa and Luganda (no information is available for Kinyambo), namely, the head of the relative clause and the following relative clause phrase together. This is illustrated in the data below. Note for Chicheŵa and Zulu that the head of the relative clause shows no penult lengthening on the vowel; for Luganda HTA applies from the relative clause leftward through its head:

17

(22) Phrasing of restrictive relative clauses (set off by square brackets)

Chicheŵa (Downing & Mtenje 2011a, b)

a. ma-kóló   a-na-pátsíra   [$_{DP}$ [$_{CP}$ mwaná   a-méné á-ná-wa-chezéera]]

    CL6-parent 6SUBJ-PST1-give   CL1.child 1-REL   1SUBJ-PST2-6OBJ-visit

    [$_{DP}$ ndalámá   zá   mú-longo   wáake]

        CL10.money10.of CL1-sister   1.her

    'The parents gave [the child who visited them] money for her sister.'

Durban Zulu (Cheng & Downing 2007, 2009)

b. Si-phul' [$_{CP}$ ím-baz'   é-théngwée   námhláánje]

    we-break   CL9-axe REL9SUBJ-buy.PASS.TAM   today

    'We broke [the axe that has been bought today].'

Luganda (Pak 2008: 154)

c. <u>nj-ágálá ókúfúúmbírá Músóké</u>   [$_{CP}$ lúmóóndé   ómúkyálà

     I-want   INF.cook.for CL1.Musoke CL11.potato CL1.lady

    gwè   y-â-m-pà]

    1.REL 1SBJ-PAST-ME-give

    'I want to cook Musoke [the potato that the lady gave me].'

Indeed, as work like An (2007), Wagner (2010) and Watson (2002) notes, it is common, cross-linguistically, for relative clauses to phrase with their heads. The Bantu data presented here conforms to this pattern.

2.2.4 Problems for a spell-out domain account: Relative clauses

Recall from (6b), repeated for convenience in (23), that the spell-out domain approach predicts the following phrasing for relative clauses:

(23) *restrictive relative clause* (domain 1 is bolded; domain 2 bolded & underlined)

    [$_{DP}$ the [$_{CP}$ **<u>man</u>** [$_{C'}$ **<u>who</u>** [$_{TP}$ **is wearing a hat**]]]] saw the visitors

Crucially, the head and complementizer/relative pronoun are expected to phrase separately from the rest of the relative clause, as they are in a separate spell-out domain (regardless of

18

whether DP is a phase). The data from Zulu, Chicheŵa and Luganda in the previous section is obviously problematic, as the head of the relative clause always phrases with a restrictive relative clause in all three languages.

Under "spell-out domains = phases" alternatives, it is predicted that the head and complementizer in a relative clause would be phrased together with the rest of the relative clause. Thus, at a first glance, it seems to fare better than the spell-out domain analysis we have been arguing against. However, if the CP-phase is a spell-out domain, the prediction is that the whole relative clause including the head and complementizer/relative pronoun would be phrased separately from the rest of the sentence. This is contrary to the data in (22) from Chicheŵa, Zulu and Luganda, where the relative clause (or the relative DP) is *not* phrased separately from the selecting verb.

Dobashi's (2004, 2009, 2010) rephrasing proposal cannot address this problem. Since relative clauses are not subject to phonological rephrasing, the head of the relative clause is incorrectly predicted to be phrased separately from the rest of the relative clause.

To account for the phrasing in Luganda relative clauses, Pak (2008: 161) proposes that Luganda relative clauses have a reduced structure (i.e., no CP phase - cf. (5)):

(24) Reduced clause analysis of Luganda restrictive relative clause (adapted, Pak 2008: 161, Fig. 49); preverbal relative marker is italicized.[11]

$[_{NP} [_{NP}$ ékítábó$]$ $[_{TP}$ $[_{DP}$ $Op_j]$ $[_{TP}$ $[_{DP}$ ómúlénzí $_i]$ $[_{T'}$ $[_T$ kye_{Agr} y-á-lábà$_k]$ $[_{vP}$ t$_i$ t$_k$ t$_j]]]]]$

        CL7.book   CL1.boy   7.REL   1SBJ-PAST-see

'…the book the boy saw'

---

[11] Note that the preverbal relative marker is only required for non-subject relatives. It appears after the subject and immediately precedes the verb. Hyman and Katamba (2010) consider it to be a syntactic clitic to the verb, while Walusimbi (1996) considers it to be a relative pronoun.

As shown in the structure in (24), the reduced relative clause is a TP, and a relative operator is moved and adjoined to TP. The advantage of this analysis is that "reduced" relative clauses will then be similar in phrasing to other reduced complement clauses such as the one in (25):

(25)   Luganda reduced complement clause (Pak 2008: 152, fig. (36a))
    <u>nj-ágál' ómúlénzí á-wándííkér-ê</u>   Mùkàsà   èbbàlúwà
    I-want CL1.boy 1SUBJ-write.to-MOOD CL1.Mukasa CL9.letter
    'I want the boy to write Mukasa a letter.'

However, even if the phrasing of Luganda relative clauses can be accounted for in a spell-out domain based approach by analyzing them as "reduced" relative clauses, this account cannot be easily extended to all the other Bantu languages discussed in section 2.2.3. In Chicheŵa, the relative marker, *-méné* (homophonous with the emphatic demonstrative, and showing class-agreement with the head) introduces a relative clause, as shown in (26a), where we see that the only long penult vowel – the correlate of a prosodic phrase break – is found in the final word of the sentence. This marker is comparable to a complementizer in its distribution (e.g., preceding a subject; see Mchombo 2004). Chicheŵa relative clauses therefore cannot be easily analyzed as reduced relative clauses. Further, non-reduced embedded clauses, like complements of *think/say* verbs (with the presence of the complementizer *kuti*), also phrase with what precedes, just like restrictive relative clauses. This is shown in (26b), where only the subject and the final word in the sentence have a long penult vowel:

(26)   Chicheŵa (Downing 2010)
    a.   *relative clause*
        A-ná-kwíyá   ndí [CP m-phunzitsi *a-méné* a-lendó
        2SUBJ-PST2-get angry   with   CL1-teacher 1-REL   CL2-visitor
        á-ná-mu-gulílá   zóóváala]
        2SUBJ-PST2-1OBJ-buy.for   CL10.clothes
        'They got angry at [the teacher for whom the visitors bought clothes].'

b. think/say *complement* (Kanerva 1990: 117)

[_{CP} Mavúuto   a-ku-gáníza   [_{CP} kutí   mw-alá   úu-gwa]]

CL1.Mavuto 1SUBJ-PRES-think   that   CL3-rock   3SUBJ-fall

'Mavuto thinks [that the rock will fall].'

To sum up this section, while the proposal that prosodic domains match spell-out domains or phases is attractively simple, it wrongly predicts that heads should not phrase with their complements. As a result, it predicts more prosodic domains for both simple sentences and restrictive relative clauses than are attested in a range of classic interface data from Bantu languages. We have shown that syntactic proposals to get around these problems are problematic, as they are ad hoc and do not account for a wide range of available data. In the next section, we develop an analysis which we show can account for all the phrasing patterns in a principled fashion.

