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Underspecification in the height harmony system of Pasiego

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1 Introduction

The recent phonological literature has witnessed the emergence of a significant body of research under the rubric of underspecification theory. This model of inquiry was first proposed by Kiparsky (1982), developed more deeply in Archangeli (1984), and is articulated most exhaustively in Archangeli & Pulleyblank (forthcoming a). One of the most basic assumptions advanced in these works is that for each contrastive feature one value is specified underlyingly and the other is inserted by default. Feature changing harmony, which requires both values to be underlying, is a particularly interesting challenge to this claim and appears to undermine its restrictiveness. Indeed, it figures prominently in some recent proposals, such as Steriade (1987b), to justify relaxing the theory and admit both feature values at the underlying level.

Feature changing harmony is generally acknowledged to be extremely rare (cf. Lieber 1987). Height harmony in the Pasiego dialect of Montañes Spanish, as analysed by McCarthy (1984), is widely cited as one of the most solid pieces of evidence for the reality of feature changing harmony. The main purpose of this article is to demonstrate that Pasiego height harmony is in fact not feature changing. Rather, the facts provide additional support for the strongly constrained model of underspecification which recognises only one underlying feature value.

In §2 I outline the basic facts and McCarthy's feature changing analysis. In §3 I account for the transparency of the low vowel /a/ in terms of the interaction of feature architecture and segmental underspecification. In §4 I motivate the underspecification of the feature [high], thus obviating the feature changing property of height harmony. In §5 I argue that in general the feature [high] is floating in underlying structure. In §6 I discuss the formalisms that first link and then spread the feature [high]. Finally, in §7 I summarise the major findings and draw conclusions for phonological theory.

2 McCarthy's (1984) feature changing analysis

Pasiego exhibits dual [ATR] (= McCarthy's [tense]) and [high] harmony systems operating on the following surface vowel inventory (disregarding reduced vowels):[1]

(1)

	+ATR		−ATR	
High	i	u	ɪ	ʊ
Mid	e	o		ɔ
Low	a		ä	

The domain of both vowel harmony systems is the phonological word, defined as the morphological word plus proclitics, if any.

[ATR] harmony is relatively simple to characterise. [−ATR] vocalism is morphologically conditioned: it is triggered by the masculine singular count suffix /-ʊ/ in word-final position. Otherwise, Pasiego vowels are [+ATR]. In interpreting these facts, the non-distinctive nature of the feature [ATR] would seem to be obvious (except perhaps in the case of /u/ *vs.* /ʊ/). I will assume, following McCarthy, that at the underlying level vowels are unspecified for the feature [ATR], that [−ATR] is derived lexically for the trigger suffix and subsequently spreads leftward, and that elsewhere vowels become specified for [+ATR] by default. Essential details, such as accounting for the transparency of [+ATR] /e/ in [−ATR] contexts and the form, component assignment and ordering of the rules, have no direct bearing on the focus of the present investigation and will therefore not be considered.

Height harmony is controlled by the stressed syllable: if the stressed vowel is high or mid, then the non-low vowels of the word are also high or mid, respectively. High glides in the onset of a stressed syllable are also triggers: they determine high vocalism to the left (see §4.1). These generalisations may be violated by both systematic and idiosyncratic exceptions.

Unstressed vowels in the final syllable are limited to the set /e u ʊ a/, so that on the surface they may violate the principles of height harmony. I will assume, along with McCarthy, the operation of late reduction processes (that also supply phonetic detail), so that in general we need not be concerned with height disharmony found in unstressed final syllables.

Height harmony is supported by both distributional and morpho-phonemic data. The forms in (2) are representative of the distributional evidence:

(2) a. bindiθír 'to bless'
čipúdus 'hunchbacks'
lubúkus 'young wolves'
c. pɪθígʊ 'pinch'
kʊntíntʊ 'happy' (count)
mɪnódʊ 'small' (count)

b. xeléča 'fern'
belórta 'hay-rake'
destorθér 'to wring'

The words in (2a) have [+A
mid, and those in (2c) [−AT
are systematically excluded
note 7.

Height harmony is further
these occur most abundantly
as in the examples in (3):[2]

(3) a. bebér 'drink'
bebémus
beberé
b. bibíːs
bibía
bibiría
c. el pélu 'the
ɪl kʊrdírʊ 'the
d. i mi díxu 'he s
me lo kompró 'he b

In (3a) the root vowels are
observed in (3c) for the defini
In all of these cases, word-leve
(desinence or root) vowel.

The low vowel /a/ (both [+
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(4) legatérna 'lizard'
ɪskälämbróxʊ 'dog-rose
se kasó 'he got m
ɪl mädírʊ 'the log'

McCarthy accounts for the
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the forms *bebámus* 'drink' (1p
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Similar argumentation detern
vowels in nominals like *pigáθa*

If non-low vowels are in gen

The words in (2a) have [+ATR] high vocalism, those in (2b) [+ATR] mid, and those in (2c) [−ATR] high. On the surface, [−ATR] mid vowels are systematically excluded from occurring in stressed syllables; see note 7.

Height harmony is further evidenced in morphophonemic alternations; these occur most abundantly in verbal paradigms and nominal proclitics, as in the examples in (3):[2]

(3) a.	bebér	'drink'	koxér 'take'	inf
	bebémus		koxémus	1pl pres indic
	beberé		koxeré	1sg fut
b.	bibí:s		kuxí:s	2pl pres indic
	bibía		kuxía	1sg imperf indic
	bibiría		kuxiría	1sg cond
c.	el pélu	'the hair (mass)'		
	ɪl kʊrdíro	'the lamb'		
d.	i mi díxu	'he said to me'		
	me lo kompró	'he bought it for me'		

In (3a) the root vowels are mid, in (3b) high; proclitic harmony is observed in (3c) for the definite article, in (3d) for the personal pronoun. In all of these cases, word-level vowel height is determined by the stressed (desinence or root) vowel.

