Proceedings of AFLA 7

The Seventh Meeting of the Austronesian Formal Linguistics Association

Edited by
Marian Klamer

Vrije Universiteit Amsterdam
Department of Linguistics
2000

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Held at the Vrije Universiteit Amsterdam
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Preface

This volume consists of papers presented at the seventh meeting of AFLA (Austronesian Formal Linguistics Association), held at the Vrije Universiteit on May 11-13, 2000.

For the first time in the history of AFLA, this meeting was held outside the North-American continent, and contained contributions by speakers from eleven different countries: New Zealand, Australia, Indonesia, Brunei Darussalam, Taiwan, the USA including Hawaii, Canada, the UK, France, Germany, and The Netherlands.

Apart from the languages that are traditionally well-represented at Austronesian conferences, we were happy to see that the program also contained work on relatively small or lesser described languages, such as the minority languages of Taiwan, North-West Borneo, Eastern Indonesia, Papua and Oceania.

Special themes of this conference were Iconicity and Argument marking. The papers in this volume show that the program covered a broad range of subdisciplines -- from discourse grammar, phonology, morphology, syntax, to semantics -- and that the authors are working within various theoretical frameworks. But despite the obvious differences in expertise, interest and background, the atmosphere on the conference was typically AFLA: lively and constructive, with an average rate of attendance of about 80%. The papers in this volume deserve the same rate of attention.

This meeting has again furthered the unwritten mandate of AFLA to encourage the formal study of Austronesian languages, especially work by speaker linguists and junior scholars. Six scholars presented analyses of their native language, and more than half of the 45 participants subscribed as 'student'. This suggests that the future of Austronesian linguistics looks very bright indeed.

The eight edition of Afla will be held in the spring of 2001 at the Massachussetts Institute of Technology (MIT) in Boston, USA. The principal organiser will be Ileana Paul.

Marian Klamer, Vrije Universiteit Amsterdam

Proceedings of previous AFLA meetings:

A Selection of the papers of AFLA 2, in 1995 is published as:
Paul, Ileana, Vivianne Phillips, and Lisa Travis (eds.). 2000. *Formal Issues in Austronesian Linguistics*. Dordrecht, Kluwer.

The proceedings of AFLA 3 and AFLA 4 in 1996/1997 are published as:
Pearson, Mathew (ed.). 1998. *Recent papers in Austronesian Linguistics*. UCLA Working Papers in Linguistics 21.

The proceedings of AFLA 6 in 1999 are published as:
Smallwood, Carolyn and Catherine Kitto (eds.). 2000. *Proceedings of AFLA VI*. Toronto Working Papers in Linguistics.

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A Non-Linear Analysis of Vowel Harmony and Vowel Harmony Blocking in Pendau

Phil Quick
Australian National University and the Summer Institute of Linguistics

1. Introduction

Vowel harmony is without a doubt the most interesting phonological feature in Pendau (and is found in many if not all of the languages in the Western Austronesian Tomini-Totoli language group, northern Central Sulawesi, Indonesia).[1] Vowel harmony in Pendau is a type of prosodic alignment where certain features of one vowel in the stem spreads to certain prefixes (it can spread in up to three prefixes from right to left) and one infix. The /o/ vowel of a prefix may front to either /a/ or /e/ depending on the features of the first vowel of the root or stem.[2]

Kenstowicz (1994:347) provides a definition for vowel harmony (carefully distinguishing it from umlaut and other similar processes):

> Vowel harmony is a phonological state in which the vowels in a given domain share or harmonize for a particular feature. It differs from other processes affecting adjacent vowels (e.g., umlaut) in that typically all of the vowels of the language participate in the harmonic constraint. In addition, the harmony applies in an essentially unbounded fashion, affecting all the relevant vowels within the domain (typically the word). Virtually any of the common features used to distinguish among vowels have been discovered to seat a harmonic system, including vowel height, backness, rounding, nasality, and pharyngeal opening or [ATR]. Vowel harmony exhibits many of the "action-at-a-distance" properties displayed by tone.

This paper begins by introducing the Pendau data which will give representative examples of vowel harmony for each of the harmonic prefixes. After this the analysis will begin with a brief classical generative analysis of the vowel harmony phenomena showing that the features back and rounding can be collapsed into one rule, but that this rule and this approach to the data is unsatisfactory (especially with the harmony blocking environments). The major part of the presentation utilizes autosegmental, feature geometry, and lexical phonology theories to describe both the vowel harmony process and the environment in which vowel harmony is blocked. Although initially it appears that vowel harmony is blocked by the sequence of two consonants there is data that also shows vowel harmony spreading past two consonants (such as *sa-n-tanga* 'half'). This analysis resolves this by showing that nasal assimilation and nasal deletion block vowel harmony from spreading at the cavity tier. Since the Well Formedness Condition (WFC) asserts that lines cannot be crossed, then by replacing the BR feature with the oral node this vowel harmony problem is resolved elegantly. Finally this paper will briefly put Pendau into a context with other Austronesian languages which have vowel harmony, concluding with the suggestion that vowel harmony can help understand some historical problems in Sulawesi languages.

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[1] This analysis has directly or indirectly benfitted from discussions over the years with: Avery Andrews, René van den Berg, John Bowden, Donald Burquest, Mike Cahill, Timothy Friberg, Chaz Mortensen, Steve Parker, Rebecca Quick. Part of this paper was originally presented in the RSPAS linguistics seminar series in 1996 with a similar title, and I also want to thank that seminar's participants for comments and feedback. Abbreviations: AV active voice, DIR directional, CAUS causative, DISTR distributive aspect, HPS harmonic prefix set, IR irrealis, IV inverse voice, NV non-volitional, ONE numeral one prefix, POSS possessive, RE realis, RSLTV resultative ST stative, STEM stem former, TZ transitivizer.

[2] See Topping 1968 and Latta 1972 for discussion of vowel fronting harmony in Chamorro which is the reverse of this, that is the first vowel of the root or stem fronts to the vowel of the preceding prefix.

2. VOWEL HARMONY DATA

A list of the harmonic prefixes (with the underlying formatives) is provided in (1).

(1) **Harmonic Prefix Set (HPS)**

mong-	AV/IR	ro-	IV/IR
nong-	AV/RE	mo_1-	ST/IR
pong-	STEM	no_1-	ST/RE
song-	ONE (verb)	so-	ONE (non-verbs)
'o-	RSLTV or POSS	po-	ST/CAUS
-ong-	DISTR		

Most of the harmonic prefixes are verbal prefixes (note that there are other verbal prefixes which are not harmonic, e.g. *me-/pe-* dynamic verb class, *mo-/no-* denominal verb class, etc.). The *so-* prefix is a numeral prefix used on classifiers and measure nouns. The *'o-* prefix is used to possess a noun or in combination with other verbal prefixes (see Quick in prep. for more details). In addition to the harmonic prefixes, there is also one harmonic infix *–ong-* which marks distributive plurality (since most of the harmonic affixes are prefixes, I will include the infix under the label *Harmonic Prefix Set*).