3   Does phonology access syntax directly or indirectly: that is, do prosodic and syntactic constituents match?

In the literature on the syntax-phonology interface, the various approaches to encoding the interface in the grammar are traditionally classified as either indirect reference or direct reference theories. Indirect reference theories (see, e.g., Féry 2011; Gussenhoven 2004; Nespor & Vogel 1986; Selkirk 1986, 1995, 2000, 2009, 2011; Truckenbrodt 1995, 1999, 2005, 2007, for discussion) propose that phonology is not directly conditioned by syntactic information. Rather, the interface is mediated by phrasal prosodic constituents, like Phonological Phrase and Intonation Phrase, which need not match any syntactic constituent. Direct reference theories (e.g., Adger 2007; Kahnemuyipour (2009); Kaisse 1985; Odden 1995; Pak 2008; Seidl 2001), in contrast, argue that phrasal prosodic constituents are

superfluous, as phonology can – indeed, must – refer directly to syntactic structure. The spell-out domain approach critiqued in section 2 is a direct reference type theory.[12]

In this section, we argue that an Edge-based indirect reference analysis of the Bantu language phrasing patterns presented above straightforwardly accounts for all the data, avoiding the problems encountered by the spell-out domain analysis. This approach is, moreover, non-cyclic, and we take up the cyclicity issue in section 4.

3.1 The Edge-based approach to prosodic phrasing

Before developing an Edge-based approach to the Bantu data, we provide a brief introduction to the theory.[13] The traditional Prosodic Hierarchy (Nespor & Vogel 1986; Selkirk 1986) provides two levels of phrasing relevant to the syntax-phonology interface: Phonological Phrase and Intonation Phrase. While there have been proposals to expand the number of levels, we follow Itô & Mester (2012, 2013) in assuming that just these two levels are sufficient to account for attested patterns of prosodic phrasing. As work like Myrberg (2013) notes, prosodic correlates distinguishing these two levels of phrasing are often hard to pin down and are subject to considerable cross-linguistic variation. However, there is wide agreement among indirect reference approaches on the syntactic distinction between the two levels of phrasing: Phonological Phrases roughly align with lexical XPs, while Intonation Phrases roughly align with root clauses, which can contain more than one lexical XP.[14] We

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[12] See Elordieta (2007) for a thoughtful, up-to-date overview of direct and indirect reference approaches to the syntax-phonology interface.

[13] Work like the following provides detailed motivation and exemplification of the Edge-based approach: An (2009); Cheng & Downing (2007, 2009); Downing & Mtenje (2011a,b); Kandybowicz (2009); Myrberg (2010); Selkirk (1986, 1995, 2000); Truckenbrodt (1995, 1999, 2005, 2007); Zerbian (2006, 2007).

[14] Work defining and illustrating this sort of syntactically-based distinction between Phonological Phrase and Intonation Phrase includes: An (2007); D'Imperio et al. (2005); Gussenhoven (2004:

adopt this syntactic distinction in labelling levels of phrasing in this paper. However, we refine the syntactic correlate of Intonation Phrases to refer to phases: *v*P and CP. In the Edge-based approach, only *one* edge of a prosodic phrase (Phonological Phrase or Intonation Phrase) must coincide with *one* edge of a syntactic constituent (lexical or functional, respectively). As a result, the string parsed by a prosodic phrase need not match any particular syntactic domain.

A crucial component of the Edge-based approach adopted here is that it meets the scientific requirement of falsifiability: all prosodic phrase edges posited in an analysis must be prosodically motivated. In the data so far, all right prosodic domain edges have been motivated by processes such as penult lengthening (Zulu and Chicheŵa), HTD (9; Kinyambo) or HTA (11; Luganda). The beginning of each sentence initiates a prosodic domain. We turn to further motivations for left prosodic domain edges in section 3.3 below.

We illustrate this Edge-based approach using Northern Sotho (a Bantu S30 language spoken in South Africa). Zerbian (2007) shows that in Northern Sotho, as in Zulu and Chicheŵa, penult lengthening is a correlate of phonological phrasing. The following data show that left-dislocated elements are phrased with what follows in Northern Sotho, while right-dislocated elements are phrased separately. Note that this is the mirror image of the pattern found in Luganda. (Lengthened penult vowels are bolded; Zerbian's phrasing is cited):

(27)   Northern Sotho phonological phrasing (Zerbian 2007: 249-252)
       Canonical order

   a.   (Mo-lámó   ó   tla   g**á:**e)
         CL1-brother 1SUBJ   come   CL9.home
         'The brother is coming home.'

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167); Kanerva (1990); Kisseberth (2010); Nespor & Vogel (1986); Prieto (2005); Selkirk (1986, 2009, 2011); Truckenbrodt (1995, 1999, 2005); Zerbian (2007).

Right dislocation

b. (Ke a   mo th**ú:**ša) (mo-kgal**a:**bje)

    I DJ 1OBJ help   CL1-old man

   'I am helping him, the old man'

Left dislocation

c. (Mo-sádí   ke a   m-m**ó:**na)

   CL1-woman   I   DJ 1OBJ-see

   'The woman, I see her.'

Zerbian (2007: 254) proposes that right-dislocated elements in Northern Sotho are adjoined to IP/TP. Under this syntactic analysis, she shows that the phrasing can be accounted for by the following OT constraints, which optimize perfect alignment between the right edge of the prosodic constituent, Intonation Phrase, and the right edge of the functional syntactic constituent, IP/TP:[15]

(28)   a.   ALIGNR(IP/TP, INTPH)

        Every syntactic IP/TP is right aligned with a prosodic Intonation Phrase.

     b.   ALIGNR(INTPH, IP/TP)

        Every prosodic Intonation Phrase is right aligned with a syntactic IP/TP.

The tableaux in (29) and (30) exemplify the analysis of the asymmetric prosodic parse of right vs. left-dislocated elements with the data in (27b) vs. (27c). In the tableaux, only the simplified syntactic structure necessary to evaluate the prosodic phrase alignment constraints is indicated, to improve readability:

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[15]   Following McCarthy & Prince (1993), both directions of mapping constraint – (morpho)syntax-prosody and prosody-(morpho)syntax – are assumed. See, too, recent work by Cheng & Downing (2009) and Myrberg (2010).

(29) *Left dislocation*

    (Mo-sádí   ke a m-mó:na)   'The woman, I see her.'

    CL1-woman   I   DJ 1OBJ-see

[CP Mo-sádí [IP/TP ke a m-móóna]]	ALIGN R (IP/TP, IntPh)	ALIGN R(IntPh, IP/TP)
☞a. [CP Mo-sádí [IP/TP ke a m-móóna]] ( )		
b. [CP Mo-sádí [IP/TP ke a m-móóna]] ( ) ( )		*!

Candidate (a), which parses the entire sentence into a single Intonation Phrase, is optimal.

The sentence contains only a single right IP/TP boundary, and this boundary is right-aligned

with an Intonation Phrase. Candidate (b), with an Intonation Phrase break following the left

dislocated constituent, is non-optimal, as this prosodic phrase break is not aligned with the

right boundary of an IP/TP, in violation of ALIGN R(IntPh, IP/TP).

(30) *Right dislocation*

    (Ke a   mo thú:ša) mo-kgala:bje)   'I am helping him, the old man'

     I DJ 1OBJ help   CL1-old man

[CP [IP/TP [IP/TP Ke a mo thúša] mo-kgalabje]]]	ALIGN R (IP/TP, IntPh)	ALIGN R(IntPh, IP/TP)
☞a. [CP [IP/TP [IP/TP Ke a mo thú:ša] mo-kgala:bje]]] ( ) ( )		
☞b. [CP [IP/TP [IP/TP Ke a mo thú:ša] mo-kgala:bje]]] (( ))		
c. [CP [IP/TP [IP/TP Ke a mo thúša] mo-kgala:bje]]] ( )	*!	

