Vowel Harmony in Tunen

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0. Introduction *

Tunen is spoken in Cameroon around Ndikinimeki (NE of Duala) by approximately
35,000 people. It is a Bantu language, A.44 in Guthrie's classification.
Tunen has been claimed by Stewart and Van Leynseele (1979) to have, underlyingly
at least, vowel harmony of the cross-height type characteristic of West Africa.
There are very few Bantu languages of that type and there is no existing
detailed study of the vowel harmony of any of them. My aim in this paper is to
give a detailed description of vowel harmony in Tunen and discuss some theoreti-
cal problems that arise in describing it. The available data on Tunen are
contained in a wordlist (DL) and a grammar by Dugast.

Tunen has eight vowels, /i, e, ɛ, a, ə, ɔ, o, u/, which are classifiable in
terms of binary features as follows:

Table 1: Binary features and segment structure conditions for vowels

	i	e	ɛ	a	ə	ɔ	o	u	
high	+	-	-	-	-	-	-	+	NOT: [+high, -ATR][1]
low	-	-	-	+	+	-	-	-	NOT: [+high, +low]
round	-	-	-	-	-	+	+	+	NOT: [+round, +low]
ATR	+	+	-	-	+	-	+	+	

1. Vowel harmony in roots

1.1. *Non-adjacent vowels in roots*

The data for vowel harmony within roots comprises the disyllabic noun roots in
the wordlist. Verb roots are not suitable for this purpose, because they are
mostly monosyllabic. With a few exceptions, polysyllabic verb stems include a
derivational suffix. The number of disyllabic verb stems that are not derived
is too small to permit conclusions on vowel cooccurrences. Nouns are written
with their noun prefix in the word list, e.g. bòhota, pl. mà- 'hair' (DL:19).

The shape of the root is always clear (in this example -hòtà). I have disregarded
noun stems which are disyllabic by virtue of reduplication. This procedure has
resulted in a list of 484 disyllabic noun roots. Possible vowel cooccurrences
for non-adjacent vowels have been checked and are presented in table 2.

Table 2: Non-adjacent vowel cooccurrences in disyllabic noun roots

second v.	ɪ	ɛ	ə	a	o	ɔ	u
first v: ɪ	x	-	x	-	-	-	-
ɛ	-	x	-	x	-	-	-
ə	x	-	x	-	-	-	x
a	-	x	-	x	x	-	-
o	x	-	-	x	x	-	-
ɔ	-	x	-	-	-	x	-
u	x	-	x	-	-	-	x

Where x means "does occur", and - means "does not occur".

The vowel e is rare in roots. My informant has ɛ where Dugast notes e, or, in
some other roots e as an optional variant of ə which must be captured by a late
phonological rule. The non-occurrence of e is captured by Well Formedness
Condition 1.

WFC 1:   NOT: $\begin{bmatrix} +voc \\ -round \\ -low \\ -high \\ +ATR \end{bmatrix}$

Apart from roots containing o, [+ATR] and [-ATR] vowels do not cooccur in one
root. Thus, apart from o, non-adjacent vowels in roots agree in their ATR value.
This is captured by Well Formedness Condition 2.

WFC 2:   NOT: $\quad$ V $\qquad$ C $\qquad$ V

$$\begin{Bmatrix} [+high] \\ [+low] \\ \begin{bmatrix} -low \\ -ATR \end{bmatrix} \end{Bmatrix} \quad \begin{Bmatrix} [+high] \\ [+low] \\ \begin{bmatrix} -low \\ -ATR \end{bmatrix} \end{Bmatrix}$$

$$[\alpha ATR] \qquad\qquad [-\alpha ATR]$$

Well Formedness Condition 2 is not sufficient to account for all the vowel
cooccurrences and non-cooccurrences in table 2. Other necessary well formedness
conditions are:

WFC 3: NOT:
$$\text{V} \begin{bmatrix} -\text{round} \\ -\text{low} \end{bmatrix} \quad \text{C} \quad \text{V} \begin{bmatrix} +\text{round} \end{bmatrix}$$

WFC 4: NOT
$$\text{V} \begin{bmatrix} +\text{round} \\ \alpha\text{high} \\ \beta\text{ATR} \end{bmatrix} \quad \text{C} \quad \text{V} \begin{bmatrix} +\text{round} \\ -\alpha\text{high} \\ -\beta\text{ATR} \end{bmatrix}$$

