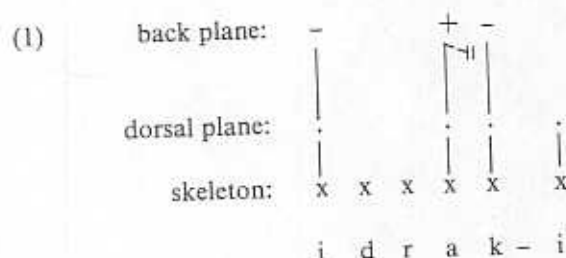


# Parasitic Harmony

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## 0. INTRODUCTION

The development of non-linear phonology has lent great depth to our current understanding of long distance phonological processes like harmony. In particular, non-linear theories have provided a formalism in which we can express harmonic assimilation and the situations in which assimilation is blocked. The blocking behavior of opaque segments in harmony systems is attributed to their specification for the harmonic feature at the time harmony takes place. For example, some consonants are underlyingly palatalized in Turkish, and are minimally distinct from their non-palatalized counterparts by an underlying [-back] specification. This [-back] feature prevents the spread of [+back] from root vowel to suffix vowel, as in the following representation of the word *idrāk-i*.<sup>1</sup>



We will refer to this kind of blocking as *direct blocking*, since the presence of a specification for the harmony feature (on a non-undergoer) results in the direct prevention of association on the harmony plane.<sup>2</sup> In this paper, we address the question of whether all instances of blocking in harmony systems are to be analyzed as cases of direct blocking. It is argued that in *parasitic* harmony systems, blocking can derive not only from a specification of the harmony feature, but also from the formal representation of an identity condition on the trigger and target of a harmony rule. Parasitic harmony is described as a harmony process which is dependent on both the trigger and target being multiply linked to some

contextual feature. Harmony can be said to operate within the domain of the contextual feature, and is therefore called *parasitic*.

We review cases of blocking in parasitic harmony systems in Menomini and Maasai. In each of these two cases, we argue for an analysis in which the segments that block harmony are not specified for the harmony feature when harmony applies.

## 1. THE NON-LINEAR ANALYSIS OF HARMONY

Several assumptions underlie the analysis of harmony systems in non-linear phonology; we pause to briefly mention a few that play a role in the analyses presented here.

### 1.1. Underspecification

Following Kiparsky (1985), Archangeli (1984), and Steriade (1987), phonological segments are represented underlyingly with only a subset of the feature values that they could bear in a fully specified surface representation. While there are differences in the theories of underspecification referred to above, they are not crucial to our analysis. We adopt Steriade's theory of underspecification in which two kinds of redundant feature specifications are recognized:

1. *R-values* are feature values that are redundant for an entire class of segments. Such redundant features are not represented in underlying representation. For example, the class of sonorants in English is redundantly [+voice], and therefore unspecified underlyingly for [voice].
2. *D-values* are feature values which serve to distinguish segments belonging to one class, and therefore are not redundant for the entire class in question. But even D-features need only be specified for a single value in underlying representation. For example, in a typical five vowel inventory containing /i,e,u,o,a/, the feature [high] distinguishes the mid vowel /e/ from the high vowel /i/, but both vowels need not bear a [high] feature in underlying representation. Rather, only [+high] or [-high] needs to be specified underlyingly, with the unspecified value filled in by a redundancy rule for the class of segments in question (the non-low vowels in this case).

While all R-values are systematically absent in underlying representation, Steriade reserves the possibility that D-values are present underlyingly in specific languages.

### 1.2. Feature Geom

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(2)

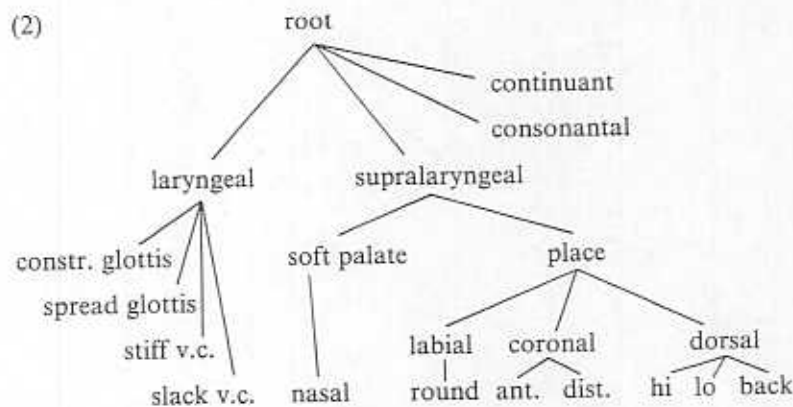
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 constr. glottis /  
 spread glottis  
 stiff v.  
 slac

Feature geomet for why certain harmony system as in many vo vowel to vowe planation for t is a redundant representation. lexically are sin multiple associ and the dorsal to specify the geometry allow other feature s onants) cannot

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## 1.2. Feature Geometry

Several researchers have recently enriched the non-linear representation of phonological segments by suggesting that distinctive features are hierarchically organized. Mohanan (1983), Clements (1985), Halle (1986), Archangeli & Pulleyblank (1986) and Sagey (1986) have all proposed models of feature geometry, arguing that a hierarchical representation groups together those features which function as a group in phonologies of human languages. All of these models have their roots in an articulatory model of phonological organization. The model proposed in Sagey (1986) is given below.<sup>3</sup>