Candidate (c) is non-optimal, as the right IP/TP boundary preceding the right dislocation is

not aligned with an Intonation Phrase break, in violation of ALIGN R(IP/TP, IntPh). The

analysis so far, though, yields two optimal candidates. Candidate (a), with non-recursive phrasing is the variant Zerbian (2007) adopts. However, candidate (b), with recursive phrasing, also satisfies both alignment constraints. We propose that candidate (b) should, in fact, be the optimal one, as it also satisfies a high-ranked constraint banning the insertion of prosodic structure without prosodic motivation, a variant of the general *STRUC(TURE) constraint (Prince & Smolensky 2004: 30, fn 13) penalizing non-input structure:[16]

(31) *STRUC/PROSODY: Prosodic domain structure must have prosodic motivation.

Since no high-ranked constraint motivates a left boundary preceding the right-dislocated phrase *mo-kgala:bje* in (30a) and there is no prosodic cue for an additional boundary, the candidate in (30a) violates (31), making it non-optimal.

In the next section, we show that this kind of OT Edge-based analysis straightforwardly extends to account for the Bantu data presented in section 2. Note that a standard OT analysis (Prince & Smolensky 2004) is inherently non-cyclic, and this is another distinction between our analysis and a spell-out domain-based approach. We return to this point in more detail in section 4.

3.2 An Edge-based account of the Bantu phrasing patterns

Let us begin by recalling the generalizations about the Bantu phrasing patterns that our analysis aims to account for:

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[16] See work like Elfner (2012), Itô & Mester (2012, 2013), Myrberg (2010, 2013) and Selkirk (2009, 2011) and Wagner (2005, 2010) for recent arguments in favor of recursive prosodic phrasing.

(32) Phrasing patterns to account for

Simple sentences

    a. In all four languages, verbs phrase together with object complements. (That is, there is no phonological evidence for a phrase break separating a verb from its complements.)

    b. There is cross-language variability in postverbal adjuncts and 'dislocated' elements:
In Zulu and Chicheŵa, temporal adjuncts (and right dislocated constituents) phrase separately. In Kinyambo, adjuncts phrase with what precedes. In Luganda, right dislocated constituents phrase with what precedes.

    c. There is cross-language and language internal variability in the phrasing of the preverbal subject: In Chicheŵa, Kinyambo and Zulu, the subject sometimes phrases with the following verb and sometimes does not; in Luganda, the subject always phrases separately from the following verb.

Restrictive relative clauses

    d. In Chicheŵa, Haya and Zulu (no data is available for Kinyambo), heads of restrictive relative clauses phrase with the following relative clause, and a phrase break follows the relative clause.

To account for these patterns, we follow work like An (2007), Ishihara (2007), Kandybowicz (2009), Kratzer & Selkirk (2007), and Selkirk (2009, 2011) in proposing that prosodic phrasing can be conditioned by phases. The Edge-based constraints relevant for the prosodic phrasing in (33) together optimize a strict match between the right edge of Intonation Phrases and the right edge of syntactic phases: vP and CP. As for the status of DP as a phase, we have seen clearly that DP objects are not phrased separately from the verb, indicating that they are not phases (at least not in the Bantu languages that we are investigating). Note that these constraints are nearly identical to those proposed by Zerbian (2007) in (28), above, to account for Northern Sotho prosodic phrasing, except that phase edges, rather than IP/TP edges, are referred to:

(33) a. ALIGNR[PHASE, INTPH] (ALIGNR-PHASE): Align the right edge of every phase (vP/CP) with the right edge of an Intonation Phrase (IntPh).

b. ALIGNR[INTPH, PHASE] (ALIGNR-INTPH): Align the right edge of every Intonation Phrase (IntPh) with the right edge of a phase (vP/CP).

The analysis of phrasing in simple sentences is exemplified in the tableaux below, using schema to generalize across the four languages. Parentheses continue to indicate prosodic phrase boundaries. For ease of exposition, only right brackets are indicated, since that is what the Align constraints optimize:

(34) Simple sentence phrasing

a. Two arguments

	ALIGNR-PHASE	ALIGNR-INTPH
☞i. S V IO DO]$_{VP}$]$_{vP}$]$_{CP}$)		
ii. S V IO DO]$_{VP}$]$_{vP}$]$_{CP}$))		*!
iii. S V IO DO]$_{VP}$]$_{vP}$]$_{CP}$))		*!

b. Argument plus Adjunct

	ALIGNR-PHASE	ALIGNR-INTPH
☞i. S V DO]$_{VP}$]$_{vP}$ Adjunct]$_{IP}$]$_{CP}$))		
ii. S V DO]$_{VP}$]$_{vP}$ Adjunct]$_{IP}$]$_{CP}$)	*!	

In tableau (34a), in a sentence with two arguments following the verb, it is optimal to parse both arguments with the verb in a single Intonation Phrase. Phrasing the arguments separately from each other, as in (34a.ii), violates the alignment constraint in (33a): the phrase break between the two objects is not at a phase edge. Phrasing the subject separately from what

28

follows, as in (34a.iii), also violates the alignment constraint in (33a), for a similar reason: the phrase break following the subject is not at a phase edge. The tableau in (34b) shows that in languages like Zulu and Chicheŵa, where adjuncts are adjoined to *v*P or above the *v*P (i.e., adjuncts are adjoined to a phase; see Cheng and Downing 2012),[17] it is optimal for a phrase break to fall between the object and the adjunct. This is demonstrated by candidate (34b.i), where we see that this phrasing satisfies both constraints in (33). Phrasing the argument and adjunct together, as in candidate (34b.ii), violates the constraint in (33b): the right edge of the *v*P phase is not followed by an Intonation Phrase break.

The same constraints also straightforwardly account for the phrasing of restrictive relative clauses. Recall from (32d) above that the generalization to account for is that heads of restrictive relative clauses phrase with the following relative clause, and a phrase break follows the relative clause. The following tableau, using the Chicheŵa example in (22a), above, for the sake of concreteness, exemplifies the analysis:

(35)   Phrasing of restrictive relative clause – Chicheŵa (22a)

(([CP ma-kóló   a-na-pátsíra   [DP [CP mwaná   a-méné á-ná-wa-chezéera]])
       CL6-parent   6SUBJ-PST1-give   CL1.child   1-REL   1SUBJ-PST2-6OBJ-visit
   [DP ndalámá   zá   mú-longo   wáake]])
       CL10.money 10.of   CL1-sister   1.her
   'The parents gave [the child who visited them] money for her sister.'

[CP ma-kóló a-na-pátsíra [DP [CP mwaná a-méné á-ná-wa-chezéera]] [DP ndalámá zá mú-longo wáake]]	ALIGNR- PHASE	ALIGNR- INTPH
☞a. (([CP ma-kóló a-na-pátsíra [DP [CP mwaná a-méné á-ná-wa-chezéera]]) [DP ndalámá zá mú-longo wáake]])		
b. ([CP ma-kóló a-na-pátsíra [DP [CP mwaná a-méné á-ná-wa-chezéera]] [DP ndalámá zá mú-longo wáake]])	*!	
c. ([CP ma-kóló a-na-pátsíra [DP [CP mwaná a-méné) (á-ná-wa-chezéera]]) ([DP ndalámá zá mú-longo wáake]])		*!

Candidate (a), with the first phrase break following the relative clause, is optimal as it satisfies the highest-ranked constraints: the right edge of every phase (vP or CP) is aligned with an Intonation Phrase, and the right edge of every Intonation Phrase is aligned with a phase. Since there are two right phase edges in this sentence – one following the relative clause and another at the end of the sentence – the phrasing algorithm correctly optimizes a parse with two right Intonation Phrase edges. (The recursive parse here is optimal for the same reasons as those given in discussing tableau (30), above.) Candidate (b), which parses the entire sentence into a single Intonation Phrase, is non-optimal, as the relative clause – the first phase edge in the sentence – is not aligned with the right edge of an Intonation Phrase, violating ALIGNR- PHASE. Candidate (c), which has a phrase break between the relative complementizer/pronoun and the relative clause – this is the phrasing expected in the spell-out domain approach (6b) – is non-optimal, as this phrase break does not fall at the right edge of a phase, violating ALIGNR- INTPH.

