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Vowel harmony in Jingulu

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Abstract

Jingulu, a language of North-Central Australia, exhibits a pattern of regressive vowel harmony which is not only difficult to characterise accurately in descriptive terms, but also poses challenges for current theories of vowel harmony. The purpose of this article is thus threefold: to describe a fascinating phonological phenomenon, to formulate accurate generalisations which capture the phenomenon, and to bring the phenomenon within the range of current theories. I argue that the phenomenon cannot be understood in purely phonological terms, but must also take morphosyntactic properties of the language into account.

Keywords: Vowel harmony; Morphosyntax; Jingulu

1. Introduction

This article deals with vowel harmony in Jingulu, the traditional language of the Jingili people of the Western Barkly Tablelands in Northern Central Australia (halfway between Alice Springs and Darwin). Jingulu harmony affects both nouns and verbs (the two open classes), is regressive (suffixes trigger harmony in roots), and is blocked by the presence of the very feature that is associated with the harmonic phenomenon. However, these are among the least unusual facts of Jingulu harmony. The set of affixes which triggers harmony does not appear to form a natural class, and finding a generalisation which accurately captures the properties of these trig-

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gers is not a straightforward task. Section 2 is given over to describing Jingulu harmony and attempting to classify the harmony-triggering morphemes.

Section 3 is devoted to finding an adequate theoretical account of the harmony facts as presented in Section 2. In Section 3.1, I show that purely phonological or morphophonological analyses cannot account for the data. Of particular interest will be the discussion of positional prominence, a notion which is much in current usage among phonologists. Beckman (1995), for instance, proposes an analysis of Shona harmony which involves features spreading from a prominent position. The triggers for harmony in Jingulu, however, would appear to be the worst possible candidates for prominent positions, being unstressed affixes.

A full account of Jingulu harmony requires an understanding of the morpho-syntactic relationship between roots and affixes, most importantly the realisation that roots and heads are not one and the same. In Section 3.2, I argue that the syntax requires the root to merge with the nearest syntactic head, and it is this head (and no other in the word) that is able to trigger harmony in the root.

In Section 3.3, I return to the notion of positional prominence, and argue that if 'syntactic head' is added to the catalogue of prominent positions (perhaps even replacing 'root'), the notion of positional prominence is best equipped to deal with the Jingulu facts. However, the catalogue of prominent positions now begins to resemble a random assortment of categories, and the definition of positional prominence runs the risk of becoming circular.

This article does not bear on the current debate between Optimality Theory (henceforth OT, see Prince and Smolensky, 1993, and work following on from that) and rule-driven approaches to phonology. Throughout the article, I have adopted an Autosegmental feature-spreading (multiple linking) approach (as developed most famously in Goldsmith, 1976), but the basic findings translate equally well to other approaches, such as that of Optimal Domains Theory (Cole and Kisseberth, 1994). I do not demonstrate this here.

Vowel harmony in Jingulu has previously been treated by van der Hulst and Smith (1985), who based their analysis on the description found in Chadwick (1975). Their work is not discussed here for a number of reasons. Chadwick's description is notoriously difficult to read for those who do not have first hand experience with Australian languages, and van der Hulst and Smith's article appears as a result to be based on a reading of Chadwick which does not match with the facts of the language which I encountered first hand. The present article is based on the descriptions in Pensalfini 1997 and on my own extensive fieldwork on Jingulu, carried out from 1995 to 1998. The harmony facts as I have found them do not fit Chadwick's description, and less so van der Hulst and Smith's interpretation and analysis of that description. This may well be due to a change in the language between the time of Chadwick's fieldwork (late 1960s) and mine.

2. Description and generalisations

Vowel harmony in Jingulu affects both nominal (1a-f) and verbal (1g-h) words. Certain affixes containing high vowels (/i/ or /u/) trigger a raising of the final vowel

of the root, if it is low (/a/), to /i/. If the preceding root vowel is also low, it also raises, and also the one preceding that, and so forth. An underlying high vowel in the root will prevent any preceding low vowels from raising.[1]

(1)	a.	warlaku	+/-rni/	→	warlakurni
		dog	f		'bitch'
	b.	ngamurla	+/-rni/	→	ngamurlirni
		big	f		'big (fem)'
	c.	ankila	+/-rni/	→	ankilirni
		cross cousin	f		'female cross cousin'
	d.	kunyarrba	+/-rni/	→	kunyirrbirni
		dog	f		'bitch'
	e.	bardarda	+/-rni/	→	birdirdirni
		younger brother	f		'younger sister'
	f.	mamambiyaka	+/-mi/	→	mamambiyikimi
		soft	v		'soft (veg)'
	g.	ngaja	+/-mindi-yi/	→	ngijimindiyi
		see	1dlInc-FUT		'we will see'
	h.	ngarrabaja	+/-wurru-nu/	→	ngirribijiwurrunu
		tell	3pl-DID		'they told'

In (1a–e), I have implied that the feminine nominals are derived from their masculine counterparts. That the reverse (which would imply lowness harmony rather than height harmony) is not the case can be demonstrated by the existence of convergent pairs such as:

(2)	a.	baba	bibirni
		'older brother'	'older sister'
	b.	biba	bibirni
		'son'	'daughter'

The masculine terms in (2) are distinct from one another, while the feminine forms are not. This might suggest that the underlying lexical forms are the distinct mas-

[1] Note that these data appears to directly contradict McCarthy and Prince's (1995) meta-constraint $\text{FAITH}_{\text{Root}} >> \text{FAITH}_{\text{Affix}}$ (faithless to the underlying properties of a root is always given higher priority than faithfulness to the underlying properties of an affix). A corollary of this meta-constraint is that 'no language can have a vowel harmony system in which all roots are varying and all affixes fixed' (McCarthy and Prince, 1995:365). Jingulu harmony is exactly such a system. All affixes are fixed, and all and only roots are subject to harmony. This phenomenon cannot be explained away in terms of ablaut or other local processes, as Jingulu harmony takes the entire root as its domain.

culine ones, which converge on the same feminine forms due to the effects of harmony. If the underlying form were the feminine one, there would be no way of deriving divergent masculine forms from the single feminine form. Further evidence for this conclusion comes from the referential possibilities of nominals in Jingulu. Masculine forms are the default, used when the sex of the referent is unknown or with mixed-sex sets of referents.

In actual fact, for both empirical and theory-internal reasons (taken up in subsequent sections of this paper and in Pensalfini, 1997, 2000), I believe that neither the explicitly masculine nor the explicitly feminine form of variant nominals is the lexically stored form. Rather, the lexicon lists genderless roots, which combine with nominal heads (which bear gender features) in the syntax, following Marantz (1996).

Note that harmony only ever occurs across a morpheme boundary. That is, there is no harmonic requirement on roots themselves. Roots can freely mix high and low vowels, as a quick glance at the unharmonised forms in (1) reveals. Jingulu harmony is thus a derived environment effect (in the sense of Kiparsky 1973), a system which affects only polymorphemic words.