Example (2) shows vowel harmony prefixes with numerals, classifiers, measure nouns, nominalized classifiers, stative verbs, stative intensification (in some cases the vowel harmony prefix is in combination with other affixes).

(2) **Numerals:**

soung	'one'	sa-gatus	'one hundred'
so-mpulu	'one ten'	se-ribu	'one thousand'

Stative Verbs (*mo-* stative irrealis prefix):

ma-pangkat	'tall'	me-empeng	'short'
me-ide	'small'	mo-onda'	'hot'
mo-oge	'large'	me-menyong	'cold'
me-itong	'black'	ma-paris	'difficult'
me-meas	'white'	ma-lamor	'easy'
mo-doda	'red'	mo-mbosi'	good
mo-bulung	'green, blue'	mo-boat	'heavy'
me-riri	'yellow'	ma-nggaang	'light'
ma-dantang	'long'		

Stative Intensification ('o- σ_e-):

'a-sa-sanang	'to be exuberent'	sanang	'happy'
'a-pa-pangkat	'to be the most high'	pangkat	'tall'
'o-to-tou'	'the end of it all'	tou'	'finish'
'a-ga-garang	'the most loved'	garang	'love'
'e-de-dea	'uncountable'	dea	'many'
'a-ga-gau'-ong	'have the most deeds'	gau'	'event, activity'

Classifiers:

sa-lai	'one thread-like, hair-like object'
sa-mata	'one eye, one sharp-pointed object'
se-mpe'a	'one flat hard object'
sa-ngkayu	'one snake-like item, tubular'
so-ngkolo	'one cut or shaped heavy object'
so-bua	'one fruit-like object (larger)'
se-ilas	'one ring-like object'
sa-dampe	'one seed-like object'
sa-nta'u	'one fruit (durian, coconuts, etc.), or 4-legged animals'

Nominalized (Quantified) Classifiers:

pe-sa-mata-ong	'one each of a sharp-pointed type object'
pe-so-bua-ong	'one each of a fruit-like object'
pe-se-ilas-ong	'one each of a ring-like object'

Measure Nouns:

se-insang	'one time'	sa-pariama	'one year'
so-ndoung	'one evening'	so-m-bulang	'one month'
se-mbengi	'one night'	se-liter	'one liter'
se-eleo	'one sun, one day'	sa-paak	'one pack'
se-minggu	'one week'	sa-rabo'	'one handful'
so-bungkus	'one package'	se-kilo	'one kilogram/kilometer'

Infixes are given in example (3) below and the infix is shown within brackets. The distributive *-ong-* infix occurs immediately after the first consonant of the word (this is in contrast with the telic aspectual infix *-um-* which is inserted after the first consonant of the root).

(3) **Distributive Infix –ong-**

Infixation	**Root**	**Gloss**
n[ong]o-po-duling=omo	duling	'lie down'
n[eng]e-teule=mo	teule	'return home'
m[ong]ong-komung	'omung	'bring, carry'
m[eng]eng-inum	inum	'drink'
m[eng]e-lolo	lolo	'search
n[eng]e-lampa	lampa	'walk, travel'

What is most revealing is a comparison of the Inverse Voice Irrealis prefix (IV/IR) with the Active Voice prefixes (AV/IR or AV/RE). For our purposes here I will only provide the Irrealis form of the Active Voice since the Realis prefix performs exactly the same way as the Irrealis form. Compare the three sets in (4).[3] In (4a) the roots have vowel initial roots, and in (4b) the roots have voiceless consonant initial roots, and in (4c) the roots have (mostly) voiced consonant initial roots. The prefix *ro-* (IV/IR) is subject to vowel harmony in all instances, whereas the prefix *mong-* (AV/IR) only undergoes vowel harmony when it occurs with a vowel initial root.

[3] Also see Rubino in prep. for using these three sets as a phonological exercise.

	IV/IR	AV/IR	Root	Gloss	
(4a)	raabut	mangabut	abut	'weed'	**vowel**
	raangka	mangangka	angka	'steal'	**initial roots**
	reinung	menginung	inung	'drink'	
	reibi'	mengibi'	ibi'	'choose'	
	rouras	monguras	uras	'sow'	
	rooyot	mongoyot	oyot	'haul, pack'	
	roulisi	mongulisi	ulisi	'peel fruit'	
(4b)	ratabola	monabola	tabola	'throw away'	**vl. consonant**
	rasambale	monyambale	sambale	'butcher'	**initial roots**
	raparesa	momaresa	paresa	'check	
	retimbang	monimbang	timbang	'weigh'	
	reketik	mongetik	ketik	'type'	
	rapake	momake	pake	'use, wear'	
	rotuda	monuda	tuda	'plant'	
	rotulis	monulis	tulis	'write'	
	rototo'	monoto'	toto'	'cut, slash'	
(4c)	rasabang	monsabang	sabang	'help'	**vd. consonant**
	ragane	monggane	gane	'pray'	**initial roots**
	rajaong	monjaong	jaong	'sew'	
	regegeri	monggegeri	geger	'file s.t., rub'	
	rabalia'	mombalia'	bali	'move '	
	rabasa	mombasa	basa	'read'	
	rosole	monsole	sole	'fry'	
	rodudul	mondudul	dudul	'light fire'	

Two possible ways of analyzing this blocking are apparent: that it is blocked by underlying consonant sequences, or that it is blocked by the assimilatory processes that also occur in (4b)-(4c) In §6 I will argue for an assimilation blocking account.

3. The Classical Generative Approach

This section begins the description of vowel harmony in Pendau by using the classical generative model. This approach is instructive in demonstrating precisely what the harmonic prosody is and also shows the inherent weakness of a linear treatment of vowel harmony.

If the first vowel in a stem is /a/ then the /o/ is fronted to the same features as /a/, that is [-rd]. The features [-hi, +bk] are redundant and implied in the remainder of the rule. The following rule (5) could be formulated (ignoring the more complicated environments for the time being).

(5)

$$\begin{bmatrix} +rd \\ -hi \end{bmatrix} \quad V \rightarrow \underset{[-rd]}{V} \quad / \# C \_\_ (C) + \underset{[-rd]}{V}$$

The generative rule can be translated like this: A mid back vowel becomes unrounded when it is in a(n) (open or closed prefix) syllable preceding a contiguous morpheme whose (first) vowel is unrounded.