3.3 Accounting for variability in the phrasing of postverbal adjuncts and dislocations

The analysis extends, with minor modification, to account for the variability we find in the phrasing of postverbal adjuncts and 'dislocated' elements, summarized in (32b): namely, in Zulu and Chicheŵa, these elements (often) phrase separately from what precedes. In Kinyambo, adjuncts phrase with what precedes, and in Luganda, right 'dislocated'

constituents phrase with what precedes. We show in this section that the phrasing of postverbal adjuncts in fact supports our proposal that the right edge of both *v*P and CP phases condition parsing into Intonation Phrases, at least in some languages. This distinguishes our proposal from other recent indirect approaches like Selkirk's (2009, 2011) MATCH theory, which only maps (the spell-out domain of) syntactic clauses to Intonation Phrases.

If *v*P can condition prosodic phrase breaks, this predicts that in some languages we should find that every *v*P is followed by prosodic phrase break. This is, in fact, what we find in Zulu and Chicheŵa. Evidence for a prosodic phrase break at the right edge of *v*P comes from the phrasing of postverbal strings containing both arguments and adjuncts. Arguments must precede locative and temporal adjuncts in a broad focus context or VP focus context in both languages. Locative and temporal adjuncts are separated from the preceding arguments by a prosodic phrase boundary; note the position of long penult vowels:

(36)   *Phrasing of adjuncts in Zulu* (Cheng & Downing 2012: 253)
    a. Q. What did Sipho do?
        A. ((ú-Síph'   ú-phék'   [ín-kuukhu _{*v*P}]) kwám'   ízoolo)
            CL1-Sipho 1SUBJ-cook CL9-chicken   CL17-1SG yesterday
            'Sipho cooked chicken at my place yesterday.'
    b. ((bá-ník'   [ú-Síph'   í-bhayisékiili _{*v*P}]) namhláanje)
       2SUBJ-gave   CL1-SiphoCL 5-bicycle   today
       'They gave Sipho a bicycle today.'
   *Phrasing of adjuncts in Chicheŵa* (Downing & Mtenje 2011b: 1971-1972)
    c. ((mbalá í-ma-phíká   [nsíima _{*v*P}]) pa-nsí   pá-mtéengo)
       CL9-thief 9SUBJ-TAM-cook 9.nsima   LOC-under LOC-CL3.tree
       'The thief cooks nsima under the tree.'
    d. ((Bandá   a-ná-ón-a   [a-leéndó _{*v*P}]) mofulumiira)
       CL1-Banda 2SUBJ-TAM-see CL2-visitor   ADV.quickly
       'Banda saw the visitors quickly.'

Dislocated objects precede adjuncts in Zulu and are separated from what precedes by a prosodic phrase boundary (Cheng & Downing 2012: 257):

(37) a. (((ú-Síph' ú-**m**-phékélée-n',ᵥP])   ú-Tháandi ᵥP]) émzini   wakh' ízoolo)
          CL1-Sipho 1SUBJ-1OBJ-cook.for-what CL1-Thandi   LOC.3.home 3.your   yesterday
          'What did Sipho cook for Thandi at your house yesterday?'
     b. Q. Who did Sipho cook chicken for yesterday?
         A. (((ú-Síph'   ú-**yí**-phékélé   ú-Tháand',ᵥP]) ín-kuukh',ᵥP]) ízoolo)
              CL1-Sipho 1SUBJ-9OBJ-cook.for CL1-Thandi   CL9-chicken   yesterday
              'Sipho cooked chicken for Thandi yesterday.'

Cheng & Downing (2012) argue that this range of facts is consistent with adjoining locative and temporal adjuncts above the νP. In Zulu, when arguments are dislocated, they are adjoined to νP, while adjuncts are adjoined higher in the structure, perhaps to XP, as shown in the structure in (38), cited from Cheng & Downing (2012: 258):

(38)
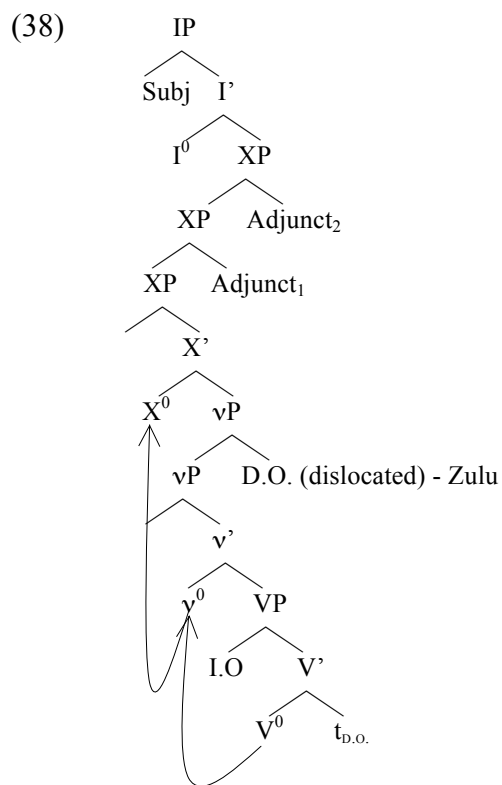
Note that prosodic phrase breaks in Zulu and Chicheŵa follow each right *v*P edge found in this structure, as predicted if Alignment constraints can refer to both *v*P and CP edges.[18]

How, then, do we account for languages like Kinyambo and Luganda, where postverbal adverbials (Kinyambo) and right-dislocations (Luganda) phrase with what precedes? The relevant data is given below, repeated from (10) and (12), for convenience. Recall that prosodic phrasing domains are defined in Kinyambo by the process of High Tone Deletion, and in Luganda, by the process of High Tone Association (the relevant sequence is underlined):

(39) Phrasing of postverbal adjuncts

    a. Adverbials in Kinyambo (Bickmore 1990: 13)

        /Nejákúha   omukózi   ekitébe   mpóra /

        s/he will give   CL1.worker CL7.chair slowly

        → (Nejákuh' ómukoz' ékitebe mpóra)

        'S/he will give the worker a chair slowly.'

    b. Right dislocations in Luganda (Hyman & Katamba 2010)

        (tè-bá-lì-lù-yìm<u>bá   á-bá-límí   ó-lú</u>-yîmbá)

        NEG-2SBJ-FUT-11OBJ-sing AUG-CL2-farmer   AUG-CL11-song

        'They will not sing it, the farmers, the song.'

To account for these data, we propose that the alignment constraints in (33) can be parameterized to refer generally to phases (*v*P and CP) or only to the propositional phase, CP. Kinyambo and Luganda illustrate languages where only the right edges of CP (the propositional phase) align with Intonation Phrases.[19]

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[18]   Note that under our analysis, adjuncts can also be adjoined to *v*Ps, as long as they follow the dislocated elements.

[19]   Whether this parameterization also has something to do with the status of *v*P as a syntactic phase in Kinyambo and Luganda is an interesting issue, which we leave for future research.

3.4 Accounting for variability in the phrasing of preverbal subjects

The analysis does not yet account for the subject phrasing patterns summarized in (32c): namely, in Chicheŵa, Kinyambo and Zulu, the subject sometimes phrases with the following verb and sometimes does not, while in Luganda, the subject always phrases separately from the following verb. The problem is that the constraints in (33) optimize phrasing subjects with a following VP. (This is demonstrated in tableau (34a), above.)