Jingulu has a three vowel system, and I follow Pensalfini (1997) in assuming the vowels to be minimally specified as in (3).

(3) /a/ = [+vocalic]
/i/ = [+vocalic, +high,-round]
/u/ = [+vocalic, +high, +round]

The reason for underspecifying the low vowel /a/ for the feature [±high] is that it simplifies the representation with respect to harmony. If harmony involves spreading of the feature [+high], as is about to be demonstrated, then specifying /a/ as [-high] would necessitate de-linking [-high] from /a/ before spreading [+high] to it. The astute reader will also observe that the high vowels are not specified for backness. I assume that the distinction between /i/ and /u/ is one of rounding, with backness being filled in by default realisation processes, though nothing crucial hinges on this assumption. Similarly, nothing crucial hinges on the underspecification of /a/ with respect to the feature [±round]. This simply follows a standard Australianist tradition of minimally specifying the underlying contrasts for vowels, motivated by the fact that in three vowel systems, great surface variation in the realisation of vowels is found.

As foreshadowed, we can view harmony as leftward spreading of the feature [+high] from the triggering affix. The leftward progress of the feature is blocked by another underlying [+high]. This is shown for all of the examples from (1) in (4), below. The blocking of feature-spreading by the very feature that is being spread is fairly unusual, and contrary to predictions made by some authors (for example van der Hulst and Smith, 1986, and to some extent implicit in Cole and Kisseberth, 1994).

(4) a. warlaku + /-rni/ → warlaku-rni
[+hi] [+hi] [+hi][+hi]

b. ngamurla + /-rni/ → ngamurli-rni
[+hi] [+hi] [+hi] [+hi]

c. ankila + /-rni/ → ankili-rni
[+hi] [+hi] [+hi] [+hi]

d. kunyarrba + /-rni/ → kunyirrbi - rni
[+hi] [+hi] [+hi] [+hi]

e. bardarda + /-rni/ → birdirdi-rni
[+hi] [+hi]

f. mamambiyaka + /-mi/ → mamambiyiki - mi
[+hi] [+hi] [+hi] [+hi]

g. ngaja + /-mindi- yi/ → ngiji- mindi - yi
[+hi][+hi][+hi] [+hi][+hi][+hi]

h. ngarrabaja + /-wurru-nu/ → ngirri biji-wurru-nu
[+hi][+hi][+hi] [+hi][+hi][+hi]

Thus far, Jingulu harmony does not pose any particular problems. The difficulty lies in characterising the set of affixes which are able to trigger harmony.

In nominals, feminine and vegetable gender endings induce harmony, as seen in (1a–f). Other nominal affixes, such as case (5a–b) and number (5c) can never trigger harmony, even if they contain a high vowel.

(5) a. bardarda-rni (vs birdirdirni)
younger brother-ERG ('younger sister')

b.	jikaya-mbili lake-LOC	
c.	wawa-bila child-dl(animate)	(vs wiwirni) ('girl' (child-f))
d.	mamambiyaka-bila soft-dl	(vs mamambiyikimi) ('soft (v)')

We might conclude, then, that only gender affixes trigger harmony. Jingulu has four genders, which can be called masculine, feminine, vegetable and (general) neuter. Each gender has a characteristic ending, which occurs on most nouns belonging to the given gender, and as agreement on adjectives modifying nouns in the given gender, as demonstrated in (6). The characteristic ending for the masculine gender is [a], for the feminine [rni] (or [rdi]), vegetable [mi] (or [bi]), and neuter [u].

(6)	a.	bininja man 'good man'	bardakurra good(m)
	b.	nayurni woman 'good woman'	bardakurrirni good(f)
	c.	babirdimi yam 'good yam'	bardakurrimi good(v)
	d.	darrangku tree 'good tree'	bardakurru good(n)

It would be entirely reasonable to treat these characteristic endings as morphemes (masculine /a/, feminine /rni/ with allomorph [rdi], vegetable /mi/ with allomorph [bi], and neuter /u/). The question now arises as to why the neuter morpheme /u/ does not trigger harmony, despite the fact that it contains the feature [+high]. As (1h) and (4h) show, a morpheme containing the phoneme /u/ can trigger harmony in verbs, and the harmony process is otherwise identical in both nominal and verbal words. The only possibility which suggests itself is that the neuter form of nominals does not involve suffixation of a high vowel, but rather that the final /u/ is underlyingly present in the root, and the neuter affix is actually null. Thus the requirement that the trigger for harmony be across a morpheme boundary from the target is not met, and no harmony occurs.

There is evidence beyond mere theoretical convenience for this assumption. The (general) neuter gender contains the greatest proportion of irregular forms (members not ending in the characteristic gender ending [u]). The genders which do induce harmony, feminine and vegetable, show the greatest regularity, with very few members not showing the ending. The feminine and vegetable genders are also the smallest, and semantically most restrictively defined (the most marked). The feminine gender comprises some 13% of nouns, primarily words for female higher animates, 'unusual'

birds, stinging insects, implements used primarily by women, and edged tools. The vegetable gender comprises about 9% of nouns, words for plant-based foods, plants with spikes or prickles, and long thin objects. The masculine gender (42% of nouns) contains words for all other animates plus flat round objects, and the neuter gender (36%) contains words for all remaining inanimates. Furthermore, words borrowed into the neuter class from other languages (typically Mudburra, Kriol, or English) are less likely to undergo regularisation to a form ending in the characteristic vowel than are words borrowed into other classes.

Based on previously presented evidence [see discussion around (2)], as pointed out by a *Lingua* reviewer, it would be entirely reasonable to propose that the masculine gender affix is also null, and that feminine forms are derived by affixation to the masculine form. Certainly this would fit nicely with the semantic classification of the genders: masculine is the unmarked animate class and neuter the unmarked inanimate class. The marked classes, feminine for animates and vegetable for inanimates, therefore involve affixation, and it is only with these marked affixed classes that harmony is found (and both feminine and vegetable affixes happen to contain high vowels). However, I prefer to follow Marantz (1996) in assuming that the roots of nominals of any gender lack categorial features, including gender, number, and the formal nominal feature [+N], and that nominal words are created by combining these categoryless roots with nominal heads which contain these formal categorial features. Under this view, it is meaningless to speak of nominals of one gender being derived from nominals of another. Nominal words may be related by sharing a root, but all nominals are derived through combination of this root with a formal categorial head.

