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# "SPIRANTIZATION" IN MOORE

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## 0. Introduction.*

McCarthy (1988) mentions several languages in which consonants that seem to be underlyingly stops surface as fricatives when they appear after vowels. Naturally enough, McCarthy calls this process "postvocalic spirantization" and names Spanish, Tigrinya and Biblical Hebrew as languages that possibly exhibit this phenomenon. To this list could be added Moore (Alexandre 1970; Canu 1976), spoken by the Mosi in Ghana and Upper Volta.[1]

Once the process is named, "postvocalic spirantization" is easy to explain; in the terms of autosegmental phonology, it is the rightward spread of the feature [+cont] from the vowel, as indicated schematically in (1).

```
(1)        V   C                         V   C
           |          --->               |  /
           |                             | /
       [+cont]                       [+cont]
```

As McCarthy notes, however, the alternations in Spanish, Tigrinya and Biblical Hebrew are not unambiguous examples of this process, as all are "open to an alternative interpretation" (McCarthy 1988:14).

In this paper I will offer such an alternative interpretation for the apparent "postvocalic spirantization" in Moore. First, I examine the data that at first sight suggest an analysis involving the rightward spreading of [+cont] from the vowel and conclude that this cannot be what is happening. Next, I discuss some aspects of Moore vowel harmony within the model of Radical Underspecification (RU) advocated in Archangeli (1984, 1988) and elsewhere, and find that these alone provide an adequate explanation for the data. Finally, in my conclusion I speculate on what Moore and other languages might tell us about the status of so-called "postvocalic spirantization" rules in general and how this might support an even more radical form of RU theory, in which universally predictable features, as [+cont] for vowels, are never specified in the phonology.

## 1. The [g]/[ɣ] alternation.

The phonemic consonant inventory of Moore is given in (2).

(2) Phonemic consonant inventory in Moore[2]

| | | | | | | |
|---|---|---|---|---|---|---|
| p | f | b | v | m | | |
| t | s | d | z | n | l | r |
| k | x | g | | | | |



Of the stop consonants listed in (2), only one of them is in complementary distribution with its fricative counterpart. This is the voiced velar phoneme /g/, which surfaces either as the "dorso-velar" stop [g] or the voiced "post-velar" continuant [ɣ] (Canu 1976:25). Of interest to us is the fact that this alternation is conditioned by a preceding vowel. The effects of this apparent postvocalic spirantization rule are seen in (3): (3) a. lists the stops as they appear word-initially, (3) b. as they appear after a variety of vowels. Note that no other consonant besides the voiced velar stop undergoes this rule; not even the voiceless "dorso-velar" stop [k] alternates with its counterpart, the voiceless "post-velar" continuant [x].

(3) Postvocalic spirantization?[3]

a. Word-initially:

| | |
|---|---|
| pipi | first |
| bUde | sow |
| to:re | mortar for grinding |
| data | (he) wants |
| ku˜ki | disocate, undo a knot |
| gabsa | (he) examines unnecessarily |

b. Postvocalically:

| | | |
|---|---|---|
| p: | pipi | first |
| | lepa | small baskets |
| | dapa | men |
| b: | dibla | twig |
| | tI:bo | fetish |
| | iubla | neck |
| | eb | 3rd person plural pronoun |
| | tabre | action of stomping |
| t: | pita | tuft of grass |
| | bItya | who has grown so far |
| | geta | seer |
| | data | (he) wants |
| d: | si˜da | (he) stopped up |
| | da uId ie | don't criticize! |
| | bUde | sow |
| | ade | here |
| k: | ki˜ka | (he) shrugged his shoulders (spasm) |
| | ku˜ki | dislocate, undo a knot |
| | kUka | lemon tree |
| | soke | ask |
| | peka | (he) washed |
| | make | examine |

| | | |
|---|---|---|
| g: | sIɣa | stones for sacrifice |
| | pU:ɣo | field |
| | go:ɣa | (he) pulled downwards |
| | teɣa | (he) pressed with his fingers |
| | paɣa | woman |

However, /g/ does not consistently appear as a fricative postvocalically. In fact, it only occurs after a vowel if that vowel is not [i] or [u], as in (4).