Work since Givón (1976) has observed that there are structural similarities between subjects and topics in Bantu languages.[20] The languages under consideration here are all *pro*-drop languages: a subject marker is obligatorily realized on a main clause verb, but an overt co-referential subject DP is optional. As work since, at least, Bresnan & Mchombo (1987) observes, subject markers therefore ambiguously have both grammatical and anaphoric agreement properties when an overt subject DP occurs. This ambiguity paves the way for subject DPs to be analysed either as a clause-external topic or as a clause-internal subject.

To account for data in Chicheŵa, Luganda and Zulu where the subject phrases separately from the following VP, we follow Cheng & Downing (2009) in proposing that when we find a phrase break, the subject is actually a left-dislocated topic, adjoined to CP,[21] and therefore is phrased separately from what follows, just as other left-dislocated constituents are. This phrasing pattern is illustrated in (40). Note the lengthened penult vowel of the preverbal objects in Zulu and Chicheŵa, and that the domain of HTA (underlined) in Luganda does not extend leftward into the subject and topic:

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[20]　See work like Creissels (2005), Green & Tabe (2013), Morimoto (2000), van der Wal (2009), Zerbian (2006) for recent discussion and critical surveys of the topic-like properties of subjects in Bantu languages.

[21]　See An (2007), Downing (2011), Feldhausen (2010) and references therein for discussion of the phrasing of topics, showing that it is common for them to be phrased separately from what follows.

(40) Pre-subject left-dislocated topic

Durban Zulu (Cheng & Downing 2009)

a. ámá-pheeph' [CP [IP úm-mél' ú-wá-sayín-ííle)]]

CL6-paper CL1-lawyer 1SUBJ-6OBJ-sign-PERF.DJ

'The lawyer *signed* the papers.'/ 'The papers, the lawyer *signed*.'

Chicheŵa (Kanerva 1990: 102, Fig. 110c)

b. a-leenje [CP [IP zi-ná-wá-luuma)]] njúuchi

CL2-hunter 10SUBJ-PAST2-2OBJ-bite CL10.bees

'The hunters, they bit them, the bees [did].'

Luganda (repeated from (12d), above)

c. òmùlènzì Mùkàsà à-<u>mú-gúlírá</u> <u>kááwà</u>

CL1.boy CL1.Mukasa 1SBJ-1OBJ-buy.for coffee

'The boy, Mukasa, [he] is buying him some coffee.'

Topics are not the only DPs which commonly phrase separately from a following clause. As we can see in the data below, non-restrictive relative clauses in Chichewa and Zulu – indeed in many languages – are also preceded by a prosodic phrase break; note long penult vowels (bolded) in the head of the non-restrictive relatives:[22]

(41) Phrasing of non-restrictive relative clauses

Durban Zulu (Cheng & Downing 2009)

a. [CP Si-mem' ú-**Jaa**bu [CP o-m-ázii-yo] é-dilíi-ni]

we-invite CL1-Jabu REL.you-1OBJ -know-REL LOC. CL9-party-LOC

'We are inviting Jabu, who you know, to the party.'

Chichewa (Downing & Mtenje 2011a,b)

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22 See, e.g., An (2007), Burton-Roberts (2006), Cheng & Downing (2007), Dehé (2009), Downing & Mtenje (2011a, b), Kanerva (1990), Selkirk (1986), and Truckenbrodt (2005) for discussion of the phrasing of non-restrictive relatives in other languages.

b. [CP A-**Bá**anda [CP*a-méné* á-ná-gulá nyama y-ówólaa-*wo*]

CL2-Banda   CL2-REL   1SUBJ-PST2-buy   CL9.meat   CL9.of-spoiled-CL2.REL

á-ma-khálá   pafúpí   ndí   ḿ-siika]

1SUBJ-TAM-live   near   to   CL3-market

'Mr. Banda, [who bought the spoiled meat], lives near the market.'

Cheng & Downing's (2009) analysis proposes that left-dislocated phrases are treated on a par with non-restrictive relative clauses and adjunct clauses, which are not syntactically selected by what precedes or follows. They account for the phrasing of these non-selected constituents by proposing a prosodic alignment constraint which refers to selectional properties. In Edge-based theory, however, only syntactic constituent edges should be visible to prosodic parsing. It is a stipulative modification of the theory to propose constraints which refer to other syntactic properties.[23]

Chomsky (2004) discusses how adjunction works, and states that intuitively, an adjunct is attached to the base as if it is on another plane. That is, cyclic merger of constituents in syntax happens on a "main" plane, and adjuncts are not merged directly onto this plane, since adjunction does not create new c-command relation or other structural relations. Instead, they are attached to the main plane via a separate plane. We take up this intuitive idea and suggest that adjuncts (i.e., non-selected constituents) are attached on a separate plane from an adjacent vP/CP. Further, assuming that such non-selected material is constructed on a separate plane, it necessarily interrupts the prosodic phrasing based on the main clause structure.[24]

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[23]   See, however, Chen (1987), which appeals to a complement-adjunct distinction in conditioning prosodic phrasing in an indirect reference account.

[24]   One potential problem associated with this account is embedded topics, which also interrupt the prosodic phrasing, though in this case, only the right edge of the topic plays a role (see Feldhausen 2010, Downing 2011). Both the left and the right edge of non-restrictive relative clauses play a role in phrasing, however, as non-restrictive relatives and other parentheticals are

In Chicheŵa and Zulu, subjects have variable phrasing because they can be left dislocated, like other DPs, when they are interpreted as topics. Because they occur on a separate plane, they are parsed separately from the non-selected material that follows. The constraint formalizing this proposal is given in (42):

(42) ALIGNL(CP, INTPH): Align the left edge of each plane-initial CP with the left edge of an Intonation Phrase (IntPh).

The prosodic break setting off a topicalized subject (and a non-restrictive relative clause) satisfies ALIGNL (42), as it coincides with the left edge of a CP which is not on the same plane as what precedes, as schematized in (43); a bolded [$_{CP}$ is plane-initial:

(43) a. Left dislocated/Topicalized subject: [Topic] ([$_{\mathbf{CP}}$

     b. Non-restrictive relative: [$_{DP}$ head N] ([$_{\mathbf{CP}}$

Further, the constraint ALIGNL (42) correctly does not optimize a phrase break preceding or following the head of the restrictive relative clauses in (22), as the restrictive relative clause complex is a complement (argument) CP, selected by its head, and thus is on the same plane as its head. An analysis for a left-dislocated (CP-external) subject implementing the constraints so far is given in (44) (based on the example in (8c)).

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typically set off prosodically from their surroundings. (Though see work like Dehé (2009) showing that the phrasing of English parentheticals is more complex than this.) This difference may be related to when non-selected material is incorporated into the main clause structure. See Chomsky 2004 for further discussion about the incorporation of materials from one plane into the "main" plane.

(44) Chichewa

((M-fúumu) ([CP i-na-pátsá [vP mwaná zó-óváala.]))

CL9-chief   9SUBJ-TAM-give   CL1.child   CL10-clothes

'The chief gave the child clothes.'

[CP Mfúmu [CP i-na-pátsá mwaná zóóvála.]]	ALIGNL	ALIGNR-(Phase, IntP)	ALIGNR-(IntP, Phase)
☞a. [CP Mfúmú [CP i-na-pátsá mwaná zóóváala.]] (( ))			
☹b. [CP Mfúumu [CP i-na-pátsá mwaná zóóváala.]] ( ) ( )			*!
c. [CP Mfúmú [CP i-na-pátsá mwaná zóóváala.]] ( )	*!		

