Harry van der Hulst & Norval Smith

Vowel harmony in Khalkha and Buriat (East Mongolian)

0. Introduction

In this paper we analyze certain aspects of the vowel harmony systems of the East Mongolian languages Khalkha and Buriat. These languages have dual harmony systems, involving both ATR and labiality. In the ATR-system the vowel /i/ functions as neutral, whereas in the system of labial harmony high vowels are neutral. Both harmony systems thus raise interesting questions regarding the behaviour of neutral vowels as either opaque or transparent.

This paper is organized as follows. In section 1 we briefly discuss the Khalkha vowel system, and its historical development. We will point out that the behaviour of /i/ in the ATR-system is predicted by the theory of neutral vowels proposed in Van der Hulst & Smith (1986). In section 2 we show that the same vowel's behaviour in the labial system is not, as it is transparent where we would expect it to be opaque. Expected and attested opacity is demonstrated using vowel harmony in Akan (Kwa) and Bashkir (Turkic). In section 3 we offer a solution, which makes use of recent proposals concerning the internal structure of segments. In section 4 we will then discuss a problematical aspect of labial harmony in Buriat, which leads to a (tentative) refinement of the model.

1. The Khalkha vowel system

Our discussion of Khalkha (K) vowel harmony relies on Svantesson (1985), who convincingly argues that East Mongolian languages have harmony based on tongue root position (cf. also Hattori 1982, Gregerson 1976). Svantesson shows that the vowel system and harmony relations in K are those in (1a) and not those in (1b), which are presumably correct for Classical Mongolian:

(1) a. Vowel system (K)

i		u
		ʊ
e		ɵ
	a	ɔ

b. Vowel system (Classical Mongolian)

i	ü			u
e	ö		a	o

(2) a. Harmonic pairs

ATR	LABIAL
u - ʊ	e - ɵ
ɵ - ɔ	a - ɔ
e - a	

b. Harmonic pairs

PALATAL
ü - u
ö - o
e - a

Before we turn to an analysis of the labial system, we will offer an interpretation of the historical development from palatal to ATR-harmony, and point out why the transparency of /i/ is exactly what we expect.

The major difference between K and Classical Mongolian resides in the fact that *ü and *ö have been backed to /u/ and /ɵ/ respectively, pushing down, so to speak, the old *u and *o to /ʊ/ and /ɔ/. As a result of this, the nature of

the relation between harmonic pairs has changed from involving the front-back dimension to involving the height-dimension. In terms of the single-valued feature system we employ (cf. Ewen & Van der Hulst 1985, this vol. and Van der Hulst & Smith 1986, ms.) the two systems are represented as follows:

(3) a. Khalkha

{E I} {E U}
U}
{E A I} {E A U}
{A} {A U}

b. Classical Mongolian

{I} {I U} {U}
{I A} {A I U} {A} {A U}

(Where [E] = advanced tongue root; [A] = open jaw; [I] = front; [U] = round) Several scholars have noted that there is an intrinsic correlation between frontness (our [I]) and advancing of the tongue root (our [E]). If we assume that vowels specified as [I] are subphonemically provided with [E], we can view the historical development as the phonemicization of [E], and concomitant subphonemicization of [I]. Phonetically the feature [I] is only preserved for /i/ and /e/. In a synchronic analysis of K this feature is quite clearly not present in the underlying representation of /e/, as the rounded counterpart of /e/ is /ø/, a back vowel. The feature [I] then will be added by a redundancy rule to derive surface /e/:

(4) a. FCR: $\neg([E] \wedge \neg([I] \vee [U]))$ b. A-rule: Add [I]

The Feature Cooccurrence Restriction (FCR) says that no segment can have the feature [E] without having either [I] or [U]. The rule in (4b), called an AUTOMATIC RULE (cf. Stewart 1983) applies whenever a violation of (4a) occurs. We assume that in the unmarked case A-rules add rather than delete features which have not (yet) been used in the representation of segments. The FCR in (5) will prevent [I] from being added to segments which possess [U]:

(5) FCR: $\neg([I] \wedge [U])$

As for /i/, we could take {E} as its representation and derive /i/ by rule (4b), but we could also assume that the representation is {I}. In that case we would need (6). This doesn't necessarily imply a more costly analysis. (6a) is a valid FCR, ruling out a class of illformed segments and as such it is part of the grammar anyway. (6b) represents the unmarked A-rule (cf. supra):

(6) a. FCR: $\neg([I] \wedge \neg[E])$ b. A-rule: Add [E]

In this paper we will simply assume that the K /i/ is represented as {E}.

