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High Vowels in Turkana: Evidence for [high]

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1 Introduction

Turkana is an eastern Nilotic language spoken in northwestern Kenya. The Turkana data considered in this paper focus on the behavior of high vowels in two areas: in the creation of 'mixed' register vowels, and in the distribution of velars and uvulars. The Halle-Sagey (HS) feature geometry (Sagey 1986, Halle 1995) can account for this behavior in both cases. The first case requires that the non-contrastive [+ATR] feature of glides be accessed. The crucial assumption to account for the second case is that uvulars are [-high] and high vowels are [+high].

Since the Clements-Hume (CH) model has subsumed both [ATR] and [high] under other features (Clements 1991, Clements and Hume 1995), this paper will examine how the behavior of high vowels in Turkana can be described in this model. I hope my arguments will show that the model can successfully accommodate [+ATR] to give the desired results in the first case. However, the logic of the model makes it impossible to give a satisfactory account of all the facts of the second case. The Turkana data provide evidence for the traditional feature [high] as a feature that may used in the specification of both vowels and consonants.

The paper is organized as follows: Section 2 gives an overview of the Turkana vowel system. In particular, the presence of two 'mixed' register vowel allophones is discussed. Section 3 contains an analysis of the 'mixed' register vowels within the HS and CH frameworks. Section 4 presents the facts of the distribution of velar k and uvular q. The central observation in this section is that uvulars are incompatible with high vowels. Section 5 gives an account of this incompatibility within the two frameworks under consideration. Finally, Section 6 recapitulates the main results presented in the paper.

2 The Vowel System

Turkana is a language with cross-height vowel harmony. Vowels belong to one of two registers (there is also a full set of unvoiced vowels that is not relevant to this discussion):
As in other eastern Nilotic languages, the two registers are distinguished in terms of tongue root position and phonatory differences. Chest register vowels have an advanced tongue root, and thus are higher than the corresponding head register vowels. Chest register is also associated with breathy phonation. Head register vowels are produced with pharyngeal constriction, and often involve ‘pressed voice’. Within the HS model, the contrast between the two registers may be described as:

(2) chest register: [+ATR, +spread glottis]

(head register: [-ATR, +constricted glottis]

(possibly also [+slack vocal cords])

The phonatory characteristics associated with each register are reported to be sporadic, suggesting that whatever feature(s) describe the differences in phonation do not suffice to distinguish the registers phonologically (Trigo 1991,120). The presence of two ‘mixed’ register vowel allophones in the language also indicates that the tongue root features are phonologically independent from the laryngeal features. These vowels, transcribed by Dimmendaal (1983,28) as ‘tense’ ɛ and ɔ, do not classify as either chest or head, because they combine features from both registers. They have an advanced tongue root and ‘pressed voice’. They may be described as:

(3) ‘tense’ vowels: [+ATR, +constricted glottis]

(possibly also [+stiff vocal cords])

Synchronic and diachronic evidence suggests that these vowels are the result of partial assimilation processes in which either a distinctive pharyngeal feature ([+ATR]/[-ATR]) or a distinctive laryngeal feature ([+spread glottis]/[+constricted glottis]) has been spread to a neighboring vowel from an opposite register. The significant fact for the purposes of this discussion is that the glides ɣ and w are one of the sources for these ‘mixed’ register vowels. Dimmendaal (1981,28) suggests that the glides spread their [+ATR] feature onto a following non-high head register vowel. The low vowel also assimilates [ɑback] from the glide. The forms in (4) illustrate this process (forms in which [ɛ] is derived from /ɛ/ are not provided, but are reported to exist):

(4)  

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3Trigo 1991 suggests that the contrast is based on two new pharyngeal features, which she labels [LL] (lowered larynx) and [RL] (raised larynx). The implications of this proposal will not be considered here. The articulatory mechanism by which pharyngeal expansion/constriction results in different phonation types is still not entirely understood.
The process is well-motivated for phonetic and phonological reasons. Glides are always [+ATR] phonetically, and in Turkana they also pattern phonologically with the [+ATR] chest register vowels.