Candidate (c) is non-optimal, as it violates ALIGNL: the CP following the topicalized subject does not initiate a new Intonation Phrase. Candidate (a), with recursive phrasing, is optimal, given the constraints so far. However, candidate (a) should not be optimal, as it does not account for the penult lengthening on the topicalized subject which motivates a prosodic break before the plane-initial CP. Recall that lengthening signals penultimate position in a prosodic phrase. For candidate (b) to be optimal (with the correct phrasing) we need an additional constraint: Selkirk's (2011: 470, fig. (38)) STRONGSTART constraint, which penalizes unparsed or recursively parsed material at the left edge of a prosodic domain.[25] Candidate b. satisfies this constraint, as "Mfumu" – the material at the left edge of the sentence – is parsed into its own Intonation Phrase. Candidate a. violates this constraint, as "Mfumu" is recursively parsed with the remainder of the sentence:

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[25] Selkirk's STRONGSTART constraint as well as Myrberg's (2010, 2013) EQUALSISTERS constraint optimize parsing the Topic as an Intonation Phrase rather than a Phonological Phrase, so the parentheses parsing Topics continue to represent Intonation Phrases.

(45)

[CP Mfúmu [CP i-na-pátsá mwaná zóóvála.]]	ALIGNL	STRONG START	ALIGNR-(Phase, IntP)	ALIGNR-(IntP, Phase)
a. [CP Mfúmú [CP i-na-pátsá mwaná zóóváala.]] (( ))		*!		
☞b. [CP Mfúumu [CP i-na-pátsá mwaná zóóváala.]] ( ) ( )				*
c. [CP Mfúmú [CP i-na-pátsá mwaná zóóváala.]] ( )	*!			

In the cases where no phrase break follows the subject in Zulu and Chicheŵa, we propose that the subject occurs clause internally (in the typical subject position). ALIGNL (42) is not applicable in this context, and the subject phrases with what follows, as shown in (34). The two possible syntactic positions for subjects thus account for the two possible phrasings in these two languages.

In Luganda, Pak (2008) argues that subjects are always CP-external adjuncts. This is accounted for by the same constraints and ranking as for Zulu and Chicheŵa, illustrated in (45), above. We find no variability in the phrasing of subjects in Luganda, as there is only one syntactic position available for subjects in this language, according to Pak's analysis.

In Kinyambo, unmodified subject nouns phrase with what follows (cf. (10b) vs. (10c), above). There are two potential accounts for this. One explanation is syntactic: they are always clause-internal. The other explanation is phonological: regardless of whether subjects are clause-external or clause-internal, if ALIGNL (42) is outranked by ALIGN R(INTP, PHASE) (33b), they will phrase with what follows.[26] Unfortunately, there is no syntactic data available

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[26] Recall from (29), above, that in Northern Sotho subjects and left-dislocations always phrase with what follows, and this is also accounted for by ranking ALIGNR(INTPH, IP/TP/PHASE), (28b) or (33b) above ALIGNL (42). See Zerbian (2007) and Downing (2011) for detailed discussion of variability in the phrasing of dislocations in Bantu languages.

allowing us to decide between these two analyses. To account for the variability in the phrasing of subjects in Kinyambo, we adopt Bickmore's (1990) branchingness analysis. (More on this in section 3.5.2, below.)

3.5 Phonology must 'know' more than phases

While the Edge-based analysis accounts very neatly for all of the Bantu phrasing patterns, one might still object that parsing the string into Intonation Phrases adds superfluous structure, and for this reason, a direct reference spell-out domain approach might still be preferable in principle (assuming all of the processes discussed above could be recast by referring directly to some aspect of syntactic structure). In this section, we show that another general problem with analyses appealing exclusively to spell-out domains or syntactic phases to account for prosodic phrasing is that the syntactic phase is not the only factor which conditions prosodic phrasing.

As Selkirk (2009, 2011) argues, there are common syntactic and prosodic sources of mismatch between prosodic domains and syntactic phases. A syntactic source of mismatch is that in many languages the basic prosodic phrasing algorithm targets a syntactic constituent smaller than the phase, namely, a lexical XP. A non-syntactic source of mismatch is that prosodic well-formedness constraints, related, for example, to minimality, often influence the prosodic parse. Below we briefly review these problems, which tend to be overlooked by proponents of the spell-out domain approach, and we show how Edge-based analyses can account for them.

3.5.1 Other syntactic factors: phrasing is conditioned by XP not the phasal spell-out domain

In a number of languages (Bantu and non-Bantu), the basic prosodic phrasing algorithm is not sensitive to functional syntactic constituents like phases (or their spell-out domains). Rather, prosodic phrases are aligned with the (right) edge of a lexical XP. The classic language in the phonology literature illustrating this pattern is Chimwiini, a Bantu language

formerly spoken in Somalia (Kisseberth & Abasheikh 1974; Kisseberth 2005, 2010; Selkirk 1986, 2011; Truckenbrodt 1995). The cue to phrasing in Chimwiini is the (potential) occurrence of a long vowel and obligatory accent (marked with an acute accent). In the data below, notice a prosodic phrase break follows every lexical XP:[27]

(46) Prosodic phrasing in Chimwiini (Kisseberth 2010); '/' separates prosodic phrases
  simple sentences
  a. su<u>t</u>ani úyu / su<u>li</u>le m-loza mw-aanáwe / mú-ke
     'This sultan / wanted to marry his son / to a woman.'
  b. ni-wa-pele w-aaná / maandá
     'I gave the children / bread.'
  c. Hamá<u>d</u>i / mw-an<u>d</u>iki<u>li</u>le mw-áana / xá<u>t</u>i / ka Núuru
     'Hamadi / wrote for the child / a letter / to Nuuru.'
  restrictive relative clauses
  d. mu-nthu ofe<u>t</u>o x-faka<u>t</u>á / na-x-pumúla
     'The man who is tired from running / is resting now.'
  e. n-uzize chi-buku ch-a Nuurú / m-bozelo mw-aaná
     'I sold the book that Nuuru / stole from the child.'
  f. Núuru / inenzeze gari ya Haají / uziló
     'Nuuru / drove the truck that Haaji / bought.'

As we can see, these phrasings are hard to reconcile with the phrasings predicted by the spell-out domain approach, repeated below from (6):

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[27] In the Chimwiini data, underlined coronal consonants are [dental]. See Kisseberth (2005, 2010) and Kisseberth & Abasheikh (1974) for more detailed discussion of Chimwiini phonology and, in particular, prosodic phrasing.

(47) Relevant structures and spell-out domains (domain 1 is bolded; domain 2 bolded & underlined)

    a. *simple sentence* [$_{CP}$ [$_{TP}$ **<u>Sipho cooked</u>** [$_{vP}$ [$_{vP}$ **Thandi chicken**]]]]

    b. *restrictive relative clause*

        We invited [$_{DP}$ the [$_{CP}$ students [$_{C'}$ that [$_{TP}$ **Tracy taught to ski**]]]] to visit the Alps.

In Chimwiini, there is always a phrase break separating the subject and verb (46a, c, d, e, f). There is always a phrase break separating postverbal complements (46a, b, c). And in a restrictive relative clause (46d, e, f), the first phrase break follows the first XP, often the subject of the relative (46e, f). These are the breaks predicted by a constraint aligning prosodic phrase edges with lexical XP edges:

(48) ALIGNR(XP, Phonological Phrase) (Selkirk 2000, Truckenbrodt 1995, 1999, Kisseberth 2010)

    Align the right edge of a lexical XP with the right edge of a Phonological Phrase.[28]

These are clearly not the phrase breaks predicted by a classic spell-out domain approach to prosodic phrasing, as a spell-out domain potentially includes more than one lexical XP (see (47), above).