With regard to the ATR-system, /i/ acts transparently. If preceded by ATR-vowels, suffixes show up with ATR-vowels, but if preceded by non-ATR-vowels suffixes have non-ATR-vowels. This is the behaviour we expect given the proposals in Van der Hulst and Smith (1986). In a nut shell, what is proposed there is that neutralization in favour of the spreading value leads to transparency, whereas neutralization in favour of the default value leads to opacity. As /i/ lacks an harmonic counterpart /ɪ/, this case represents a neutralization toward the spreading value and thus /i/ should behave transparently.

We realize that there is more to say on the ATR-system and we refer to Van der Hulst and Smith (ms.). Here we choose for discussing the more challenging data involved in the labial system, which appear to provide a problem rather than support for our earlier proposals.

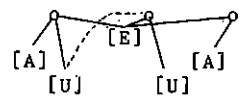
2. Labial harmony

In K /ø/ and /ɔ/ occur non-initially if and only if /ø/ or /ɔ/ occur in the initial syllable. There is no rounding correlation for high vowels, and these vowels are therefore neutral with respect to labial harmony. On the basis of what was said at the end of the preceding section we would expect /i/ to be opaque, as it represents a neutralization toward the default value (i.e. non-round), whereas /u/ and /ʊ/ ought to act transparently as they represent a neutralization toward the spreading value. Unfortunately, it turns out that the behaviour of both the rounded and the unrounded high vowels is precisely the other way around. We will first look at the rounded vowels /u/ and /ʊ/ and then turn to /i/ later.

/u/ and /ʊ/, in whatever position, can never be followed by rounded low vowels. This implies that rounded high vowels do not function as triggers, but it also means that such vowels function as blockers. We can explain this behavior by requiring that vowels whose [U] feature is spread as well as vowels to which this [U] may associate must be low, i.e. [A]-specified. This is a language-specific constraint on [U]-harmony:

(7) a.
[E] -----o-----o-----o------
[A] -----o----------o------
[I] ----------------------
[U] -----o>>>>>o----------
(/ø/ /u/ + /e/)

b.



(7a) should be read as follows. The little circles represent features associated to a node, which bears all the vocalic features. Adjacent features are assumed to be one specification (due to the OCP). ">>>" represents a spreading of [U]. (7a) then expresses the same as (7b). Below our conception of the way in which vocalic features are hierarchically structured will change, but we will keep the notation used in (7a) constant.

The spreading in (7) is not allowed since /u/ is not specified for [A]. If such spreading was allowed, the feature [U], characterizing /u/, would be set afloat and associate to the suffix vowel, i.e. /u/ would behave transparently. The opacity of high rounded vowels follows then from the fact that they are P-bearing units for [U], while [U]-harmony does not apply to them because of the extra requirement that a target vowel must be [A]-specified.

We now turn to /i/. A central question in this paper is how we can account for the fact that /i/'s appear to be transparent. We expect /i/ to be opaque, given the proposals in Van der Hulst and Smith (1986). Let us explain in more detail why we have this expectation.

The strongest claim concerning assimilation is that it always involves spreading under adjacency. Let us express the adjacency requirement in terms of the following condition:

(8) COLINKING CONSTRAINT
Colinking involves adjacent elements.

Assuming (8) as a universal principle we arrive at a quite simple theory of opacity, as was first pointed out by Pulleyblank (1985). Given that some segment S is P-bearing with respect a spreading feature F, S will be opaque if F may not associate to it either due to an extra condition on the spreading

rule or due to a FCR (cf. Archangeli and Pulleyblank 1986, Ewen and Van der Hulst, this vol). The first case is exemplified by the opacity of high rounded vowels in the labial system in K. The second case will now be illustrated with two examples involving ATR and rounding harmony.

- Like many African languages, Akan has ATR harmony (Clements 1981). The low vowel /a/ which belongs to the non-[E] set has no harmonic counterpart, at least not at the phonological level. To account for this gap we assume a FCR which rules out the presence of [E] in the absence of both [I] and [U]:

(9)

i	u	ɪ	ʊ	{E I}	{E U}	{I}	{U}
e	o	ɛ	ɔ	{E A I}	{E A U}	{I A}	{U A}
-		a			-	{A}	

(10) FCR: $\neg([E] \wedge \neg([I] \vee [U]))$

When a low vowel occurs between a [E]-specified stem vowel and a suffix vowel which is harmonic with the stem, it acts opaquely. On the assumption that the low vowel is a P-bearing unit for [E], the expected result is indeed that the low vowel will block the propagation of [E]. The point is that the low vowel may not be associated to [E] due to the FCR in (10) and that, as a P-bearing unit, it may not be skipped because this would violate the condition in (8).