Feature geometry, together with underspecification affords an explanation for why certain classes of segments are systematically ignored in some harmony systems. Consider the Turkish example once more. In Turkish, as in many vowel harmony systems, the harmonic feature spreads from vowel to vowel, skipping over and ignoring most consonants. The explanation for this derives from the fact that for most consonants [back] is a redundant feature (an R-value) and is therefore absent in underlying representation. The consonants that do not bear a [back] specification lexically are simply not seen by Back Harmony, a process which creates multiple associations on the back plane between the spreading [back] feature and the dorsal node of target vowels. Underspecification allows us not to specify the transparent consonants with a [back] feature, and feature geometry allows the association of [back] to proceed on a plane where other feature specifications (in particular, those of the transparent consonants) cannot interfere.

The non-linear analysis of harmony provides a way of characterizing blocking segments in harmony systems: all those segments which are

specified for the harmonic feature at the stage in the derivation where harmony applies will be able to block harmony. If harmony applies early in the derivation, before the redundancy rules have applied, then only segments which are underlyingly specified for the harmonic feature will block harmony. Harmony can also be ordered after some redundancy rules, in which case a larger class of segments could potentially block harmony.<sup>4</sup> But in either case, blocking occurs by virtue of a specification on the harmony plane, and for any harmony system, we can predict the class of segments which can potentially block, by assessing the distinctions between segments in underlying representation. We turn now to consider two cases of indirect blocking in parasitic harmony.

## 2. PARASITIC HARMONY

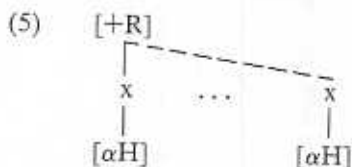
Many harmony systems share the property of allowing spreading of the harmonic feature *F* only when trigger and target are similarly specified [ $\alpha$ G], for some contextual feature *G*. One well-known example of this type is Yokuts Round Harmony, illustrated in (3), which spreads [+round] from [ $\alpha$ high] to [ $\alpha$ high] vowels (Archangeli 1984, Kisseberth 1969, Newman 1941).

(3)	Yawelmani:			
	<i>gloss</i>	<i>fut.pass.</i>	<i>pass.aor.</i>	<i>prec.ger.</i>
	'tangle'	xilnit	xilit	xil?as
	'know about, recognize'	hudnut	hudut	hud?as
	'take care of an infant'	gopnit	gopit	gop?os
	'procure'	maxnit	maxit	max?as

Round Harmony does not apply when the trigger and target vowels are of dissimilar height, as in the following examples:

(4)	mo:xil?as	'grow old-prec.ger.'
	suhwa:hin	'make by means of supernatural powers'

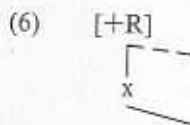
It is possible to represent this condition as in (5), using the formalism of Autosegmental Phonology:



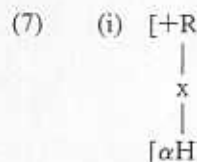
## Parasitic Harmony

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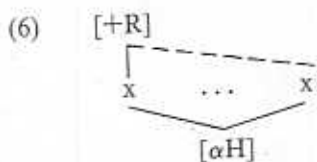
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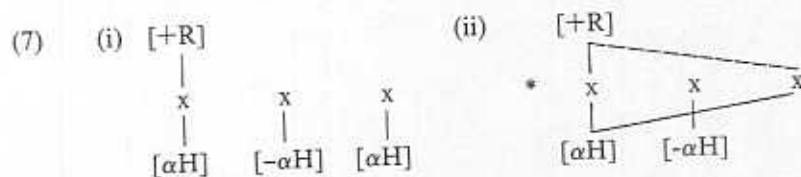
In fact in Yokut and not [-round The Linked S many languages of a contextual in some of the harmony proces process (Steriad Primary Round

Yet, such a representation does not capture the significance of the fact that the contexts specified on both target and trigger must be identical. Equally plausible would be a harmony system which spread the harmonic feature only from  $[\alpha F]$  triggers onto  $[-\alpha F]$  targets, yet no such cases are known to exist.<sup>5</sup>

An alternate representation of the identity condition on Yokuts Round Harmony is obtained by allowing harmonic spreading of  $[+round]$  only when both target and trigger are linked to a single contextual feature  $[\alpha high]$ , as in (6). We will refer to this analysis as the Linked Structure Analysis.



The representation of the harmony rule in (6) is simpler than (5), since it refers to fewer features. It also allows a clear expression of the identity condition. The Linked Structure Analysis makes the prediction that Round Harmony will be blocked whenever a segment which is specified as  $[-\alpha high]$  at the time harmony applies intervenes between trigger and target. The presence of an intervening  $[-\alpha high]$  segment will prevent the trigger and target from multiply linking to a single  $[\alpha high]$  feature without creating crossing association lines. This situation is illustrated in (7), where the configuration in (i) does not meet the rule in (6) because the trigger and target are not linked to a single occurrence of  $[\alpha high]$ . Obviously (ii) is not well-formed.