(4)

| | |
|---|---|
| pi:ga | ten |
| kugri | stone |

It can be seen already that this is a peculiar case of postvocalic spirantization. First, it is only one particular phoneme, the voiced velar /g/, that undergoes the alternation. And second, the [g]/[ɣ] alternation is sensitive to vowel quality, not merely the presence or absence of a vowel.

Since the vowel features have become relevant, I now give them in (5).

(5) Moore vowel inventory (all of these vowels also contrast with their long counterparts).[4]

| | i | I | e | a | o | U | u | i˜ | e˜ | a˜ | o˜ | u˜ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| hi | + | + | - | - | - | + | + | + | - | - | - | + |
| rd | - | - | - | - | + | + | + | - | - | - | + | + |
| bk | - | - | - | + | + | + | + | - | - | + | + | + |
| lo | - | - | - | + | - | - | - | - | - | + | - | - |
| atr | + | - | - | - | - | - | + | + | - | - | - | + |
| nas | - | - | - | - | - | - | - | + | + | + | + | + |

One highly unusual aspect of this inventory should be noted: the feature [atr] is contrastive only for high vowels. Based on Maddieson's (1984) extensive survey of segment inventories of the world's languages, Archangeli and Pulleyblank (forthcoming) conclude that with virtually no exceptions, high vowels contrast in [atr] only if the mid vowels do as well. The markedness of the Moore system will become relevant a little later.

The full range of environments affecting the [g]/[ɣ] alternation can now be given in (6)-(10).



(6) /g/ following a [-hi] vowel is [ɣ]:

| | | |
|---|---|---|
| a. | teɣa | (he) pressed with his fingers |
| b. | paɣa | woman |
| c. | go:ɣa | (he) pulled downwards |
| d. | beɣne | to give up, in place of |
| e. | be˜dɣe | trap (n.) |
| f. | kosɣo | cough (n.) |
| g. | karɣa | leg |
| h. | uobɣo | elephant |
| i. | a˜bɣa | African panther |
| j. | namsɣo | fatigue |
| k. | ga˜tɣa | handle (A) |
| l. | gasɣe | (she) bites leaving teeth marks (A) |

(7) /g/ following a [+hi,-atr] vowel is [ɣ]:

| | | |
|---|---|---|
| a. | sIɣa | stones for sacrifice |
| b. | pUɣa | stomach |
| c. | kUɣse | lemon trees |
| d. | pU:ɣo | field |
| e. | bItɣa | who has grown so far |
| f. | kUlɣa | marigot |
| g. | kUdɣa | age, customs |
| h. | kUmbɣa | tomato field |
| i. | bI:sɣo | to become ripe (A) |

(8) /g/ word-initially is [g]:

| | | |
|---|---|---|
| a. | ga˜nde | fur bracelet |
| b. | go:ɣa | (he) pulled downwards |
| c. | g$^{ɣ}$ere | thigh |
| d. | ge˜ | live at... |

(9) /g/ following a homorganic nasal consonant is [g]:

| | | |
|---|---|---|
| a. | liŋga | gourd |
| b. | beŋga | bean |
| c. | boŋga | (he) picked, cleaned |
| d. | wUŋga | deaf |
| e. | liŋgi | to take by surprise (A) |
| f. | diu:ŋgu | kingdom (A) |

(10) /g/ following a [+hi,+atr] vowel is [g]:

| | | |
|---|---|---|
| a. | diga | (he) defended, forbad |
| b. | nugu | hand |
| c. | kugri | stone |
| d. | girgu | piece |
| e. | bulga | spring (n.) |
| f. | kuitga | stamp (n.) |
| g. | misgu | small sour pancake of millet (A) |
| h. | mitga | who is known (A) |

Notice that the ability of the vowel to condition the [g]/[ɣ] alternation is unaffected by the presence of an intervening consonant (unless that consonant is an immediately adjacent velar nasal). Relevant examples are repeated in (11).

| | | | | |
|---|---|---|---|---|
| (11) | a. | gasyɛ | she bites leaving teeth marks | [=(6)l] |
| | | ga¯tɣa | handle | [=(6)k] |
| | b. | bI:syo | to become ripe | [=(7)i] |
| | | bItɣa | what has grown so far | [=(7)e] |
| | c. | misgu | small sour pancake of millet | [=(10)g] |
| | | mitga | who is known | [=(10)h] |