- Bashkir has labial harmony. It has a vowel system of the following type. Note that /a/ and /ae/ lack a rounded counterpart.

(11)

i	ü	-	u	{E I}	{E I U}	- {E	U}
e	ö	ʌ	o	{E A I}	{E A I U}	{E A}	{E A U}
ae	-	a	-	{A I}		{A}	

(12) FCR: $\neg([U] \wedge \neg[E])$

Only non-high vowels trigger rounding harmony, but if a low vowel occurs in between a mid rounded vowel and a mid suffix vowel, the suffix will have an unrounded vowel (Poppe 1962). Hence low vowels act opaquely. This is what we predict if we assume that low vowels are P-bearing units for [U].

Given the above it is reasonable to ask how we can give content to the claim that the opaque vowels in Akan and Bashkir are considered P-bearing units with respect to a spreading feature to which they cannot be associated due to a FCR, as it will be clear that this is crucial to the account of opacity just illustrated.

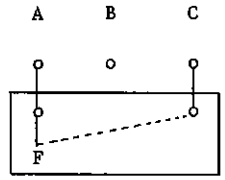
3. On the difference between transparency and skippability

(8) implies that all spreading involves adjacent elements. Clearly, we cannot simply take this to mean that spreading involves strictly adjacent SEGMENTS, since in the case of harmony consonants may intervene between vowels. Rather "elements" should be understood as P-bearing units. What does it mean for some segment to be a P-bearing unit with respect to some feature F? To clarify what this means we must provide some background. In recent autosegmental work it is assumed that segments are not represented by an unordered set of phonological features, but rather by an HIERARCHICALLY ordered set of features. Individual features do not associate directly to points on the "skeletal tier" but to non-terminal nodes in the segmental tree called class nodes (cf. Clements

1985 (and references there), Sagey 1986, Steriade 1986, Schein & Steriade 1986, Archangeli & Pulleyblank 1986). In an underspecification framework, class nodes which bear no features need not be present in the representation of a segment (cf. especially Archangeli & Pulleyblank 1986). Such nodes however must be generated, if necessary, by a convention.

Given this view, we can regard a segment S P-bearing with respect to some feature F iff S is (or can be) provided with a class node C to which F associates. In addition, it follows that a segment S which is not provided by the class node C will be skipped by a spreading F if S is not "invited" to generate the class node in question. Schematically, skipping is illustrated in (13). Observe that (8) is not violated:

(13)



Can we use this notion of skipping to account for the behavior of K /i/? In most proposals concerning the hierarchical structure of segments [Round] is set apart from the other "vocalic" features by associating it to a separate class node. We believe that the key to explaining the skippability of /i/ lies herein.

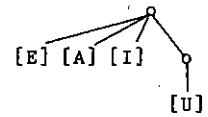
/i/ obviously has no specification [U]. Since [U] is the only feature associating to the [U]-bearing node, /i/ does not have this node underlyingly. Now recall that segments involved in [U]-spread must be [A]-specified. Given this condition, /i/'s will not be considered at all and therefore not be invited to generate the [U]-bearing node. This explanation then is based on the following hierarchical grouping of vowel features:

(14) a.

[E] ----------
[A] ---o--------o----
[I] -------o---------
[U] ---o>>>>>>>>o----

(/ɔ/ /i/ + /ɔ/)

b.



Suppose we were to simply say that /i/ must be ignored because it doesn't fulfill the requirement of being [A]-specified, instead of assuming the structure in (14). This implies that we loosen the adjacency requirement by allowing discontinuous colinking as long as no target is skipped. This is more or less the way in which Goldsmith (1985) handles K /i/. It will be clear that this less constrained notion of adjacency broadens the possibility of skipping vowels in other types of harmony as well. Consider again the case of Akan. Since we have observed that the low vowel cannot be associated to [E] we might just as well say that only nonlow vowels are targets. Since the low vowel does not fulfill this condition it will be skipped, but we claim that in systems of this type low vowels are never skipped.

Since the presence of a feature obviously implies the presence of the class node which bears it, we explain, given (14), why the low vowel in Akan is

opaque with respect to [E]-spreading. Being [A]-specified this vowel is P-bearing for [E]. If we were to assume that /a/ is completely unspecified, it is no longer clear why [E] couldn't pass it, so we will have to rule out complete unspecification in this case.