WFC 5: NOT:
$$\text{V} \begin{bmatrix} +\text{round} \\ -\text{high} \end{bmatrix} \quad \text{C} \quad \text{V} \begin{bmatrix} -\text{round} \\ +\text{ATR} \end{bmatrix}$$

WFC 6: NOT:
$$\text{V} \begin{bmatrix} -\text{round} \\ +\text{ATR} \end{bmatrix} \quad \text{C} \quad \text{V} \begin{bmatrix} +\text{round} \\ -\text{high} \end{bmatrix}$$

Note that the feature [round] is present in all these four conditions and that
WFC 6 is exactly the mirror-image of WFC 5. These sequence structure conditions
are also valid for noun roots with more than two syllables, for noun roots with
a final vowel that is voiceless or deleted in citation form, and for verb roots.
The restrictions of well formedness conditions 3, 4, 5, and 6 do not operate
across morpheme boundaries.

1.2. *Adjacent vowels in roots*

The vowel cooccurrences for *adjacent* vowels within roots are presented in table 3.

Table 3. Adjacent vowel cooccurrences in roots

	second v: i	ε	ə	a	o	ɔ	u
first v: ɪ	⁻	⁻	×	×	×	×	⁻
ε	⁻	⁻	⁻	⁻	⁻	⁻	⁻
ə	⁻	⁻	⁻	⁻	⁻	⁻	⁻
a	⁻	⁻	⁻	⁻	⁻	⁻	⁻
o	⁻	⁻	⁻	(×)	⁻	⁻	⁻
ɔ	(×)	(×)	⁻	(×)	⁻	⁻	⁻
u	×	×	×	×	⁻	⁻	⁻

Where (×) means "occurs only in a few cases", which are treated as
exceptions. These exceptions are:

(1)   èɪòàk   'germ'
        èɪóá yé   'to, for (prep.)'
        hòàt   'to take a propitious position'
        hɔàlɛ̀n   'to stand up'
        hɔ̀anJ   'to scratch'
        hɔ̀ɛ̀ɪ   'god'
        hɛ̀tɔ̀ɪ̀ɲ   'trial by ordeal'

Instead of hɔèl my informant had hwèl, and instead of èlɔ́á yé, èlwá yé. The
other words were not familiar to him. Apart from those exceptions one can make
the generalization that the first of two adjacent vowels must be high.

   Whereas Dugast transcribes the first segment of these VV sequences as a
(high) *vowel*, I heard a *glide* generally. Dugast herself writes a glide in a
number of cases (e.g. bwà = /bò+à/ 'year, class 14', DL:29). I would therefore
prefer to analyse the first of two adjacent vocoid segments as a glide. This
has some other advantages. It makes the possible syllable structures simpler,
i.e. V, CV, GV, or CGV. And it does away with disharmonic VV sequences.
Instrumental phonetic measurements are needed to answer the question whether
there is an opposition vowel versus glide in the context C__V. For the moment
I shall assume that there is no such opposition and analyse these segments as
glides. This means that there are no VV sequences, as is stated in Well Formedness
Condition 7.

WFC 7:   NOT: V V

Futher restrictions are captured by Well Formedness Condition 8 which excludes
/ıi/ and /iɛ/, and Well Formedness Condition 9 which excludes /uɔ/, /uo/,and /ʋu/.

WFC 8:   NOT: $\begin{bmatrix} \text{-cons} \\ \text{-round} \end{bmatrix}$ $\begin{bmatrix} \text{-cons} \\ \text{-round} \\ \text{-low} \end{bmatrix}$

WFC 9:   NOT: $\begin{bmatrix} \text{-cons} \\ \text{+round} \end{bmatrix}$ $\begin{bmatrix} \text{-cons} \\ \text{+round} \end{bmatrix}$

2. Vowel harmony in affixes

2.1. *Recessive suffixes and the word structure condition*

Verbs can have derivational suffixes that are attached to the verb stem. One of
those is the applicative suffix /-ɛn/ 'to do for someone'. It has the form
after [-ATR] verb roots and in after [+ATR] verb roots. For example:

(2)   fàlàb   'to build'   fàlàbɛn   'to build for somebody'
       fèŋ   'to exchange'   fèŋìn   'to exchange for somebody'
       fɔ̀l   'to borrow'   fɔ̀lɛ̀n   'to borrow for somebody'
       húk   'to blow'   húkín   'to blow for somebody'

The alternation [ɛ] with [ɩ] in the applicative suffix is straightforward. The underlying form is /ɛn/ which becomes [+ATR] after [+ATR] roots. As a consequence of WFC 1, a [-low, +ATR] vowel must be [+high], the [+ATR] variant of ɛ is ɩ.