Characterising the triggers for harmony in verbal words poses an even greater challenge. In verbs, only subject agreement markers and imperatives of motion or negative imperatives trigger harmony (triggers underlined):

(7) a. Ngangarra ngaja-nga-ju.
wild_rice see-1sg-DO
'I can see wild rice.'

b. Ngangarra ngiji-ngurru-ju.
wild_rice see-1plInc-DO
'We can see wild rice.'

c. Ngiji-kunyi-ju ngangarra?
see-2dl-DO wild_rice
'Can you two see the wild rice?'

d. Mankiya-ju ambaya-ju.
sit-DO talk-DO
'He's sitting down talking.'

e. Nyami-rni ngaya mankiyi-mindu-ju, arrinjku
2sgNOM-FOC 1sgNOM sit-1dlInc-DO language
imbiyi-mindu-ju.
talk-1dlInc-DO
'You and I are sitting, talking language.'

f. Ngiininiki dika maja-nga-yi kurlukurlu.
this(n) fat get-1sg-FUT small(n)
'I'll get a little bit of this fat.'

g. Ngunu buba miji-yirri!
DEM(n) fire get-GOIMPV
'Go get some firewood!'

h. Ngarrabaja-mi jamaniki-rni marliyi-ngirri-ju!
tell-IRR this(m)-FOC sick-1plExc-DO
'Tell that person that we're sick.'

i. Ngirribiji-ji ngiininiki-rna.
tell-NEGIMPV this(n)-FOC
'Don't go spreading this around!'

In (7a) we see the unharmonised form of the root /ngaja-/, 'see'. In (7b and c) we see harmony triggered by agreement markers containing the high vowel /u/. Note that the tensed element /-ju/ does not trigger harmony in (7a), nor in (7d), where we see the unharmonised form of /ambaya-/, 'speak/talk/say'. In (7e) we see the same root undergo harmony in the presence of an agreement marker containing the high vowel /i/. In (7f) the root /maja-/ 'get' appears in its unharmonised form (once again the tensed element /-yi/ does not trigger harmony, while in (7g) it undergoes harmony due to the affix /-yirri/, the imperative of motion ('go and do X'). Similarly, the unharmonised root /ngarrabaja-/, 'tell', in (7h) undergoes harmony in (7i) when appearing with the negative imperative affix /-ji/.

So far, it would seem that a trigger has to contain a high vowel and be adjacent to the root. But not all morphemes containing high vowels can trigger harmony, even if they are immediately adjacent to the root (the affix in question is underlined):

(8) a. Wawa-rni ngaja-nyu-nu.
child-ERG see-2Obj-DID
'The child saw you.'

b. Ngangarra ngaja-mi!
wild_rice see-IRR
'Look at the wild rice!'

c. Kijurlurlu-ngkami ngaja-ni-ngurru-ju.
stone-ABL see-INV-1plInc-DO
'He sees us from the rock.'

Object agreement markers, as in (8a), never trigger harmony. The 'regular' imperative (and irrealis) marker /-mi/ also never triggers harmony (8b), in which respect it contrasts with the specialised imperatives of motion and negation seen in (7g) and (7i). Finally, the inverse marker /-ni/, seen in (8c), cannot trigger harmony either.[2] Yet all of these morphemes contain high vowels, and all occur adjacent to the root.

[2] The function of the inverse marker is discussed in Section 3.2.2.

The different behaviour of the three kinds of imperative marker with respect to harmony can be understood with closer examination of the morphological context in which these affixes can appear. All three of these markers preclude the use of other tense/direction markers, and would appear to take the place of these markers. The specialised imperatives of motion (7g) and negation (7i), which trigger harmony, can furthermore never co-occur with agreement markers (9a–d). The unmarked imperative affix /-mi/, on the other hand, may occur with subject (9e) or object (9f) agreement (subject and object agreement may co-occur, as demonstrated in (9g), though portmanteau morphemes which combine subject and object agreement are usually used- there are no examples in the available corpus of the imperative /-mi/ occurring with both subject and object agreement in the same word, though this seems to be possible in principle).

(9) a. *Maja-nya-yirri!/*Miji-nyi-yirri!
get-2sg-GOIMPV
'Go and get it!'

b. *Ngarrabaja-nya-ji!/*Ngirribiji-nyi-ji
tell-2sg-NEGIMPV
'Don't tell anyone!'

c. *Maja-arna-yirri!/*Miji-irni-yirri!
get-1Obj- GOIMPV
'Go/come and get us!'

d. *Ngarrabaja-arna-ji!/*Ngirribiji-irni-ji!
tell-1Obj-NEGIMPV
'Don't tell us!'

e. Arduwa-nama kunyila langalanga-nya-mi.
slow-time 2dlNOM think-2sg-IRR
'You just think about it first!'

f. Ngunya-arna-mi kungka.
give-1Obj-IRR another(n)
'Give me another one!'

g. Ngiji-ngirri-nyu-nu kunyaku.
see-1plExc-2Obj-DID2dlACC
'We saw you two.'

We have seen, then, that the suffixes which trigger harmony are those suffixes which contain [+high] vowels and which cannot be preceded in the word by any phonological material other than the root. Suffixes containing [+high] vowels which may be preceded by other suffixes never trigger harmony, even in those instances where no other affixes interevene between them and the root. The inverse marker /-ni/ seems to escape this generalisation, as it is never preceded by other affixes, and yet cannot trigger harmony, despite containing a [+high] vowel.

3. Analysis

In this section we will examine potential analyses of Jingulu vowel harmony. The analysis I wish to propose involves the creation of a harmony domain by head movement in the syntax. However, before proposing and defending this rather radical analysis, I will first consider more traditional analyses which are purely phonological or morphophonological, and do not involve positing syntactic movement. A purely phonological or morphophonological explanation of Jingulu harmony is preferred on the grounds of simplicity, but we shall see that no such analysis is empirically viable.

3.1. Traditional analyses that do not work

It is immediately clear that an analysis purely depending on phonological adjacency of a suffix to the root is insufficient. If a trigger simply had to be an affix containing a [+high] vowel and adjacent to the root, we would expect object agreement and the regular imperative suffix to trigger harmony when they are phonologically adjacent to the root.

It is quite reasonable to argue (and in fact I do so in the next section) that object agreement and the regular imperative always co-occur with subject agreement, but that sometimes the subject agreement morpheme is null. Indeed, the third person singular agreement marker in Jingulu, as in most Australian languages with agreement systems, is null. However, it is not reasonable to argue that object agreement and the regular imperative fail to trigger harmony because of the phonological presence of the null subject agreement morpheme (the presence of nothing). Harmony, as we have seen in Section 2, is a vowel-to-vowel process that is insensitive to the presence of consonants. Given that consonants cannot block harmony, phonologically null material cannot conceivably block harmony either.

I, therefore, conclude that no purely phonological analysis can account for the data seen in Section 2. However, it is conceivable that a morphological account might. One such account might argue that harmony is not directly the result of the presence of the feature [+high] in the trigger, but is the result of a floating (diacritic) feature associated with the morphemes in question (call it [+VH]). Such an account would observe that among the regular subject agreement markers, those which contain high vowels (and thus trigger harmony) are all and only those associated with non-singular subjects. The harmony-triggering feature [+VH] is therefore associated with the morphological features of non-singular subject agreement, and also with the specialised imperatives.