As Diana Archangeli has pointed out to me, pairs like those in (11) a. and b. establish conclusively that the [g]/[ɣ] alternation cannot be a case of [+cont] spread. In the word bI:svo, for example, [+cont] would have to spread over the segment [s]; we are therefore forced to conclude that the feature [cont] is underlyingly absent for [s], since its presence would block spread, as seen in (12).

```
(12)      b  I:  s  /g/  o
             |   |                (rightward spread of [cont]
             |   |                 is blocked)
       [+cont] [+cont]
```

In the word bItva, however, [+cont] would have to spread past [t] as well, forcing us to conclude that it too is underlyingly unspecified for [cont]. But presumably [t] and [s] differ crucially in their values for [cont]. If both were unspecified for [cont], the underlying representations of these contrastive phonemes would be identical. Hence we must accept that it is not the spread of [+cont] from the vowel that conditions the [g]/[ɣ] alternation.

What does condition this alternation then? As we've seen, the particular features of the vowel play an important role. Could it be that it is one of these features that is spreading? As it turns out, there is independent motivation to support such a hypothesis. Thus in the next section we turn to an investigation of vowel harmony in Moore.



**2. Vowel harmony in nominals.**

**2.1 Data and analysis.**

Nouns in Moore typically consist of a monosyllabic stem with a monosyllabic suffix that indicates number and noun class. The vowel of the suffix undergoes harmony.[5] In (13) I give some examples involving the Class II singular suffix -ka/-ga/-ɣa, in (14) examples with the Class II plural suffix -se/-si, and in (15) examples with the Class IV plural suffix -to/-do/-tu/-du. (I won't be discussing the voicing alternations of the stops in these suffixes.) Within each figure the data is arranged by the features of the stem vowel; the first group has [-hi] vowels, the second group has [+hi,-atr] vowels, and the third group has [+hi,+atr] vowels.

| | | | |
|---|---|---|---|
| (13) | a. | n$^{y}$e¯bɣa | alligator (A) |
| | b. | saka | quarter |
| | c. | kI:ɣa | ground squirrel |
| | d. | kUka | lemon tree |
| | e. | pi:ga | group of ten |
| | f. | bulga | spring (A) |
| (14) | a. | n$^{y}$e¯bse | alligators (A) |
| | b. | savse | quarters |
| | c. | kI:se | ground squirrels |
| | d. | kUɣse | lemon trees |
| | e. | pi:si | groups of ten |
| | f. | bulsi | springs (A) |
| (15) | a. | be¯to | trap (A) |
| | b. | do:to | hut, room with bed (A) |
| | c. | bato | basket-willow (A) |
| | d. | dUɣdo | cooking pot |
| | e. | bIto | sorrel (A) |
| | f. | gu¯:du | mushroom |
| | g. | titu | granary (A) |

All the possible stem and suffix vowel combinations in Moore appear in the figures above except for [o] with [e] and [a], so to round out my examples I give in (16) the singular and plural forms of the Class III noun /tol/ (order). (Alexandre (1970) gives the the singular suffix here as -re/-de/-le/-re/-di/-li and the plural suffix as -a/-ya; this latter suffix causes epenthesis of a: after an o, o: or o¯ in the stem.)

| | | | |
|---|---|---|---|
| (16) | a. | to:lle | order |
| | b. | toa:la | orders |

In (17) these alternations are summarized in terms of what vowels can appear in the stem (V1) and in the suffix (V2). The numbers and letters in the body of the table refer to examples from (13)-(16); empty spaces mean that that particular vowel combination does not occur.

(17) Possible vowel combinations.

| | | V2 | | | | |
|---|---|---|---|---|---|---|
| | | i | u | a | e | o |
| | i | (14)e | (15)g | (13)e | | |
| | u | (14)f | (15)f | (13)f | | |
| | a | | | (13)b | (14)b | (15)c |
| V1 | e | | | (13)a | (14)a | (15)a |
| | o | | | (16)b | (16)a | (15)b |
| | I | | | (13)c | (14)c | (15)e |
| | U | | | (13)d | (14)d | (15)d |