When the first vowel in a stem is /e/ or /i/ then the /o/ is fronted to the same features as /e,i/ that is [-bk]. Here the important redundant features are [-hi,-rd], as shown in (6).

(6)

$$\begin{bmatrix} +rd \\ -hi \end{bmatrix} \quad V \rightarrow \underset{[-bk]}{V} \; / \# C \_\_ (C) + \underset{[-bk]}{V}$$

The two rules above shows that in Pendau the vowel harmony agrees in unrounding[4] and backing of [-hi] vowels. When a word has the high back vowel [u] in the initial position no rules are needed since [o] and [u] agree in backness. To capture this natural process we can collapse the two rules above into the rule in (7). In addition we will add the important condition that consonant sequences block the vowel harmony, as there does not seem a convenient way to notate that only one consonant is allowable at a time for vowel harmony to occur. Further it should be noted that the vowel in the stem closest to the prefix is the vowel to which the prefix vowel harmonizes. The specific prefixes are abbreviated as the Harmonic Prefix Set (HPS) as there are other prefixes which do not allow vowel harmony. The word initial boundary is not identified as there are cases where vowel harmony may spread iteratively up to three prefixes.

(7)

$$\begin{bmatrix} +rd \\ -hi \end{bmatrix} \quad V \rightarrow \begin{bmatrix} -rd \\ \alpha bk \end{bmatrix} \quad V \; / \; C \_\_ (C) \Big]_{[+HPS]} + \Big[(C) \quad \underset{\begin{bmatrix} -rd \\ \alpha bk \end{bmatrix}}{V} \Big]_{\text{Word Stem}}$$

Harmonic Prefix Set (HPS); Condition: A consonant sequence will block the rule.

4. Feature Geometry and Vowel Underspecification

The feature geometry in this analysis will follow the general consensus as presented in Kenstowicz (1994). The description of Pendau phonology is enhanced by understanding the theoretical model of feature geometry. Feature geometry models a close relationship between phonology and phonetics. The basic model of feature geometry is given in figure 1 below.

The vowels in Pendau can be underspecified as displayed in figure 2. Since a vowel chart can be displayed in several possible ways, the fact that the /o/ is the underlying vowel in vowel harmony and is used in epenthesis was a determing factor in developing this particular underspecification configuration (originally suggested to me by Steve Parker personal communication).

[4] I am indebted to Tim Friberg for pointing out to me the unrounding process in an early analysis.

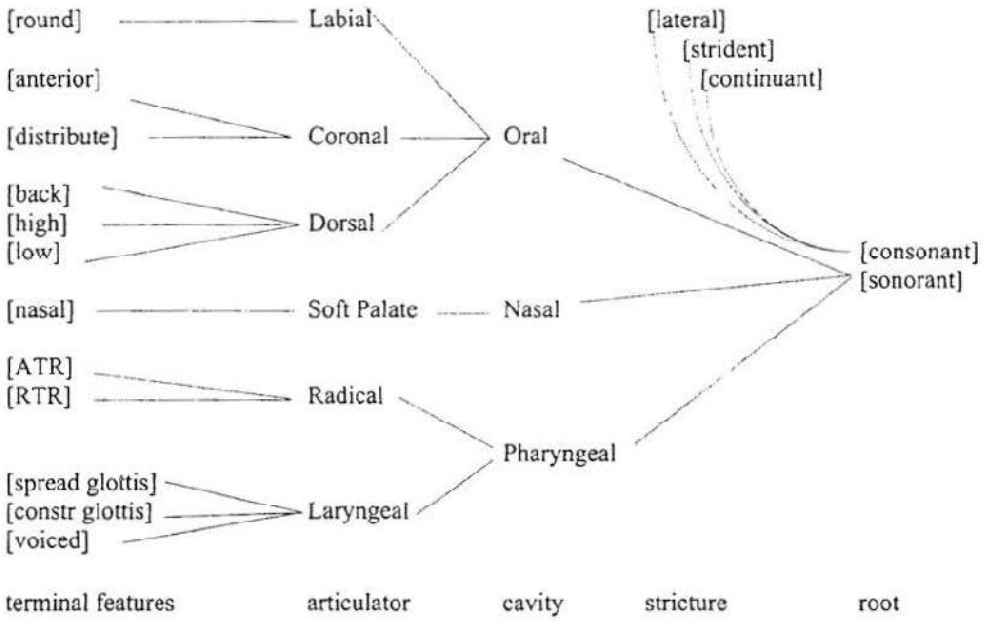


Figure 1. Feature Geometry
(Adapted from Kenstowicz 1994:146; but compare to 1994:452)

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

Figure 2. Vowel Underspecification in Pendau

Listed below are the redundancy rules for Pendau vowels. The post-lexical complement rules derive the /o/ in epenthesis. These also apply to the underlying /o/ when vowel harmony is blocked (see §6).

(8)

Lexical Rules		Post-Lexical Complement Rules		
[-back]	→ [-rd]	∅	→	[-high]
[+low]	→ [-rd]	∅	→	[+back]
		∅	→	[-low]

5. An Autosegmental Analysis Of Vowel Harmony In Pendau

Vowel harmony in Pendau is a type of prosodic alignment where certain features of one vowel in the stem spreads to vowels in some prefixes. Vowel harmony has been found to operate in much the same manner as tone cross-linguistically. The Autosegmental Theory can be applied in the analysis of Vowel Harmony and is more revealing and elegant than the Classical Generative approach. Autosegmental theory assumes that there is more than one tier and that each tier may operate independently of the other. The theory assumes a set of universal Well Formedness Conditions and each specific language may have its own specific conditions in addition.

5.1 Pendau Vowel Harmony Data and Analysis (Lexical [Level 2])

In Pendau the harmonizing feature is back-round harmony. There are several competing views about the location of the consonant node and the vocalic node. Quoting Kenstowicz (1994:473):

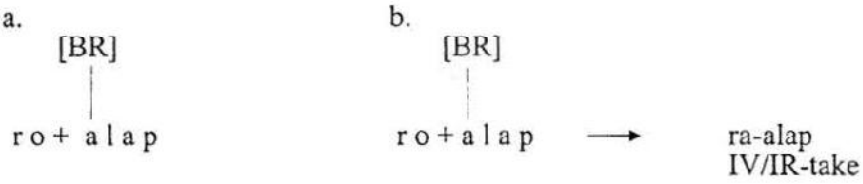
> In the Clements model, the Vocalic node branches into V-Pl and Aperture. This groups vocalic rounding and backness together and isolates height -- a natural acoustic parsing since height is primarily reflected in the first formant and backness and rounding in the second formant. On the other hand, the articulator-based Halle-Sagey model groups backness and height as Dorsal dependents and isolates rounding as a Labial dependent. Odden (1991) discusses a number of cases that appear to support the former partitioning.

