Why prefixes (almost) never act as triggers in vowel harmony
Antonio Fábregas & Martin Krämer
University of Tromsø – The Arctic University of Norway

1. Introduction: the problem

A well-known observation in the morphophonological literature is that suffixes interact with roots and stems in ways that prefixes do not. Specifically in the case of Vowel Harmony (Lightner 1965, Clements 1976, 1980, 1985, Anderson 1980, Kiparsky 1981, Smolensky 1993, Pulleyblank 1996, Gafos 1999, Bakovic 2000, Kiparsky & Pajusalu 2003, among many others), it is well-known that cross-linguistically this process normally acts progressively from the root to the suffix and not vice versa (Beckman 1998, Krämer 2003, Hyman xxxx). A fact that is perhaps surprising given the general preference for progressive assimilation (Hyman 2008) is that prefixes almost never trigger vowel harmony into their base. Similarly, prefixes can be left unaffected by vowel harmony: spreading from the root to the prefix is frequently blocked. In short, prefixes are almost always isolated from their bases when it comes to vowel harmony processes: they don't undergo it, and they don't trigger it.

Hansson (2001: 180) suggests that this gap could be a typological accident based on the general preference for suffixation over prefixation in the languages of the world. However, it would be theoretically preferable to have a deeper explanation, beyond typological accident, of this gap. Accounts of this asymmetry between prefixes and suffixes have been developed using positional faithfulness (Beckman 1998), but that approach needs extra provisos in order to somehow isolate the prefix from the domain of the root in a way that suffixes are not isolated.

The problem becomes even more interesting when one considers the attested exceptions to this tendency, namely cases of prefixes that trigger or undergo vowel harmony, such as Tunen (Mous 1981, noted in this context in Krämer 2003: 69, footnote 24; see also Hyman 2002: 21 on Kinande).

On the surface, Tunen is a puzzling case from the perspective of how the prefix behaves in vowel harmony. In pronominal forms –demonstratives, possessives, numerals and wh-elements– the prefix triggers vowel harmony on the base (Mous 1981: 292). Specifically, there is [ATR] agreement on the base controlled by the vowel of the prefix. Note in (1) that the prefix that marks the noun class 3 triggers [+ATR] on the base, while the class 1 prefix is neutral with respect to that.

(1)   a. mó:-táná
            1-this
        b. mú-tɔ́nɔ́
            3-this

This involves the prefix markers for classes 3, 4, 13 and 19. In contrast, when the agreement prefixes attach to lexical nouns, containing a lexical root, they do not trigger vowel harmony. In fact in such cases the prefixes undergo vowel harmony triggered by the [ATR] properties of the base (Mous 1981: 290). This affects all noun classes. For instance, in class 1, *mò-* is used with [-ATR] stems and *mù-* with [+ATR].

In this chapter we will argue that the morphosyntactic configuration that the affix establishes with the base is a necessary but not sufficient condition for vowel harmony. Suffixes are more receptive to vowel harmony than prefixes because of their word-internal morphosyntactic configuration with respect to the root. The prefixes that are isolated from vowel harmony are introduced as complex specifiers or adjuncts, so they are –following Uriagereka's (1999) Multiple Spell-Out approach– closed domains for spell out. The

exceptional cases of prefixes that intervene in vowel harmony processes involve situations where the affix is linearised to the left for independent reasons –they are neither adjuncts nor specifiers. In other words: prefixes do not belong to the same morphosyntactic class, and the exceptions to the generalisation are underlyingly morphosyntactic suffixes, even if they end up linearised to the left. Our account derives the facts covered by the positional faithfulness theory from the syntactic hierarchical position of the heads involved in the word and the generally accepted idea that spell-out acts from bottom to top, spelling out first the most deeply embedded heads, which then can condition the segmental properties of the material spelled out after them (Bobaljik 2000).