There are several facts that need to be accounted for in this pattern. First, it is only the suffix vowel that alternates, never the stem vowel. Second, [i] and [u] appear as V2 only if they also appear as V1. In other words, [+atr] and [+hi] only appear on V2 if V1 is also [+atr] and [+hi], or, to put it more succinctly (since [i] and [u] are the only explicitly [+atr] vowels), V2 is [+hi] and [+atr] iff V1 is also [+atr]. Third, the [-atr,+lo] vowel [a] can appear after [i] and [u] (and indeed, after any vowel). And finally, the [-hi,-lo] vowels [e] and [o] only appear on V2 if V1 is [e,a,o] (that is, [-hi]) or [I,U] (that is, [-atr,+hi]).[6]

The fact that only the suffix vowel alternates indicates that Moore vowel harmony involves the rightward spread of some feature. That the allophones of the suffix vowel (-se/-si, -to/-do/-tu/-du) differ only in their value for [hi] and [atr] indicates that this feature must be some value (or both values) for [hi] and/or [atr].

I propose (following a suggestion made to me by Diana Archangeli) that Moore vowel harmony involves the rightward spread of [+atr]. [-atr] and values for [hi] can be filled in automatically later, since they are entirely predictable from the distribution of [+atr].

In order to fully explicate this proposal, I will need to briefly explain some assumptions I take from RU theory.
In order to eliminate all redundancies in the underlying phonological representation, RU theory stipulates that only one



value for any feature may be specified in UR, the value chosen being language-specific, not predictable from universal grammar. This necessitates the existence of redundancy rules to fill in the values that are not underlyingly present. Only some of these redundancy rules are language-specific; the remainder are listed in UG. Thus, for example, Archangeli (1988:196) gives the following universal redundancy rules:

(18) a. [+low] --> [+back]
b. [+low] --> [-high]
c. [] --> [-back]
d. [] --> [+high]
e. [] --> [-low]

Such rules are meant to capture the relative markedness or unmarkedness of phoneme inventories. Thus the rule [+lo] --> [+bk] encodes the fact (among other things) that low vowels are much more commonly back than front, while [+lo] --> [-hi] means that low vowels are never high. The convention "[] --> [a F]" means that the value a ("+" or "-") is to be filled in for the feature F in all cases where the value for F has not yet been specified.
To this list can be added the rules given below in (19).

(19) a. [+hi] --> [-lo]
b. [+atr] --> [-hi]
c. [+hi] --> [+atr]
d. [+lo] --> [-atr]
e. [] --> [-atr]

The first of the rules in (19) and the rule [+lo] --> [-hi] together imply *[+lo,+hi], that is, [+lo] and [+hi] cannot cooccur on the same segment. The next two rules in (19) are meant to capture the generalization pointed out in section 1, namely, that [atr] is generally a contrastive feature only for [-hi] vowels, [+hi] vowels being predictably [+atr]. The rule [+lo] --> [-atr] indicates that [atr] is usually not contrastive for low vowels, being predictably [-atr]. More strongly, we should say that there is a universal constraint *[+lo,+atr] (this distinction will be relevant shortly). Finally, the last rule [] --> [-atr] means that in the unmarked system, [atr] is underlyingly specified [+atr], not [-atr]. (Archangeli and Pulleyblank (1989) conclude that this is indeed the case on the basis of work done in a wide variety of languages.)

These universal rules imply that the unmarked underlying values for the features [hi], [atr], [lo] and [bk] should be [-hi], [+atr], [+lo] and [+bk], respectively. The value [-hi] works especially well in capturing the generalization that [atr] only contrasts for [-hi] vowels in the unmarked system. However, as I pointed out above, in Moore the exact opposite is the case: [atr] only contrasts for [+hi] vowels. A concise way to account for this is to stipulate a set of redundancy rules specific to

Moore that override the rules given in (18) d., (19) b. and (19) c. above:

```
(20) a.   [] --> [-hi]        [overrides (18)d]
     b.   [+atr] --> [+hi]    [overrides (19)b]
     c.   [+hi] --> [-atr]    [overrides (19)c]
```