Vowel harmony in Pendau may contribute to an understanding of this current issue, as we will see shortly. Clements and Hume (1995:227) further states that back and rounding features can be eliminated in their model:

> A further innovation of this model is that the features [labial], [coronal], and [dorsal], occuring under the V-place node in vocoids, are sufficient, by themselves, to distinguish place of articulation in vowels, and replace the traditional features [back] and [round]. In order to fulfill this new and expanded role in the theory, they must be redefined in terms of constrictions rather than articulator movements as such.

For this analysis I will begin by using BR as a useful heuristic to initially demonstrate that each word stem or word base carries the preassociated feature of the back-round node (BR).[5] Accordingly the following steps would be followed to harmonize the vowel, see example (9) below. First in (9a) the correct preassociation with the Vowel Harmony Tier is drawn. Secondly, since vowel harmony spreads from the root or stem to the prefix the association spreads from right to left (see 9b).

(9)



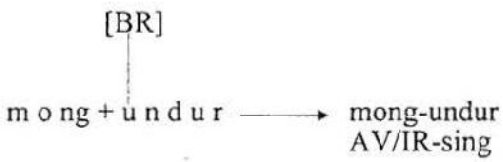
The rules for associating the vowel harmony spreading in Pendau can be stated in these three steps:

Step one	Every root/stem has [BR] as a preassociated feature which is associated to the first vowel of the stem/root.
Step two	If nasal assimilation or glottal assimilation takes place, then vowel harmony is blocked (vowel harmony is blocked in assimilation processes due to the Well Formedness Condition that association lines do not cross, see discussion in §6).
Step three	Prosodic vowel alignment spreads from right to left, so an association line is attached to the vowel(s) of the prefixes. This occurs in level two of the lexical module, and since level two is cyclic, the vowel alignment spreads consecutively to harmonic prefixes to its left.

[5] Odden 1991 describes back-round as a formal part of vowel geometry.

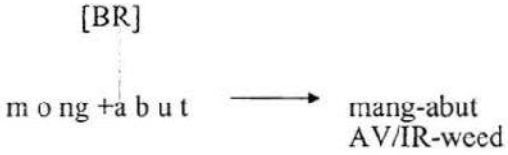
When the preassociated vowel harmony tier already has the same BR value, as in (10), there is no change (notice that the BR restricts the vowel from harmonizing with [+high]).

(10)



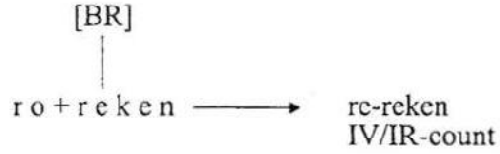
Example (11) shows the BR unrounding the *o* to become a low *a*, in effect fronting it.

(11)



Example (12) further illustrate the process where the back rounded vowel becomes a front vowel.

(12)

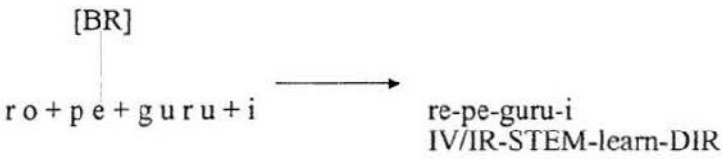


Example (13) illustrates that despite mixed vowels in the root the primacy must be on the first vowel of the stem or root base in deciding which vowel has the preassociation, or last prefix to undergo vowel harmony where there are multiple harmonic prefixes.

(13)

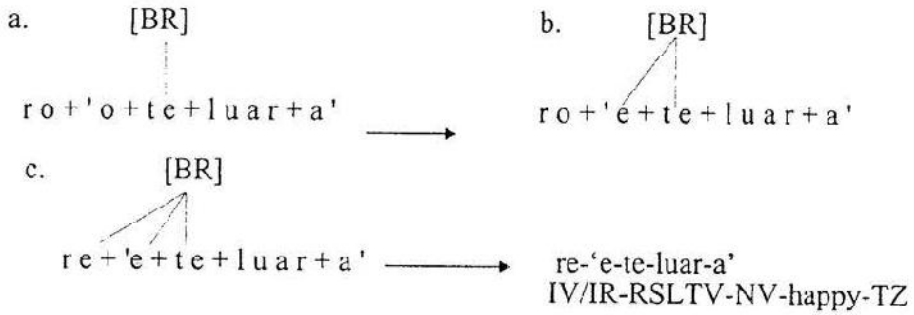
Pendau has several types of derivational prefixes which attach and become the stem of the word as far as vowel harmony is concerned. The vowel in this prefix becomes the vowel to preassociate the features for the vowel harmony/alignment tier.

(14)

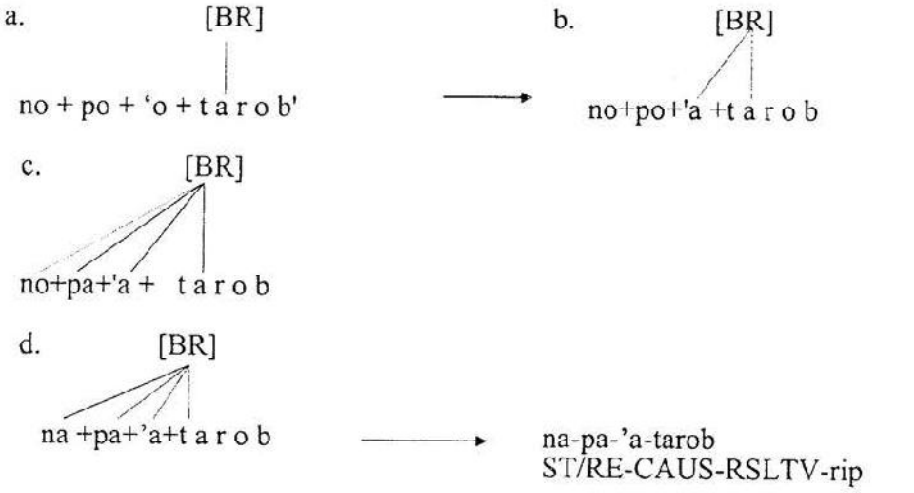


Examples (15)-(16) demonstrates that vowel harmony predictably spreads to more than one possible prefix. Example (15) shows harmony of two prefixes, and example (16) shows harmony spreading into three prefixes. The language specific spreading from right to left still holds true for a more complicated affix situation. Examples (15)-(16) demonstrates how vowel harmony applies iteratively as each affix applies vowel harmony in its turn.