The low vowel /a/ (both [+ATR] /a/ and [−ATR] /ä/; I will refer to both simply as /a/) is neutral (transparent) with respect to the height harmony system: it does not alternate in height and is impervious to the propagation of height values from a stressed high or mid vowel. Both of these characteristics are apparent in the following examples:

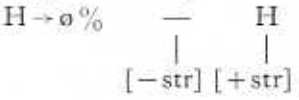
(4)	legatérna	'lizard'
	ɪskälämbróxʊ	'dog-rose'
	se kasó	'he got married' (Penny 1969b)
	ɪl mädíro	'the log'

McCarthy accounts for the transparency of low vowels by excluding them from the class of segments that can be associated with the autosegment H ([high]). This move, McCarthy argues, has the consequence that non-low vowels must be underlyingly specified for height, since in the context of a stressed low vowel both high and mid vowels appear. Thus, the forms *bebámus* 'drink' (1pl pres subj) and *koxámus* 'take' (1pl pres subj) suggest that the verbal roots in (3) are underlyingly mid vocalic, while *sintáis* 'feel' (2pl pres subj) implies underlying high vocalism (for height harmony, cf. *sintír* 'feel' (inf) and *sentémus* 'feel' (1pl pres indic)). Similar argumentation determines the underlying height of non-low vowels in nominals like *pigáθa* 'magpie' and *ontárga* 'lard'.

If non-low vowels are in general underlyingly specified for the feature

[high], then, clearly, height harmony must be a feature changing operation. McCarthy proposes the following mirror image rule:

(5) [*high*] *Harmony*

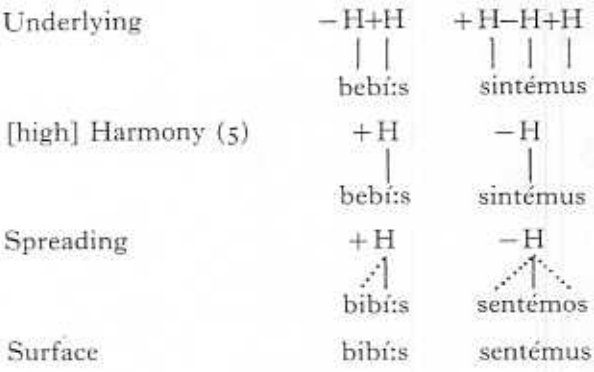


Rule (5) deletes the H feature of an unstressed vowel in the context of a stressed vowel specified for H. The stressed vowel must be non-low, since low vowels are not specified for H. As a consequence, underlying height contrasts remain if the stressed vowel is low. The mirror-image formulation of [high] Harmony accounts for the distribution of non-low vowels in the relatively scarce proparoxytone words in which height harmony obtains to the right of the stressed vowel. Some examples are provided in (6):

(6) a. andíbula 'jaw' b. trébede 'lawn'
antigwísimu 'oldest' bjéspora 'wasp'
c. díθɪmo 'tenth'
rɪkítɪko 'rickety'

Following the application of [high] Harmony, the H feature of the stressed non-low vowel spreads to an unstressed non-low vowel by convention. (7) is a slightly modified version of McCarthy's sample derivation (19):

(7)



In summary, McCarthy treats height harmony in feature changing terms and the transparency of low vowels by means of a filter. I will take these positions to constitute an appropriate entry level for a reexamination of the facts from the perspective of underspecification theory.

3 Neutral /a/

In the tradition of autosegmental phonology three distinct approaches have been employed in the analysis of neutral segments. In the earliest

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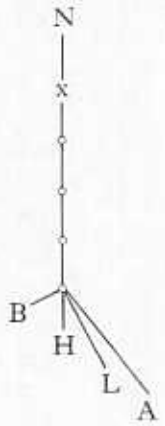
(8)



proposal, neutral segments undergo a deep level alternation and are subject to a late neutralisation rule. In subsequent developments of the theory, neutral segments are excluded from the set of targets of the vowel harmony rule and are specified for the harmonic feature in one of two ways: by a late default rule, or underlyingly on a tier which is independent of the harmonic autosegmental tier. We may call these respectively the ABSTRACT, DEFAULT and DUPLICATE TIER analyses of neutral segments.[3]

McCarthy's account of neutral /a/ falls within the default category. This analysis derives the transparency of /a/ with respect to height alternations from the fact that /a/ is specified as +L ([+low]). It is true universally that +L may not cooccur with +H; this filter explains why low /a/ does not become high in +H harmony contexts, i.e. why /a/ is non-alternating. Furthermore, the structure preservation principle of Lexical Phonology (Kiparsky 1985) precludes the association of −H to a vowel specified as +L, since −H is never distinctive for vowels so specified; this explains why /a/ neither triggers nor blocks the propagation of H values. In brief, /a/ is associated with +L underlyingly and receives its −H specification by a late default rule, applying, crucially, after the rule(s) spreading the feature H.

On the face of it, the default analysis appears to be a reasonable account of the transparency of /a/. However, underspecification theory makes this position untenable on a principled basis. To see this, two assumptions of the theory need be appealed to: general feature geometry and the Locality Condition. I will briefly discuss these in turn.

Recent research lends strong support to a model of segment structure in which features are hierarchically organised. Arguments in favour of hierarchical feature geometry are advanced in such works as Clements (1985), Sagey (1986), Schein & Steriade (1986), Archangeli & Pulleyblank (1987, forthcoming a, b) and Steriade (1987a). The proposals of these publications differ in precise detail, but a common thread running through all is the idea that terminal features and higher level class nodes are each arrayed on independent tiers. For present considerations, the partial hierarchy in (8) will suffice:

(8)

Nucleus

Skeleton

Root node

Supralaryngeal node

Place node

Dorsal node

Of particular interest to us here is the internal organisation of the dorsal node: as seen in (8), it dominates terminal feature tiers for the dorsal articulator features [back], [high], [low] and [ATR].[4]

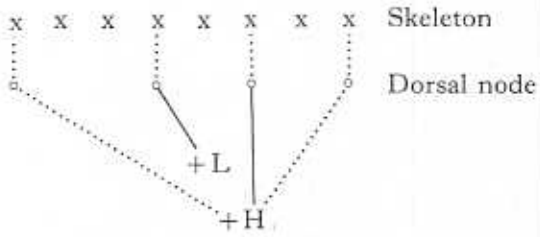
In addition to hierarchical feature structure, the argument against the default analysis of neutral /a/ relies crucially on the following constraint of underspecification theory:[5]

(9) *Locality Condition* (Archangeli & Pulleyblank 1987)
A rule can apply only if a specified target is adjacent to a specified trigger.