    The alert reader will have noticed, however, that Dobashi's (2004, 2010) recasting of spell-out domains – schematized in (16) and (20), and repeated below for convenience – does

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[28] Recall that it is a basic assumption, common to all indirect approaches, that the Phonological Phrase is the level of phrasing which aligns with lexical XPs, while Intonation Phrases align with larger constituents – phases, in our approach. This is what motivates the reference to Phonological Phrases in ALIGNR-XP. The labeling of the prosodic phrases should not distract us from the main point: namely, that lexical XPs are not syntactically equivalent to spell-out domains.

    In languages where prosodic phrasing is insensitive to XP edges, ALIGNR-XP must be outranked by a constraint such as *STRUC (31), which optimizes minimal prosodic structure in the output representation, unless positively motivated by a higher-ranked prosodic constraint.

neatly account for the Chimwiini phrasings, in the case of simple sentences. The subject is correctly followed by a phrase break, and a phrase break separates two objects:

(49) a. one object: $(C\ Subj)_{\varphi 3}\ (T^0\ V^0\ DO)_{\varphi 1}$ (result of phonological rephrasing)
      b. two objects: $(C\ Subj)_{\varphi 3}\ (T^0\ V^0\ IO)_{\varphi 2}\ (DO)_{\varphi 1}$

However, Dobashi cannot account for why only some languages have this phrasing while in others, like those discussed in section 2, above, prosodic boundaries align with phase edges, not lexical XP edges.

3.5.2 *Prosodic factors: more on branchingness and other size constraints*

The syntactic properties of a string are not all that phonology needs to know to define the contexts for phrasal tone domains. It has been recognized since the earliest work on phrasal phonology – e.g., Nespor & Vogel (1986) – that the phrasing of, especially, DPs, can be conditioned by whether or not the noun is modified. Non-modified nouns tend to be phrased with adjacent material, while modified nouns are not.

As we saw in (9) and (18), above, Bickmore (1990) demonstrates this pattern for Kinyambo. (For convenience, we repeat the relevant data in (50), below.) Recall that prosodic domains condition the phrasal process of High tone deletion (HTD): the rightmost High tone of a word is deleted if the following word within the prosodic phrase has a High tone. Examples (50a) and (50c) show that the entire sentence can be the domain of HTD if none of the XPs contained in it branch (i.e., if all are subminimal). However, examples (50b) and (50d) show that a branching XP (underlined) is not phrased with what follows. The example in (50d) differs from the one in (18) in that the object branches, rather than the subject:

43

(50) Kinyambo (Bickmore 1990: 14-15)

    a.   (ba-kuru   bá-ka-júna).

        CL2-mature.ones   2SUBJ-TAM-help

        'The mature ones helped.'

    b.   (Aba-kozi   bakúru)   (bá-ka-júna).

        CL2-worker   CL2-mature   2SUBJ-TAM-help

        'The mature workers helped.'

    c.   (Nejákworech'   ába-koz'   émbwa.)

        1SUBJ.TAM. show   CL2-worker CL9.dog

        'S/he will show the workers the dog.

    d.   (Nejákworech'   ómukama w'ábakózi)   (émbwa).

        1SUBJ.TAM. show CL1-chief   CL1.of.CL2-worker CL9.dog

        'S/he will show the chief of the workers the dog.'

We find a similar phenomenon in Chicheŵa. Recall from (8), above, that verbal complements

phrase with a preceding verb when the nominal complement is not modified. However, as

shown by the data below, VP-internal modified nouns are followed by a phrase break, as

evidenced by the long penult vowel in the modifier:[29]

(51) Chicheŵa (Downing & Mtenje 2011a, b)

    a.   (A-na-ményá   nyumbá   ndí   mw-áála)

        s/he-TAM-hit   CL9.house   with   CL3-rock

        'S/he hit a house with a rock.'

    b.   ((A-ná-ménya   nyumbá   yá í-kúulu)   ndí mw-áálá)

         1SUBJ-TAM -hit   CL9.house   CL9.of CL9-big   with CL3-rock

        'S/he hit a big house with a rock.'

    c.   ((M-nyamatá a-ná-ménya   nyumbá   yá-pá-kóona)   ndí mw-áálá)

        CL1.boy   1SUBJ-TAM-hit   CL9.house   9.of-LOC-corner   with CL3-rock

        'The boy hit the house on the corner with a rock.'

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[29]   In this data, recursive Intonation Phrasing continues to be assumed for constituents following the

     first Intonation Phrase break of a sentence for the reasons discussed in section 3.2.

(52) a. (Alendó a-na-dyétsa a-nyaní nsóomba)
    CL2.visitor 2SUBJ-TAM-feed CL2-baboon CL10-fish
    'The visitors fed the baboons fish.'

  b. ((Alendó a-na-dyétsa a-nyaní á m-fúumu) nsóomba)
     CL2.visitor 2SUBJ-TAM-feed CL2-baboon 2.of CL9-chief CL10-fish
    'The visitors fed the chief's baboons fish.'

  c. (((A-lendó a-na-dyétsá a-nyaní á-saanu) á-á-kúulu) nsóomba)
     CL2.visitor 2SUBJ-TAM-feed CL2-baboon CL2-five CL2.of- CL2-big CL10-fish
    'The visitors fed five big baboons fish.'

Kisseberth (1994) and Selkirk (2011) discuss a further example of the effect of modifiers on the phrasing of DPs from the Bantu language Tsonga.[30]

As work like Feldhausen (2010), Prieto (2005) and Selkirk (2011) shows, the interaction between syntactic and prosodic factors on phonological phrasing are easy to model in an indirect reference approach, as one expects prosodic constituent formation to be subject to well-formedness constraints on prosodic constituent size. However, the interaction is a challenge for direct reference approaches, including Dobashi (2010). Recall from section 2.2.2 that Dobashi proposes that subminimal (one word) subjects in Kinyambo do not form a separate prosodic domain from a following verb, because subminimal phrases can rephrase rightward with material in the preceding phase. This is illustrated in (50a). However, a subminimal verb cannot rephrase with a preceding subject (50b), as the phase containing the verb is finished when the subject becomes visible for phonological phrasing. For the same reason, the length of an object NP following the verb should have no effect on the phrasing of the verb: the phase containing the object is closed when the verb becomes visible for

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[30] Outside of Bantu languages, work like D'Imperio et al. (2005), Elordieta et al. (2005), Feldhausen (2010), Ghini (1993), Nespor & Vogel (1986), and Prieto (2005) has demonstrated the effect of length and branchingness on prosodic phrasing in a number of Romance languages.

phonological phrasing. In fact, the verb and first object should always phrase together, while the IO and DO should always phrase separately, as the verb plus first object form a spell-out domain in Dobashi's account (see (16), repeated here as (53)).