The opacity of Bashkir /a/ and /ae/ with respect to [U]-spread now presents a problem, however. The [I] and/or [A] specifications of these vowels do not imply the [U]-bearing node. We thus predict that these vowels can be skipped, but they are not, as we have seen. To complicate matters even further, it may not even be relevant that K /i/ is not invited to generate the [U]-bearing node. This point is suggested by an aspect of labial harmony in Buriat. In the next section, we first deal with the Buriat case and then we will return to the opacity of low vowels in Bashkir.

4. The skippability of Buriat /e/

Buriat has a vowel system like that of K, with one difference. Svantesson (1985, 318): "In Buriat the rounding harmony rule is more complicated, since e has been unrounded in certain positions, and has merged with u in others." The development alluded to by Svantesson has the result that short /e/ (schwa in Buriat) lacks a harmonic counterpart. Being [A]-specified, /e/ belongs to the set of targets. Since /e/ lacks a rounded counterpart, [U] should not associate to it. We predict that /e/ will be opaque if we were to assume that segments which are invited to generate the [U]-bearing node behave in the same way as segments which have this node to begin with (because its presence is required by other features). However, Poppe (1960) makes it clear that /e/ is not opaque. If /e/ is preceded by a low rounded vowel, i.e. /ɵe/, subsequent /AA/-suffixes turn up with /ɵe/: /xɵereld-ɵe/ "they conversed" (Poppe, 23). Presumably, the /e/ derives historically from *ɵ. Suffixes with a low short vowel surface with /e/ after a stem ending in /ɵe/. Surprisingly a subset of the short /u/'s also trigger labial harmony. Presumably these go back to *ɵ as well. We seem to have two problems then. We must explain why /e/ does not block RH and we must account for the fact that some /u/'s trigger harmony.

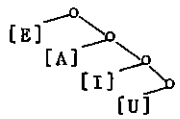
Both problems indicate that short /e/ is not phonologically absent, but only phonetically, i.e. that the initial /u/ which cause labial harmony is in fact an underlying /ɵ/, and also that due to labial harmony /e/'s are derived in non-initial position. To account for the absence of these /e/'s in the surface we assume the following post-lexical FCR and A-rules:

(15) a. FCR: $\neg([U] \wedge [A] \wedge [E] \wedge SHORT)$ b. A-rules: i. Delete [A] initially
ii. Delete [U] elsewhere

(Observe that, apparently, post-lexical A-rules can delete features.) A drawback of this (abstract) analysis is that we have now predict the existence of a nine vowel ATR system in which the low vowel does not block ATR-spreading, since we could assume that the FCR barring the ATR counterpart of /a/ is post-lexical and "correct" the output of the lexical derivation in the post-lexical phonology. We have no reason to assume that such a case should be allowed and we will therefore consider a way of constraining the theory.

In van der Hulst & Smith (ms) we defend a view found in various forms elsewhere (e.g. Schane 1971, Archangeli 1985) viz. that the hierachically organization of vowel features is more sophisticated than what we assumed so far:

(16)



Now suppose that we do not treat nodes which are generated in the course of a spreading process on a par with nodes which are there to begin with, and assume that a generated node will disappear again if the intended association is not brought about. We then explain why the Buriat /e/ does not block [U]-spreading, whereas the Akan /a/ will always block [E]-spreading. Clearly, in the first case [U] is hierarchically lower than any specification of /e/. In the second case however /a/'s feature make-up implies the presence of the [E]-bearing node. There is no way then in which [E] can pass over /a/. This approach is of course still compatible with our treatment of K and Buriat /i/.

(17) a. Akan: opaque /a/

```
[E]--o>>>x---------
[A]------o---------
[I]--o--------o----
[U]----------------
   (/i/ /a/ ✦/ʊ/ )
```

b. Buriat: skipped /e/

```
[E]--o---o---o-----
[A]--o---o---o-----
[I]------o---------
[U]--o>>>>>>>o-----
   (/ɵ/ /e/✦/a/ )
```

We now return to the case of Bashkir in which [U] fails to spread across low vowels. Again we proceed on the assumption that this is necessarily the case. Here a second proposal advanced in Van der Hulst and Smith (ms.) is of relevance, viz. that harmony is basically PARASITIC, a notion introduced in Steriade (1981). By this we mean the following. Given that features are hierarchically ranked one might suggest that the spreading of lower features is dependent on the spreading, colinking or adjacency of higher features. A tentative way of expressing this parasitic principle is the following:

(18) PARASITIC PRINCIPLE
Two segments A and B can be colinked on tier T iff their shared specifications on all higher tiers are adjacent

If we apply this to Bashkir it is necessarily the case that low vowels block labial harmony, because the segments to be colinked are both specified for [E] without being colinked due to the intervening low vowel which is not [E]-specified.