In fact in Yokuts, we can observe that  $[-\alpha high]$  segments block harmony, and not  $[-round]$  segments.

The Linked Structure Analysis of harmony expresses the fact that in many languages harmonic spreading of  $[F]$  is dependent on prior association of a contextual feature  $[G]$ . Very clear examples of this sort are found in some of the Uralo-Altaic languages, where the application of one harmony process is dependent on the prior application of another harmony process (Steriade 1981, and references cited there). For example, in Kirghiz, Primary Round Harmony applies freely in words that have undergone

harmonic spreading of [-back]. Words with [+back] vowels have not undergone Back Harmony (their [+back] specification is provided by redundancy rule), and consequently, do not exhibit uniform Round Harmony. Rather, words with [+back] vowels are subject to a Secondary Round Harmony rule which spreads [+round] onto vowels of similar height. Primary Round Harmony is thus seen to be *parasitic* on prior application of Back Harmony, which creates the multiply-linked contextual structure. The feature [+round] spreads across all segments linked to the same [-back] feature.

### 3. MENOMINI HEIGHT HARMONY

Menomini vowel harmony is another example of parasitic harmony, whose peculiar characteristics receive a straightforward explanation using the Linked Structure Analysis.<sup>6</sup> Menomini has a system of regressive height harmony which raises long /ē,ō/ when followed by one of the high vowels /i,u/, in the same word.<sup>7</sup> For example, the long /ē,ō/ in the roots in (8i-iii) raise to /ī,ū/, respectively, when a suffix is added which contains /i/ or /u/:<sup>8</sup>

- (8) i. /kōnl-/ kū-niak 'lumps of snow' (MG p.96)  
(cf., kōn 'snow' (MG p.96))  
ii. /āteqnōhk-/ āteqnūhkuwew 'he tells him a sacred story'  
(MG p.96)  
(cf., ātqnōhkew 'he tells a sacred story' (MG p.96))  
iii. /nēmU-/ nīmit 'when he dances' (MG p.96)  
(cf., nēmow 'he dances' (MG p.96))

There are six underlying vowels in Menomini: /i,e,ε,u,o,a/.<sup>9</sup> All six vowels have both short and long variants. In addition to these, there are two diphthongs: /ia/, /ua/. The occurrence of the vowel /ε/ between the target and trigger of harmony will block harmony from applying, as seen in (8iv,v):

- (8) iv. kēwaskepīw 'he is drunk' (MG p.96)  
v. kēwētuaq 'when they go home' (MG p.96)

In contrast, the vowel /a/ is transparent to harmony. In the form in (8vi), the root /o/ undergoes harmony triggered by the suffixal /i/; the intervening /a/ does not block harmony, as /ε/ does in examples (8iv,v).<sup>10</sup>

### Parasitic Harmony

- (8) vi. mōs  
(cf.,

Ignoring for a moment we can say that the feature from a nucleus position. spreading rule, as

- (9) Height H

In this analysis, before the D-rule

We will first apply Harmony. Since this would result in that there is a u [+high, +low]. In particular, the [+high] onto the undergoing harmony from spreading locally, from a segment in the We assume that rules must be superposition of together with the derivations, resulting

We turn now why it is that this vowel in the /ε/ is a lax front vowel, alternating

- (8) vi. mōskamU- mūskaMIT 'if he emerges' (ML)  
 (cf., mōskamow'he comes up from under water' (ML))

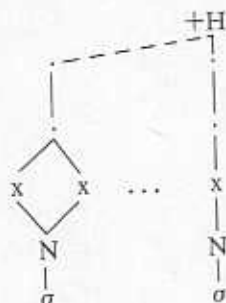
Ignoring for a moment the behavior of transparent /a/ and opaque /ε/, we can say that Height Harmony is the regressive assimilation of a [+high] feature from a syllable nucleus position to a long (branching) syllable nucleus position. This rule can be formally stated as an autosegmental spreading rule, as in (9).

(9) Height Harmony

Dorsal Node:

Root Node:

Skeleton:



In this analysis, Height Harmony is a feature-filling rule which applies before the D-rule has supplied the feature [-high] to the mid vowels.

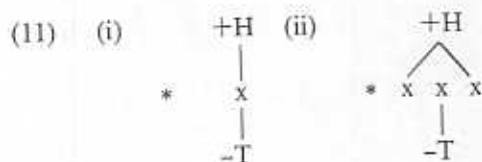
We will first address the problem of transparent /a/ in Menomini Height Harmony. Since /a/ is specified as [+low], assimilating [+high] to /a/ would result in the illicit feature combination [+high, +low]. We suggest that there is a universal filter that prohibits the combination of features [+high, +low], and that this filter acts as a constraint on derivations. In particular, this filter will prohibit Height Harmony from assimilating [+high] onto the vowel /a/.<sup>11</sup> However, while the filter prevents /a/ from undergoing harmony, it does nothing to stop the harmonic [+high] feature from spreading past /a/. In this view, harmony is not constrained to operate locally, from syllable to syllable, in Menomini.<sup>12</sup> Harmony can skip over a segment in the event that the segment is not able to undergo harmony. We assume that non-local application is the unmarked case, and that local rules must be specially constrained, though nothing hinges on this interpretation of markedness. The minimal statement of Height Harmony, together with the strategy of interpreting the filter as a constraint on derivations, results in a system where /a/ is transparent.