According to Archangeli & Pulleyblank (1987, forthcoming a), for spreading purposes the Locality Condition is computed on one of two levels: on the tier that dominates the spreading feature, or on the highest level of syllabic structure on which the target is represented. The former is called MINIMAL SCANSION, the latter MAXIMAL SCANSION. Since minimal, but not maximal, scansion is what is required for transparency, that is what we need to assume for the subject matter at hand.

On the relatively uncontroversial assumption that the features [low] and [high] dock onto the same tier, i.e. the dorsal tier in (8), and accepting the claim that the Locality Condition is well motivated, deriving the transparency of /a/ in the Pasiego height harmony system from its [+low] specification is not possible. To see this, consider the putative representation of the last word in (4) if +H were to spread to the unstressed proclitic vowel through the intervening low vowel, analysed in terms of [+low] (irrelevant tiers are omitted):

(10) i l m ä d í r u



We note first that /a/ is an ineligible target for spreading: the +L specification precludes association with +H. In view of this, spreading +H from the stressed vowel through /a/ to the proclitic vowel violates the Locality Condition: the trigger and target nodes are not adjacent on the tier that is scanned for rule application, namely the dorsal tier. Representation (10) is therefore disallowed.

The Locality Condition has the following consequences for the analysis of low vowels in height harmony systems where the spreading feature is [high]. It predicts that low vowels which are associated with [+low] will block the spreading of [+high]. This then is an entirely appropriate characterisation of low vowels which are opaque to height harmony, as in

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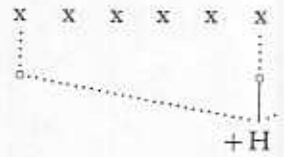

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The vowel inventory of Pasieg

Kikuria (David Odden, personal communication); alternatively, maximal scansion obtains. On the other hand, low vowels which are transparent to height harmony, as is the case in Pasiego and Menomini (Cole & Trigo 1987), must not have any associations on tiers that are dominated by the dorsal tier, at least at the stage when spreading from the [high] tier takes place. Finally, low vowels which participate in height harmony, as in Kera (Ebert 1974), are linked to some feature other than [low] that is dominated by the dorsal tier.

As far as the analysis of neutral /a/ in the Pasiego height harmony system is concerned, underspecification theory precludes any specification for the features [high], [back], [low] and [ATR], all of which, *ex hypothesi*, dock onto the dorsal tier. This forces maximal underspecification. I will thus assume that at the underlying level, and at least through the derivational level where the [high] Harmony rule or its equivalent applies, /a/ is represented on the skeletal tier with an empty node, i.e. one that is not associated with any tier below the skeleton. If /a/ has no representation on the dorsal tier, then the trigger stressed vowel and the target proclitic vowel will have adjacent dorsal nodes in the representative example *il mädíro*. The Locality Condition will therefore allow spreading +H through the 'intervening' low vowel, as in (11):

(11)

ɪ	l	m	ä	d	í	r	o	
x	x	x	x	x	x	x	x	Skeleton
					⋮			Dorsal node
					+H			

Another possible view might be to specify /a/ only as [−round], if, as is commonly, though not universally (cf. Archangeli & Pulleyblank 1987) assumed, [round] attaches to a separate labial tier which is immediately dominated by the place tier. In that case, /a/ would fall outside the purview of the dorsal tier within which the feature [high] spreads. However, this alternative should be rejected, for at least two reasons: (i) [round] is otherwise not distinctive for Pasiego, as shown in §4.3; (ii) maximal underspecification is the preferred alternative on theory-internal grounds.

To sum up, underspecification theory explains transparency in a highly constrained manner. In what we may call the GEOMETRIC analysis, conceived by Archangeli & Pulleyblank (forthcoming a) and advocated further in Vago (in preparation), transparent behaviour falls out from the language-specific underspecification of features whose architecture is fixed by universal grammar.

4 The underspecification of [high]

The vowel inventory of Pasiego reveals that the feature [high] is distinctive

in this language. On the assumption that this feature has binary values, the specification of [high] can be analysed in one of three ways:[6]

(12) a. *−H Default Hypothesis*: +H is specified lexically; −H is derived by a default rule applying after the [high] Harmony rule.

b. *+H Default Hypothesis*: −H is specified lexically; +H is derived by a default rule applying after the [high] Harmony rule.

c. *Feature Changing Hypothesis*: both +H and −H are specified lexically and both are targets of the [high] Harmony rule.

The −H Default Hypothesis can be falsified by showing that −H must spread in the lexical phonology, the +H Default Hypothesis by showing that +H spreads lexically, both under the general conditions of [high] Harmony. Neither of these cases would falsify the Feature Changing Hypothesis. It is thus fair to assert that the Feature Changing Hypothesis is the most powerful of the three analyses in (12), the adoption of which is justified if and only if evidence is shown to exist that contradicts the claims of *both* the +H and −H Default Hypotheses.

In this section I intend to show that in the Pasiego height harmony system there is abundant evidence for the raising of mid vowels, i.e. for spreading +H, and further, that solid evidence supporting the lowering of high vowels, i.e. for spreading −H, is non-existent. These facts are automatically explained by the −H Default Hypothesis. Therefore, there is no justification for analysing the height harmony system in feature changing terms.

McCarthy's conclusion that height harmony in Pasiego is feature changing is based on data that are of two sorts: distributional evidence, namely cooccurrence restrictions between high and mid vowels that hold intramorphemically, and alternations observed chiefly in nominal proclitics and verbal inflectional suffixes. Of these, distributional evidence is weaker: in principle, it is compatible with any of the three analyses of lexical height given in (12) above. As regards alternations, proclitics are generally dependent on the height of the host words. Height alternations in the conjugation system, however, are quite revealing. It is this evidence that I would like to examine now; I will take up proclitic alternations and stem-internal harmony in §5.

Verbal roots in Spanish, as is well known, are assigned to one of three conjugation classes. Verbal stems are formed with one of the vowels /i/, /e/ or /a/; the choice is determined by the conjugation class classification of the root. As far as height harmony in Pasiego is concerned, the height of root vowels and that of the stem vowel agree in general; low /a/ can, of course, mix with either the high or low set. I will first consider contexts in which mid vocalic roots are raised, and then environments in which high vocalic roots are lowered.