   This could be handled by a phonological rule along the lines proposed by Anderson (1980).

$$[-ATR] \rightarrow [+ATR] / [+ATR] C \underline{\quad}$$

However, we would have two independent statements for the vowel harmony, a well formedness condition (WFC 2) and a P-rule. Clements objects to this (Clements 1981:125-26). "Within Schachter and Fromkin's framework, it is entirely acciden-tal that the same set of restrictions on vowel cooccurrence should apply internally in roots and externally across morpheme boundaries". This, among other reasons, leads Clements to a non-linear treatment of vowel harmony in Akan, with ATR autosegments on a separate autosegmental tier. Clements' objection can be met without rejecting the linear framework, as Stewart (1983) shows for Akan. Stewart's proposal is to extend the scope of the structure condition from the morpheme to the word. To meet an obvious difficulty which this creates, he introduces automatic rules (A-rules) which state how the structure conditions are met when morphemes are combined to form a word. I will follow this line. Thus we will extend Well Formedness Condition 2 to the word· all vowels in the word, except o, must agree in their value for ATR. However, we have to state explicitely how the well formedness condition is met. In the above examples, changing the root vowels to [-ATR] would be another theoretically possible way to meet the structure condition, and we have to make clear that taht does not in fact happen. Therefore we have to add an A-rule to state that vowels become [+ATR] in order to meet the well formedness condition.

WFC 2: NOT. V C V   A 2: V → [+ATR]

$$
\begin{array}{cc}
\left\{ \begin{array}{c} [+high] \\ [+low] \\ \left[\begin{array}{c} -low \\ -ATR \end{array}\right] \end{array} \right\} &
\left\{ \begin{array}{c} [+high] \\ [+low] \\ \left[\begin{array}{c} -low \\ -ATR \end{array}\right] \end{array} \right\} \\
[\alpha ATR] & [-\alpha ATR]
\end{array}
$$

In the same way Well Formedness Condition 1 needs an A-rule. It is theoretically possible to make a vowel round in order not to violate WFC 1, but this is not what happens. A vowel becomes high to meet WFC 1, as we have seen in the applica-

tive suffix.

WFC 1: NOT: V   A 1. V → [+high]
$$\begin{bmatrix} \text{-round} \\ \text{-low} \\ \text{-high} \\ \text{+ATR} \end{bmatrix}$$

The well formedness conditions are a set of unordered conditions that apply simultaneously at every stage in the derivation. They can be viewed as filters. As a consequence the automatic rules that go with them are also unordered. The well formedness conditions 1 and 2 now give the correct results for the examples of the applicative suffix above:

(3)   fàlàb+èn   WFC 1 and 2 are met: fàlàbèn
       fèŋ+èn   WFC 2 is not met, A2: fèŋèn, WFC 1 is not met, A1: fèŋìn
       fɔ̀l+èn   WFC 1 and 2 are met: fɔ̀lèn
       húk+én   WFC 2 is not met, A2: húkén, WFC 1 is not met, A1: húkín

For vowel final verb roots we can follow the same procedure and extend Well Formedness Conditions 7, 8, and 9 to the word with accompanying automatic rules:

A 7a: [+low]   → ∅ / __ V   A 7b: [-low] → $\begin{bmatrix} \text{-voc} \\ \text{+high} \end{bmatrix}$ / __ V

A 8:   [-round] → ∅ / __ V

A 9:   [+round] → ∅ / __ V

(4)   fà+èn   WFC 7 is not met, A7a: fèn 'to fall'
       hɔ́+én   WFC 7 is not met, A7b: hwén 'to finish'
       bè+èn   WFC 8 is not met, A8: bèn 'to pull down'

The vowel of the suffix has to harmonize. The harmony condition, WFC 2, as it is stated, only applies to non-adjacent vowels. The WFC 2 can easily be extended to adjacent vowels if we replace C by C_0 where C_0 can be series of consonants or the absence of consonants. Well Formedness Conditions 7, 8, and 9 apply simultaneously.