This chapter is structured as follows: first we will present our account of the cross-linguistically unmarked case, where vowel harmony acts progressively from the base to the affix. This will give us a baseline that allows us to propose the configurational constraints in the process, from a morphosyntactic perspective. Then (§3), we will go to the prefixes and we will show why they are correctly expected not to participate in vowel harmony in general, using Uriagereka's (1999) Multiple Spell-Out theory. In §4 we will take a moment to examine what 'prefix' actually means in the tradition, in order to show that in principle morphosyntactic objects that have the configurational properties of suffixes could be linearised to the left of the base for independent reasons, and then they would be expected to participate in vowel harmony even if they are descriptively, due to their surface position, prefixes. We illustrate the type of exception we are dealing with by the case of Yoruba. In §5 we deal with the more complicated case of Tunen, and §6 presents the conclusions.

2. Vowel harmony from roots to suffixes.
The most common cases of vowel harmony involve progressive spreading from the root to the suffix. Turkish is a good example of this (3).

(3)   a. kilim-*im*   Turkish
           carpet-my
        b. gül-*üm*
           rose-my

Here we are interested in the nature of the suffixes that undergo the vowel harmony. The 1st person singular possessive marker in (3) is a prototypical suffix in the sense that it acts as a head that expresses part of the extended functional structure of the noun in its base: as such, it introduces definiteness and determines the syntactic distribution of the base, having when appropriate the capacity to alter the grammatical category, as it is the case with nominalisers or verbalisers. Suffixes are generally heads that define grammatical properties of the base. Configurationally, they are specifically heads that dominate the root –contained in the base– in the abstract structure presented in (4), which represents the syntax previous to Vocabulary Insertion.

(4)   PossP

          Poss   nP

               n $\sqrt{1453}$
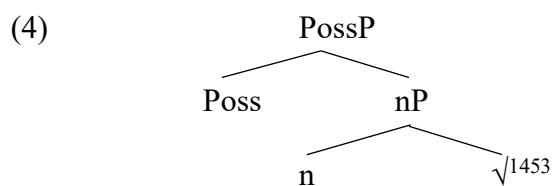
Following constructivist theories (Halle & Marantz 1993, Embick 2000, Borer 2013, among others), we assume here that roots are category-less elements containing a phonological index. This root must receive a grammatical category from a higher head; in our example, little n

defines a noun. The following head extends the functional structure of the noun (Grimshaw 2005). We assume also Late Insertion (Bonet 1991, Halle 1997, Embick 2000): at PF, these constituents are matched with vocabulary items. In the case of (3) the items would be:

(5)   a. $\sqrt{1453}$ <---> gül-
       b. n   <---> ø
       c. Poss   <---> -Vm

What is phonologically special about these vocabulary items is that the suffix associated to the possessive determiner undergoes vowel harmony.

Even though the linear order between these vocabulary items is reversed with respect to the tree,[1] in the morphosyntactic configuration the root is the lowest head. Consider the configuration once the sets of morphosyntactic features have been replaced by specific morphophonological exponents.

(6)   PossP
              ╱───────────╲
          Poss   nP
          -Vm   ╱───────╲
                    n $\sqrt{1453}$
                    ø   gül-
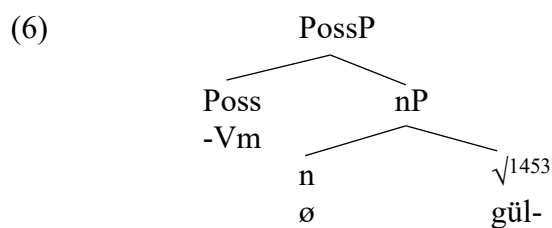
From this configuration, the surface effect of vowel harmony is obtained if the root, the lowest element in the configuration, spreads the vowel harmony to the underspecified item placed in its extended functional projection.