4.1 Raising contexts

The principal inflectional par
indicative, present subjunctiv
In (13) I list the paradigms of
to be representative of mid v

(13)

	a. Present indicative
1sg	kwéxu
2sg	kwéxes
3sg	kwéxe
1pl	koxémus
2pl	kuxí:s
3pl	kwéxen

	d. Perfect
1sg	kuxí
2sg	kuxíste(s)
3sg	kuxjó
1pl	kuxímus
2pl	kuxí:stes
3pl	kuxjéin

It can be readily observed
determines that of the preced
desinence vowel is low or mid,
both the root vowel and stem
vowels appear in the context of
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The mid root (and stem) vow
before a high stressed vowel
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(14) a. -ís 2pl present indica
b. -í imperfect
c. -í perfect
d. -ís 2pl future
e. -í conditional

Past participles are further inst
vowel: cf. for example *bibíu*, *ku*
komér 'to eat' (Penny 1969b).

Evidence in support of raising

4.1 Raising contexts

The principal inflectional paradigms of finite verbs are as follows: present indicative, present subjunctive, imperfect, perfect, future and conditional. In (13) I list the paradigms of the verb *koxér* 'to take', which we may take to be representative of mid vocalic verbal stems (Penny 1969a):

(13)

	a. Present indicative	b. Present subjunctive	c. Imperfect
1sg	kwéxu	kwéxa	kuxía/kuxjá
2sg	kwéxes	kwéxas	kuxías/kuxjás
3sg	kwéxe	kwéxa	kuxía/kuxjá
1pl	koxémus	koxámus	kuxíamus/kuxjámus
2pl	kuxí:s	koxáis	kuxíeis/kuxjáis
3pl	kwéxen	kwéxan	kuxían/kuxján

	d. Perfect	e. Future	f. Conditional
1sg	kuxí	koxeré	kuxiría
2sg	kuxíste(s)	koxerás	kuxirías
3sg	kuxjó	koxerá	kuxiría
1pl	kuxímus	koxerémus	kuxiríamus
2pl	kuxí:stes	kuxirí:s	kuxiríeis
3pl	kuxjéin	koxerán	kuxirían

It can be readily observed that the height of the stressed vowel determines that of the preceding vowels. In particular, if the stressed desinence vowel is low or mid, and is not preceded by a high glide, then both the root vowel and stem vowel show up as mid. The fact that mid vowels appear in the context of /á/ argues for analysing the root as mid vocalic underlyingly.

The mid root (and stem) vowel becomes high in two general contexts: before a high stressed vowel and before a high glide immediately preceding a stressed vowel. The following is a list of the high vowel suffixes appearing in the paradigms of (13), all of which induce raising:

(14) a. -ís 2pl present indicative
b. -í imperfect
c. -í perfect
d. -ís 2pl future
e. -í conditional

Past participles are further instances of raising before a stressed high vowel: cf. for example *bibíu*, *kumíu*, derived from *bebér* 'to drink' *komér* 'to eat' (Penny 1969b).

Evidence in support of raising induced by the high glides /j/

in the onset of a stressed syllable runs deep. Some representative data are given in (15):

(15) a.	belórta	'hay-rake'	bilurtjár	'carry by hay-rake'
	ménus	'less'	mingwár	'to lessen'
	kornéxa	'crow'	kurnixjár	'to caw'
b.	Infinitive	Gerund	3sg imperfect subjunctive	
	koxér	kuxjéndu	kuxjéra	'take'
	komér	kumjéndu	kumjéra	'eat'
	bebér	bibjéndu	bibjér	'drink' (Penny 1969b)
c.	se kasó	'he got married'	si kumjó	'it's been eaten'
	lo málu	'the bad thing'	lu pjór	'the worst thing'
	el ganáu	'the cattle'	il mjéu	'fear'
d.	rrɔsárjɔ	'backbone'		
	rrekápjɔ	'bee-swarm'		
	médjas	'middle' (fem pl)		

As seen, mid vocalic roots become high vocalic if the onset of the stressed syllable contains a high glide, regardless of whether the stressed vowel is low (15a) or mid (15b); the perfect forms *kuxjó* and *kuxjéin* and the alternant imperfect forms of the paradigms in (13) are additional examples. The alternations in (15c) establish that glide triggered raising extends to proclitics as well. (15d) demonstrates that a high glide in an unstressed syllable does not determine high harmony to the left.

In sum, the evidence for [+high] vowels and glides which spread their height values is compelling. That the spreading process is lexical is underscored by the fact that it has exceptions; an apparently complete set of exceptional forms (to both vowel and glide induced harmony) can be found in McCarthy's article.[7]

4.2 Lowering contexts

A glance through the paradigms given previously in (13) reveals that the imperfect, perfect and conditional paradigms are formed either with a stressed high desinence vowel or have a high glide in the onset of the stressed syllable. Since in both cases right-to-left raising obtains, the patterning of high vocalic verbal stems in these paradigms is of no consequence. I give below the potentially revealing paradigms of the verb *sintír* 'to feel', representing the class of high vocalic verbal stems:[8]

(16) a. Present indicative	b. Present subjunctive	c. Future
síntu	sínta	sintiré
síntes	síntas	sintirás
sínte	sínta	sintirá
sentémus	sintámus	sintirémus
sintí:s	sintáis	sintirí:s
sínten	síntan	sintirán

It will be observed that t
tradictory behaviour: in *sentí*
of the high root vowel (that [
with a stressed low vowel), bu
it does not. As a matter of
lowering of the root vowel in
some roots belonging to the [
the 1pl present indicative infle
and *salímus*, derived from *salí*
of the *-ír* class do not assimil
vowel, either obligatorily or o
iskupír 'to spit' (Penny 1969b)
say' (Penny 1969a).

It appears then that the 1p
roots are unstable and subject
region: some verbs harmonise
(*iskupémus*), some do so opt
variation in the stressed vowel
that *-ér* and *-ár* verbs do not
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There are thus reasons to c
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homonymy. In any event, the
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motivate general vowel lowerir
analysis in terms of underspe
vowels are unspecified for [hig

Underspecification theory a
metric patterning of stressed
provides an explanation for
harmony: stressed mid-vowel
with high vowels (cf. McCarth
(stressed) mid vowels are unsp
feature to high vowels. Both of
Feature Changing Hypothesis.