### 3 Analysis of Mixed Register Vowels

The HS feature geometry can easily account for the partial assimilation process described above. The glides that trigger the process and the three head vowels that are targeted by the rule would be represented as in (5):4

![Feature Diagram](image_url)

In terms of these representations, the process that derives the surface ‘tense’ vowels can be stated formally as a partial assimilation rule:

(6) Turkana Glide Assimilation (HS version)
- **Operation:** spread [+ATR]
- **Trigger:** [-consonantal, -vocalic]
- **Target:** [-high, -ATR]

By applying (6), the glide’s non-contrastive [+ATR] feature will spread to the following non-high head register vowel. As a result, [-ATR] will be delinked, but the original laryngeal features are preserved. In the case of the low vowel, I assume that [+low] will also be delinked to repair the disallowed configuration *[-low, +ATR],5 thus producing e or o. The assimilation of the feature [back] is carried out by a separate rule.

The fact that chest register vowels and glides pattern together in the phonology has been attributed to the feature [+ATR], which is common to both types of segments in the HS feature geometry. The presence of this feature in glides is crucial in deriving ‘mixed’ register vowels.6 How would the CH model describe these facts if the feature [ATR] has been eliminated?

---

4Only relevant portions of the feature geometries will be given in this paper.

5See Calabrese 1988 for a full discussion of filters and repair strategies. The basic claim of this approach is that UG contains a list of feature co-occurrence restrictions (filters), that reflects a universal hierarchy among segments. All languages must violate a certain number of filters in order to derive their segment inventories. Disallowed feature combinations arising during the course of derivations are repaired by a fixed set of operations, one of which is the delinking of an incompatible feature and its replacement by a compatible feature.

6'Mixed' register vowels also surface as a result of the spreading of the laryngeal feature [+constricted glottis] onto a chest register vowel in certain environments.
In the CH model, there are two potential ways of encoding the glides’ [+ATR] feature. The first option is to assign to these segments the feature [-open 3]. Under this interpretation, the representation of chest register vowels and glides would include the following aperture features:

\[
\begin{array}{c|cccc}
    & i & u & e & o \\
 1 & - & - & - & + \\
 2 & - & - & + & + \\
 3 & - & + & - & + \\
\end{array}
\]

The other option is to distinguish between three underlying heights, by using the aperture features in (8):

\[
\begin{array}{c|c}
    & i & u \\
 1 & - & - \\
 2 & - & + \\
\end{array}
\]

The head register vowels i u e o would also be specified for the articulator feature Pharyngeal, while chest i u e o would lack this feature.

Assimilation always entails that some feature is spreading from one segment to another. This fact forces one to select the analysis in (7) over (8). Note that in (8) there is no way of referring directly to the feature that is spread by the assimilation rule. Pharyngeal corresponds to the feature [-ATR] of the HS framework, but there is no feature that corresponds to [+ATR].

It is widely accepted that articulator features for consonants are monovalent, and the same should hold for vocoids. Therefore, the putative feature [-pharyngeal] should be disallowed. Appealing to a binary feature beneath Pharyngeal would not solve the problem:

\[
\begin{array}{c|c}
    & [\text{radical}] \\
 1 & \text{Pharyngeal} \\
\end{array}
\]

Glides and chest register vowels can not be specified as [-radical], because by definition Pharyngeal implies pharyngeal constriction, never expansion. Features dominated by the Pharyngeal node would be expected to refer to the specific shape or the location of the pharyngeal constriction (e.g. the distinction between ‘lower’ pharyngeals like h and i and ‘upper’ pharyngeals like χ and y).

The only way in which the analysis in (8) could be maintained would be by postulating the implicational rule: Pharyngeal → [+open 3]. A default rule would be needed to insert [-open 3] elsewhere. Only then could the glides’ [-open 3] feature be accessed by the assimilation rule. In addition, note that even if features like [-pharyngeal] and [-radical] were available, they would not explain the ‘tensing’ that occurs as a result of assimilation. A connection with vocalic aperture features will have to be established at some point, in
order to account for the concomitant height difference (Vaux 1995). Unless independent evidence requires the presence of a Pharyngeal node in head register vowels (e.g. some type of interaction with pharyngeal consonants), there is no reason to prefer the roundabout analysis in (8) to that in (7). By allowing direct access to [-open 3] ([+ATR]), the representation in (7) avoids the problems noted above.