(5)   íì+èn   WFC 2 is not met, A2: íìèn, WFC 1 is not met, A1: íìin,
                WFC 8 is not met, A8: íìn 'to win'
       bə̀+èn   WFC 2 is not met, A2: bə̀èn, WFC 1 is not met, A1: bə̀ìn,
                WFC 7 is not met, A7: bìn 'to reward'

Other verbal suffixes that behave similarly are -ɛm stative suffix, -ɛ neuter
suffix, -ɛnən reciprocal suffix.

2.2. *Dominant suffixes and the double nature of* o

The causative suffixes -ı and -əsı and the simultaneous suffix -ənı change the
[-ATR] vowels in the verb stem into their [+ATR] counterparts. For example:

(6) fàlàb+ì   WFC 2 is not met, A2: fəlàbì   'let build'
     fɛ́f+ì   WFC 2 is not met, A2: fífì   'make blow'
     fɔ̀l+ì   WFC 2 is not met, A2: fòlì   'cause to lend'

In some verb roots o changes to u if a dominant suffix, i.e. a suffix containing
a [+ATR] vowel, is attached to the root. In other verb roots the o does not
change:

(7) kòl 'to go and buy   causative: kòl+ì   → kùlì
          protective medicine' applicative: kòl+ɛ̀n → kòlɛ̀n
     kòl 'to create'   causative: kòl+ì   → kòlì
                                applicative: kòl+ɛ̀n → kòlìn

We need a phonological rule changing o to u if followed by a [+ATR] vowel in
the word:

P1. $\begin{bmatrix} +\text{voc} \\ +\text{round} \\ +\text{ATR} \\ -\text{high} \end{bmatrix} \rightarrow [+\text{high}] \; {}^{\emptyset}_{\emptyset} \_\_ C_0 \, [+\text{ATR}]$

P1 is a mirror image rule because the inversive suffix, -on, changes to -un
after verb stems with a [+ATR] vowel, e.g.

(8) tál 'to put down'   tálón 'to lift'
     fə̀ŋ 'to exchange'   fə̀ŋùn 'to give back the exchange'
     tìŋ 'to tie'   tìŋùn 'to untie'

Verbs like kòl 'to create' are marked [-P1], in order not to change to *kùlì
with a causative suffix. Note that the applicative suffix ɛn changes to ìn
after the verb root kòl 'to create'. This instance of vowel harmony is not
handled by WFC 2 since o is excluded from the harmony condition. We need a
phonological rule that changes ɛ to ì. For this aim P1 can be extended.

Similar changes occur with noun prefixes, as we shall see in 2.3, which can be handled with the same P1 because it is a mirror image rule.

$$
P1: \quad \left[\begin{array}{l} +voc \\ -high \\ \left\{ \begin{array}{l} \left[\begin{array}{l} +round \\ +ATR \end{array} \right] \\ \left[\begin{array}{l} -round \\ -low \end{array} \right] \end{array} \right\} \end{array} \right] \rightarrow [+high] \;\% \; \_\_ \; C \; [+ATR]
$$

Roots like kòl 'to create' do not *undergo* P1 (causative is kòlì) but can *condition* it (applicative is kòlìn).We have to make a distinction between rule undergoer and rule conditioner. Roots that contain a dominant o, like kòl'to create' will be labeled [-P1 undergoer] and [+P1 conditioner]; roots that contain a recessive o, like kòl 'to go and buy protective medicine' will be labeled [+P1 undergoer] and [-P1 conditioner]. For example:

(10)   kòndèn [+P1 undergoer,-P1 conditioner] + ì → kùndìnì 'arrive at the top'
        bákón [+P1 undergoer,-P1 conditioner] + ì → bʷə́kúnì 'separate'

It seems to be possible to do with just one rule feature and a structure condition: [+P1 undergoer]   [-P1 conditioner]. There is, however, some confusion in the language due to the different behaviour of morphemes containing o. Some verb stems containing o are irregular: they take ɛn for the applicative ([-P1 conditioner]), but do not change to u with a causative suffix ([-P1 undergoer]). See table 4.