We turn now to the problem of opaque /ε/. In order to understand why it is that /ε/ can block [+high] assimilation, we first characterize this vowel in terms of the vowel inventory of Menomini. The vowel /ε/ is a lax front vowel which shows more surface variants than any other vowel, alternating between æ ~ ε ~ ɛ̃. The surface realization of this vowel



instead of feature-filling or default rules. Moreover, there does not appear to be any other aspect of the phonology that requires / $\epsilon$ / to be specified for height at any stage in the derivation.

The second way in which opaque segments are sometimes explained in autosegmental treatments of vowel harmony is by the introduction of filters which prohibit the harmonic feature from associating to and skipping over opaque segments (Kiparsky 1981).<sup>16</sup> Thus, Menomini could invoke the filter in (11i) to prevent [+high] from linking to [-tense], and the filter in (11ii) to prohibit the harmonic spread of [+high] from skipping over the opaque [-tense] segment.

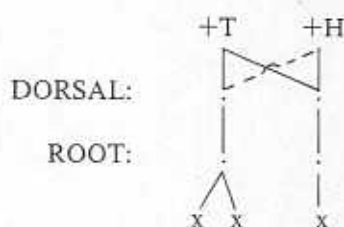


The filter in (11ii) can be reinterpreted as a locality condition on harmony, preventing harmony from skipping over non-undergoers (non-undergoers being created by filters like (11i)). However, this interpretation of harmony blocking in Menomini is at odds with the fact that harmony appears to be a very non-local process; not only does harmony skip over all instances of /a/, it also skips over all short mid vowels, since only long mid vowels undergo. In short, it is a fact that harmony is only blocked by one out of four possible non-undergoers (/e,o,a, $\epsilon$ /), and that it is not a local process. Claiming that harmony is strictly local, as part of the explanation for the opacity of / $\epsilon$ /, would require that all short mid vowels and /a/ actually undergo height harmony. This would in turn require a neutralizing rule of [+high]-fission to re-derive [-high] /e,o,a/ at the surface. The obvious problem here is that not all instances of short /i,u/ would be candidates for this [+high]-fission rule. Some short /i,u/ would be underlying - not the product of Height Harmony - and as such must not undergo [+high]-fission, in order to surface as [+high].

In the case of Menomini, in order to entertain a Kiparskian "filters" analysis of opacity, it would be necessary to allow a filter like (11ii) in the grammar, without interpreting it as a general locality condition on spreading rules. Then, the filters in (11i,ii) together would account for the opacity of / $\epsilon$ /: The short mid vowels and /a/ would not block simply because no filters would prevent Height Harmony from skipping over these vowels. However, even leaving aside the plausibility of filters of the sort in (11ii), we observe that there is no motivation for positing the filter (11i) in Menomini; [+high, -tense] segments *must* be derived in the phonology, since they appear in the surface vowel inventory as allophones of / $\epsilon$ /.

The opacity of / $\epsilon$ / in Menomini Height Harmony can be easily explained by employing the Linked Structure Analysis presented in the discussion of Yokuts, above. Our proposal is that Height Harmony is dependent on structures which are already multiply linked to a single [+tense] feature. The Linked Structure Analysis directly relates the opacity of / $\epsilon$ / to its [-tense] specification. The rule of Height Harmony is reformulated in (12).<sup>17</sup>

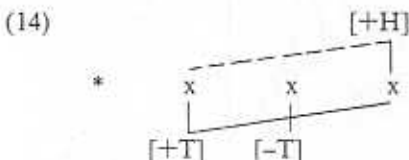
## (12) Height Harmony



The formulation of Height Harmony in (12) explains the opacity of / $\epsilon$ / in the following way. First, it is necessary to assume that there is a process within Menomini that conflates adjacent, identical [tense] specifications into a single, multiply-linked feature, as in (13):<sup>18</sup>



Let us assume that this process applies to all [tense] features before harmony applies. If [+high] assimilation only occurs when both trigger and target are linked to the same [+tense] feature, it follows both that / $\epsilon$ / will not undergo harmony, and that it will block harmony. Blocking will occur because the [-tense] specification of / $\epsilon$ /, when it intervenes between the trigger and a potential target, will prohibit the trigger and target from becoming multiply linked to a single [+tense] specification, as illustrated in (14). Multiply linking the trigger and target to a single [+tense] feature creates a violation of the "no crossing association lines" principle.



We have seen that the Linked Structure Analysis offers a simple explanation for the puzzling facts of Menomini, without invoking any *ad hoc* special rules or filters into the theory. Moreover, as is argued in section 2, harmony

## Parasitic Harmony

rules which employ general observations in those rules, as in

## 4. MAASAI [ATR] H

The vowels in Maasai [+ATR] class are

- (15) +ATR  
i  
e

The vowels in Maasai are described by two rules of ATR Harmony, described

## 4.1. General Harmony

General Harmony as [+ATR] in the specification, the [-ATR] is assigned a [+ATR] suffix in (16ii), a [+ATR] (16iii) illustrates the vowel.<sup>19</sup>

- (16) i. I-tOr  
2-sit-  
A-Irc  
1-col  
ii. E-do  
3-pul  
E-no  
3-hur  
iii. E-jIn  
3-ent  
A-I-s  
1-II-s

rules which employ the Linked Structure context are well-motivated from general observations about the types of contextual information specified in those rules, as observed in known harmony systems.