(19) Bashkir: opaque /a/ or /ae/

```
[E]--o---x---o------
[A]--o---o---o------
[I]--o---o---o------
[U]--o--------------
   (/ö/ /ae✦/e/)
```

Observe that in the Buriat case [U] is not prevented from passing over /e/ in terms of the principle in (18) (cf. 17).

5. Conclusion

In this paper we have studied the conditions under which neutral vowels which predictably have the default value act opaquely in vowel harmony. We considered a variety of cases, which, put together, present a rather chaotic picture in which everything seems to go. Assuming however that the distribution found is not random, showing the systematic rather than the accidental absence of conceivable other cases, we have attempted to develop a theory which predicts what we find, nothing more nothing less.

The account offered in section 4 fulfills this goal. It relies on the the Colinking Condition (11), the Opacity Condition (cf. Ewen and Van der Hulst, this vol.), the feature hierarchy in (16) and the Parasitic Principle in (18). It is of course essential that all these aspects of the analysis can be motivated in terms of phenomena which are independent from the cases considered here, but limitations of space prevent us from doing so here. We refer to Van der Hulst and Smith (ms.).

Bibliography

ARCHANGELI, D.
1985 Yokuts harmony: evidence for coplanar representation in Nonlinear phonology. LI 16/3, 335-372

ARCHANGELI, D. & D. PULLEYBLANK
1986 The content and structure of phonological representations. MS. UCSD

CLEMENTS, G.N.
1981 Akan vowel harmony: a nonlinear analysis. In G.N. Clements (ed.), Harvard studies in phonology. Vol. II, 108-177. [IULC].

CLEMENTS, G.N.
1985 The geometry of phonological features. PhY 2, 225-253

EWEN, C. & H.G. VAN DER HULST
1985 Single-valued features and the nonlinear analysis of vowel harmony. In Bennis & Beukema (1985)(eds.), Linguistics in the Netherlands. Dordrecht: Foris, 39-48

EWEN, C. & H.G. VAN DER HULST
this vol. Single-valued features and the distinction between [-F] and [OF].

GOLDSMITH, J.
1985 Vowel harmony in Khalkha Mongolian, Yaka, Finnish and Hungarian. PhY 2 (1985), 253-277

GREGERSON, K.
1976 Tongue-root and register in Mon-Khmer. In P. Jenner et al. (eds.), Austroasiatic Studies. Part I. Oceanic Ling. Spec. Publ. no 13. Hawaii, THE University Press.

HALL, B. & R. HALL
1980 Nez Perce vowel harmony: an Africanist explanation and some theoretical questions. In R. Vago (1980) (ed.), Issues in vowel harmony. Amsterdam, 201-236

HATTORI, S.
1982 Vowel harmonies of the Altaic languages, Korean, and Japanese. Acta Orientalia Academiae Scientiarum Hung. Tomus XXXVI (1-3), 207-214

HULST, H.G. VAN DER & N. Smith
1986 On Neutral Vowels. In K.Bogers, H. van der Hulst & M. Mous (1986) (eds.), The representation of suprasegmentals in African languages. Dordrecht: Foris Publications, 233-279

HULST, H.G. VAN DER & N. SMITH
ms. Harmony systems.

POPPE, N.
1960 Buriat Grammar. Indiana university publications Uralic and Altaic series, vol 3. Bloomington: Indiana University.

POPPE, N.
1962 Bashkir Manual. Indiana university publications Uralic and Altaic series, vol 36. Bloomington: Indiana University.

PULLEYBLANK, D.
1985 Tonal and vocalic redundancy rules. [Paper presented at the Colloque phonologie pluri-lineaire, Lyon 1985]

SAGEY, E.
1986 The representation of features and relations in non-linear phonology. MIT, Diss.

SCHANE, S.
1973 [back] and [round]. In S. Anderson and P. Kiparsky (eds.), A Festschrift for Morris Halle. New York, 174-184.

SCHEIN, B. and D. STERIADE
1986 On geminates. LI 17/4, 691-745.

STERIADE, D.
1981 Certain parameters of metrical harmony. GLOW lezing.

STERIADE, D.
1986 Non-underlying feature values. Lecture Phonology Workshop Wassenaar.

STEWART, J.
1983 Akan vowel harmony: the word structure conditions and the floating vowels. Studies in African linguistics 14.

SVANTESSON, J.-O.
1985 Vowel harmony shift in Mongolian. Lingua 67/4, 283-329.