Table 4: Irregular causatives after o

stem	meaning	applicative	causative 1	causative 2
óbɛ́m	to brood	óbɛ́mɛn	óbími∿óbɛ́mɛ	
fátón	to open	fátónɛn	fátónì	fátónə̀sì
ónɟwàn	to blow	ónɟwànɛn	ónɟwènì	onɟwànə̀sì
álòbòtòn	to answer summons	álòbòtònɛn	álòbòtònì	álòbòtònə̀sì
bótán	to multiply		bótə́nì	
lòbòn	to weed	lòbònɛn	lòbùnì	lòbùnə̀sì
nótɛ́n	to compel	nótɛ́nɛn	nótínì	
sómbán	to be equal	sómbánɛn	sómbʷə́nì	
yòbɛ̀	to do it carelessly	yòbɛn	yòbì	yòbə̀sì
bɛ́lóŋóm	to listen carefully	bɛ́lóŋómɛn	bɛ́lóŋómì	
sókóm	to work in vain	sókómìn	súkúmì	súkúmʷə̀sì

Win Zonneveld has argued that this usage of rule environment features is
illegitimate. The rule environment features are part of the *morpheme*, and, by
convention, each segment in the morpheme has the feature specification for
these rule environment features. In our example, kòndèn [-P1 conditioner, +P1
undergoer] the feature specification [-P1 conditioner] on the n in the stem
will block P1 on the preceding o contrary to the feature specification [+P1
undergoer] of this o. Other arguments forwarded by Zonneveld against rule
environment features are: The feature [-rule undergoer] will block a rule
whether it is part of a lefthand environment or of a righthand environment; it
makes no difference with respect to the *direction* of the blocking. Secondly,
if an exceptional morpheme contains both the focus and the environment of the
rule, it becomes arbitrary to mark it [-rule conditioner]or [-rule undergoer],
e.g. a French word like album, where the vowel is unexpectedly not nasalized,
might be labelled either [-nasalization undergoer] or [-nasalization conditioner].
Zonneveld's proposal is to handle these exceptions with alphabet features. A
feature, say [+R], will be added to the lexical representations of certain
morphemes, and segments in such a morpheme sill undergo rules that have [+R] in
their structural description. He futher claims the following constraint on
overapplication of alphabet features (One Feature Hypothesis). If alphabet
features are braced into phonological rules, they may be collapsed with only
one feature at a time. (Zonneveld 1978.181-233).

   Let us apply this proposal to our analysis. Some cases of o change to u in
a [+ATR] environment. These morphemes are marked [+R] (recessive) in the lexicon.
And [+R] becomes part of the focus of P1:

$$
\text{P1:} \quad
\begin{bmatrix}
+\text{voc} \\
-\text{high} \\
-\text{low} \\
\left\{ \begin{matrix} [-\text{round}] \\ [+\text{R}] \end{matrix} \right\}
\end{bmatrix}
\rightarrow [+\text{high}] \; \% \underline{\quad} \; C_0 \begin{bmatrix} -\text{R} \\ +\text{ATR} \end{bmatrix}
$$

Prefixes containing e are labelled [+R] too (see 2.3). As a consequence all dis-
harmonic vowels, instances of e and o in a [-ATR] environment, are marked [+R].
Thus WFC 2 can be restated:

$$
\text{WFC 2} \quad \text{NOT.} \quad \begin{matrix} V \\ \begin{bmatrix} -R \\ \alpha ATR \end{bmatrix} \end{matrix} \; C_0 \; \begin{matrix} V \\ \begin{bmatrix} -R \\ -\alpha ATR \end{bmatrix} \end{matrix} \qquad \text{A 2.} \quad V \rightarrow [+\text{ATR}]
$$

All morphemes that are not marked [+R] are marked [-R] by convention. Note that
the change from ε to ı in the applicative suffix which was handled by the
automatic rule of WFC 1, is now also covered by P1. We can therefore restrict
WFC 1 to non-grammatical morphemes.

2.3. *Vowel harmony in noun prefixes*

Like all Bantu languages Tunen has a noun class system which assigns paired
singular-plural prefixes to all nouns in the language. The noun class prefixes,
with their standard Bantu numbers are presented in table 5.

Table 5. Noun class prefixes

singular class				plural class			
	prefix before -ATR stem		prefix before +ATR stem		prefix before -ATR stem		prefix before +ATR stem
1	mò		mù	2	bà		bwə̀
3	mò		mù	4	mè		mì
	ò		ù		è		ì
5	nè		nì	6	mà		mwə̀
7	è		ì	8	bè		bì
9	mè		mì	4			
	è		ì				
19	hè		hì	13	tò		tù
14	bò		bù	6			

Note that labial consonants are rounded before ə.