By adopting the analysis in (7), the CH model can account for the Turkana facts. The Glides and the head register vowels would be assigned the partial feature geometries in (10):

\[
\begin{align*}
\text{(10)} & \\
\text{y w} & \quad \text{ [+vocoid]} \\
\text{C-PI} & \quad \text{ Vocalic} \\
\text{Aperture} & \quad \text{V-PI} \\
\text{-open} &-\text{open} & \text{+open 1} & \text{+open 2} & \text{+open 3}
\end{align*}
\]

The assimilation rule can then be stated as spreading [-open 3] from the glides to e o a:

\[
\begin{align*}
\text{(11)} & \\
\text{Turkana Glide Assimilation (CH version)} \\
\text{Operation: spread [-open 3]} \\
\text{Trigger: [-open 2]} \\
\text{Target: [+open 2, +open 3]}
\end{align*}
\]

The notion of repair by delinking is compatible with the CH framework, as it is with the HS framework. The laryngeal features would remain in situ, and the configuration *[+open 1, -open 3] is repaired by delinking of [+open 1].

4 The Distribution of Velars and Uvulars

The distribution of uvulars in Turkana is predictable. Surface uvulars are always derived from an underlying velar /k/. The data in (12) show that the voiceless velar obstruent /k/ obligatorily becomes uvular [q] when it is in contact with a tautosyllabic o, o, or a (this

\[
\text{[Vaux 1995 also observes that CH feature geometry would require another kind of implicational rule relating laryngeal features with vocalic aperture features. Such an implication would be needed to account for languages in which an original voicing contrast in obstruents has resulted in height changes in the following vowels.]

\[
\text{See Zetterstrand 1996 for other problems in connection with the relationship between the Pharyngeal node and [open 3].}
\]
uvularization rule will be stated formally in the next section): 9

(12)  
\[ e-kori \quad [e.qo.ri] \quad \text{‘rattle’ (sg)} \\
\[ e-kolocor \quad [e.qol.corr] \quad \text{‘pelican’} \\
\[ e-kod \quad [e.qod] \quad \text{‘tax’ (sg)} \\
\[ e-koyi \quad [e.qoi] \quad \text{‘matter’} \\
\[ e-kaalees \quad [e.qa.lees] \quad \text{‘ostrich’} \\
\[ yi-kayo \quad [yi.qa.yo] \quad \text{‘kind of tree’ (pl)}

These data also show that register distinctions are irrelevant in the uvularization process; both head register \( \overset{o}{\circ} \) (and \( a \)) and chest register \( o \) trigger uvularization.

The forms in (13) illustrate the effect of a later rule, which further changes \( [q] \) into the uvular fricative \( [\chi] \), when the uvular obstruent occurs between two members of the set \( o \overset{o}{\circ} a \):

(13)  
\[ na-bokobok \quad [na.bo.\chi.o.boq] \quad \text{‘elephant shrew’} \\
\[ lo-kori \quad [lo.\chi.o.ri] \quad \text{‘Lokori village’} \\
\[ a-kamu \quad [a.\chi.a.mu] \quad \text{‘dry season’} \\
\[ a-bokok \quad [a.bo.\chi.oq] \quad \text{‘turtle’} \\
\[ a-ko\chi-ti-aan-ut \quad [a.\chi oo.kyaa.nut] \quad \text{‘loneliness’}

The final set of forms in (14) demonstrates that other tautosyllabic vowels have no effect upon the velars. \( [k] \) surfaces in all cases:

(14)  
\[ a-kiru \quad [a.ki.ru] \quad \text{‘rain’} \\
\[ a-makuk \quad [a.ma.kuk] \quad \text{‘stool’} \\
\[ yi-keno \quad [yi.ke.no] \quad \text{‘fireplace’ (pl)} \\
\[ ya-kima-k \quad [ya.ki.maq] \quad \text{‘old woman’} \\
\[ a-rukum \quad [a.ru.kum] \quad \text{‘cough’} \\
\[ a-kepu \quad [a.ke.pu] \quad \text{‘vein’}

The crucial observation for my argument is that high vocoids are incompatible with uvulars. Uvulars are systematically absent before \( iu \ y \ w \). If the uvularization rule is informally stated as above, one would not expect to find sequences like \( [qi] \) and \( [qu] \), because \( /ki/ \) and \( /ku/ \) do not meet the condition of the rule.