If this is so, we would expect that non-singular subject agreement affixes will always trigger harmony. However, there exists a small set of productive non-singular subject agreement morphemes which are used with the (regular) imperative suffix /-mi/. These, the dual /(w)anya/ and plural /(w)arra/ (underlined in (10)), do not contain [+high] vowels, and do not trigger harmony.

(10) a. Yabanju maja-<u>wanya</u>-mi dunjuwa-kaju wanyu-mi!
small(n) get-2dlIMPV-IRR burn-THRU 2dl-IRR
'You two get a little fire going!'

b. Kunyiyirrini dalkbaja-anya-mi!
2dlERG pull-2dlIMPV-IRR
'You two pull this!'
c. Ngaja-arra-mi!
see-2plIMPV-IRR
'Look, you mob!'

This suggests that harmony is indeed dependent on the presence of a [+high] vowel, and cannot be associated with a morphophonological feature. The [+VH] proposal might be defended by saying that the feature [+VH] is only present in those allomorphs which also happen to contain a [+high] vowel. However this is a very weak and circular hypothesis, there being no principled explanation for the absence of the triggering feature [+VH], associated with non-singular subject agreement, in cases such as (10).

Recall now the generalisation formulated at the end of Section 2: triggers for harmony are those morphemes which must always occur adjacent to the stem. This generalisation would appear to lend itself to analysis in terms of templatic (slot-filler, position class) morphology (see, for instance, Inkelas, 1993). We might represent the morphological structure of Jingulu nominals as in (11a), and of Jingulu verbs as in (11b). Triggers for harmony are underlined.

(11)		0	1	(2	3	4	5)
Nominals:	a.	root	gender	number	focus	case	deictic
	b.	0	1	2	3	(4	5)
Verbs:		root	subject	object	T/A	focus	switch-reference[3]
			Inverse	reflexive	IRR(IMPV)		
			Imperative of Negation		1		
			Imperative of Motion		1		

Slots 2–5 for nominals and slots 4 and 5 for verbs are only optionally filled. The periods and line following the entries for the specialised imperatives (of motion and negation) in (11b) is intended to show that these morphemes actually occupy slots 1–3 of the verbal affix positions. This captures the observation that, while they behave like tense/aspect markers in other respects, they do not co-occur with agreement. This analysis accounts for harmony in very simple terms, associating it with a given slot, rather than a set of morphemes. The ability to trigger harmony is a property of slot 1: if an element in slot one contains the appropriate phonological trigger (a [+high] vowel), harmony will take place.

This analysis does indeed capture most of the generalisations uncovered in Section 2, but cannot account for the behaviour of the Inverse marker. It is clearly a position 1 affix: it always occurs next to the root, and never co-occurs with overt subject agreement, and it may co-occur with object agreement (see Section 3.2.2) or the reflexive morpheme and tense/aspect marking. However, it does not trigger harmony, despite containing a [+high] vowel [see (8c) or (23b) for examples].

[3] Focus, deictic, and switch reference morphology are not discussed in this paper, but are included here for completeness. Details of these systems can be found in Pensalfini 1997.

One final analysis worthy of consideration here is a level-ordering analysis in the terms of Lexical Phonology (see, for example, Mohanan, 1986). Under such an analysis, harmony-triggering morphemes would be considered level one affixes, while those which do not trigger harmony would be level two affixes. The spreading of [+high] which results in harmony is ordered between level one affixation and level two affixation. There are two problems with such an analysis, one minor and one more serious. The minor problem is that the division of affixes into levels seems quite unprincipled. While all subject agreement and gender morphemes would be level one affixes and all object agreement morphemes and the inverse marker would be level two affixes, the tense/aspect/mood encoding morphemes are divided, with the specialised imperatives belonging to level one and all other belonging to level two. This analysis offers no explanation as to why the level one imperative affixes cannot co-occur with other level one affixes such as subject agreement markers (though it would explain why they cannot be preceded by the level two object agreement markers).

The more serious objection to a level-ordering analysis comes from the apparent fact that the verbal morphemes which trigger harmony are not morphologically affixed to the verbal root at all. Rather, agreement markers are affixed to the final tense/aspect/mood bearing morpheme, and verbal roots appear to be late prefixes to this complex (see Section 3.2.1, data in (14)–(17), and Pensalfini, 2000, for evidence). That is to say, the morphosyntactic structure of verbal words is not [[root-AgrS-]AgrO-]T] as required by the level-ordering approach, but rather [root-[AgrS-[AgrO-T]].

Before going on to consider a morphosyntactic analysis, some observations about the triggers of harmony with respect to the theory of positional prominence are in order. A much discussed phenomenon in current phonological literature is the role of an element's position in its ability to license marked phenomena. Much of this work (I am thinking primarily of Beckman, 1995, following observations by Steriade, 1993) has been within the framework of OT, but the observations are not dependent on that framework. The thrust of the argument is that elements occupying prominent positions are able to dominate a larger prosodic domain in ways that they could not if they occurred in other positions. Beckman (1995) shows this to be so for vowel harmony in Shona, where the triggering element is in the word's initial syllable. Prominent positions have been held to include word-peripheral (some would restrict this to only word-initial) positions, syllable onsets or nuclei (as opposed to codas), stressed (as opposed to unstressed) syllables, and roots (as opposed to affixes). On the face of it, Jingulu harmony appears to be as strong a counterexample as possible to this claim. The triggering vowels are always in affixes, and are almost always unstressed. The vowels which undergo harmony are always in roots, and often stressed. In the next section, after presenting my morphosyntactic analysis, I will propose a minor amendment to the catalog of prominent positions which will allow this approach to account for Jingulu harmony.

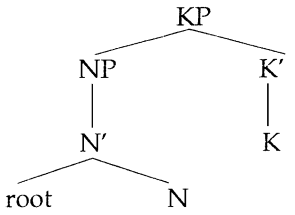
3.2. Morphosyntactic analysis

The crucial claim behind the analysis for Jingulu harmony that I wish to advance is that, in Jingulu at least [though Marantz (1996) claims this is so for all languages],

the lexical root and the category head (the element bearing the features [±N, ±V]) are not the same morpheme (see also Pensalfini, 2000). For nominals, the [+N] element is the gender ending itself. For verbs, the [+V] element is the tense/aspect morpheme. In both cases, the lexical root, while rich in encyclopedic information, is devoid of syntactic category features. In order to be licensed in the syntactic representation, the root attracts the (structurally) nearest syntactic head and merges with it. The element formed by merger of the root with a syntactic head is the domain in which harmony occurs.

For nominals, the nearest syntactic head is always the gender ending. This is demonstrated in (12), which shows that the categoryless root is the complement of the [+N] head. Affixes such as case markers are projections of higher heads [such as K in (12)], and so can never merge with the root.