(7)   PossP
              ╱───────────╲
          Poss   nP
          -*ü*m   ╱───────╲
                    n $\sqrt{1453}$
                    ø   gül-
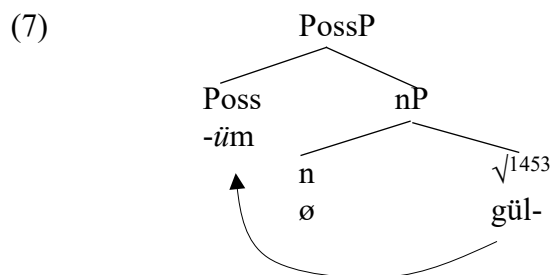
This is consistent with Bobaljik's (2000) proposal that any kind of allomorphy that is conditioned or controlled by phonological properties must act outwards, that is, from the hierarchically lower elements to the hierarchically higher elements within the extended syntactic projection. Let us assume for the moment that this descriptive observation is correct and let us state it as (8).[2]

---

[1] We remain neutral with respect to the nature of the operation that reverses the ordering among prefixes; among the existing theories in the market we have the Mirror Principle (Baker 1985, 1988), cyclic head-to-head movement (Travis 1984) or Morphological Merger (Halle & Marantz 1993). This is, as far as we can see, orthogonal to our analysis.

[2] Even though vowel harmony is generally acting from the root to the suffix, cases where the suffix triggers vowel harmony in the root are not unattested, although much less frequent (Hyman 2008: 319 estimates the ratio as 3/4 vs. 1/4). Of course that directionality is unexpected given our principle (8), and such cases are not covered by our proposal. Although we lack an explanation of such cases at this point, we suggest that the explanation might lie at the possibility of parametrising the timing of application of vowel harmony. The languages that allow to see (8) on the surface are those where vowel harmony applies previous to the reordering of morphological exponents, while the less frequent languages that have regressive vowel harmony

(8)   Morphosyntactic condition on vowel harmony
        Vowel harmony spreads bottom-top from a lower item in the configuration to
        higher items within its extended projection

This would characterise in configurational terms, the most common case of vowel harmony: from the root to a suffix, or in our terms, from a low item in the structure to the heads that define its extended projection.

   Before we move further to the case of prefixes, a caveat is in order. Here we are exploring the configurational conditions on vowel harmony, and therefore we have nothing to say about cases where the vowel harmony applies within the phonological material that corresponds to a single head, for instance a root. We have nothing to say in this chapter, thus, about vowel harmony triggered in root-internal epenthetic vowels, as in the Turkish example in (9) (Krämer 2003: 64). This type of vowel harmony vacuously satisfies the configurational conditions.[3]

(9)   a. grup > gVrup > gurup
        b. prens > pVrens > pirens
        c. kral > kVral > kıral

3. Prefixes that are isolated from vowel harmony processes.
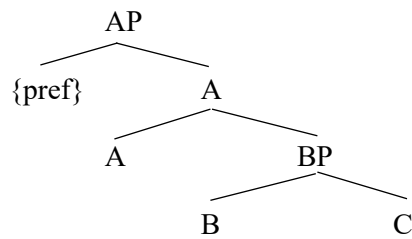
   Even though prefixes should be part of the word at least for prosodic reasons (for instance, syllabification), they generally do not trigger vowel harmony in dominant-progressive systems, and they do not undergo the process in dominant-recessive systems (Krämer 2003: 69). Here we will attempt a configurational explanation of this.

   Prototypical prefixes are generally treated as adjuncts (DiSciullo 2005). Instead of introducing additional heads that impose their category label to the base, they act rather as modifiers, operators or other types of morphosyntactic objects that do not radically alter the syntactic distribution of the bases they are attached to. For this reason, they would correspond to a configuration like (10), where *pref* stands for 'prefix'.

---

apply the directionality after the morphemes have undergone movement: in such configuration, the affix no longer c-commands the root and therefore the hierarchical relations are inverted.