It will be observed that the stressed mid vowel /é/ exhibits contradictory behaviour: in *sentémus* (1pl pres indic) it induces the lowering of the high root vowel (that [+high] is basic is shown by the inflections with a stressed low vowel), but in *sintiré* (1sg fut) and *sintirémus* (1pl fut) it does not. As a matter of fact, there are strong indications that the lowering of the root vowel in *sentémus* is an aberration. For one thing, some roots belonging to the [+high] class have high vocalic variants in the 1pl present indicative inflection: e.g. Penny (1969a) cites both *salémus* and *salímus*, derived from *salír* 'to leave'. For another, some verbal roots of the *-ír* class do not assimilate their high vowels to the stressed mid vowel, either obligatorily or optionally: cf. for example *iskupémus*, from *iskupír* 'to spit' (Penny 1969b) and *iθémus/eθémus*, from *(d)iθér/(d)iθír* 'to say' (Penny 1969a).

It appears then that the 1pl present indicative forms of high vocalic roots are unstable and subject to a great deal of variation across the dialect region: some verbs harmonise in height to /é/ (*sentémus*), some do not (*iskupémus*), some do so optionally (*iθémus/eθémus*), and some show variation in the stressed vowel (*salémus/salímus*). A relevant point here is that *-ér* and *-ár* verbs do not exhibit such variation in the 1pl present indicative.

There are thus reasons to consider the 1pl present indicative forms of *-ír* verbs not to be representative of the regular patterns of height harmony. There might even be a functional reason why the stem vowel is not the expected /í/: Penny (1969a: 123) conjectures that since *sintímus* is the 1pl perfect inflection, mid vocalism in the 1pl indicative avoids homonymy. In any event, the number of verbs that assimilate in height to *-émus* is highly limited: the great majority of verbs belong to the *-ár* class (Penny 1969a), where the present indicative forms have /á/. In brief, the set of verbs in which lowering applies in the context of *-émus* can simply be memorised.

As far as I have been able to determine, there appears to be no other suffix in Pasiego with a mid vowel, stressed or unstressed, that triggers the lowering of an inherently high vowel. If correct, then we have a system in which there is strong support for vowel raising, but no evidence to motivate general vowel lowering. These facts, surely, are tailor-made for analysis in terms of underspecification: high vowels are [+high], mid vowels are unspecified for [high].

Underspecification theory accords a principled account of the asymmetric patterning of stressed high and mid vowels in suffixes. It also provides an explanation for a set of systematic exceptions to height harmony: stressed mid-vowel nominal derivational suffixes freely mix with high vowels (cf. McCarthy 1984: 297 for a complete list). Clearly, if (stressed) mid vowels are unspecified for [high], they cannot spread this feature to high vowels. Both of the above facts remain curious under the Feature Changing Hypothesis.

4.3 The underspecified vowel system

We are now in position to set up the underlying representations of the Pasiego vowels. First, it will be recalled that the feature [ATR] is not distinctive: [−ATR] vocalism is morphologically conditioned, [+ATR] vocalism is derived by default. I have suggested that /e/ and /o/ lack specification for the feature [high], /i/ and /u/ do not. We also know that /e/ and /o/ must be specified for at least one of the features {[low], [back]}: these vowels are targets of the [high] Harmony rule, so they must have a dorsal node. By the same reasoning, neutral /a/ will lack values for each of the features in the set {[high], [low], [back]}. These three dorsal features are jointly sufficient to distinguish the five underlying vowels, so that the feature [round] is not distinctive either. The proposed underlying vowel system is thus arrived at:

(17)

	i	e	u	o	a
high	+		+		
low			−	−	
back	−	−			

The following default specifications are applicable:

(18) Default Rules

a. [ ] → [+back]
b. [−back] → [−low]
c. [ ] → [+low]
d. [+back, −low] → [+round]
e. [ ] → [−round]
f. [ ] → [−high]
g. [ ] → [+ATR]

As claimed by the theory, none of the above orderings is extrinsic. (18a, b) precede (18d), since the latter applies to the output of the former. I also assume that the 'Elsewhere Condition' (Kiparsky 1982) sequences (18b) before (18c) and (18d) before (18e).

5 Floating [high]

I have argued in the preceding section that only the + specification of the feature [high] is evidenced in the Pasiego lexicon. The following question is of immediate concern: how is the feature [+high] represented in underlying representations? Suppose we take what perhaps represents the conventional view, that it is the property of individual segments. In that case, every underlyingly high vowel is linked to +H on the [high] tier of the feature hierarchy. Below I give four arguments against what I will dub the LINKED ANALYSIS.

First, it is not immediately obvious that the notion 'morpheme-internal harmony' has any satisfactory interpretation. Any account of height harmony must state that as a rule, high and mid vowels do not mix in polysyllabic morphemes. Thus but (19c) is generally not (ignc

(19) a. i i b.

It might be possible to say tha represented on the dorsal tier (i. to +H or none are. But such a

Secondly, if height specificati fact is not explained that in ver agree in height, disregarding lo stem vowel is /e/ are mid vocali *é-r*, *sint-í-r*, where the morpholo facts are fortuitous.

Thirdly, the linked analysis polysyllabic roots whose stressec to Penny (1969b), these roots fal with high vowels, those that cooc doublet forms. The non-low voc of related forms; in other cases, consequently the root has altern

(20) a. lındásku 'embankmer
äyudáu 'helpful'
binágre 'vinegar'
tirár 'to pull'
b. äkɔmbáu 'curved'
äpɔkáu 'cowardly'
sedál 'fishing-line'
pendáse 'to comb one
c. soláŋu/sɔláŋu 'st
xoráku/xɔráku 'h
piruxál/peroxál 'w
kukaráča/kokaráča 'b

What is hard to understand in doublets like those in (20c) shoul stressed vowel is low allow double harmonic roots whose stressed v behaviour of disharmonic roots, v and frequently have harmonic dou a stressed low vowel.