(15)



(16)

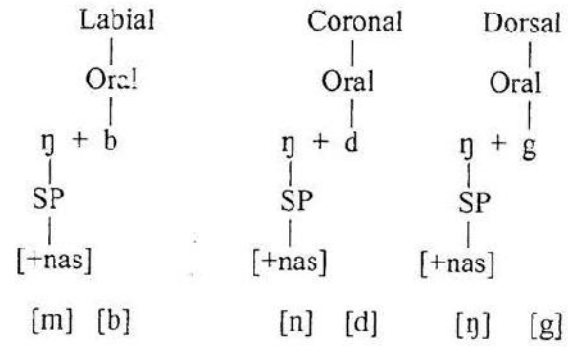


6. ASSIMILATORY PROCESSES THAT BLOCK VOWEL HARMONY

6.1 Nasal Assimilation (Lexical [Level 1 and 2]) and Voiceless Consonant Deletion (p, t, k, s) (Lexical [Level 2])

In Pendau, as in many other Austronesian languages the final nasal assimilates to a point of articulation homorganic with the initial consonant of the stem/root to which it is attached. Example (17) illustrates nasal assimilation to the following voiced obstruent (the affricate [dʒ] assimilates the nasal to the same point of articulation as the voiced coronal obstruent [d] below, e.g. *ponjaong* 'the sewing place').

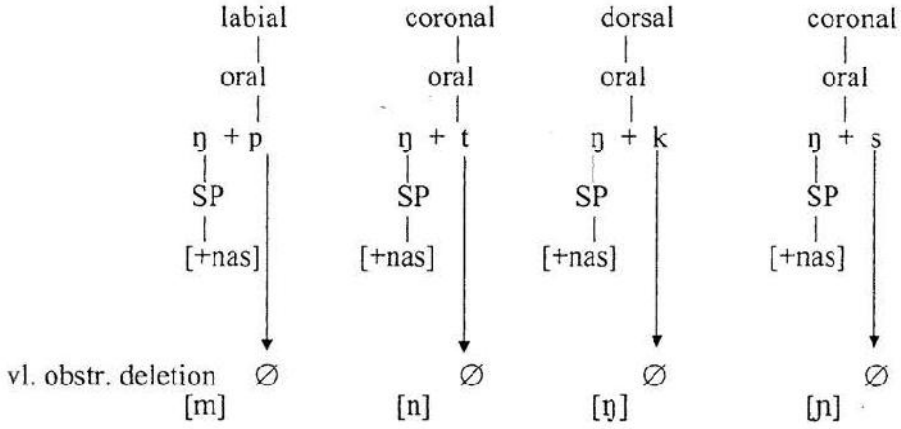
(17) *nasal assimilation before voiced stops*



In example (18) it is assumed that voiceless obstruents are deleted because of

underspecification of voicing (or possibly due to some other spreading motivation which isn't specifically germane to the vowel harmony topic).

(18) *nasal assimilation before voiceless obstruents*[6]



Classifiers and some measure nouns are other word classes prefixed by the harmonic prefix *so-* 'one'. Many classifiers and measure nouns have a problematic nasal that occurs before an obstruent on some words (see (18) for some examples). There are two possibilities for the source of this nasal. One is that the nasal is diachronically a genitive linker no longer productive (or marginally productive), and the second alternative is that they are part of the word stem inherently (it appears that there are instances of both). Some words clearly have environments without the nasal when used as a noun.

(19)	se-m-pea	one flat hard object	so-ndoung	one night
	sa-n-ta'u	one four-legged animal	so-m-bulang	one month
	sa-ng-kayu	one snake-like object	se-m-biti	one time
	sa-n-jangang	one handspan	sa-m-paa	one cluster of s.t.
	se-n-si'u	one cubit	so-m-buli	one branch of s.t.
	sa-n-tanga	one-half	so-m-bo'a	one plate of s.t.
	so-ng-kolo	one cut/shaped heavy object		

The vowel in *so-* 'one' always follows vowel harmony regardless of the consonant sequence, which is contradictory to previous examples which shows that *mong-* does not take vowel harmony when the root or stem begins with a consonant. However, if we assume that *ŋ-* is a productive prefix, then by assigning it to level 1 and nasal assimilation to level 1 (L1), then it becomes a new stem or "lexical item" which can then allow vowel harmony to occur in level 2 (L2) without the vowel harmony blocking that occurs from nasal assimilation (see (20).

(20)	[[so][[ŋ][pea]]]	Underlying representation
	[[so][mpea]]	L1 nasal assimilation, bracket erasure
	[sempea]	L2 vowel harmony, bracket erasure, resyllabification
	sempea	surface representation

[6] The phoneme /s/ does not delete in all lexical words, and in some words it appears to be optionally deleted. When the /s/ is not deleted the preceding nasal becomes the alveolar /n/. Nasals preceding /s/ behave irregularly in many other Western Austronesian languages (e.g. Indonesian, etc.).

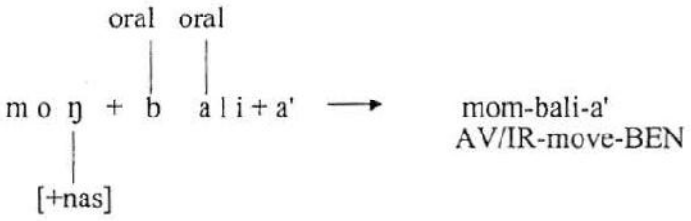
6.2 Vowel Harmony Blocked by Nasal Assimilation (Lexical [Level 2])

We have seen that the nasal assimilation is a kind of spreading. Similarly we have seen that vowel harmony spreads. In this section I demonstrate how nasal assimilation blocks the vowel harmony from spreading, since the WFC states that association lines cannot cross (see McCarthy 1988, Kenstowicz 1994, Goldsmith 1990, etc.). Current work on feature geometry appears to be moving towards a consensus that the vowels and consonants have a node on the same tier. We will now dispense with the heuristic useage of [BR] and replace it with the oral node. For example Kenstowicz (1994:469) says:

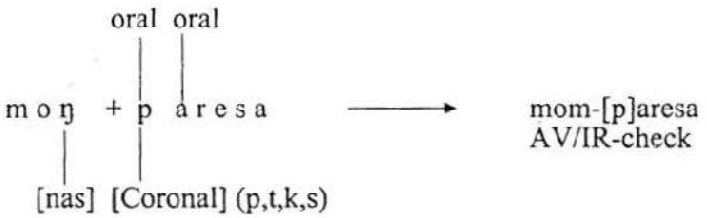
> Attaching the V-Pl node as a subtree under C-Pl predicts that rules spreading a V-Pl feature from one vowel to another across an intervening consonant will block when the consonant is specified for the relevant feature as a secondary but not as a primary articulation. Although this prediction remains to be systematically investigated, there are cases on record that point in the right direction.