The alternation a ∿ ə in prefixes of classes 2 and 6 is straightforward and
handled by WFC 2 and its A-rule. The same holds for the prefix of class 13, hè ∿
hì, which is also regular (identical to the alternation in the applicative
suffix). The alternation o ∿ u in the prefixes of classes 1, 3, 13, and 14 is
similar to the inversive suffix, see (8) above. So the change from o to ʋ
before [+ATR] stems in these prefixes is acounted for by P1; the prefixes are
labelled [+R].

   The remainder of the noun class prefixes, class 4, 5, 7, 8, and 9, have an e
in their underlying form. This is not excluded by WFC 1, since we have now
restricted WFC 1 to non-grammatical morphemes. The change from e to ı can be
handled by P1 because the input of P1 includes e, [-round] and [-low]. These
prefixes are labelled [+R]. Some sample derivations are·

(11)   màɨbàt   All WFC's are met, P1 does not apply: màbàt 'clothes, cl.6'
       mà+kɘ̀nù   WFC 2 is not met, A2: màkɘ̀nù → mʷɘ̀kɘ̀nù 'bellows, cl.6'
       hɛ̀+bɔ̀b   All WFC's are met, P1 does not apply: hɛ̀bɔ̀b 'ring, cl.19'
       hɛ̀+bìl   WFC 2 is not met, A2: hɛ̀bìl , P1 applies: hìbìl 'bracelet'
       mò[+R]+nìf WFC 1,2 do not apply. P1 does: mùnìf 'whirlpool, cl.3'
       mè[+R]+nìf WFC 1,2 do not apply. P1 does: mìnìf 'whirlpools, cl.4'
       bò[+R]+hɛ̀k WFC 1,2 do not apply, nor P1: bòhɛ̀k 'beauty, cl.14'
       è[+R]+bò   WFC 1,2 do not apply. P1 does: ìbò 'nine, cl.7' P1 does not
                   reapply on ò because ò is [+ATR, -R].
       e[+R]+bòk[+R] WFC 1,2 do not apply, nor P1 because ò is [+R]:èbòk
                   'mortar, cl.7'
       mò[+R]+ɛ̌b   WFC 1,2 do not apply, WFC 7 does, A7. mwɛ̌b 'termite, cl.3'
       mè[+R]+ɛ̌b   WFC 1,2 do not apply, WFC 7,8 do, A8. mɛ̌b 'termites, cl.4'

There is a tendency in the noun prefixes for e, [+R], to become ɛ before [-ATR]
stems. This tendency is complete in the class 19 prefix hɛ̀. In other class
prefixes this is an "incidental" assimilation. The assimilation is most frequent
before stems with an ɛ as the first vowel, less frequent before stems which have
an ɔ as the first vowel and rare with an a as first stem vowel. This assimilation
is parallel to the assimilation of class 14 prefix bò- to bɔ̀- before certain
stems with a mid [-ATR] vowel as first stem vowel. Similarly mà- becomes mɔ̀-
before some stems in class 6 with ɔ as the first stem vowel and mʷè- varies with
mɔ̀- before a few stems containing a dominant o ([-R]). There is a lot of variation
in these assimilation processes and both forms, assimilated or not assimilated,
are acceptable in the majority of cases.

2.4 *Vowel harmony in pronominal prefixes*

Apart from nouns a number of other words have class prefixes. They show agreement
in noun class with the governing noun. Demonstratives, possessives, connectives,
numerals, question words, and pronouns agree in class by their pronominal prefix
with the noun to which they refer. Unlike other Bantu languages, Tunen has no
verbal prefix that agrees with the subject. It has subject pronouns that agree in
class with the (understood) subject but a noun object can intervene between these
pronouns and the verb, so they are separated by a word boundary. There are three
different sets of pronominal prefixes which I call type 1, type 2, and type 3.
See table 6.

   Type 1 is similar in form to the noun prefixes having an initial m in classes
1, 3, 4, and 9. Type 1 is used with emphatic demonstratives and complement pro-
nouns. Prefixes of type 2 are very similar to the proto Bantu numeral prefixes
(Meeussen 1967:96-98), and are used with the numerals 'one' ('some' in plural),
'two', and the question word 'how many?' (only in the plural). Prefix type 3 is

similar to the proto Bantu pronominal prefix (Meeussen 1967:96-98). It is used
for possessives, non-emphatic demonstratives, connectives, subject pronouns,
relative pronouns, and questionwords.