Finally, if a morpheme has two is predictable from that of the oth

polysyllabic morphemes. Thus, (19a) and (19b) are possible structures, but (19c) is generally not (ignoring neutral /a/ and back /u/ and /o/):

(19) a. i i b. e e c. i e

It might be possible to say that of those vowels of a morpheme that are represented on the dorsal tier (i.e. high and mid vowels), either all are tied to +H or none are. But such a statement is awkward and unrevealing.

Secondly, if height specifications are determined individually, then the fact is not explained that in verbs stem vowels and root vowels generally agree in height, disregarding low vowels. Thus, in general, roots whose stem vowel is /e/ are mid vocalic, those with /i/ are high vocalic, e.g. *kox-é-r, sint-í-r*, where the morphology is [root–stem vowel–inf]. Rather, these facts are fortuitous.

Thirdly, the linked analysis is hard put to explain the patterning of polysyllabic roots whose stressed syllable contains neutral /á/. According to Penny (1969b), these roots fall into three categories: those that cooccur with high vowels, those that cooccur with mid vowels, and those that have doublet forms. The non-low vocalism can often be established on the basis of related forms; in other cases, however, no such relationship exists, and consequently the root has alternant forms:

(20) a. lɪndášku 'embankment' (cf. línde 'boundary')
äyudáu 'helpful' (cf. ayúda 'help')
binágre 'vinegar' (cf. bínu 'wine')
tirár 'to pull' (cf. tíra 'strip')
b. äkɔmbáu 'curved' (cf. kómba 'curve')
äpɔkáu 'cowardly' (cf. póku 'little')
sedál 'fishing-line' (cf. séda 'silk')
pendáse 'to comb one's hair' (cf. pénde 'comb')
c. sulánu/sɔlánu 'sunny'
xurákɔ/xɔrákɔ 'hole'
piruxál/peroxál 'wild pear-tree'
kukaráča/kokaráča 'beetle'

What is hard to understand in the linked analysis of +H is: (a) why doublets like those in (20c) should exist at all; (b) why only roots whose stressed vowel is low allow doublets with any degree of frequency, but not harmonic roots whose stressed vowel is mid or high; and (c) how the behaviour of disharmonic roots, which contain both high and mid vowels and frequently have harmonic doublets, can be related to that of roots with a stressed low vowel.

Finally, if a morpheme has two or more high vowels, the height of one is predictable from that of the other. The linked analysis, however, denies

this redundancy, and runs counter to the strong claim of underspecification theory (among others) that predictable values should not be specified underlyingly.

Suppose we say that each morpheme can have at most one linked high vowel underlyingly; height harmony would then propagate from that vowel. In some cases the choice as to which of several high vowels should be underlyingly linked would be arbitrary, though, as in [$H_1 \ldots H_2 \ldots$á$\ldots H_3$], where H is a high vowel. One might get around the arbitrariness problem by restricting linked [+high] features to stressed positions only. But this will not work if the stressed vowel is low or in those cases where stress might be assigned by rule, rather than assumed to be underlying.

I have considered and dismissed above several versions of the linked analysis of height, one in which spreading is initiated by vowels which are linked to +H. I would like to suggest instead that in the regular cases height is the property of morphemes.[9] Accordingly, we may conceive of two sets of morphemes: those that contain an unassociated, i.e. floating, +H feature on the [high] tier, and those that have no such feature. The former represent formally the class of high vocalic morphemes, the latter either mid vocalic morphemes or disharmonic morphemes, which contain individually specified, i.e. opaque vowels. These classifications are schematised in (21), using front vowels as examples:

(21) a. i i b. e e c. i e e i

[V V]$_\mu$ [V V]$_\mu$ [V V]$_\mu$ / [V V]$_\mu$

+H +H +H

High glides that occur in the onset position of stressed syllables will also be associated with [+high], since they control [+high] harmony to the left; a rule can be assumed to derive such predictable opacity.

The objections to the linked analysis of height given above cease to be problematical. The fact that ordinarily high and mid vowels do not cooccur intramorphemically is an automatic consequence: there is only one morpheme-sized floating +H feature per morpheme, or none at all. As regards the harmony between the root vowel(s) and the stem forming vowel of verbs, only one of them will be classified as high vocalic, and its +H feature will spread to the other under the general conditions of height harmony. The fact that disharmonic roots tend to have harmonic alternants makes perfect sense: in Pasiego, +H is morpheme-sized (floating), so the removal of segment-sized (linked) +H values is a case of regularisation. Finally, the unstressed non-low vowels of roots whose stressed vowel is low will be analysed as opaque in case they are high (20a), unspecified in case they are mid (20b), or optionally opaque in the case of free variation (20c). There is thus a uniform explanation for the existence of doublets in disharmonic roots and in harmonic roots with a stressed low vowel: in both cases opacity is reduced.

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height alternation is countenar

(22) a. po álya 'over there
b. pɑ̃ l prɑ̃u 'through t

Positing a floating +H feature
to be unavoidable.

6 The association of [hig

In the preceding section I ha
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procedures for +H.

6.1 Linking

The generalisation that [+high
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the stressed vowel of the word:

(23) *H-Linking*

[+stress]

Dorsal no

+H

But crucially, there is evidence that no analysis of the Pasiego height harmony system can outright deny the assumption of a floating +H. Consider the prediction the linked analysis makes for proclitic harmony in case the root contains only low vowels in tonic and pretonic positions. The expectation is that a proclitic vowel will be mid vocalic by default, since the low vowels of the root are not specified for [+high]. In point of fact, height alternation is countenanced, e.g.:

(22) a. po álya 'over there'
b. po l prắu 'through the field'

Positing a floating +H feature for roots of the type in (22b) would seem to be unavoidable.

6 The association of [high]

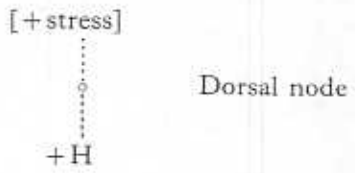
In the preceding section I have suggested an analysis of the height harmony system of Pasiego in which the underspecified feature [+high] is in general unassociated at the underlying level. If this is the case, a mechanism is needed to link the floating [+high] feature to a particular vowel; of course, this step is bypassed for segmentally specified high vowels (in disharmonic roots and in roots with /á/). In either case, the linked [+high] must spread to eligible target vowels within the harmonic domain. In this section I will complete my proposed account of the height harmony system of Pasiego by motivating the linking and spreading procedures for +H.