(12)



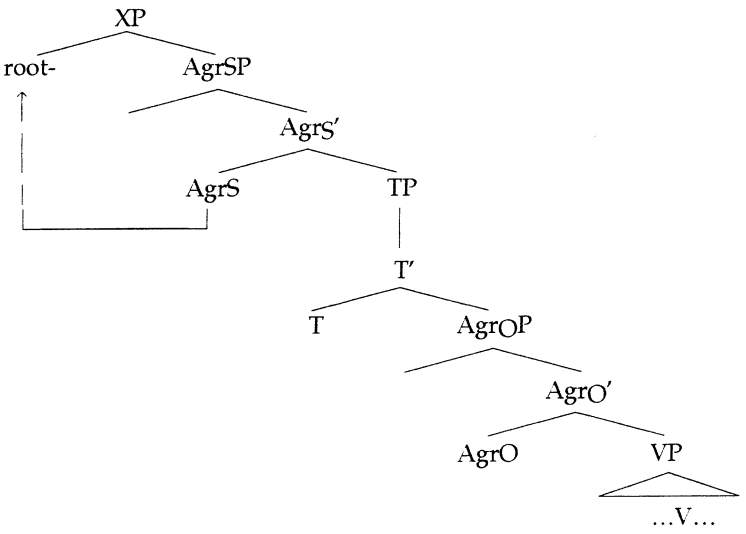
Examples of how this structure derives the harmony facts are given in Section 3.2.2.

The idea that an apparently lexical item such as a nominal word is actually composed of a categoryless root merged with a syntactic head is taken from Marantz (1996) and the theory of Distributed Morphology (DM), Halle and Marantz, 1993). Pensalfini (1997) provides detailed analyses of all the morphological systems of Jingulu in terms of the mechanics of DM. Marantz's examples come primarily from English, where the category-bearing syntactic heads are generally null. Jingulu actually provides a more stark illustration of the theory: syntactic nominal heads are realised as gender markers, and verbal heads (discussed below) are actually separated from the roots by other morphemes. Such a theory would argue (or at least I would) that characteristic gender endings in the southern Romance languages are also examples of categorial heads, and that these merge with categoryless roots to give bi-morphemic words which are traditionally called 'nouns' and 'adjectives'.

For verbs, the unmarked structure is as given in (13), based on Chomsky (1993).[4] As mentioned above, the (usually) word-final tense/agreement element is actually the main syntactic verb. Evidence for this claim is presented in Section 3.2.1. The lexical root is adjoined to the inflectional structure, and the subject agreement head, being the closest to the root, adjoins to it and merges with it.

[4] The choice of a Minimalist-style syntactic analysis over an analysis within any other formal theory of syntax is made largely out of familiarity (both on the part of the author and a hazarded guess regarding the readership) with this model over others. I do not wish to suggest that this is the only theory of syntax which can account for these facts. The analysis could be framed within any model which distinguishes relative hierarchical depth between syntactic heads, and which allows for dependencies between hierarchical positions (encoded in Minimalism via the metaphor of movement).

(13)



Examples of how this structure derives the harmony facts are given in Section 3.2.2.

3.2.1. Evidence for these structures

In the previous section, I proposed that nominals are headed by their gender features. Some evidence for this comes from the behaviour of personal names. It would be culturally inappropriate to cite personal names here, but one difference between these and other nominals is relevant to the discussion. Other nominals, be they common nouns, adjectives, or demonstratives, bear endings characteristic of their grammatical gender. There are exceptions, but these generally involve neuter nominals (for which, it is argued in Section 2, the gender affix is null) or borrowings, and these never result in a feminine gender nominal with a typically masculine ending.

Personal names, on the other hand, do not adhere to these restrictions. Many women's names end in the characteristic masculine /a/, and many men's names in the non-masculine /i/. There appears to be no preference for men's or women's names to follow any pattern at all. Unlike other (grammatically gendered) nominals, personal names cannot be used in sentences. To some extent, this may be put down to a general and widespread cultural avoidance of personal names, especially when the person is within hearing (kinship or subsection names being the preferred term of reference), but in Jingulu this appears to extend further than in neighbouring languages within the same cultural area. Even with third person reference when the person is not within earshot, personal names cannot be used in sentences. When pressed, Jingulu speakers will use a personal name, but then it is dislocated and separated from the clause by a lengthy pause.

I argue that the absence of gender morphemes in personal names renders them syntactically categoryless, and this is why they cannot be used in regular clauses. In

this respect they resemble exclamatives (cross-linguistically). Like exclamatives, personal names often show aberrant phonology. Clusters are found in personal names of Jingili people that are not found in regular vocabulary items of the language. Interested readers are referred to Pensalfini to appear 2002 for a full discussion of the status of personal names in Jingulu.

Evidence for treating verbs as categorially-deficient roots adjoined to syntactically rich structures, as in (13), is more pervasive and, I believe, more convincing. For a start, not all verbal notions can be expressed by roots. The notions 'come', 'go', 'do' and 'be' are expressed by agreement markers and the final tensed element (the true syntactic verb) alone, and there is no word-initial root with these meanings that can combine with these structures. A partial paradigm for these elements is given in (14) for 'come', in (15) for 'go', and in (16) for the motion-neutral series which translates as either 'do' or 'be' (depending on context). The verbal elements, which I claim are [+V] heads, are underlined.

(14) a. Ya-jiyimi bininja.
3sg-COME man
'The man is coming.'

b. Ya-ngku ngurrarrungka.
3sg-WILL.COME tomorrow
'He'll come tomorrow.'

c. Ya-miki murdika-mbili.
3sg-CAME car-LOC
'He came in a car.'

(15) a. Nga-ardu.
1sg-GO
'I'm going.'

b. Nga-rriyi.
1sg-WILL.GO
'I'll go.'

c. Nga-rruku idajku.
1sg-WENT yesterday
'I went (there) yesterday.'

(16) a. Wayabij nya-ju.
tired 2sg-DO
'You are tired.'

b. Ngindi-mbili nga-nu.
here-LOC 1sg-DID
'I did it here.'

c. Wurraka-na ya-yi.
3plGEN-m 3sg-FUT
'He'll do it for them.'

d. Yukulurrubi ya-marriyi nginimbili.
grass_species 3sg-DID(DIST) here
'*Yukulurrubi* used to be here.'

Other verbal notions are usually expressed by combining an encyclopedically rich root (the elements which undergo harmony) with agreement and the head verb. Examples are found throughout this article, notably in (7 and 8).

While the encyclopedically rich roots can be freely omitted from the clause, the final (tensed) element cannot:

(17) a. Ajuwara manyan nya-nu? - Ngindi-mbili nga-nu.
where sleep 2sg-DID DEM-LOC 1sg-DID
'Where did you sleep?' - 'I did it there.'