#### 4. MAASAI [ATR] HARMONY

The vowels in Maasai can be divided into two partially symmetric classes: a [+ATR] class and a [-ATR] class, as in (15).

(15)	+ATR		-ATR	
	i	u	I	U
	e	o	E	O
			A	

The vowels in roots and suffixes alternate between [-ATR] and [+ATR] by two rules of ATR Harmony – General Harmony and Diphthong-induced Harmony, described in the next two sections.

##### 4.1. General Harmony

General Harmony has the effect of causing all vowels in a word to surface as [+ATR] in the presence of a morpheme that contains an underlyingly [+ATR] vowel. If no vowel in a word has an underlying [+ATR] specification, then all vowels will surface as [-ATR]. We can say that [-ATR] is assigned by a default rule in Maasai. In the examples in (16i), a [+ATR] suffix vowel causes root vowels to surface as [+ATR], while in (16ii), a [+ATR] root vowel causes suffix vowels to surface as [+ATR]. (16iii) illustrates the default application of [-ATR] in words with no [+ATR] vowel.<sup>19</sup>

- (16) i. I-tOn-ic → i-ton-ic  
 2-sit-App.  
 A-Irobl-ju → A-irobi-ju  
 1-cold-Inc.
- ii. E-dot-U → e-dot-u  
 3-pull-MT  
 E-nor-IshO → e-nor-isho  
 3-hunt-intran.
- iii. E-jIn-U  
 3-enter-MT  
 A-I-sUf-IshO  
 1-II-wash-intran.

As illustrated in (16i), and in the forms in (17) below, the low vowel /A/ blocks General Harmony.

- (17) i. O-IE-m-AA-nin  
MS-Rel-Neg-I-hear  
(cf. o-le-m-e-nin from O-IE-m-E-nin)
- ii. E-nUk-Ar-ic-kI → E-nUk-Ar-ic-ki  
3-bury-MA-APP-Pass
- iii. I-gurAn-U → i-gurAn-U  
II-play-MT

Since /A/ is not minimally distinguished from any other underlying vowel by the feature [ATR], it will receive its [-ATR] value by a R(edundancy)-rule, in Steriade's (1987) theory of underspecification, sketched earlier. The R-rule will assign [-ATR] to all unspecified low vowels at the same time. The non-low vowels are minimally distinguished in underlying representation by the feature [ATR]. If we assume that [+ATR] is the lexical value, then [-ATR] will be filled in on all non-low vowels by a D(istinctive)-rule in Steriade's theory. Steriade suggests that R-Rules always follow other redundancy rules (D-rules). If this is true, then before [-ATR] is filled in on the low vowels, it will first be filled in on all unspecified non-low vowels.<sup>20</sup> In this case, all vowels would be fully specified for [ATR] when harmony applies. If harmony is feature-filling, then all vowels would block harmony – an absurd situation.

We are left with three alternatives at this point:

1. We could deny the proposed ordering of D-rules before R-rules, and specify [-ATR] on the low vowel as the first redundancy rule. This solution would lead to a weaker theory of underspecification, inasmuch as Steriade (1987) has argued for the opposite ordering on the basis of the facts of harmony systems like Finnish Back Harmony. At best, we would have to allow the ordering of D-rules and R-rules to be determined on a language specific basis.
2. We could accept that D-rules apply before R-rules, and allow harmony to be ordered after both types of redundancy rules have applied. In this case, harmony would have to be of the feature-changing variety. While we accept that feature-changing harmonies do exist (as in Poser's (1982) discussion of Chumash and McCarthy's (1984) discussion of Montañes Pasiego), Maasai simply doesn't bear the hallmarks of a feature-changing system. Most notably, there is no evidence that harmony causes a bidirectional shift of [+ATR] → [-ATR] and [-ATR] → [+ATR]. In fact, there is no evidence that both values of [ATR]

- are active  
the [ATR]
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- (18) kI-tA-t  
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- (19) \* [+

are active in the phonology: only [+ATR] needs to be specified in the [ATR] Harmony rules (to be discussed below).

3. We could accept the ordering of D-rules before R-Rules, but specify that General Harmony applies before either class of redundancy rule. This ordering would account for the fact that the mid and high vowels undergo General Harmony; these vowels can all be unspecified for [ATR] when General Harmony applies. But /A/ would also be unspecified for [ATR], and therefore we would yet have no explanation for the opacity of /A/.

Adopting the third analysis above, we might attempt to account for the opacity of /A/ by assigning it the value [-ATR] in the lexicon. We reject this analysis because it requires a totally redundant feature value in underlying representation for the sole purpose of getting the harmony facts right. Moreover, it would be an ad-hoc solution, since it would remain unexplained why it is /A/ that blocks, and not some other vowel. It would be equally plausible to stipulate that /E/ is underlyingly [-ATR], in which case it would be the blocking vowel.

There is further evidence from a rule of Raising against the analysis that assigns a lexical [-ATR] value to /A/. Raising is a non-local rule that has the effect of changing all occurrences of /A/ in a suffix to /o/ after a [+ATR] root vowel, as in the following example.