[3] If the vowel harmony process is defined at the postsyntactic level, the direction of spreading can be defined autonomously by the phonological component, ignoring syntactic hierarchy. One possible instance of this situation comes from Jingulu. Pensalfini (2002) documents cases in Jingulu where some nominal and verbal suffixes trigger vowel harmony on the root. He shows that, syntactically, the specific suffixes do not form a natural class: their only common property is that, linearly, the suffixes must be adjacent to the root without the possibility that any other exponent intervenes between them –which is a linear, not hierarchical, generalisation. He proposes to analyse the vowel harmony pattern in the set of post-syntactic morphological rules made available by Distributed Morphology, following head movement from the root to the suffix. At that level, the hierarchical relations have been superseded by the linear representation, and therefore the process counts as defined in the PF branch of the grammar, where as noted above the direction of spreading can be autonomously defined without regard for the syntactic hierarchy. So-called dominant/recessive patterns, where the presence of a feature triggers a change to both right and left (cf. Kalenjin ATR-harmony, Hall et al. 1974) would be treated also in this sense; we note in passing that the prefixes affected by the harmony in Kalenjin express tense and aspect, notions codified as heads in the spine of the tree (see §3 below). Similarly, post-cyclic rules –which always ignore the internal structure of the word– would fall within this class (for instance, Chumash distributed harmony, cf. Poser 1982: 132).
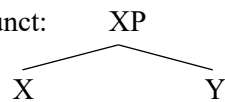
(10)

```
              AP
          ／      ＼
      {pref}        A
                 ／    ＼
               A        BP
                     ／    ＼
                   B        C
```
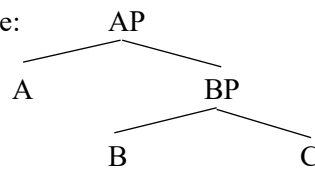
  Crucially, the prefixes that correspond to adjuncts do not belong to the extended projection of the base, that is, they do not expand the base into functional structure, simply because they do not impose their label on the whole object.

  This has immediate consequences for how these objects are spelled out. Uriagereka (1999) gathers all the evidence that has accumulated through the years about the isolation of adjuncts from the core spine of the syntactic tree: adjuncts, syntactically, disallow extraction of phrases (Ross 1967) and do not trigger binding violations (Lebeaux 1988); phonologically they tend to form their own prosodic constituents. Uriagereka (1999) takes all this evidence and proposes that they are due to adjuncts being built in a parallel working space independent of the one where the core spine of the tree, with the sequence of functional heads, is built.
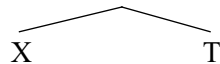
(11) a. Adjunct: XP   b. Spine: AP

```
       a. Adjunct:   XP              b. Spine:     AP
                   ／    ＼                      ／    ＼
                 X        Y                    A        BP
                                                     ／    ＼
                                                   B        C
```
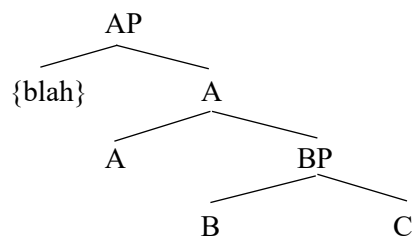
In order to be able to merge the adjunct with the spine, then, the adjunct must be spelled out first, and then the spelled out element is merged with the spine.

(12) a. Spell-out adjunct: XP   <---> {blah}

```
                              XP
                          ／    ＼
                        X        T
```

  b. Merge {blah} with the spine.

```
              AP
          ／      ＼
      {blah}        A
                 ／    ＼
               A        BP
                     ／    ＼
                   B        C
```

Consequently, the adjunct is already spelled out when it is combined with the spine: that is why it shows autonomy in syntax and phonology. It is impenetrable to any interaction with the spine, which will not be able to alter its internal syntactic structure or its spell out.