6.1 Linking

The generalisation that [+high] values initiate harmonic domains from the stressed syllable of the word seems undeniable to the language learner. That the stressed syllable is the preferred focus for the propagation of +H values is particularly salient in the verbal inflectional system and with the patterning of high glides: in both cases [+high] spreads outward from the stressed syllable. The significance of the stressed syllable is further manifested in the fact that non-low vowels often alternate freely in case the stressed vowel of the stem is low: low vowels are not bearers of [+high], hence they cannot be triggers of height harmony.

In the light of the relevance of the stressed syllable for the propagation of [+high], the target for the linking of a floating [+high] feature will be the stressed vowel of the word:

(23) *H-Linking*



The feature [stress] is purely interpretive and has no theoretical significance. I will assume that in statements like the above only the broken line is taken to constitute the structural change. That is, an association line is inserted between an *already existing* +H feature and the dorsal node. In particular, the dorsal node is not obtained through node generation (Sagey 1986), so that neutral /a/, which has no dorsal node, is not a target.

As discussed in detail in such works as Harris (1969, 1983) and Cressey (1978), the primary stress of Spanish words usually falls on any one of the final syllable (oxytones), penultimate syllable (paroxytones) or antepenultimate syllable (proparoxytones). Of these, penultimate stress represents the unmarked pattern. For present purposes, I will assume that penultimate stress is assigned by rule, but that final and antepenultimate stress is marked underlyingly.

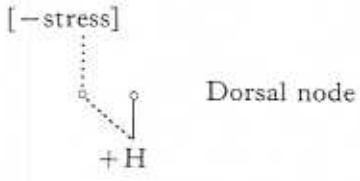
As a consequence of the preceding assumptions, the linking of floating [+high] features must follow penultimate stress assignment in the case of paroxytones. Since the stress assignment rule is often fed by the morphology, e.g. a number morpheme containing syllabic segments is added to the nominal stem, linking sometimes will take place on suffix cycles. But with oxytone and proparoxytone nominal stems, where stress is underlyingly indicated, linking is activated on the root cycle.

In the present analysis, H-Linking is needed only for morphemes whose stressed vowel is high: only these have a floating +H feature. Morphemes whose stressed vowel is mid are underspecified; high vowels in disharmonic roots and morphemes whose stressed vowel is low are underlyingly linked to +H. What about nominal roots that contain only low vowels? We saw in (22b) that one such class triggers raising in proclitics. I will assume, without further discussion, that such roots have a floating +H feature which becomes linked to a proclitic vowel in the postlexical phonology.

6.2 Spreading

Once linked, [+high] spreads by the following rule:

(24) *H-Spread (mirror image)*



I assume that H-Spread is a cyclic rule; I am aware of no data that suggest otherwise. In that case the Strict Cycle Condition can be invoked to explain the failure of H-Spread to apply morpheme internally in disharmonic roots. For the details of this approach, see Kiparsky (1985) and Pulleyblank (1986).

As formulated, both stressed and
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about opaquely [+high] unstress
vowel is low? The available evide
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/á/, it is of no consequence, for tv
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posttonic syllables occur only, as
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The mirror image formulation
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restricted to unstressed syllables.
which constitute evidence in su
inflections such as *sintiré* 'I will
vowels, as in *bibjéndu* 'drinking'; (
lindéra 'hillside'.[10] In each case,
stressed mid vowel.

The above facts force the linkin
on which suffixes with stressed n
Linking would associate a floating
high vowels. One immediate impli
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cycle; since in *-ír* verbs both root
neutral /a/), the height of at least
underspecified. I will assume that
stem vowel of *-ír* verbs is linked
vowels on the stem forming cycle,
high root vowels, if any, that are s
high vowels in verbal inflections th
as having a floating +H.

In the final analysis, Pasiego he
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Nilotic languages, among others: t
exerts its control over the harmo
phological distinctions like root *vs*

7 Conclusion

This work has examined the ch
harmony system from the persp

As formulated, both stressed and unstressed high vowels will be triggers of H-Spread. The evidence is overwhelming that stressed high vowels induce raising, as will be recalled from the discussion in §4. But what about opaquely [+high] unstressed vowels, as in roots whose stressed vowel is low? The available evidence poses no obstacles to this view. As regards right-to-left spreading, the [+high] feature will spread to proclitics uncontroversially, and there does not appear to exist a genuine case of an inherently linked high vowel suffix that could spread +H through a preceding stressed low vowel. As for left-to-right spreading through /á/, it is of no consequence, for two reasons: (i) stressed syllables can be followed by at most two (unstressed) syllables, and (ii) vowels in final unstressed syllables undergo reduction, including height. Non-final posttonic syllables occur only, as far as I have been able to determine, in the case of proparoxytone nominal stems, where stem-internal spreading takes place anyway.

The mirror image formulation of H-Spread is suggested by proparoxytones, where +H spreads from the stressed syllable in both directions. If H-Spread is bidirectional, then the target vowels must be restricted to unstressed syllables. There are at least three general contexts which constitute evidence in support of this conclusion: (a) future inflections such as *sintiré* 'I will feel'; (b) high glides followed by mid vowels, as in *bibjéndu* 'drinking'; (c) mid-vowel derivational suffixes, e.g. *lindéra* 'hillside'.[10] In each case, +H cannot spread rightward to the stressed mid vowel.

The above facts force the linking of high vowels to +H *before* the cycle on which suffixes with stressed mid vowels are derived: otherwise, H-Linking would associate a floating +H to the stressed mid vowel, yielding high vowels. One immediate implication is that in verbal stems either the root or the stem vowel should be linked by the end of the stem vowel cycle; since in *-ír* verbs both root and stem vowels are high (disregarding neutral /a/), the height of at least one is predictable and thus should be underspecified. I will assume that *-ér* verbs bear no +H feature, that the stem vowel of *-ír* verbs is linked to +H which will spread to the root vowels on the stem forming cycle, and that in the case of *-ár* verbs it is the high root vowels, if any, that are segmentally linked to +H. The stressed high vowels in verbal inflections that we saw in §4.1 can safely be treated as having a floating +H.