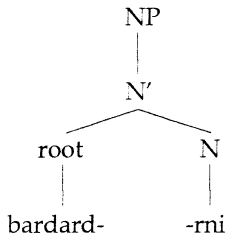
b. Ajuwara manyan nya-nu? - *Ngindi-mbili (manyan) nga.
where sleep 2sg-DID DEM-LOC sleep 1sg
'Where did you sleep?' - 'I (slept) there.'

c. Marlarluka ya-marriyimi.
old_men 3sg-DID(DIST)[5]
'They did (it) in the old days.' (literally: 'olden folk did it')

d. Ngini-mbilimankiya-nga-yi, ngawu nga-yi.
here sit-1sg-FUT home 1sg-FUT
'I'll stay here, I will (stay) home.'

These 'root-drop' constructions can be distinguished from VP-ellipsis in a number of ways. At least two properties of VP ellipsis (in languages like English for which the process is well-established) are not met by the Jingulu 'root-drop' construction. First of all, VP-ellipsis requires a linguistic antecedent — the antecedent cannot be gestural or supplied by non-linguistic context. Sentence (17c) was uttered while the investigator and several Jingulu speakers were leafing through a picture book, on seeing a picture of women grinding seeds with stones. Note how this differs from the English *They did that in the old days* in lacking a demonstrative (the equivalent sentence, with a demonstrative, is also permissible in Jingulu).

(18) a. *birdirdirni* (younger_brother-f = 'younger sister', from (1e))



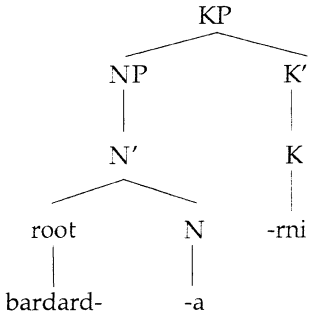
= [bardard(a)-rni][6]

→ [birdirdirni] (harmony within root domain)

[5] Note that there is no agreement between the subject and the verb here. This is quite common in Jingulu when the subject is non-singular but generic—in this instance 'old men' is being used to refer to people (men and women) who lived in days of old.

[6] I assume the linking vowel which surfaces in this form as /i/, represented here by '(a)' (the least specified vowel), is mandated by morpho-phonological requirements. However, it is quite conceivable that this vowel is actually part of the N head itself.

b. *bardardarni* (younger brother-ERG, from (5a))

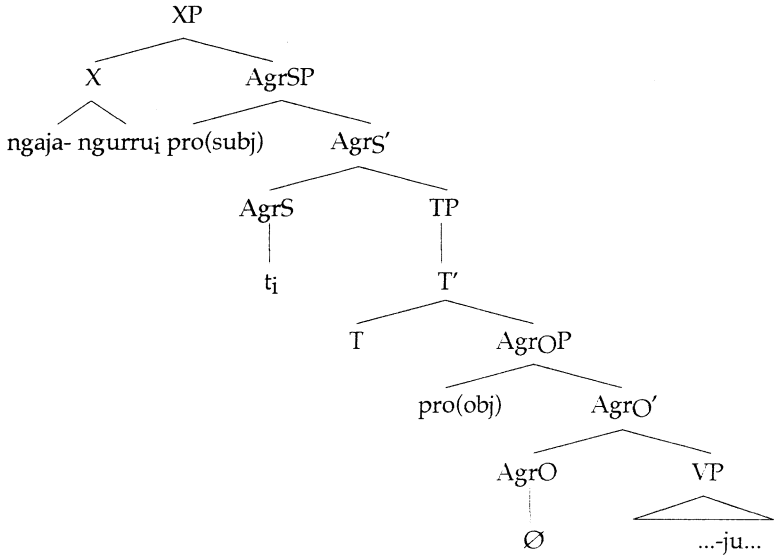


= [[bardard-a]-rni]
→ [[bardarda]rni] (no harmony within root domain)

Secondly, VP-ellipsis demands ellipsis of complements as well as the verb. That is, VP-ellipsis is Verb **Phrase** ellipsis, not just verb ellipsis. One cannot say, for instance **I love passionfruit and Anne (does) passionfruit too*, nor can one say **I'll stay here, I will home*, though this is perfectly acceptable in Jingulu (17c).

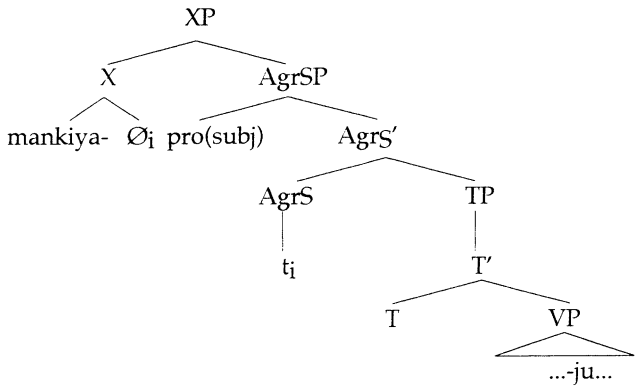
The empirical evidence for analysing verbs as composed of a categoryless root plus a syntactic light verb is admittedly much stronger than that for analysing nominals as similarly polymorphemic. However, in the interests of a uniform analysis for harmony across categories, in the spirit of the DM framework, and in the

(19) a. *ngijingurruju* (see-1plInc-DO = 'we see (it)', from (7b))



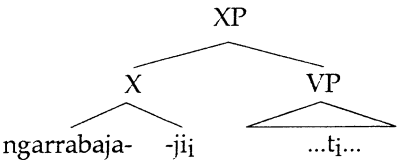
= [ngaja-ngurru$_i$][t$_i$-Ø-ju]
→ [ngijingurru][ju] (harmony within root domain)

b. *mankiyaju* (sit-DO = 's/he is sitting', from (7d))



= [mankiya-Øi][ti-ju]
→ [mankiya][ju] (no harmony within root domain)

(20) *ngirribijiji* (tell-NEGIMPV = 'don't tell!', from (7i))



= [ngarrabaja-jii][ti]
→ [ngirribijiji] (harmony within root domain)

absence of empirical evidence to the contrary, I will assume this analysis as presented in this section for both nominal and verbal words.

3.2.2. How the structure derives the harmony facts

The general idea behind this analysis is that harmony takes place across a morpheme boundary in the 'root domain', the item formed by merger of the root with the nearest syntactic head. For nominals, as discussed in the previous section, this will always be the constituent formed by the merger of the root and the gender affix. Some examples are given in (18).

There remains the question of how a neuter agreeing nominal (like *bardakurru* 'good' or *mamambiyaku* 'soft') gets its final /u/. This cannot be the gender ending, as it would trigger harmony, containing a [+high] vowel as it does. Following the late insertion theory of DM, I claim that the appearance of this /u/ on the root is conditioned by the presence of a following neuter gender head. That is, when vocabulary insertion applies to a root node such as that for 'good', it inserts /bardakurru/ into the root if and only if followed by a nominal head with neuter gender features. Otherwise, if followed by a nominal head with features other than neuter, it inserts the root/bardakurr-/.