  Then, prefixes that correspond to adjuncts would never undergo or trigger vowel harmony because the spine and the prefix are spelled out as independent objects, resulting in prosodification in different domains in the phonology, that is the spine is parsed as a prosodic word to the exclusion of the adjunct. We expect, then, no spreading of vowel harmony from the base to the prefix, because by the time that the prefix is introduced it has already been spelled out. Given the principle stated in (8), spreading of vowel harmony from the prefix to the base is excluded, because it would involve top-bottom spreading within the configuration,
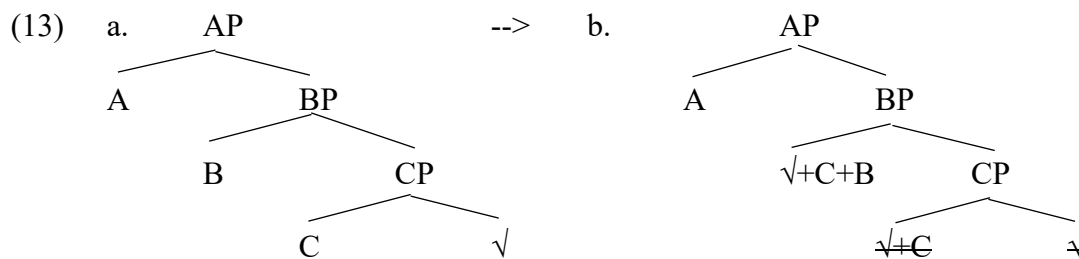
which by hypothesis is excluded by the restriction on phonologically-conditioned allomorphy (Bobaljik 2000).

What happens, then, with prefixes that undergo or trigger vowel harmony? In short, these are not adjuncts, even if they are linearised to the left. The next two sections will discuss those.

4. Prefixes: position is not enough

On the surface, the claim that prefixes don't intervene in vowel harmony seems falsified by the existence of some exceptions. In order to address these exceptions, we must first look at what it means in descriptive terms to be a prefix. The notion of prefix is defined by the surface position of an affix: to the left or to the right of the base once the items have been linearised. This notion is very old in linguistic tradition (Black 2000 finds a positional classification of affixes even in Sumerian-Akkadian grammatical lists), and clearly pretheoretical. The problem is that we already know that position is not enough to determine the nature of an item, as items of different kinds might occupy the same position on the surface –just think about how many distinct classes of items can appear immediately to the left of the finite verb in English.

In other words, being linearised to the left does not immediately imply that the affix merged there will be an adjunct and not a head. We will see one example of this situation that we will first present as a theoretical construct, to argue later that it is actually instantiated in Yoruba. Imagine a sequence of heads like (13a), with a root dominated by three functional heads, C, B and A, that are part of its functional structure. Imagine now that the operation that reverses the relative order of the heads in morphophonology (say, for instance head movement) does not apply to the head A (13b).

(13) a.

```
          AP                    -->    b.          AP
         /  \                                     /  \
        A    BP                                  A    BP
            /  \                                     /    \
           B    CP                                √+C+B    CP
               /  \                                      /   \
              C    √                                   √+C     √
```

Under these conditions, on the surface we would obtain the order [A [[[√]C]B]], where descriptively C and B will be considered suffixes and A would be classified as a prefix. However, A is, in the morphosyntactic configuration, a head belonging to the core spine of the base, so we expect it to participate in vowel harmony processes, unless the phonological computation places a major boundary (e.g., prosodic word boundary) between A and the lexical root √.

We claim that this situation is found in Yoruba (Pulleyblank 1988: 239). In this language, the prefix *oní-* is affected by vowel harmony triggered by the base. Next to assimilation of the /n/, the vowel shares the [ATR] value with the first vowel of the base.


(14) Yoruba
  a. [oʃewe] 'publisher'   ò/ɔ̀ + /ʃèwé/   'publish a book'
     [oɟowu] 'jealous person'   ò/ɔ̀ + /jowú/   'be jealous'
  b. [ɔkɔsɛ] 'person who refuses   ò/ɔ̀ + /kɔ/ /iʃɛ/   'refuse'
              to run errands'   'message'   (Pulleyblank 1996:306)

However, the behaviour of *oní-* in Yoruba corresponds to a syntactic head, not to an adjunct. The arguments for this claim are the following (data taken from Folarin 1988). First of all, this prefix is able to change the grammatical category of the base (Folarin 1988: 45), specifically from adverb to noun:

(15) wérewére   >   oní-wérewére
      'aimlessly'   'someone who does things aimlessly'

This shows that the prefix is a nominaliser that imposes its grammatical label on the base. Moreover, heads are expected to select their complements, imposing to them specific interpretations. In the case of oní-, the prefix imposes a necessarily animate reading on the derived form that changes the distribution of the form, as the translation in (15) shows. In other words, *oní-* acts morphosyntactically a lot as the English morpheme *-er* in agent nouns (*writ-er*), even though *oní-* linearises to the left –for reasons unknown to us, but independent of the morphosyntactic role that it plays.