This provides theoretical motivation for the vowel harmony blocking in the case of active voice consonant sequences (contrast to example (18) in §6.1 above where vowel harmony crosses consonant sequences--the lexical phonology module is needed to explain this apparent inconsistency of the phonology, see this discussion in §6.1 and §7). In (21)-(22) the dotted lines show assimilation of features taking place. After nasal assimilation has taken place, vowel harmony cannot apply now because in the current cycle the association lines cannot be crossed. So vowel harmony is blocked by assimilation of a consonant in the same cycle where vowel harmony would normally apply.

(21)



(22)

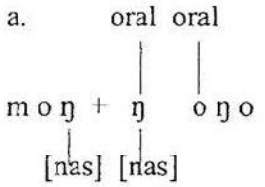


6.3 Nasal deletion before Sonorants (Lexical [Level 2])

Nasal deletion occurs according to the Obligatory Contour Principle (OCP). The OCP states that "adjacent identical elements are prohibited (see McCarthy 1988:88)" Any word root or stem with an initial sonorant consonant will invoke this rule when preceded by a nasal prefix. When the nasal assimilation occurs, the OCP is met and the initial consonant is deleted. Vowel harmony is still blocked, as occurs when nasals precede obstruents, as shown in (23)-(25).

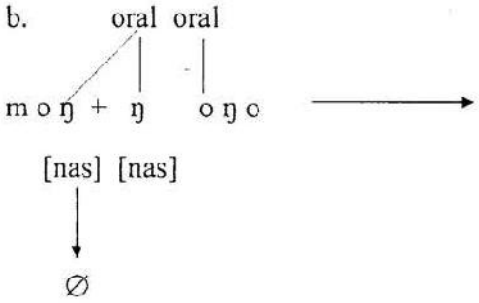
(23)

a.



nasal assimilation
vowel harmony blocked

b.

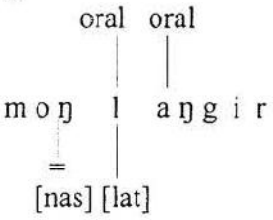


mo(ŋ)-ŋoŋo
AV/IR-cook

OCP causes nasal deletion

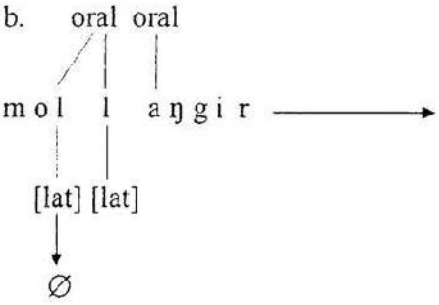
(24)

a.



nasal assimilation
vowel harmony blocked

b.

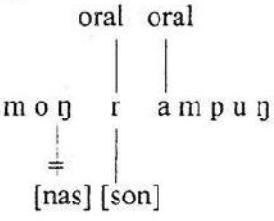


mo(ŋ)-laŋgir
AV/IR-ceremonial washing

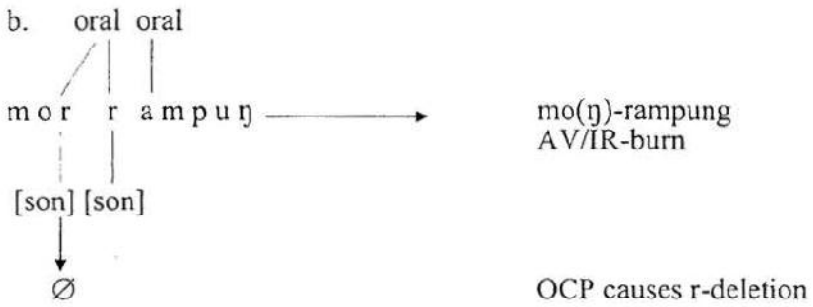
OCP causes lateral deletion

(25)

a.



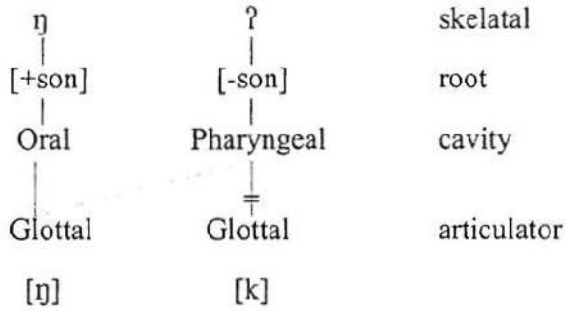
nasal assimilation
vowel harmony blocked



6.4 Glottal Assimilation (Lexical [Level 2])

Autosegmental phonology once again provides motivation for selecting the glottal stop over the voiceless velar stop [k] as underlying where they alternate. Diachronically it is clear that the glottal stop in Pendau, in many words (if not all), is a reflex of *k (see for example Kaili-Pamona languages, Martens in prep.). Positing an underlying *k for glottal stops does not work since there are minimal pairs which show contrast and there are clear instances of [k] in many other analagous environments. Following an autosegmental approach I will show that the simplest approach is to posit the glottal stop as underlying in the cases where it alternates with [k], and that when [k] appears after the velar nasal it is due to a spreading of a point of articulation to the adjacent glottal stop. The rule presented in (26) demonstrates how the point of articulation assimilates to the nasal voicing, and then delinks the constricted glottis point of articulation resulting in the back velar stop [k].

(26)



The paradigm in (27) illustrates that all of the data can be accounted for under this viewpoint. Underlying *k* can be contrasted with underlying ʔ in the environment of active voice prefixes. Underlying *k*s will delete like the other obstruents in its natural class (*p, t, k, s*) when preceded by the nasal segment (voiceless obstruent deletion rule).[7] Whenever a [k] is found in the surface following a nasal segment (in this particular boundary) it has to be from an underlying glottal stop. This can also be verified by other affixes which end in a vowel. The glottal stop remains a glottal stop intervocalically.[8]

[7] This phonological process is not isolated to Pendau. The same process that assimilates the glottal stop to the voicing in Pendau occurs in the neighboring Kaili-Pamona group. In Da'a and Ledo (Kaili languages) voiceless obstruents assimilate the voicing of an affixed nasal. It is also clear that the two sets of data reflect two different historical stages of Pendau. Those with *k* probably reflect borrowing at a later stage, as Bill Foley pointed out during the AFLA7 conference.

[8] Glottal stops appear to have a different range in the Kaili languages. Many cognates words between Da'a and Pendau for example contrast *k*s and glottal stops, as in *kayu* and *'ayu* 'wood, tree' respectively. The Da'a data is from Barr's lexicon database, personal communication, and Barr 1990; also compare Ledo data in Ghani Hali 1990.