Table 6: Pronominal preixes

class	type 1	type 2	type 3
1	mɔ́	ɔ́	wò
2	bɑ́	bɑ́	bɑ́
3	mʉ́	ɔ́	wʉ́
4	mî	î	yî
5	nɛ́	nɛ́	nɛ́
6	mɑ́	mɑ́	mɑ́
7	yé	é	yé
8	bé	bé	bé
9	mé	é	yè
19	hî	hî	hî
13	tʉ́	tɔ́	tʉ́
14	bɔ́	bɔ́	bɔ́

The striking point for these pronominals with all three types of prefixes, is
the fact that the *prefix* can dominate the root of the pronominal in harmony. The
prefixes of classes 3, 4, 19, and 13 are underlying [+ATR][2], and all the vowels
in the word have to become [+ATR]. This can most clearly be seen with underlying
[-ATR] and consonant-initial roots like mɔtɛ́ 'one, some', fàndɛ́ 'two', and `tɑ́nɑ́
'emphatic this'. See table 7.

Table 7: Surface forms of some pronominals

class	class prefix	this	class prefix	one, some	two
1	mɔ́	mɔ́ːtɑ́nɑ́	ɔ̀	ɔ̀mɔ́tɛ́	
2	bɑ́	bɑ́ːtɑ́nɑ́	bɑ́	bɑ́mɔ̀tɛ́	bɑ́fàndɛ̀
3	mʉ́	mʉ́ːtɑ́nɑ́	ɔ́	ɔ́mòtî	
4	mî	mîːtɑ́nɑ́	î	îmòtî	îfàndì
5	nɛ́	nɛ́ːtɑ́nɑ́	nɛ́	nɛ́mɔ̀tɛ́	
6	mɑ́	mɑ́ːtɑ́nɑ́	mɑ́	mɑ́mɔ̀tɛ́	mɑ́fàndɛ̀
7	é	yéːtɑ́nɑ́[3]	é	émɔ̀tɛ́	
8	bé	béːtɑ́nɑ́	bé	bémɔ̀tɛ́	béfàndɛ̀
9	mé	méːtɑ́nɑ́	é	émɔ̀tɛ́	
19	hî	hîːtɑ́nɑ́	hî	hîmòtî	
13	tʉ́	tʉ́ːtɑ́nɑ́	tɔ́	tɔ́mɔ̀tɛ́	tɔ́fàndɛ̀
14	bɔ́	bɔ́ːtɑ́nɑ́	bɔ́	bɔ́mɔ̀tɛ́	
underlying:		`tɑ́nɑ́		mɔ̀tɛ́	fàndɛ̀

Some derivations:

(12) bá+mɔ̀tɛ́   WFC 1,2 are met: bámɔ̀tɛ́ 'some, cl.2'
      í+mɔ̀tɛ́   WFC 2 is not met, A2: ímòtɛ́, WFC 1 is not met, A1 (or P1):
                  ímòtí 'some, cl.4'
      má+mɔ̀tɛ́   WFC 1,2 are met: mámɔ̀tɛ́ 'some, cl.6'
      é⌈+R⌉+mɔ̀tɛ́ WFC 1,2 do not apply, nor P1: mámɔ̀tɛ́ 'one, cl.9'
      ó⌈-R⌉+mɔ̀tɛ́⌈-R⌉ WFC 2 does apply: ómòtɛ́,   WFC 1 is not met, A1 (or P1):
                  ómòtí 'one, cl.3'
      bó⌈+R⌉+`táná WFC 1,2 do not apply, nor P1: bó˙táná 'this (emphatic)cl.14'

Most pronominal roots are vowel initial and all the pronominal prefixes are vowel
final. The processes which apply to two abutting vowels are stated in WFC 7, 8
and 9 and are exemplified in (4) and (5) above. The different possible initial
vowels for those roots are a ɛ e i. For each of those, one example is given in
table 8, all with prefix type 3.