However, there are a number of glide formation rules in Turkana, that could potentially interact with the uvularization rule. These rules are schematized in (15):

(15)  
a. \[ e \quad \rightarrow \quad y/ - a \\
b. \[ u + a \quad \rightarrow \quad waa \\
c. \[ i + a \quad \rightarrow \quad yaa \\
d. \[ u + w + V \quad \rightarrow \quad wVV \\
e. \[ i + y + V \quad \rightarrow \quad yVV

If any of these rules should introduce a glide after an underlying \( /k/ \) that is tautosyllabic

9 Other rules applying to the Turkana forms that appear in this paper will be disregarded.
with $o \circ a$, the velar never surfaces as $[q]$ 10:

(16)  
  a. $l-k\epsilon-ar \rightarrow [i.kyar]$  'to raise'  *[i.qyar]  
  b. $a-k\ell'ar\ell \rightarrow [a.kwa.a.r\ell]$  'night'  *[a.qwa.a.r\ell]  
  c. $a-kiyo \rightarrow [a.kyoo]$  'mirror'  *[a.qyoo]

A possible explanation for this fact is rule ordering: uvularization applies before the glide formation rules. None of the underlying forms in (16) meet the conditions of the uvularization rule ($k$ is not tautosyllabic with $o \circ a$). Alternatively, the rules could apply in either order and adjacency could be specified as a necessary requirement for uvularization: $k$ must be adjacent to $o$, $\circ$ and $a$.

There is another rule in Turkana that optionally inserts glides after $i(C)C$ and $u(C)C$ sequences (in rhyme-initial position). Examples of this process are:

(17)  
  $\psi i$-k\$e$-no $\rightarrow [\psi i$-kye.no]  'fire-places'  
  e-lupe $\rightarrow [e.lu.pwe]$  'clay'

Some of the underlying forms that may undergo the rule exemplified above do meet the conditions for uvularization.11 In these cases, what one finds is free variation. A glide may be inserted, as in (18a):

(18a)  
  $\psi i$-turkana-it $\rightarrow [\psi i$.tur.kwa.na]  'the Turkana people'  
  e-turkana-it $\rightarrow [e$.tur.kwa.na.it]$  'a Turkana person'  
  turkan $\rightarrow [t u r k a n]$  'the Turkana area'

Or the uvularization rule applies, as in (18b):

(18b)  
  $\psi i$-turkana-it $\rightarrow [\psi i$.tur.qa.na]$  
  e-turkana-it $\rightarrow [e$.tur.qa.na.it]$  
  turkan $\rightarrow [t u r q a n]$

But both rules never apply to the same underlying form. The forms in (18c) are impossible:

(18c)  
  *[\psi i$.tur.qwa.na]$  
  *[e$.tur.qwa.na.it]$  
  *[tur.qwa.na]

The forms in (18c) show that rule ordering by itself does not suffice. Whether uvularization is ordered before or after glide formation, the forms in (18c) would not be excluded. This suggests that unless an alternative explanation is found, an adjacency condition will have to be imposed upon uvularization. Even if one adopts this condition, glide insertion would have to be ordered before uvularization, in order to block derivations like: $\psi i$-turkana/ $\rightarrow$ (uvularization) $[\psi i$.tur.qa.na] $\rightarrow$ (glide insertion) $[\psi i$.tur.qwa.na].

10 The comparison of underlying $l-k\epsilon-ar$ and surface $[i.kyar]$ shows that the introduction of a glide initiates a second harmonic span to its left. Other forms illustrating this are $/e\omega r\ell/ \rightarrow [e\omega r\ell]$ and $/a\ell k\omega k\ell a.n\ell/ \rightarrow [a\ell k\omega k\ell a.n\ell]$. Forms like these provide further evidence that $[-ATR]$ or $[-open 3]$ must be represented at some level in order to be spread.  
11 Unfortunately, I was able to find very few of these forms.
Another fact to consider is that there is a general tendency not to uvularize velars after any high vowel (i u i u), although it is not an absolute prohibition (Trigo 1991,123). The forms in (19) are in free variation:

\[
\begin{align*}
\text{y} & \text{i} & \text{ka} & \text{.t} & \text{o} & \text{t} & \text{y} & \text{i} & \text{qa} & \text{.d} & \text{o} & \text{t} \\
\text{a} & \text{m} & \text{u} & \text{.k} & \text{a} & \text{t} & \text{a} & \text{m} & \text{u} & \text{.q} & \text{a} & \\
\text{n} & \text{i} & \text{k} & \text{r} & \text{n} & \text{i} & \text{q} & \text{o} & \text{r} & \\
\text{l} & \text{o} & \text{u} & \text{k} & \text{o} & \text{l} & \text{o} & \text{u} & \text{q} & \text{g} & \\
\end{align*}
\]

‘monkeys’
‘shoes’
‘Samburu’ (pl)
‘in this lung’

This distribution cannot be explained by adding an adjacency requirement to the uvularization rule, nor by the type of rule ordering that has been considered so far.