- (18) ki-tA-bol-A-ki-t-A → ki-tA-bol-o-ki-to  
2-Past-open-Ep-Dat-Pl-Past

If /A/ were underlyingly [-ATR], then the rule in question would have to be feature-changing: the [+ATR] value of the root vowel displacing the [-ATR] value of an arbitrary number of low suffix vowels. Assuming /A/ to be unspecified for [ATR] allows us to formulate Raising as a rule changing [+low] /A/ to [-low] /O/, which would be followed by General Harmony, deriving surface /o/. Since General Harmony is well-motivated for other data, exploiting its application here allows us to maintain the simpler rule of Raising which does not manipulate a [-ATR] feature.

Another possible explanation for the opacity of /A/ would be to rely on filters to prohibit /A/ from acquiring a [+ATR] specification, as in (19):

- (19) \*  $\begin{array}{c} [+ATR] \\ | \\ x \\ | \\ [+low] \end{array}$

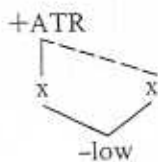
and to further restrict harmony from skipping over any non-undergoers. This type of analysis was considered and rejected above for Menomini (see discussion of the filters in (11i,ii)). The problem with the filter analysis is that in certain environments /A/ actually does assimilate [+ATR], surfacing as [ə]. Tucker describes a local [+ATR] assimilation process in Maasai that spreads the feature [+ATR] from lexically specified [+ATR] glides onto the immediately preceding and following vowels, irrespective of the height of the preceding vowel. Consider the following examples:

- (20) i. A-I-rOwA → A-I-rowə  
 Inf-II-hot  
 ii. A-I-wAn → A-i-wən  
 Inf-II-evade  
 iii. Ol-owAru → ol-owəru  
 MS-beast

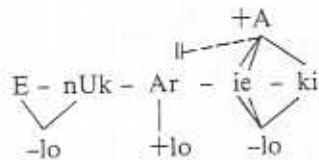
We can see from the form in (20i) that this local assimilation rule follows General Harmony, since the derived root vowel /o/ does not cause the preceding prefix to surface as [+ATR] /i-/. If we were to adopt the filter analysis, we would have to say that the filter in (19) is somehow deactivated before local [ATR] assimilation takes place.

A third alternative to explaining the opacity of /A/ is to say that General Harmony is parasitic on structures linked to the feature [-low]. This accounts for the fact that all high and mid vowels undergo harmony, and that the vowel /A/ is the only blocker. Parasitic General Harmony is formulated in (21). A sample derivation is given in (22).

- (21) Parasitic General Harmony (bidirectional)



(22)



The analysis of General Harmony parasitic on a linked [-low] configuration is consistent with the analysis of Raising suggested above. Recall that Raising

changes the [+ATR] (/i,u,e,o/). We need a redundancy rule that the simples affect the [ATF] Harmony, which /o/. This analy:

1.  $\emptyset \rightarrow [-ATR]$
2. Raising
3. General

Since [-low] is used to exploit the parasitic General Harmony in (21).

While the analysis is very strong, the filter in (19) if we allow filter a better argument in the following

#### 4.2. Diphthong-

Another source of induced Harmony glides, glides do all glides that trigger [+ATR].

- (23) i. I-tl  
 2-P  
 ii. kI-  
 1P-  
 iii. Im.  
 loo

Mid vowels do block this harm

- (24) i. A-  
 1-I

changes the [+low] feature of /A/ to [-low] after [-low, +ATR] vowels (/i,u,e,o/). We can view this as a [-low] assimilation rule if we allow the redundancy rule specifying [-low] to apply before Raising. We also argued that the simplest analysis of Raising was to assume that it does not directly affect the [ATR] specification of /A/, but rather is followed by General Harmony, which will always specify the output of Raising (/O/) as [+ATR] /o/. This analysis imposes the following rule ordering:

1.  $\emptyset \rightarrow [-low]$  (Redundancy Rule)
2. Raising
3. General Harmony

Since [-low] is specified before General Harmony takes place, it is possible to exploit the presence of this feature, as in the analysis of Parasitic General Harmony in (21).

While the analysis of General Harmony as parasitic on a linked [-low] configuration does explain the opacity of /A/, we concede that it is not yet very strongly motivated. In particular, the analysis which relies on the filter in (19) and a locality condition on harmony is also plausible if we allow filters to apply only to some levels of derivation. However, a better argument for a parasitic harmony system in Maasai is presented in the following discussion of Diphthong-induced Harmony.

#### 4.2. Diphthong-induced Harmony

Another source of [+ATR] vowels in Maasai is the rule of Diphthong-induced Harmony. With the exception of a few lexically specified onset glides, glides do not generally play a role in General Harmony. In contrast, all glides that are the first member of the diphthongs /yA/ and /wA/ trigger [+ATR] harmony on preceding high vowels, as in (23).

- (23) i. I-tU-pUnU-t-U-A → i-tu-punu-t-w-A  
2-Past-come-Pl-MA-Past
- ii. kI-tI-bIrI-A → ki-ti-biry-A  
1P-Past-come-Pl-MA-Past
- iii. ImArIrI-A [-] ImAriry-A  
look up to-Past

Mid vowels do not undergo Diphthong-induced Harmony; rather, they block this harmony process, as shown in (24).