In the final analysis, Pasiego height harmony is reminiscent of asymmetric or dominant vowel harmony systems, such as [ATR] harmony in Nilotic languages, among others: the lexical value of the harmonic feature exerts its control over the harmonic domain, without regard to morphological distinctions like root *vs.* affix.

7 Conclusion

This work has examined the challenging facts of the Pasiego height harmony system from the perspective of the general framework of

underspecification theory. Two major points were advanced that have theoretical import: transparency was claimed to be analysable in geometric terms and full (binary) lexical specification was shown not to be a necessary condition for the description of height harmony.[11] In contrast, it is not obvious if any approach that denies underspecification in the height harmony system could provide principled accounts for facts like the following: (a) the distributional restrictions of vowel height that hold intramorphemically; (b) the asymmetric patterning of high and mid vowels in height alternations; (c) the systematic disharmony of stressed mid-vowel derivational suffixes; (d) the general transparency of low vowels.

McCarthy's specific proposals, in particular, need to be augmented for many of the problems enumerated above, as well as for three additional reasons. First, spreading only from linked stressed vowels predicts, incorrectly, that proclitic vowels do not alternate preceding low vowel nominal stems. Second, delinking followed by automatic spreading is dubious in light of Pulleyblank's (1986) strong arguments against automatic spreading in tone systems. And third, the Locality Condition, if accepted, renders illicit the spreading of [+high] beyond /a/ if that vowel is specified as [+low]; rather, it forces /a/ to block spreading.

If correct, the results might be interpreted in the strongest possible terms: as general constraints on the class of possible harmony phenomena. One such constraint might proscribe feature changing analyses altogether; another might prescribe one and only one description for transparency, namely segmental underspecification interacting with immutable feature geometry.[12] An important direction for future research might be to test these strong claims of underspecification theory on a wide assortment of empirical data.

NOTES

[1] The Pasiego dialect is spoken in the Cantabrian mountains, located in the south-central area of the province of Santander in north-central Spain. Penny's (1969a) grammar is the primary source material; Penny (1969b) concentrates on the patterns of vowel harmony. Both descriptions are in traditional terms and form the basis of McCarthy's painstaking investigation.

Unreferenced Pasiego forms used in this study are cited in McCarthy's article; those taken from Penny (1969a, b) are so identified.

[2] The forms *koxémus* and *kuxiría* are taken from Penny (1969a).

[3] For details and examples, cf. especially Vago (1985, in preparation), van der Hulst & Smith (1986), Cole & Trigo (1987) and Lieber (1987).

[4] Some authors, such as Archangeli & Pulleyblank (1987), include a secondary place tier mediating between the place tier and the dorsal articulator features. Others, e.g. Steriade (1987a), dock [ATR] on a separate velar tier. As far as I can tell, these modifications have no effect on the analytical points raised in this paper.

[5] An anonymous referee has pointed out that the Locality Condition is not an inalienable part of underspecification theory, but that a theory of underspecification that incorporates it is much more constrained than one which does not.

[6] In Archangeli's (1984) terms, (12a) lement rules.

[7] In [−ATR] contexts stressed mid their left; see McCarthy's discuss would constitute still additional ins

[8] A few of the forms given in (16) ar the primary source materials (Penny on the basis of the conjugation of t low, it should be noted, so that it i given fully in Penny (1969a: 108ff) mediately below, the correctness of t and the 1pl present indicative form regard it must be borne in mind Penny (1969b: 156), as well as Mc carries some significance for presen ever, given the attested form *sintir* spit' (Penny 1969b: 156)), its corre

[9] The idea that harmonic features i morphemic status is not new: it is by Archangeli & Pulleyblank (fort much less constrained autosegmen and Hungarian, Steinberger & Vag for Turkana.

[10] Forms like *iskupémus* 'spit' (1pl examples.

[11] A third fact also has theoretical re angeli (1984), Archangeli & Pulley case [+ATR] and [−high] are th the redundant ones. The fact that strongly against theories that adm Hulst & Smith 1986).

[12] For an approach along these lines, fresh proposal to preclude the fe phenomena.

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[6] In Archangeli's (1984) terms, (12a) would involve default rules, (12b) complement rules.

[7] In [−ATR] contexts stressed mid vowels become high and trigger raising to their left; see McCarthy's discussion of what he calls Raising. These then would constitute still additional instances for the spreading of [+high].

[8] A few of the forms given in (16) are cited neither in McCarthy's article nor in the primary source materials (Penny 1969a, b). Rather, I have constructed them on the basis of the conjugation of the verb *salír* 'to leave' (whose root vowel is low, it should be noted, so that it is uninteresting as regards height harmony), given fully in Penny (1969a: 108ff). Within the context of the discussion immediately below, the correctness of the two future inflections *sintiré* and *sintirémus* and the 1pl present indicative form *sentémus* is of critical importance. In this regard it must be borne in mind that both *sintiré* and *sentémus* are cited by Penny (1969b: 156), as well as McCarthy. Thus, the only unattested form that carries some significance for present considerations is *sintirémus* (1pl fut); however, given the attested form *sintiré* (1sg fut) (cf. also *iskupiré*, from *iskupír* 'to spit' (Penny 1969b: 156)), its correctness is all but assured.

[9] The idea that harmonic features in vowel harmony systems may be assigned morphemic status is not new: it is advocated within underspecification theory by Archangeli & Pulleyblank (forthcoming b) for Yoruba, and in a different, much less constrained autosegmental framework by Vago (1984) for Finnish and Hungarian, Steinberger & Vago (1987) for Bari, and Vago & Leder (1987) for Turkana.

[10] Forms like *iskupémus* 'spit' (1pl pres indic), discussed in §4.2, are further examples.

[11] A third fact also has theoretical relevance. It is generally assumed, e.g. Archangeli (1984), Archangeli & Pulleyblank (forthcoming a), that in the unmarked case [+ATR] and [−high] are the distinctive values, [−ATR] and [+high] the redundant ones. The fact that in Pasiego the marked case obtains argues strongly against theories that admit single-valued features only (e.g. van der Hulst & Smith 1986).

[12] For an approach along these lines, see Vago (in preparation). Odden (1988) is a fresh proposal to preclude the feature changing analysis of non-assimilatory phenomena.

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