Table 8: Some pronominals with vowel initial stem

class	class prefix	1 sing. poss.	1 pl. poss.	that	that (far)
1	wò	wàmɛ̀	wə̀sú	wəǹí	wéyé
2	bá	bámɛ̀	bʷə́sú	bʷə́ní	báyé
3	wú	wə́mì	wə́sú	wəǹí	wíyí
4	ví	yə́mì	yə́sú	vəǹí	yíyí
5	né	nyámɛ̀	nyə́sú	níǹí	néyé
6	mə́	mámɛ̀	mʷə́sú	mʷə́ní	máyé
7	yə́	yámɛ̀	yə́sú	víǹí	yéyé
8	bé	byámɛ̀	byə́sú	bíǹí	béyé
9	vè	yàmɛ̀	və̀sú	víǹí	yéyé
19	hí	hyə́mì	hyə́sú	híǹí	híyí
13	tú	twə́mì	twə́sú	twíǹí	twíyí
14	bó	bwámɛ̀	bwə́sú	bwíǹí	bwéyé
underlying:		ámɛ̀	ə́sú	íǹí	éyé⌈+R⌉

The demonstrative stems ini and eye behave exceptionally, in that the
of the two adjacent vowels drops: A8a: V → ∅ / V __ .

(13) wò⌈+R⌉+ámɛ̀ WFC 7 is not met, A7: wwàmɛ̀→ wàmɛ̀ 'my, cl.1'
      bá+ámɛ̀   WFC 7 is not met, A7: bámɛ̀ 'my, cl.2'
      wú+ámɛ̀   WFC 2 is not met, A2: wúámɛ̀, WFC 1 is not met, A1 (or P1):
                 wúámì, WFC 7 is not met, A7: wwə́mì → wə́mì 'my, cl.3'
      né+ámɛ̀   WFC 1,2 are met, WFC 7 is not met, A7: nyámɛ̀ 'my, cl.5'
      bó⌈+R⌉+ə́sú WFC 2 does not apply, P1 does: búə́sú, WFC 7 is not met, A7:
                 bwə́sú 'our, cl.14'
      má+ə́sú   WFC 2 is not met, A2: mə́ə́sú, WFC 7 is not met, A7: mə́sú →
                 mʷə́sú 'our, cl.6'

(13)   yè⌈+R⌉+íní   P1. yìíní, WFC 7,8 are not met, A8· yíní 'that, cl.9'
         yè⌈+R⌉+éyé⌈+R⌉   P1 does not apply because the environment is not ⌈+ATR,
                          -R⌉, WFC 7,8 are not met, A8. yéyé 'that (far), cl.9'
         tú+éyé⌈+R⌉   P1· túívé, P1 túíyí, WFC 7 is not met, A7 twíyí
                          'that (far) cl.13'

3. Conclusions

Tunen has the ATR-type of vowel harmony with dominant (+ATR) suffixes and
prefixes. The vowel o in prefixes and the vowel e in a number of morphemes behave
as if they are [-ATR, +high], ɪ and ʊ . They become [+high] in a [+ATR] environ-
ment. I have preferred not to analyse them as /ɪ/ and /ʊ/ underlyingly, because
this would result in absolute neutralization of /ʊ/ and /o/ in [o]. Kiparsky
(1968) has convincingly argued against such abstractness in phonology. As a
consequence I am obliged to use a diacritic feature, an alphabet feature, to
capture the differnt behaviour of these o's.

The objection against two different statements about vowel harmony - a
condition for harmony within roots , and a rule for harmony in affixes - can be
met within the segmental framework by Stewart's (1983) proposal for the word
structure condition, see my WFC 2. The extra phonological rule needed, P1, is
a consequence of the preference for an alphabet feature over a different under-
lying phoneme plus absolute neutralization. This rule handles the harmonic
behaviour of the segments that would be underlying ⌈-ATR, +high⌉ in an abstract
analysis. The rule is somewhat cumbersome in that it says that certain segments
become ⌈+high⌉ in a (dominant) ⌈+ATR⌉ environment while the relation between
the features high and ATR is a priori unclear There is a connection in the
fact that ⌈+high⌉ vowels are ⌈+ATR⌉ but this cannot be related to it formally

Notes

1.   See the article by Thilo C. Schadeberg in this volume for preferability of
     negative conditions. ATR stands for Advanced Tongue Root.

2.   In fact the type 2 prefix of class 13 is underlyingly [-ATR].

3. This form has an exceptional initial glide.

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