- (24) i. A-I-nOr-U-A → A-I-nOr-w-A  
1-II-look-MT-Past

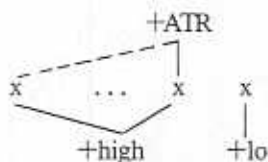
- (24) ii. k-I-nOr-U-t-U-A → k-I-nOr-u-t-w-A  
 Ip-II-look-Pl-MT-Past  
 iii. En-k-ItOrE-A → In-k-ItOry-A  
 FS-II-command-Nom.  
 iv. Il-nOjInE-AA → Il-nOjiny-AA  
 MP-hyena-Pl

Diphthong-induced Harmony must follow General Harmony, since otherwise the blocking effects of the mid vowels would never be realized. The reverse ordering would result in the following ill-formed derivation of the word in (24ii).

- (25) k-I-nOr-U-t-U-A  
 k-I-nOr-u-t-w-A Diphthong-induced Harmony  
 \* k-i-nor-u-t-w-A General Harmony

We propose that the blocking behavior of mid vowels in Diphthong-induced Harmony is explained by stipulating that Diphthong-induced Harmony is parasitic on structures linked to a [+high] contextual feature, as in (26).

- (26) Parasitic Diphthong-induced Harmony:



The analysis of Parasitic Diphthong-induced Harmony requires ordering the D-Rule specifying [-high] on the mid vowels before harmony. Then the mid vowels will bear a [-high] specification when harmony applies, and will block the formation of the necessary linked [+high] contextual feature. As illustrated in (27), the presence of a mid vowel in between a glide and a high vowel target prevents the glide and the high vowel from being linked to the same [+high] feature.

- (27)
- 

One might suggest that mid vowels block Diphthong-induced Harmony

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- (28) -A +  
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## 5. CONCLUSION

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by virtue of being specified [-ATR] at the time harmony applies. If this were the case, then the derivation of (24iv) could proceed as in (28).

$$(28) \quad \begin{array}{c} -A \quad +A \\ | \quad \nearrow \\ \text{Il-nOjiny-AA} \end{array}$$

The problem with this analysis is that it requires a special redundancy rule that will specify the mid vowels as [-ATR] before the high vowels (recall that *all* vowels surface as [-ATR] in words that have no [+ATR] vowel). In the theory of underspecification adopted here, the D-Rule for [ATR] will specify [-ATR] on mid and high vowels at the same time (since these are the vowels for which the feature [ATR] is minimally distinctive in underlying representation). Therefore, the analysis which relies on a [-ATR] specification on mid vowels to explain their opacity would require weakening the theory by allowing languages to tailor their redundancy rules to their own needs. Needless to say, such a theory is lacking in predictive power.

Of course, as we saw in the discussion of Menomini, it would be possible to explain the behavior of the blocking segments by ordering harmony after the redundancy rules specify the blockers for the harmonic feature. In this case it would mean allowing Diphthong-induced Harmony to apply after both high and mid vowels are specified as [-ATR]. In this case, harmony would be a feature-changing rule that transforms [-ATR] high vowels into [+ATR] high vowels. As we saw for Menomini, there is no motivation for calling this harmony a feature-changing process, since only one value arguably spreads. Moreover, under the feature-changing analysis, we would still need some way of explaining why mid vowels do not undergo harmony, and the linked structure analysis in (26) seems the best explanation.

##### 5. CONCLUSION

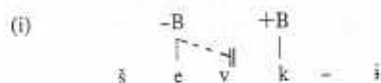
Menomini and Maasai illustrate that not all blocking phenomena can be explained by referring to specifications of the harmonic feature alone. In these two cases, the class of blocking segments is characterized by referring to some contextual feature: the blocking segments form the complement of the class of segments that trigger and undergo harmony with respect to the contextual feature. In Menomini Height Harmony, the [+tense] vowels comprise the triggers and undergoers, while the [-tense] vowel blocks. In Maasai Diphthong-induced ATR Harmony, the [+high] vowels and certain glides are triggers and undergoers, while the [-high] vowels

block. What is important is that the unusual blocking phenomena in both of these languages can be explained by referring only to properties of the representations to which harmony applies. By adopting the non-linear theory of phonological representation, together with the theory of underspecification, we can explain blocking in parasitic harmony systems as well as the more familiar type of direct blocking, as seen in Turkish, without introducing powerful filters or diacritic devices into the theory.

## NOTES

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1. Example and analysis from Clements & Sezer (1982). Note that in this particular case, the analysis would not change significantly if we were to adopt [-back] as the spreading value, and specify [+back] by default. In such an analysis *idrāk-i* would not exhibit harmony blocking; however, analogous cases exist in which a non-palatalized velar consonant appears root-finally after front vowel roots, yet conditions back vowel suffixes: *ševk-i*. In the analysis that takes [-back] as the lexical (spreading) value, such consonants would have to be represented lexically with the feature [+back]. This lexical value would prohibit the spread of [-back], as in the following derivation:



2. The terms "plane" and "tier" are used somewhat ambiguously in the literature to refer to the level of representation in which a feature associates to segments independent of the association of other features. We adopt the term "plane", and use it throughout this paper. The particular analysis of feature geometry we assume is spelled out in the next section.