5 Analysis of the Velar-Uvular Distribution

This section attempts to derive the incompatibility of uvulars and high vocoids from the two competing feature geometries, and from the autosegmental devices that are common to both models. In particular, I focus on the interaction between the uvularization rule and the two optional rules exemplified in (17) and (19): glide insertion and [+high] assimilation (to be discussed), respectively.

A dorso-uvular articulation can be achieved by producing a dorso-velar articulation and sliding the tongue further back, while slightly opening the mouth (Catford 1977,160). This description supports the traditional SPE analysis of (at least some) uvulars as [+back, -high] dorsals. Thus, a plausible representation of the Turkana velar-uvular contrast within the HS framework is:

\[
\begin{align*}
\text{velar} & \quad \text{uvular} \\
[+\text{cons}] & \quad [+\text{cons}] \\
| & | \\
\text{PL} & \text{PL} \\
| & | \\
\#\text{dorsal} & \#\text{dorsal} \\
+\text{high} & +\text{back} \\
+\text{back} & +\text{high} \\
\end{align*}
\]

In (20) the features [+back] and [-high] are both crucial to defining a uvular. The uvularization rule could be formulated as in (21):

\[
\begin{align*}
\text{Turkana Uvularization (HS version)} \\
\text{Operation: spread [-high]} \\
\text{Trigger: [-consonantal, +back]} \\
\text{Target: [+consonantal, dorsal]} \\
\text{Condition: trigger and target are tautosyllabic} \\
\end{align*}
\]

Rule (21) would spread [-high] to the velar k from a tautosyllabic o o a.\textsuperscript{12} This formulation

\textsuperscript{12}This means that the uvularization rule spreads non-contrastive and contrastive [-high] features.
explains why only these three vowels cause uvularization. They are the only vowels that are dorsal[+back, -high]:

\[
\begin{align*}
(22) & \quad [\text{-cons}] & \quad [\text{-cons}] \\
& \quad \text{PL} & \quad \text{PL} \\
& \quad \text{dorsal} & \quad \text{dorsal} \\
& \quad -\text{high} & \quad -\text{high} \\
& \quad -\text{low} & \quad -\text{low} \\
& \quad +\text{back} & \quad +\text{back}
\end{align*}
\]

If the glide insertion rule applied before uvularization, the epenthetic glide would be expected to block uvularization, because glides are [+high]. The blocking effect would follow automatically from the line-crossing prohibition:

\[
\begin{align*}
(23) & \quad \text{velar} & \quad \text{y} & \quad \text{w} & \quad [\text{-cons}] & \quad [\text{-cons}] & \quad [\text{-cons}] \\
& \quad \text{PL} & \quad \text{PL} & \quad \text{PL} \\
& \quad \text{dorsal} & \quad \text{dorsal} & \quad \text{dorsal} \\
& \quad +\text{high} & \quad +\text{high} & \quad -\text{high}
\end{align*}
\]

On the other hand if uvularization applied first, a multiply-linked representation would result. The uvular and the back vowel share a [-high] node as a result of the assimilation. By convention, this is represented as:

\[
\begin{align*}
(24) & \quad \text{uvular} & \quad \text{o} & \quad \text{a} & \quad [\text{+cons}] & \quad [\text{-cons}] \\
& \quad \text{PL} & \quad \text{PL} \\
& \quad \text{dorsal} & \quad \text{dorsal} \\
& \quad +\text{back} & \quad -\text{high} & \quad +\text{back}
\end{align*}
\]

In terms of the representation in (24), the blocking of glide insertion could be described as an inseparability effect. Other partial assimilation rules have been reported to block epenthesis.\(^{13}\)

Recall that it was also noted in (19) that uvulars tend to be absent after high vowels. Trigo (1991,123) suggests that a possible account of this fact is that velars may optionally assimilate the vowels' [+high] feature. Since velars are phonetically [+high], and in this

\(^{13}\text{See Kenstowicz 1994, chapter 8 for a summary of the evidence supporting the inseparability and inalterability of structures resulting from partial assimilation rules.}\)
analysis [+high] is also a distinctive feature in their representation, there are two possible analyses.