Given the role that *oní-* plays, we propose the following configuration for words that use this prefix.

(16)   nP
           ／   ＼
        n   ...VP
      [animate]   ／ ＼
             V   √633
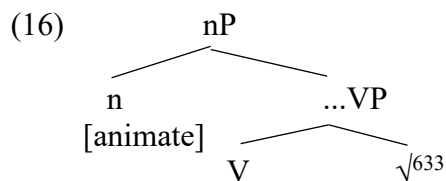
The configuration satisfies the context for vowel harmony as stated in (8). Therefore there is nothing remarkable with *oní-* from the perspective of the constraint we proposed, once we consider the morphosyntax of the form. If the prefix is underspecified, it is expected that the root will be able to condition vowel harmony in exactly the same configurational terms. The only remarkable thing about this affix happens in the linearisation, because it does not reverse its order with respect to the base, unlike other bases.[4]

5. Tunen or what happens when there is no root.
The case of Tunen seems more complicated on the surface because of the apparently contradictory behaviour that the prefix has with lexical nouns as opposed to pronouns. As we mentioned, when there is a lexical noun, all the prefixes that mark the noun class invariably undergo vowel harmony triggered by the base. However, with pronouns, certain prefixes – those belonging to classes 3, 4, 13 and 19– trigger vowel harmony on their bases. Why?

In our terms, the explanation is simpler than it seems. The minimal morphosyntactic difference between a lexical noun and a pronoun is that the lexical noun contains a root, while in the case of the pronoun all overt morphophonological material corresponds to functional structure:
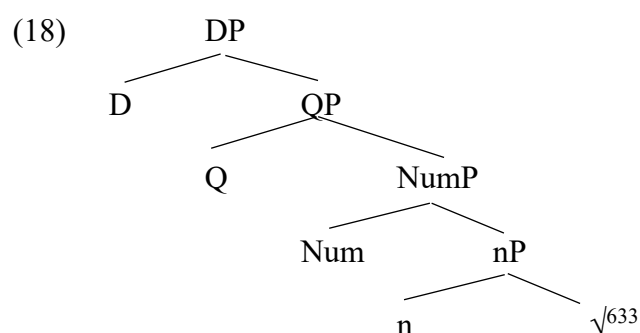
(17) mà-bàt
      NM6-clothe
      'clothes'

---

[4] Another relevant case is Akan subject agreement prefixes, that agree in ATR value with the base (Nevins 2010: 39-40). Of course, agreement is treated as a relation expressed through functional heads, not via adjuncts.

By hypothesis, the root –when present– is always the lowest constituent in the tree: this follows from its acategorial nature, which forces it to be dominated by all functional structure in order to be licensed –see also Borer (2013), where arguments are provided that roots, being phonological indices, will be unable to introduce complements. With respect to the prefix, note that in (17) it is assigning a noun class to the root and defining its number: it is clear then that under our assumptions it is a head within the extended functional projection of the nominal structure. The case of (17), then, is no different from the case of Yoruba. In the syntactic configuration, we have a structure of the form [A [...[√]]], where A corresponds to the noun class marker. For some reason, at linearisation the relative order between the root and the A head is not altered, so the affix emerges linearly as a prefix, but it is a head and it satisfies the configurational condition (8) on vowel harmony.

Consider now the cases where the prefix triggers vowel harmony on the base. Crucially, these cases involve functional elements where there is no root present –at least, there is no overt exponent for the root–. We need now to see what type of head the prefix corresponds to, and what configuration that head establishes with the base in the case of the pronominal.