For verbs, the root domain is created under the root node by attraction of and merger with the nearest syntactic head. The root is categoryless, as previously discussed (this in indicated in the tree diagrams by giving the root the label 'X'). In regular structures with agreement morphemes, this is as given in (13). Examples are given in (19). In (19a), the root domain includes an affix with a high vowel, which triggers harmony. In (19b), however, the agreement marker is phonologically null. It is still, however, syntactically present, bearing the third person singular number and agreement features. It therefore constitutes a syntactic head and is attracted up to the root. Being phonologically null, however, it cannot trigger harmony.

Note that the VP is headed by the core or light verb which inflects for tense and associated motion. One at first suprising claim made by the suggested structure is that the root does not contribute to the argument structure of the clause, being adjoined to, or at best a complement of, the core AgrP. In actual fact, this is empirically supported in Jingulu, where no root is strictly either transitive or intransitive, but rather any root can appear with or without an object, so long as a valid interpretation for the clause can be found.

The crucial cases of the specialised imperatives, which do trigger harmony, and the inverse marker, which does not, are illustrated in (20) and (24) respectively. The specialised imperatives (of motion and negation), recall, can never co-occur with agreement morphology. I propose that these [+V] heads do not project functional heads. In Minimalist terms, these verbs do not have T and Agr features to check off, and so are incompatible with the appearance of these heads. This means that the syntactic head nearest to the root is the V itself, resulting in the V being attracted into the root domain, enabling it to trigger harmony:

The inverse marker's inability to trigger harmony is a result of the fact that is is not a syntactic head. At this point a word about the inverse construction is in order. The regular agreement paradigms for Jingulu are given in (21).

(21) a. subject agreement

	singular	dual		plural	
		inclusive	exclusive	inclusive	exclusive
1st person	/nga-/	/minda-/	/nginya-/	/ngurra-/	/ngirra-/
2nd person	/nya-/	/kunya-/		/kurra-/	
3rd person	Ø *or* /ya-/[9]	/wunya-/		/wurra-/	

[9] The overt 3sg marker /ya-/ occurs word-initially. Elsewhere, the null form appears. This is because object agreement and the V head are phonologically bound, so that where there is no word-initial root, subject agreement must be phonologically overt so as to host object agreement and/or the V.

The precise identity of the vowel in the second syllable of non-singular subject markers is determined by an optional local ablaut rule, and typically does not surface as /a/ (the symbol /a/ is used as this is the maximally underspecified vowel). This ablaut is distinct from the harmony process described in this article. Details can be found in Pensalfini 1997.

	b. object agreement
1st person	/-na-/
2nd person	/-nyu-/
3rd person	Ø

Subject agreement (21a) distinguishes person, number, and an inclusive/exclusive contrast for non-singular first person. Object agreement (21b), on the other hand, distinguishes only person. As a result a form like (22) is ambiguous with regard to the number (and inclusiveness) of the object.

(22) Ngaja-ana-ju.
see-1Obj-do
He/she sees me/us.

There are two ways of resolving this ambiguity (aside from context). An independent object pronoun may occur in the sentence, or the inverse construction may be used.

The inverse construction is only allowed when the clausal subject is third person (any number) and the object is first or second person and non-singular. The term 'inverse' implies a reversal of the prototypical transitive relationship wherein an agent acts upon a less animate patient. For a more comprehensive discussion of inverse marking in Jingulu, see Pensalfini (1997).

In the inverse construction, the morpheme /-ni/ appears immediately following the root and is followed by an element from the subject agreement paradigm in (21). However, the agreement marker in an inverse construction agrees with the syntactic object, not the subject, of the clause. The inverse therefore exploits the distinctions available to subject agreement but applies them to object agreement. Two potential misconceptions about the inverse construction must be dealt with immediately: first of all, the inverse construction is not a passive, as the construction does not affect case assignment, argument structure, or any syntactic aspect of the clause:

(23) a. Bininja-rni ngurraku ngaja-ana-ju.
man-ERG *1plInc*ACC*see-1Obj- do*
The man can see us.
b. Bininja-rni ngurraku ngaja-ni-ngurru-ju.
man-ERG *1plInc*ACC*see-inv-1plInc-do*
The man can see us.

Secondly, the inverse morpheme /-ni/ is not a subject marker. While it is true that it can only ever appear with third person subjects, and cannot co-occur with overt subject marking (being a slot 1 morpheme in the terms of the templatic approach discussed in Section 3.1), it lacks two crucial properties of Jingulu subject markers. First of all, it does not distinguish between singular, dual, and plural third person number for subjects. Secondly, it cannot begin a phonological word, but is a true suffix.

In pre-theoretical or functional terms, the inverse marker appears in a verb complex purely to signal that the subsequent morpheme, which has the form of a typical **subject** agreement marker, is being used to indicate the person and number of the **object**. A number of analyses of this morpheme present themselves. The simplest, and one suggested by an anonymous *Lingua* reviewer, would be to say that [ni] does not constitute a morpheme in and of itself, but rather forms part of a set of specialised object markers. Under such an analysis, while /-kurra/ is the marker for second person plural subject, /-nikurra/ would be the marker for second person plural objects, and so forth. Part of the lexical entry for these object markers would be that they may only occur with null third person subject marking. Under such an analysis, the systematic similarity between the general subject markers and these specialised object markers remains unexplained.

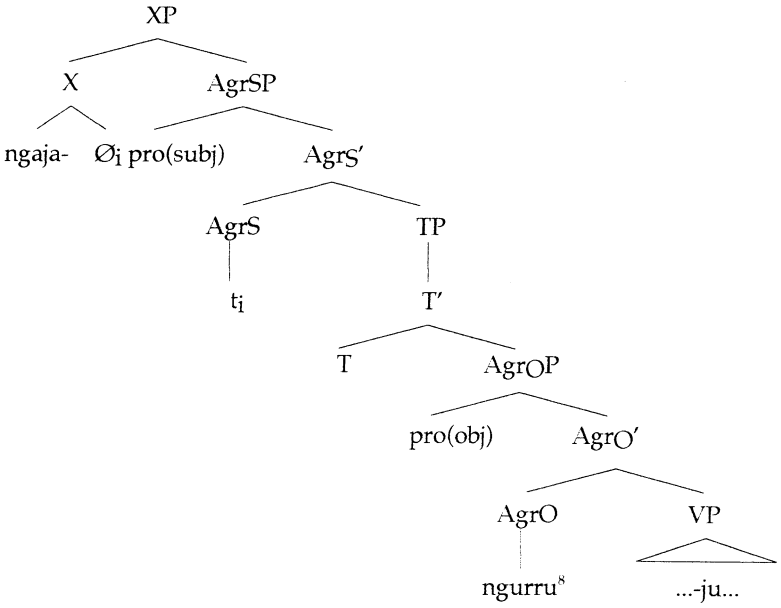
I personally prefer another analysis, one which exploits the machinery of DM. Under this analysis, the inverse marker is a syntactically (and semantically) empty morpheme introduced by the morphological component to signal that the following morpheme is to be understood as object agreement. This is indicated in (24). The null subject agreement head is still syntactically present, and is the head nearest to the root, and so is attracted into the root domain. The inverse marker is introduced post-syntactically and falls outside this domain.[7]

However, the problem now remains of explaining the inverse marker only ever co-occurs with null subject agreement. At this stage, all I can offer is the rather unsatisfying explanation that the post-syntactic rule that introduces this morpheme does so only on the condition that subject agreement is null. The precise distribution and use of this morpheme could certainly stand to be investigated in more depth in the field, and this is a priority for future field research on Jingulu.