The underlying values in Moore, then, are [+hi], [+atr], [+lo] and [+bk]. If these specified features are combined in all logically possible ways (following the method of Archangeli 1988), the pattern given in (21) of possible specifications for the oral vowels is generated.

```
(21)       i       |I      |e      |a      |o      |U      |u

     hi    + +     |+      |       |       |       |+ +    |+ + +   +
     atr     + +   |       |       |       |       |       |  +    + +
     lo            |       |       |+ +    |       |       |
     bk            |       |       |  + +  |+      |   + + |    + + +
```

Choosing the simplest specification for each vowel such that it is distinct from that of every other vowel gives us the underspecified vowel inventory given in (22).

```
(22)      i  I  e  a  o  U  u

     hi      +           +

     atr  +                 +

     lo            +

     bk               +  +  +
```

As it turns out, these specifications are all that we need (along with the redundancy rules given above) to account for vowel harmony in Moore nominals. The vowel harmony rule is given below in (23).

(23) Spread [+atr] rightward.

In order to demonstrate that this rule accounts for the vowel harmony pattern, I give some representative derivations. In (24), I give an example involving a [+atr,+hi] stem vowel and the Class II plural suffix <u>-se/-si</u>.



(24) <u>pi:si</u>.

```
                                                  [+hi]
                                                   | \
         pi: + sV    -->   pi:sV        -->       pi:si
         |                 | /                    | /
         |                 |/                     |/
       [+atr]            [+atr]                 [+atr]

         UR             [+atr] spread         [+atr] -> [+hi]
```

In (25), the stem vowel is again [+atr,+hi] and the suffix is the Class II singular suffix <u>-ka/-ga/-ya</u>. Note how the spread of [+atr] is blocked by the universal constraint *[+lo,+atr].

(25) <u>pi:ga</u>.

```
                 [+lo]            [+hi] [+lo]
                   |                |     |
         pi: + ga          -->     pi:ga
         |                          |   |\
       [+atr]                   [+atr]  | [-hi]
                                        |
                                     [-atr]

         UR                      [+lo] -> [-hi]
                                 [+atr] -> [+hi]
                                 [] -> [-atr]
```

In (26) a and b, the stem vowel is [-hi] and [-atr,+hi respectively; the suffix is again the Class II plural suffix.

(26) a. <u>nye¯bse</u>.

```
                                       [-hi]
                                        / \
          nye¯b + sV      -->        nye¯bse
                                        \ /
                                       [-atr]

          UR                         [] --> [-hi]
                                     [] --> [-atr]
```

b. <u>kI:se</u>.

```
                                  [-atr]
                                    /\
          kI: + sV       -->      kI:se
          |                        |   |
          |                        |  [-hi]
        [+hi]                    [+hi]

          UR                         [] --> [-hi]
                                     [] --> [-atr]
```

The [+atr] spread rule thus explains all the generalizations gave near the beginning of this section.

## 2.2 Other possible analyses.

In this section I will show that other possible analyses of Moore vowel harmony involving the spread of [-hi] or [+hi] are not as satisfactory as the analysis with [+atr] spread.

Suppose we take [-hi] as the underlying value for [hi] (with [+hi] filled in by default), leaving the underlying values for the other features as before. Then suppose that instead of (23) we take (27) as our harmony rule.

(27) Spread [-hi] rightward.

The problem with such an analysis is that it cannot give an account for the appearance of [-hi] vowels after [+hi,-atr] vowels, as is seen in the derivation in (28).

```
(28)      kI:se.                    [-atr]
                                      /\
           kI: + sV       -->     * kI:si
                                      \/
                                     [+hi]

             UR                    [] -> [-atr]
                                   [] -> [+hi]
```

To account for such cases, we would need to add the rule in (29).

(29) Insert [-hi] on segments following a [-atr] segment.

This rule is clearly stipulatory and explains nothing.

On the other hand, suppose we take the underlying values for the vowels exactly as we did above in section 2.1, but replace (23) with (30).

(30) Spread [+hi] rightward.

This rule also comes up against the problem with the [+hi,-atr] vowels, as the derivation in (31) shows.

```
(31)      kI:se.                                   [-atr]
                                                     /\
           kI: + sV   -->      kI:sV    -->   *  kI:sI
            |                   |/                |/
            |                   |                 |
          [+hi]               [+hi]             [+hi]

             UR             [+hi] spread      [] -> [-atr]
```

Again we must stipulate an extra condition, in this case by altering (30) to restrict the trigger to [+atr] segments only, as in (32).