(27)

gloss	*root*	*AV/IR*	*IV/IR*	*IV/RE*
bring	'omung	mongkomung	ro'omung	ni'omung
call	'ai	mongkai	ra'aia'	ni'aia'
shave	'our	mongkour	ro'our	ni'our
cut, break	'olog	mongkolog	ro'olog	ni'olog
scratch	'a'ar	mongka'ar	ra'a'ar	ni'a'ar
type	ketik	mongetik	reketik	niketik
file	kikir	mongikir	rekikir	nikikir
carry	kova	N/A	rokova	nikova

7. Lexical Phonology Levels (Strata) in Pendau

Lexical phonology splits the phonology into two modules: the lexical and the post-lexical modules. Phonological processes within the lexical module apply in a cyclic manner. In figure 3 I have proposed three levels for the Pendau lexical phonology.

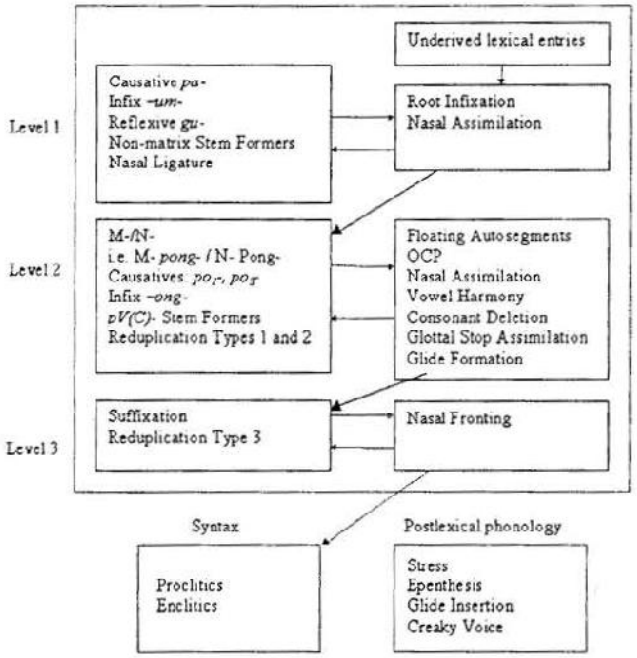


Figure 3. Levels in Pendau Lexical Phonology

The Strict Cycle Condition and the Elsewhere Condition both apply at all levels within the lexical module. The Elsewhere Condition allows disjunctive phonological rules to apply the more specific or idiosyncratic rules when there is a choice between two rules that would apply. The Strict Cycle Condition allows phonological processes to be recycled such as vowel harmony and resyllabification as additional affixes are combined into a word. The Strict Cycle Condition is a complex formulation that has solved complex problems in phonology and solves an apparent conflict in Pendau phonological rules as well. Goldsmith provides a simplified statement of the formulation (1990:223; see Kenstowicz 1994:208 for a more formal statement):

> ...a rule must apply to phonological material at the first chance – the first cycle – or else for ever hold its peace, and must never return to that earlier cycle to have an effect.

Each morphological non-root formative (i.e. affixes) is associated with a particular level and is added at the appropriate level for the word formation process, and not at the beginning of the entire lexical module. All lexical derivations go through each level (see Kenstowicz 1994:214). Each level has phonological rules that interact cyclically with each applicable process for that particular string sequence (the Strict Cyclicity Rule and Elsewhere Condition constraining the overall procedures). After all phonological processes have applied for one level than the bracket erasure convention is applied on those formatives which have been affected. The bracket erasure invokes resyllabification where that is applicable. The output of each level is a "lexical item" (as defined by Kenstowicz 1994:214). Later levels must interact with the new string output as a whole unit.

Earlier levels in the word formation process are assigned affixes closer to the root. Level 1 in Pendau has the more idiosnycratic processes such as nasal ligature assimilation as well as the *pa-* causative, the *gu-* reflexive, the infixation of the *–um-* aspectual infix, etc. These are all affixes close to the root. Nasal assimilation is the only feature changing phonological process in level 1 (notice that it also applies in level 2; phonological processes may apply in adjacent levels, see Katamba 1993:140).

Level 2 has the greatest number of affixes assigned to it and also has the greatest number of phonological processes which can apply. The affixes assigned to level two are *pV(C)-* stem formers, causatives po_1-, po_3-, the infix *–ong-* and the reduplication types 1 and 2. Feature changing phonological processes which apply here are vowel harmony, nasal assimilation, glottal stop assimilation, voiceless consonant deletion, the application of the obligatory contour principle (OCP), and template copying for reduplication types 1 and 2. Some processes such as vowel harmony are iterative as they may apply to more than one affix.

Examples of word formation processes at level 2 are illustrated in example (28). The first cycle deals with the root (see Kenstowicz 1994:208-209), but none of these phonological processes are applicable to the root (or stem). Cycle 2 applies vowel harmony and nasal assimilation processes on the words that will be output as *momaresa* 'check' and *mangabut* 'weed, clear'. Blanks (indicated by dashes) are rules inapplicable at that cycle for those formatives. Vowel harmony and nasal assimilation have to be on the same level. If nasal assimilation applied at a previous level to vowel harmony then vowel harmony would be blocked in all words (not just those with underlying consonant sequences) since the bracket erasure convention would erase the affix boundary from the word base, and vowel harmony could never apply. Sample derivations of nasal assimilation, vowel harmony (and blocking), and voiceless consonant deletion are provided in (28).

(28)

[moŋ] [paresa]	'check'	[moŋ] [abut]	'clear, weed'	Cycle 1 (Level 2)
---		---		Nasal Assimilation
---		---		Vowel Harmony
---		---		Vl. Cons. Deletion
---		---		Glottal Stop Assim.
---		---		Glide Formation

		Cycle 2 (Level 2)
[mom] [paresa]	----------	Nasal Assimilation
(blocked)	[maŋ] [abut]	Vowel Harmony
[mom] [aresa]	----------	Vl. Cons. Deletion
----------	----------	Glottal Stop Assim.
----------	----------	Glide Formation
[momaresa]	[maŋabut]	Bracket Erasure, Resyllabification

In Pendau not all voiceless consonants are deleted in apparently the same environment, however the application of the Strict Cycle Condition (SCC) easily resolves this issue. The sample derivation in (29) demonstrates that the harmonic stative causative prefix *po$_1$-* remains unaffected by the voiceless consonant deletion rule. The roots *lalo'* 'deep' and *ide* 'small' are causativized and mean 'deepen' and 'decrease' respectively. Cycle 2 can only refer to information between the [po] [ide] boundaries, and so only vowel harmony applies. Cycle 3 can only refer to information between the [moŋ] [pe] and the nasal assimilation applies, but then nasal assimilation blocks the vowel harmony from applying (see §6). Voiceless consonant deletion cannot apply because the segments in [pe] were already affected in an earlier cycle (cycle 2).