There are undoubtedly those who will take issue with the introduction of elements in this fashion, which is allowed in the DM model as morphological re-adjustment. Many languages use morphological material that has no syntactic or semantic role, and DM would have all such material introduced post-syntactically. Examples that spring to mind include the use of dummy syllables to lengthen a sub-minimal root [Axininca Campa, Payne (1981)] or to satisfy phonotactic requirements (such as Warlpiri /pa/ which is added to a consonant-final (typically borrowed) item; Ken Hale, personal communication), or so-called 'theme vowels' in many European languages

[7] The term 'post-syntactic' here follows from a version of Chomsky's T-model, as commonly used in Government and Binding theory (Chomsky, 1981), and modified in the Minimalist Program (Chomsky, 1993). The relevant idea is that morphological ordering and phonological processes follow (in a derivational sense) the construction of the surface syntactic structure of a sentence.

(24) *ngajaningurruju* (see-INV-1plInc-DO = 'he sees us', from (8c))



= [ngaja-Øi][ti-ngurru-ju] (rebracketing)
→ [ngaja-Øi][ni][ti-ngurru-ju] (post-syntactic insertion of inverse)
→ [ngaja][ni][ngurruju] (no harmony within root domain)

(such as in Latvian, where they occur between a nominal root and certain case/number markers, without having any apparent function; Morris Halle, personal communication). For those critics that cannot be placated in this fashion, it would be possible to retract the statement that the inverse is not syntactically present, but

[8] Note that the AgrO head here appears as [ngurru], not as [ana] as would normally be the case for first person object agreement. An anonymous *Lingua* reviewer took issue with this, noting that I had not explained how /ana/ 'becomes' /ngurru/ in this case. Within the DM framework, however, there are no phonological features present in the syntax. All morphemes in my trees appear as shorthand for formal feature bundles. The features [1st person, +plural (-dual)] will be spelled out post-syntactically depending on their context. The spelling out of features follows all syntactic computation and morphological readjustment (in other words where bundles of features are arranged in linear order, not in hierarchical configuration). In contexts where these features immediately follow a subject agreement morpheme, they will be spelled out as [ana], as will any [1st person] features irrespective of number. In other environments (such as word-initially or immediately following a root, where they signify subject agreement, or else following an inverse marker, where they signify object agreement), [1st person, +plural (-dual)] will be spelled out as /ngurru/.

to claim that whatever the syntactic status of the inverse morpheme, it is not a syntactic head. This is quite defensible, as the inverse marker appears to play no role in the syntactic computation—it does not affect the argument structure or clause structure in any way. If it is not a syntactic head, it cannot be attracted up into the root domain, and so follows its inability to trigger harmony. I will, however, leave it up to these critics to suggest what its syntactic position might in fact be.

3.2.3. Evidence from other languages

It is reasonable to ask why, if the analysis presented in this section is the best account of the Jingulu harmony facts, there are not many other languages in which surface phonological phenomena require this level of abstract syntactic explanation. An all-too-easy answer would be that there simply has not been a thorough search for such phenomena, and that such a search falls well outside the scope of this paper and is left for future research. I intend to take this all-too-easy option. However, I will point to nascent work by Mary Laughren, who argues that case allomorphy, vowel harmony, and apico-palatal stop versus flap allophony in Warlpiri all operate over domains which must be defined in terms of syntactic, rather than phonological constituency (Laughren, 2000).

3.3. Saving positional prominence

As mentioned at the end of Section 3.1, Jingulu harmony appears to be a counter-example to the theory of positional prominence in that it allows a word to be dominated by the features of an unstressed and often word-medial affix. If the analysis in Section 3.2.2 is correct, however, Jingulu harmony can be brought within the bounds of positional prominence by refining the notion of which positions may indeed be prominent. The catalog of prominent positions in the phonological literature has ignored the syntactic role of elements, focusing on morphological (root versus affix) or prosodic (stressed versus unstressed, rime versus onset) constituency instead. The Jingulu facts suggest that syntactic constituency may indeed play a role as well. The catalog of potentially prominent positions must be extended to include 'syntactic head'.

The extent to which the syntactic 'head' could replace the morphological 'root' is an empirical question. The majority of languages do not separate the lexical root from the syntactic head by other morphological material as Jingulu does. The result of this is that in most cases where 'root' might have been posited as the prominent position, there is little evidence to distinguish whether this prominence comes from the element's being a root or from its being a syntactic head.

However, the extension of the catalog of prominent positions in this manner is not entirely without problems. The catalog now consists of elements defined as prominent by a number of apparently unrelated criteria, with some defined by prosodic

prominence (stressed), some by morphological position (root), some by linear phonological position (initial), and now some by syntactic prominence (head). The question remains as to whether these positions can be identified as prominent by independent criteria.

4. Conclusion

This article has described a most unusual vowel harmony system, that of Jingulu. It has shown that the Jingulu harmony system can only be adequately characterised, and analysed, by taking into account the syntactic properties of the morphemes involved and the constructions in which harmony manifests. If this is indeed the only means to an accurate analysis of the Jingulu data (or at least the best means), it is to be hoped that future inquiry will turn up phonological phenomena in other languages that require a similarly syntactic explanation.

Acknowledgements

The ideas in this article have evolved through discussion with a number of colleagues. I would like to thank audiences at invited talks at the Massachusetts Institute of Western Australia, the University of Chicago, North Western University, the University of California at Berkeley, and the University of Queensland. Thanks also to anonymous reviewers who have commented on various versions of this work over the last few years. Usual disclaimers apply (it's all my fault). Special thanks, above all else, must go to the Jingili people.

Appendix- abbreviations used in this article

Glosses for verbal heads, such as *do, did, fut* are explained and illustrated in (14)–(16).

1, 2, 3	first, second, third person
sg, dl, pl	singular, dual, plural number
Incl, Excl	inclusive, exclusive (for non-singular first person)
Obj	object
IMPV	imperative (mood)

IRR	irrealis (mood), used for the regular imperative
m, f, n, v	masculine, feminine, neuter, vegetable gender
ERG, NOM, ACC	Ergative, Nominative, Accusative (core) case
LOC, ABL	Locative, Ablative (peripheral) case
FOC	discourse prominence, 'focus'
DEM	demonstrative
THRU	adverbialiser, 'thoroughly'

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