One possibility is that the high vowels' [+high] feature has been linked to the velars' [+high] feature. This would amount to saying that the OCP is optionally enforced on the [high] tier. The result is a multiply-linked representation:

\begin{equation}
\begin{array}{c}
\text{iu} \quad \text{velar} \\
[-\text{cons}] \quad [+\text{cons}]
\end{array}
\end{equation}

\begin{align*}
& | \\
& | \\
& \text{PL} \quad \text{PL} \\
& | \\
& \text{##dorsal} \quad \text{##dorsal}
\end{align*}

The uvularization rule would be prevented from applying to preserve the integrity of the partial geminate. I will refer to this analysis as the rule-inhibition analysis.

Alternatively, one could claim that the effects of the uvularization rule may sometimes be reversed, as a result of the optional [+high] assimilation:

\begin{equation}
\begin{array}{c}
\text{iu} \quad \text{uvular} \\
[-\text{cons}] \quad [+\text{cons}]
\end{array}
\end{equation}

\begin{align*}
& | \\
& | \\
& \text{PL} \quad \text{PL} \\
& | \\
& \text{##dorsal} \quad \text{##dorsal}
\end{align*}

\begin{align*}
\text{##dorsal} & \quad \text{##dorsal} \\
+\text{high} & \quad -\text{high}
\end{align*}

Note that a rule with the effect of (26) would violate inalterability, because the output of the uvularization rule is a multiply-linked representation, as shown in (24). One could argue that (26) is a low-level (post-lexical) rule, and therefore, that it can affect the uvular in spite of its linked [-high] node. I will refer to this second analysis as the rule-reversal analysis.

The analysis presented so far relies on independently motivated conventions of the autosegmental framework, as well as on the particular feature geometry proposed by HS. The advantage of this analysis is that it does not require any rule ordering; nor does it require an adjacency condition.\footnote{Note, however, that the crucial data for deciding whether uvularization requires adjacency are missing. Turkana syllable-structure constraints do not allow complex onsets other than CG (Dimmendaal 1983,45). Most of these onsets are derived. The few underlying CG onsets occur in borrowed nouns (Dimmendaal 1983,46). Therefore, one can not test whether segments that are not [+high] (e.g. liquids) would block the rule.} I now consider whether an autosegmental analysis that assumes the CH feature geometry has the same advantages.

The CH model requires that the difference between the Turkana velars and uvulars be represented as follows (Kenstowicz 1994,469):
The vowels that trigger uvularization would be represented as in (28):

Recall that glides have the following representations:

If one assumes the representations in (27-29), the uvularization rule can be stated very simply:
(30) Turkana Uvularization (CH version)
Operation: spread [dorsal]
Trigger: [+open 2]
Target: C-PI[dorsal]
Condition: trigger and target are tautosyllabic

The rule spreads the articulator feature [dorsal] beneath V-PI to the tautosyllabic velar from a [+open 2] vowel (the aperture requirement prevents u and u from triggering the rule).

Consider first what would happen if glide insertion applies before uvularization. In that case the blocking effect could not be derived from the line-crossing prohibition. The glides in (29) have no feature(s) that are obviously incompatible with [dorsal], the feature that is being spread by the uvularization rule. Even if one could appeal to negative values of articulator features, the correct result can not be derived: y would be V-PI[-dorsal], but w would be V-PI[+dorsal] by definition. Therefore, the only way of blocking the sequences *qGa *qGo *qGɔ is by including adjacency amongst the conditions for uvularization.

The second possibility is that uvularization takes place before glide insertion. In that case the following multiply linked representation results (I assume that when [dorsal] spreads, a Vocalic node and a V-PI node are inserted by convention in the representation of the uvular. The rule can not spread the entire V-PI node, because the vowel a is also V-PI[pharyngeal], and ɔ ɔ are also V-PI[labial]):

```
(31)   uvular   o ɔ a
   -son   +vocoid
   -appr
  /   /
 C-PI  C-PI
 /   /
dorsal Vocalic Vocalic Aperture
 |   |
 V-PI  V-PI  +open 2
     |
     dorsal
```

The insertion of the glide could then be blocked by appealing to inseparability.

The analysis of the interaction between glide insertion and uvularization within the CH framework is slightly more complex, in that the rule ordering: (1) glide insertion (2) uvularization, would call for an adjacency condition. However, the crucial argument against adopting the CH feature geometry is provided by the [+high] assimilation rule. If the high vowels that trigger this rule are represented as in (32):
it is impossible to account for the appearance of a velar.