(29)

[moŋ] [po] [lalo']	'deep'	[moŋ] [po] [ide]	'small'	Cycle 1 (Level 2)
----------		----------		Nasal Assimilation
----------		----------		Vowel Harmony
----------		----------		Vl. Cons. Deletion
----------		----------		Glottal Stop Assim.
----------		----------		Glide Formation
				Cycle 2 (Level 2)
----------		----------		Nasal Assimilation
[moŋ] [pa] [lalo']		[mom] [pe] [ide]		Vowel Harmony
----------		----------		Vl. Cons. Deletion
----------		----------		Glottal Stop Assim.
----------		----------		Glide Formation
				Cycle 3 (Level 2)
[mom] [pa] [lalo']		[mom] [pe] [ide]		Nasal Assimilation
(blocked)		(blocked)		Vowel Harmony
----------		----------		Vl. Cons. Deletion
----------		----------		Glottal Stop Assim.
----------		----------		Glide Formation
[mompalalo']		[mompeide]		Bracket Erasure

The derivation in (30) shows the interaction between level one and level two and demonstrates the need for assigning the causative prefix *pa-* to a different level than the other causative prefixes. Since the voiceless consonant in *pa-* deletes it cannot be in the same level as the *po$_1$-* causative prefix, since the SCC would prohibit the deletion of this consonant. This supports the lexical phonology model where bracket erasure at the end of a level, level 1 in this case outputs in essence a "lexical item" and enters the next level as a

unit. This will then allow the initial voiceless consonant to delete as it does in words like *paresa* 'check' (see the derivation in (30)). The causative prefix *pa-* changes the lexical meaning of *guru* 'learn' to *paguru* 'teach' and *inang* 'eat' to *painang* 'feed'.

(30)

[moŋ] [pa] [guru] 'learn'	[moŋ] [pa] [inaŋ] 'eat'	Cycle 1 (Level 1)
----------	----------	Nasal Assimilation
[moŋ] [paguru]	[moŋ] [painaŋ]	Bracket Erasure
		Cycle 1 (Level 2)
----------	----------	Nasal Assimilation
----------	----------	Vowel Harmony
----------	----------	Vl. Cons. Deletion
----------	----------	Glottal Stop Assim.
----------	----------	Glide Formation
		Cycle 2 (Level 2)
[mom] [paguru]	[mom] [painaŋ]	Nasal Assimilation
(blocked)	(blocked)	Vowel Harmony
[mom] [aguru]	[mom] [ainaŋ]	Vl. Cons. Deletion
----------	----------	Glottal Stop Assim.
----------	----------	Glide Formation
[momaguru]	[momainaŋ]	Bracket Erasure

Going back to level one will provide the motivation for explaining why vowel harmony is blocked by nasal assimilation when there are consonant sequences for the active voice prefixes *mong-/nong-* but vowel harmony is allowable for certain cases such as for classifiers (see §6.1). So a combination of theoretical insights from lexical phonology and autosegmental phonology provide a powerful, motivating and elegant solution to the vowel harmony blocking problem.

8. Vowel Harmony in Western Austronesian Languages

Vowel harmony exists in several Western Austronesian languages, however there has never been a diachronic overview of the historical relationship of this interesting phonological phenomenon or a systematic study or survey. It appears that vowel harmony may have been an innovation that occurred at some point in the history of these languages. Languages in Sabah, Malaysia are noted to have vowel harmony. Hurlburt (1988) mentions briefly vowel harmony in Eastern Kadazan where the root vowels are affected by affixes (i.e. the root vowel(s) harmonize to a specific vowel in a prefix or a suffix). Boutin (1988, 1994) mentions vowel harmony in Bonggi (also called Banggi) which has some similarities to Pendau and Balantak. Kroeger (1994) mentions vowel harmony in Kimaragang, and it is clear from the pronoun and verbal systems in Sabah that there are a lot of similarities between some Sabah languages and of languages in Central Sulawesi. Balantak, a Saluan language in eastern Central Sulawesi has vowel harmony in prefixes and suffixes (see Busenitz 1991, 1994). Lauje and Tialo have similar vowel harmony as Pendau (Whatley nd. and 1984; Himmelmann 1991; Yoshimura in prep.). Vowel harmony in the Tomini-Tolitoli group is a striking phonological characteristic of the verbal system of many if not all of these languages. In light of indications that this is a significant group characteristic, the historical and comparative implications demands a close look at the data

and a detailed investigation over these Western Austronesian languages. Historical comparativists should welcome an additional phonological feature that will lend another criterion to reconstruction and increase the accuracy of their methodology.

Van den Berg has proposed a verbal reconstruction for Proto-Celebic (1991, 1995; see figure 4 below; also compare Mead 1997, 1999). Vowel harmony phenomena should provide a more detailed explanation for the Proto-Celebic verbal marking system. Some readjustment of his proposal will be required in light of the major use of vowel harmony in the Tomini-Tolitoli group. Van den Berg (1991:4) states: "Most modern Celebic languages have verb classes marked by *ma-/mo-/me-*, some of which appear to have semantic or grammatical correlates (notably transitivity), but usually with a large degree of randomness. Data from the Tomini languages suggest that these classes may have developed from an earlier partial vowel harmony system." In the Kaili-Pamona languages it is clear that vowel harmony has littered the prefix system in the Da'a and Ledo (Kaili languages) and left it non-productive (see Barr 1988 and Evans personal communication). It is hard to imagine that vowel harmony did not precede the Kaili languages at an earlier proto stage which overarches Kaili and the Tomini-Tolitoli groups (again compare figure 4, since the Proto-Celebic is essentially the same as the Kaili language affixes). Noting that vowel harmony appears in several Western Austronesian languages is more than curious. It suggests that either vowel harmony was an important part of the protolanguage or that there is as yet some unexplained phonological motivation (or both?) similar to tonogenesis that creates this phenomenon. The rapid growth of phonological theory has already made an impact in our understanding of the processes of vowel harmony.

	Proto-Celebic	Pendau
Active Voice	mo-/no- ma-/na- me-/ne-	mong-/nong- (mang-/nang-, meng-/neng-)
Dynamic	Ø-/Ø- me-/ne- mo-/no-	me-/ne-
Stative	Ø-/Ø- ma-/na- mo-/no-	mo-/no- (ma-/na-, me- /ne-)

Figure 4. Some Proto-Celebic Verbal Prefixes Compared with the Cognate Pendau Prefixes (parentheses indicate Pendau Vowel Harmony; Proto-Celebic Affixes based on van den Berg 1995)

This discussion has provided extensive data of vowel harmony in Pendau. The large number of prefixes that are harmonic provides an interesting showcase for vowel harmony. Theoretical implications of vowel harmony as described for Pendau should provide further fodder for phonological theoreticians as well as for historical and comparative researchers.

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