(53) $(\text{C Subj})_{\varphi 3} (\text{T}^0 \text{ V}^0 \text{ IO})_{\varphi 2} (\text{DO})_{\varphi 1}$

As Dobashi (2010) acknowledges, a rephrasing process that applies to subminimal (one word) object NPs violates his rephrasing principles (only leftward subminimal constituents can be rephrased) and should therefore be disallowed. This means that the proposed rephrasing principles cannot apply to well-known data like Italian (Nespor & Vogel 1986), but no alternative analysis is provided. The Kinyambo and Chicheŵa data in this section showing that objects also have a different phrasing depending on their length is equally problematic for Dobashi's account. Even though Dobashi motivates rephrasing from Kinyambo data, he does not account for why modified object DPs phrase differently from non-modified (subminimal) object DPs. Indeed, this rephrasing should not be allowed by his principles.[31]

To conclude this section, direct reference approaches which refer to the spell-out domain or phase face two important challenges which indirect reference approaches avoid. First, an approach referring directly to spell-out domains not only predicts prosodic domains which are too small – as we showed in section 2 – it also predicts domains which are too large. In

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[31]   There are several analyses of the effect of prosodic size on prosodic phrasing – unsurprisingly, since the details of the effects of nominal modification are somewhat different from language to language, and the authors of the analyses have different theoretical commitments. (See, e.g., Bickmore 1990, Downing & Mtenje 2011, Prieto 2005, Nespor & Vogel 1986 and Selkirk 2011 for a sampling of approaches.) Where the analyses agree is in acknowledging that this phrasing pattern is not motivated by syntactically-grounded principles. It is beyond the scope of this paper to defend a particular analysis, since, from the point of view of syntax, the internal structure of a noun phrase should not be relevant for its prosodic phrasing.

languages like Chimwiini and Catalan, the edge of each XP defines a prosodic domain edge, whether the XP defines an independent spell-out domain or not. Second, in direct reference approaches it is not a straightforward expectation for prosodic factors, like phrase minimality and maximality, to condition the parse into prosodic domains. In indirect approaches, on the other hand, where phonology's access to syntax is mediated by prosodic constituents like Phonological Phrase and Intonation Phrase, it is expected for phrasal domains to be subject to prosodic well-formedness constraints.

4   When does phonology access the syntax?

In the previous section, we argue that phonology only accesses syntax indirectly. The issue of (in)direct accessibility is also connected to the question of when phonology accesses syntax. In particular, given the current syntactic theory of phases, and multiple spell-out, many have proposed a cyclic syntax-phonology interaction (see, e.g. Adger 2007; Ishihara 2007; Kahnemuyipour 2009; Kratzer & Selkirk 2007; see also the quote from Chomsky 2001 in section 2.1). That is, syntactic derivation interweaves with phonological processes. In this section, we argue that though such a model is attractively simple, it has both conceptual and empirical problems, when the prosodic facts discussed in section 2 and 3 are taken into consideration. We would however like to emphasize that we are not advocating a non-cyclic syntactic derivation. What we are concerned about is how syntax interacts with phonology.

Grohmann (2009) presents a recent survey of conceptual problems with a cyclic model of the interaction. For instance, production and parsing are top down (and left to right), not bottom up as in a typical spell-out domain model (Shiobara 2009; see also Phillips 2003, Watson 2002, among others). An OT output oriented edge-based model for prosodic phrasing can be easily implemented in a top-down parsing model, allowing for observed asymmetries between right and left edges. Further, cyclicity is considered a marked value in classic post-lexical phonology (Booij & Rubach 1987, Gussenhoven 2004). It has mainly been appealed

47

to in analyzing the placement of sentential stress in a handful of Indo-European languages (see Halle and Vergnaud 1987, Adger 2007, Kratzer and Selkirk 2007). The burden is on a cyclic model to explain why cyclicity at the phrasal level is so poorly attested outside of this domain and outside of this language family.

Most importantly, if cyclic domains are prosodic islands, then we should not find processes that have to consider material from more than one domain. However, we have discussed above several prosodic processes that demonstrate that one cyclic domain can be prosodically integrated with another cyclic domain. Examples of this include the branchingness and minimality constraints exemplified in section 3.5.2, as well as the processes of HTA (11) and HTD (9) in Luganda and Kinyambo, respectively, which apply in prosodic domains across cyclic phase boundaries. New material in successive phases does not trigger new prosodic domain formation for any of the processes discussed.

As a reviewer points out, it is possible that in the phonological component, cyclic domains are not prosodic islands. The idea is that syntax (the operation Spell-out in particular) sends a syntactic object out, and the phonological component does not have to act upon this object right away. It is possible that this syntactic object is then later combined with other syntactic objects being sent out (e.g., from a higher phase). We acknowledge that this is indeed a possibility, though this essentially entails that the phonological "cycle" does not correspond to the syntactic cycle, which is precisely what we would like to show. Furthermore, it should be noted that from the data that we have illustrated above, the problem does not just involve a lack of direct mapping between a phase-cycle and a prosodic cycle, but also that there is an asymmetry between the left and right edges of the phase.

For these reasons, it is an advantage for the Edge-based approach that the cyclic phase-by-phase derivation in the syntactic computation does not interact with phonology. Instead, phonology accesses the final output of the syntactic representation, which crucially still

retains some structural information, for example, phase edges. This is implicit in our presentation in section 2 and 3. Consider the Zulu example in (7d), repeated here as (54).

(54) (([_{CP} [_{TP} bá-ník'   [_{vP} [_{VP} ú-Síph'   í-bhayisékiili]]]])   namhláanje])
          2SUBJ-gave   CL1-SiphoCL   5-bicycle   today
        'They gave Sipho a bicycle today.'

As we see in (54), the whole sentence is recursively parsed into two Intonation Phrases. Given that the prosodic phrasing is aligned with the right edge of a syntactic phase in Zulu, this is what we expect, assuming that the adverbial *namhláanje* 'today' is adjoined above the vP. The right edge of the vP-phase and the right edge of the CP-phase each aligns with the right edge of an Intonational Phrase. This phrasing correctly predicts that in Zulu (and in Chicheŵa), prosodic cues to phrasing (like penult lengthening) are found at the right edges of phases. Left phase edges do not have any prosodic realization (unless they are "plane-initial" CPs; recall (42), above), as we would expect if the prosodic parse proceeded cyclically: both edges should regularly be symmetrically associated with prosodic cues.[32] Further, there is no evidence that new material in successive phases is matched to a new prosodic phrase with independent phonological properties in Zulu, contrary to what a cyclic model would predict.

Note that in a sort of "assembly-line" version of phonology noted above, to ensure that the vP-phase is not "acted upon" in the phonological component immediately (because the raised verb is not prosodically separated from its objects), one would wait until the CP-phase. However, if that were the case, we would not expect the adjuncts to be phrased separately (in

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[32] There are, of course, some languages which do provide prosodic cues to both left and right constituent edges: e.g. Xitsonga (Selkirk 2011), Irish (Elfner 2012) and Swedish (Myrberg 2010, 2013). There is no ALIGNR dominance as in Chicheŵa and Zulu. As Myrberg (2010) argues, in an Edge-based analysis, ALIGNL and ALIGNR would be equally high-ranked in languages like these. A simple factorial typology can account for this range of facts.

(54)), unless we analyze the adjuncts to be adjoined to the CP phase.[33] Lastly, this problem arises not just for adjuncts but also for right-dislocated elements, which are prosodically separated from the adjuncts as discussed earlier (e.g., (37)).

5   Conclusion

To sum up, while the proposal that prosodic domains match spell-out domains can be considered the null hypothesis, it wrongly predicts that heads of verb phrases and restrictive relative clauses should not phrase with their complements. Syntactic proposals to get around these problems were shown to be unconvincing, as they are ad hoc and do not account for a wide range of available data. The spell-out domain approach also cannot account for the fact that other factors besides spell-out domains, both syntactic and prosodic, condition prosodic phrases.

In contrast, we have shown that a non-derivational Edge-based approach in the phonological component straightforwardly accounts for: the fact that heads and complements phrase together, the variable phrasing of postverbal adjuncts and preverbal subjects, and the interaction of other syntactic and prosodic factors in conditioning prosodic phrasing. We have also shown that a static (non-cyclic) model of the syntax-phonology interface can be phase sensitive. In short, the best account of prosodic phrasing is provided by a "syntactically informed" theory, rather than by a syntax-driven theory.

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[33]   Note that this would have to hold even for manner and locative adjuncts as well, which we consider to be highly unlikely.

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