We follow Panagiotidis (2002) and others on the claim that pronominals contain an nP structure, but lack a root. We know that the prefix codifies information about (i) the noun class and (ii) the number of the pronoun. The bases where prefixes can trigger vowel harmony include demonstratives, numerals, possessives and interrogatives. All these items involve information about the higher functional structure of nominal constituents: demonstratives and possessives express definiteness, while interrogatives and numerals are quantifiers. Following standard assumptions about the internal structure of nominal constituents (see for instance Ritter 1991, Zamparelli 1998, Cinque 2005, Wiltschko 2014), we know that quantifiers and determiners are hierarchically higher than Number and noun classes; in fact, Picallo (2006) has argued that noun class and possibly some forms of number should be treated as information contained in the little n head that defines the structure as nominal. Thus, in the case of one of the pronouns whose base undergoes vowel harmony triggered by the prefix, we have a configuration like (18), where the prefix corresponds to Number or n –possibly both, as a portmanteau morpheme– and the base corresponds to D or Q.

(18)

$$
\begin{array}{c}
\text{DP} \\
\diagup \;\; \diagdown \\
\text{D} \qquad \text{QP} \\
\diagup \;\; \diagdown \\
\text{Q} \qquad \text{NumP} \\
\diagup \;\; \diagdown \\
\text{Num} \qquad \text{nP} \\
\diagup \;\; \diagdown \\
\text{n} \qquad \sqrt{633}
\end{array}
$$

Crucially for our purposes, in the absence of a root both Num and n are lower than either Q or D. If the prefix is introduced no higher than Num, it will be able to trigger vowel harmony on the base (Q or D) because it satisfies the conditions of (8): the element that undergoes vowel harmony is a head within the extended projection of the element that triggers the harmony, and the trigger is hierarchically lower than the element undergoing the harmony.

Again, the remarkable thing takes place at the stage of linearisation, because the lower head is linearised before the base, which is higher in the tree than its head, and that is why it is taken to be a prefix on the surface. Although this ordering could in principle be accounted for with a standard Mirror Principle analysis, the fact that the class marker also precedes the root

in lexical nouns shows that the story has to be more complicated in linear terms. Specifically, what we would need to obtain the right surface ordering would be an operation that takes the constituent headed by the noun class marker (presumably NumP) and displaces it, containing the root, to a position preceding the higher layers D and Q.

(19)   [[NumP **mú** [n ø]] X [DP **tɔ́nɔ́** [NumP]]]

However, from a configurational perspective these cases are unproblematic, and follow from (8), which also accounts for the linearly well-behaved cases of suffixes.

The very same second scenario is satisfied by Kinande (see Downing & Krämer in press for a detailed analysis of vowel harmony in this language, following the configurational restrictions proposed here). Hyman (2002: 21) reports that the class marker of class 4 and 10 triggers [ATR] harmony into the following high vowel. Notice that, crucially, that the prefix /i-/ that triggers the vowel harmony combines only with numerals.

(20)   a. i-nɪ   -->   i-ni   *cf.* ba-nɪ
          4-four   2-four
        b. i-tanʊ   -->   i-tanʊ
          4-five

The situation is the same as in Tunen, only that simpler because the class marker combines with numberals and not with lexical nouns that lack a root. On the assumption that the numeral is placed in QP, and the class marker belongs to NP, the prefix is configurationally a head that triggers the harmony into an element of its extended projection.

6. Conclusions

In this chapter we have argued that there is a morphosyntactic restriction that restricts potential cases of vowel harmony according to the structural relation between the trigger of harmony and the item undergoing it. We have argued that that restriction only makes vowel harmony possible when the trigger is hierarchically lower than the affected item, and the affected item is a head within the core spine of the trigger. This straightforwardly accounts for the cross-linguistic preferences –suffixes are heads in the functional spine, most prefixes are adjuncts outside of that spine–, as well as for several apparent counterexamples, which reduce to situations where the prefix is configurationally a head that happens to linearise to the left of the base.

Our analysis has several consequences for the nature of vowel harmony processes: it treats them on a par with situations of phonologically-conditioned allomorphy, as a bottom-top process that extends from lower heads to higher heads; it dissociates vowel harmony from linear order, showing that the hierarchical organisation of the items plays a stronger role than the linear position that the items occupy.

References