(32) Spread [+hi] rightward from a [+atr] segment.



Such an analysis is unsatisfactory since it makes the relation between the features [hi] and [atr] in Moore an accident of the [+hi] spread rule, instead of handling the markedness of the Moore system through the overwriting of universal redundancy rules. Furthermore, it is more complex than the [+atr] spread rule, as it must refer to a feature other than the feature that is being spread.

## 4. Returning to the [g]/[γ] alternation.

The reader should have noticed the close relationship between vowel harmony and the [g]/[γ] alternation. In fact, [γ] only appears after [-hi] and [-atr,+hi] vowels, that is, precisely in the contexts where there is no [+atr] spread. We can therefore think of [g] as being the allophone of /g/ that is derived due to the spreading of [+atr], with [γ] appearing by default.

This idea will be formalized shortly, but first we must face the fact that if [g] is derived in the postvocalic environment, then it must be derived in the other two unrelated environments in which it appears as well. That is, it must also be derived word-initially and after a homorganic nasal stop (see (8) and (9) above).

The appearance of [g] word-initially can be accounted for by the rule given in (33) below.[7]

(33) Insert [-cont] on a [+vcd] Dorsal consonant word-initially.

```
     Wd[  C                   --->       Wd[  C
          |\                                 /|\
          | [+vcd]                   [-cont] | [+vcd]
     Dor  o                              Dor  o
```

The appearance of [g] and not [v] after homorganic nasals is part of a general pattern in Moore, in which voiced fricatives never surface immediately after a nasal stop, as seen in (34).

(34)

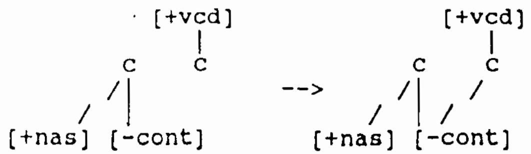
| | | | |
|---|---|---|---|
| | mb: | ka˜mba | children |
| | md: | iemde | hippopotamus |
| | nd: | bo˜ndo | thing |
| | mf: | zimfu | fish |
| | ms: | so˜:mse | rabbits |
| | nf: | ki˜nfu | pearl |
| | ns: | tense | villages |

*[mv,mz,nv,nz]

The rule necessary to generate this pattern is given in (35).

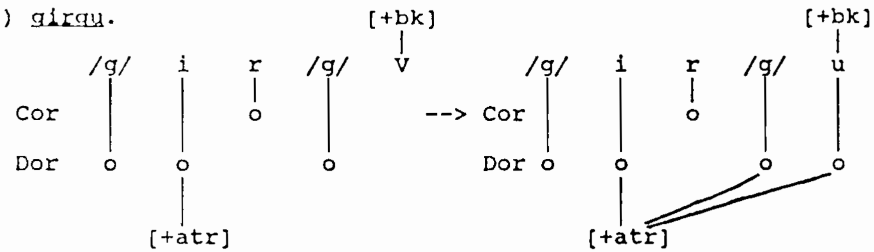
(35) Spread [-cont] rightward from a [+nas] consonant to a

immediately adjacent [+vcd] consonant.




The third case, the case where [g] appears after [+atr] vowels, is the one that is interesting for us. Analyzing this as resulting directly from the spread of [+atr] gives us the means for explaining why it is only the voiced dorsal consonant that is affected. On the surface, the only voiced segments with a Dorsal node in Moore (besides [ŋ], whose place of articulation always results through place assimilation) are /g/ and the vowels. As Diana Archangeli has suggested to me, this could follow from a constraint determining which segments can receive a [+atr] feature in Moore, namely, only voiced segments compatible with a Dorsal node. Coronals, for example, would not be compatible, since there are no palatalized coronals in the language. The [+atr] spreads mechanically to the right, only latching onto those segments that the constraint condones. A sample derivation is given in (36).[8]

(36) girgu.




This analysis also gives us a reasonable explanation for the alternation in place of articulation found in the pair [g]/[ɣ]. As noted above, Canu calls [g] a "dorso-velar," while [ɣ] is called a "post-velar." This suggests that [g] is produced with the body of the tongue touching the velum, while [ɣ] is produced with the body of the tongue further back, perhaps even a uvular position. This difference in articulation correlates nicely with the features [+atr] (dorso-velar) and [-atr] (uvular). The fact that [ɣ] is realized phonetically as [+cont] and [g] as [-cont] then follows immediately from the phonetic generalization that in the world's languages, uvulars tend to be fricative.