3. Sagey emphasizes a distinction between the terminal nodes in hierarchical representation and non-terminal class nodes. Only the former have binary values ("+" and "-"); class nodes are either present or not - but there is no "-" value of a class feature like coronal in her model.

4. Steriade (1987) argues that some harmony processes apply after redundancy rules have already supplied the targets of harmony with a specification for the harmonic feature. Such harmony processes would be *feature-changing*. See also McCarthy (1984) and Poser (1982) for a discussion of feature-changing harmony in Pasiego and Chumash, respectively.

5. In fact, there is only one example cited in the literature of a harmony rule which specifies a context on both target and trigger, yet where the contexts are not identical. This is the case of Sanskrit *n-Retroflexion* (*ṅati*), which requires that the targets be [+nasal], while the triggers are [+cont, -ant, -dist]. But even in this case, the trigger and target are both coronal. See Whitney (1889), Schein and Steriade (1986).

6. All Menomini data are obtained from Bloomfield (1962, 1975). For a more lengthy presentation of the facts relating to harmony, and other vowel alternations, see Cole (1986).

7. The glides /y,w/

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nucleus (i.e., high vow

8. The abbreviation and (1975), respective

9. In this paper we distribution of the v

underlying U, a [+hi] U-Lowering must prec

takes place will includ source, and treat u,o :

10. In this example loss of root final /ʌ see Cole (1986a).

11. For the use of fi and Archangeli & Pu

12. For a different Pulleyblank (1986).

13. Short e is reali is realized as [æ] bef

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14. We do not pres here. In fact, it is p

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15. Note that such or R(edundancy)-rul

16. This type of a Smith (1986).

17. Although in (1: in true three-dimensi

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*tongue root* articulat

18. An obvious ca merging is a reflex

19. The sources for

20. Even in Archa vowels would be fill

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 Archangeli, D. and Representations, California, Los Ange

7. The glides /y,w/ in onset and coda positions do not trigger harmony, although they derive from the same underlying segments - /I,U/ - as the high vowels /i,u/. These facts can be explained by constraining the triggers to [+high] segments which belong to a syllable nucleus (i.e., high vowels).

8. The abbreviations MG and ML are used to indicate references in Bloomfield (1962) and (1975), respectively.

9. In this paper we are ignoring the interesting problem posed by the complementary distribution of the vowels *u,o*. In Cole (1986a), it is argued that both vowels derive from underlying *U*, a [+high, +back] vowel, which is lowered in certain environments to *o*. Since *U-Lowering* must precede Height Harmony, the derived segment inventory at the time harmony takes place will include the vowel *o*. For clarity, we will abstract away from their underlying source, and treat *u,o* as distinct vowels.

10. In this example, Vowel Harmony is seen to apply after suffixation and subsequent loss of root final /U/. For a discussion of the coalescence rules that precede harmony, see Cole (1986a).

11. For the use of filters in constraining derivations, see Kiparsky (1981), McCarthy (1984), and Archangeli & Pulleyblank (1986).

12. For a different perspective on the locality of association rules, see Archangeli and Pulleyblank (1986).

13. Short *ε* is realized as [ɛ] in the personal prefixes before *hC*. In all other words, [ɛ] is realized as [æ] before *h* or *q*, and as [e] elsewhere. In rapid speech, *ε*, when not preceding *h* or *q*, is realized as [ɪ]. Long *ε* ranges over [ε],[æ] and even [α], although Bloomfield does not state the environments for these alternations.

14. We do not present a complete analysis of the underlying underspecified vowel inventory here. In fact, it is possible to distinguish /*ε*/ solely on the basis of the feature [-tense], even though the low, back vowel /*a*/ is most likely also [-tense]. The [-tense] feature on /*a*/ is predictable, given the vowel inventory, on the basis of its [+low] feature.

15. Note that such a special redundancy rule would qualify neither as a D(istinctive)-rule or R(edundancy)-rule in the underspecification theory of Steriade (1987).

16. This type of analysis is also discussed in Pulleyblank (1985) and Van der Hulst & Smith (1986).

17. Although in (12) it appears that the association lines linking [tense] and [high] cross, in true three-dimensional structures both of these features occupy independent planes. Also, we are assuming here that the feature [tense] links to the dorsal node, but this analysis is completely consistent with a theory of representation in which [tense] links to a separate *tongue root* articulator node.

18. An obvious candidate here is the OCP. Also, McCarthy (1986) argues that feature merging is a reflex of Plane Conflation. For discussion of his proposal see Cole (1987).

19. The sources for these forms are Levergood (1984) and Tucker & Mpaayei (1955).

20. Even in Archangeli's (1984) theory of underspecification, the [-ATR] value on low vowels would be filled in after or at the same time as the [-ATR] value on non-low vowels.

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## Transparent

Hamida Demirdache  
M.I.T.

### 1. WHAT IS A TRANSPARENT?

Consider the following

(1)

*Harmonic fe*

As we can see in (1) in a phonological counterpart. Opaq also fail to alterna block spreading of which has a domin

(2)

i. *Harmic*

ii. o-be-  
o-be-  
o-bis-

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