If the rule-inhibition analysis were to be pursued, we would have to link \( i \ u \ u \) and \( k \) for some feature. However, the high vowels share no common feature with the velar, to the exclusion of all other vowels. As a result the OCP can not be invoked, and no multiply-linked representation can be derived in order to block uvularization. On the other hand, if the rule-reversal analysis is adopted, the high vowels have no common feature that could change a following uvular back into a velar. There is no apparent reason for which the uvular’s V-PI[dorsal] node would be delinked, thus creating a velar.

The antagonism between uvulars and high vocoids is clearly based on phonetics. The articulation of a uvular involves a lower tongue-body position, which is incompatible with the more raised tongue-body position of \( y \ w \ u \ u \). In the HS framework in which all features have an anatomical basis, this fact can be formally expressed by assigning uvulars and high vocoids opposite values for the dorsal feature [high]. All of the interactions between high vocoids and uvulars in Turkana can be explained in a straightforward manner with reference to this feature. This is not possible in the CH feature geometry where uvulars and high vocoids share functional nodes like C-PI, Vocalic and V-PI, but have no common (potentially binary) terminal features.

The problem with the [+high] assimilation rule could easily be resolved if uvulars were specified as [+open 2], and high vocoids and velars as [-open 2]. Given these feature specifications, the OCP could then apply to the high vowels’ and the velars’ [-open 2] features (rule-inhibition analysis). Alternatively, the high vowels could spread their [-open 2] feature to the uvular, thus deriving a velar (rule-reversal analysis). However, the logic of the CH model does not allow the assignment of vocalic stricture features to consonantal articulations.

One might attempt to salvage the CH analysis by allowing [open 2] to play a role in defining uvulars and velars as a marked option, but this seriously weakens the model. The central organizing principle of the CH model is the idea of constriction. This entails that vocoids and consonants are analogous in structure. They share the same set of place features, but each is associated with a characteristic stricture. Consonantal stricture is defined by the feature [continuant] and vocalic stricture by the [open] features. A language in which two places of articulation are systematically described with a vocalic stricture feature would be highly anomalous.

Finally, recall that when discussing the rule-reversal analysis in the context of the
HS feature geometry, I made the following assumption: because [+high] assimilation is a low-level rule, it is allowed to apply to a multiply-linked representation. An adamant supporter of the CH model could argue that because we are dealing with a low-level rule, [-open 2] can spread to the velar.

Note, however, that these two moves do not have the same status. In the first case, one is dealing with the suspension of a condition on rule application in the post-lexical phonology—a claim that is not surprising. The second case entails that an ill-formed configuration arises as a result of spreading, and it is subsequently repaired (I assume that an Aperture node will be inserted as a result of the spreading of [-open 2]):

\[(33)\]

The representation in (33) is ill-formed, because it violates the configuration *[-vocoid, Aperture]. Well-formedness would be restored by delinking of the entire Vocalic node (which dominates Aperture). The output would be a velar.

This is the desired result, but it leaves an important question unanswered. Why is it that only high vowels reverse the effect of the uvularization rule? If spreading of an aperture feature is the real motivation behind the repair, one would expect that spreading of any [open] feature would have the same effect. Yet uvulars are free to surface after non-high vowels. This suggests that the high vowels’ [-open 2] feature is the reason for the feature conflict, and therefore, that something is being missed by this type of analysis.

6 Conclusion

The evidence presented in section 3 of this paper has shown that the HS model’s feature [ATR] can be successfully encoded as [open 3] in the CH framework, so as to account for the derivation of ‘mixed’ register vowels in Turkana. Both models fare equally well in this respect. However, the discussion in section 5 shows that the interaction of the glide insertion rule and the uvularization rule is slightly more complex in the CH framework. If glide insertion applies before uvularization, an adjacency condition would have to be included in the second rule.

Furthermore, if one assumes the CH feature geometry, it is not possible to describe the [+high] assimilation rule. One would have to allow consonantal articulations to be defined with vocalic stricture features, contrary to one of the basic tenets of the model.
Alternatively, one could uphold this tenet; but this would not explain why only high vowels can reverse the effects of uvularization. The facts of the [+high] assimilation rule strongly support the HS feature geometry, in which the feature [high] is binary and it can be shared by vowels and consonants alike.

References


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