V. Conclusions.

We have seen that the [g]/[ɣ] alternation in Moore is not a case of postvocalic spirantization. Very likely this is also true of a similar alternation in the related language of Dagbani,



where, as Wilson and Bendor-Samuel (1969:58) write, "/g/ has an allophone [ɣ] after short vowels," but where [g] is described as "velar" and [ɣ] as varying "freely from a velar to a uvular fricative, sometimes even giving way to a glottal stop." It is interesting to note here that according to the data given in Schein (1981), the "spirantization" rule in Tigrinya also affects only velar stops, in this case, voiceless ones.

Is there, then, such a thing as postvocalic spirantization? From this brief survey it appears that there may not be. But why might this be so? RU theory could offer an answer. In its most extreme form, RU theory would imply that features that are totally predictable in all languages need never be made explicit in the phonology. Thus, since all vowels are necessarily continuant, there is no reason to make them explicitly [+cont] in the phonology of any language. At no phonological level would vowels have a [+cont] feature to spread. If in fact postvocalic spirantization never occurs, this would be strong support for this extreme form of RU theory.

NOTES

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[1]The data is from Canu (1976) in his transcription system unless otherwise noted; an (A) appearing after a gloss indicates that the example comes from Alexandre (1970). All glosses and quotations from Canu and Alexandre have been translated from the French by myself. I take responsibility for any errors in translation. I also omit Canu's tone marks (Moore has low, mid and high tones) to make his data consistent with Alexandre, who doesn't include tone marks at all.

[2]My "x" is Canu's "h"; he classifies it as "velar" (p. 32) and in fact uses only "x" in surface phonetic forms.

[3]My "u˜", "i˜", etc are Canu's "ṵ", "ḭ", etc; the ˜ signifies nasalization.

[4]I write "I" and "U" for Canu's "ɩ" and "ʋ", respectively. To develop this chart I use the standard features associated with the IPA symbols. Canu calls [i] and [u] "tense" and [I] and [U] "lax"; he also explicitly states that [I] and [U] are "articulated with the base of the tongue further back" (pp. 37,40) than [i] and [u], respectively. I therefore feel justified in my [atr] values for these vowels. However, Canu indicates nothing about the value of [atr] for the vowels [e], [a] and [o]. Since [atr] is not a contrastive feature for nonhigh vowels in Moore, I haven't considered it important to determine conclusively what [atr] values these vowels have in the phonology. I have settled on [-atr] as it is the unmarked value for nonhigh vowels (see Archangeli and Pulleyblank (forthcoming) and the text below); this choice is not crucial to my analysis.

[5]Canu states explicitly (p. 190) that "this phenomenon of vowel harmony only appears in the nominals," and gives in support the following two verbs: nkise (cut) and mbure (to speak between

the teeth) None of his other examples of verb suffixes (eg. p. 257) involve verb stems containing [i] or [u]. Alexandre, however, lists verbs that do show vowel harmony, such as the following with the suffix -ve/-gi for the "singular form (once, a little)" [v.1,p.90]: ko:ve (to break by hitting), to:ve (to strike), werve (to grind a little), vu:gi (to drag toward oneself), biligi (to return). I haven't found any clear cases of vowel harmony occurring within a single morpheme.

[6]The additional notable fact, namely, that [+hi,-atr] vowels never appear on suffix vowels, may be ascribed to some morphological constraint, not relevant to the present discussion.

[7]Rules like this, in which [-cont] is inserted on word-peripheral segments, although formally inelegant, are actually rather common. As Hualde (1988) shows, similar rules also operate in Spanish and Basque. Even within Moore, such a rule may also serve to explain the fact that /r/ optionally surfaces as [d] word-initially (Canu 1976:23). The final-devoicing rules of German and Russian are similar examples of rules that "strengthen" segments at the edge of a word.

[8]Here I represent [atr] as dependent from the Dorsal node. This simplifies the analysis of the Moore facts, but I don't know what consequences this might have in other systems.

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