Rule Governed Vowel Harmony and the Strict Cycle

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0. Introduction

In this paper, it will be argued that autosegmental spreading in Maasai vowel harmony must be an ordered rule governed by the Strict Cycle Condition (SCC).*

The need for the SCC has been well motivated in cyclic analyses by Chomsky (1973), Kean (1974), Mascaró (1978), and Kiparsky (1983). The autosegmental theories of tone and vowel harmony of Goldsmith (1976) and Clements (1980,1981), respectively, do not explicitly include the SCC since they do not consider data that require it. However, it will be argued that the SCC must govern spreading in Maasai vowel harmony.

Language particular rules of autosegmental association which take precedence over universal well-formedness conditions governing (automatic) spreading have been proposed in tonal analyses (cf. for example, the contributions in Clements and Goldsmith (in press)). Pulleyblank (1983), however, argues that all (tonal) spreading is by rule, thereby eliminating automatic spreading altogether.[1] In support of Pulleyblank's claim based on tonal phenomena, it will be argued here that spreading in Maasai vowel harmony is not automatic, but that it is the result of a rule that is crucially ordered on the cycle before two rules that derive harmony

autosegments.

In the first section of this paper, I will argue for an analysis of the canonical cases of vowel harmony in Maasai. In the second section, it will be argued that forms in which spreading appears to be blocked are immediately accounted for if spreading is an ordered rule governed by the SCC. In the third section, some of the implications of the analysis for the theory of vowel harmony and for autosegmental theory in general will be briefly discussed.

1.0 Canonical spreading

Maasai is a Nilo-Saharan language, classified as Paranilotic by Tucker and Bryan (1966). Maasai is spoken in southern Kenya and northern Tanzania. The data on which this study is based come from Tucker and Mpaayei (1955).

1.1 The vowel harmony system

On the surface, Maasai has the twenty vowel system set out in (1) (and possibly in addition, the vowels described in footnote 14). There are short and long vowels, and for each tongue body configuration, there is a pair of vowels distinguished by the feature [ATR] (advanced tongue root). The [+ATR] low vowel is very restricted in its distribution and does not figure in the analysis to be presented here.

(1) Maasai vowels (short and long)

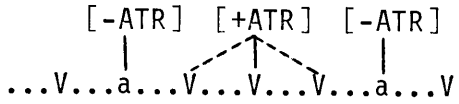
[-ATR]		[+ATR]	
I	U	i	u
ɛ	ɔ	e	o
a		(ə)	

The vowel harmony system of Maasai is a dominance type. Dominant vowels are those non-low vowels which are invariant [+ATR] and are responsible for initiating vowel harmony. Recessive vowels may surface as either [+ATR] or [-ATR], that is, they are subject to vowel harmony. The low vowel [a] may be opaque. Opaque [a] is not subject to the harmony process in question, and furthermore it delimits the domain of harmony. I will follow Clements (1980) and Kiparsky (1983) in assuming that the formal representation of opaque [a] is as an archisegment lexically associated with [-ATR].[2] There is also a lexically unassociated [a] in Maasai, but the analysis of this segment is outside of the scope of this paper.[3]

Vowel harmony is initiated by a (dominant) [+ATR] vowel anywhere in the word. Underlying dominant vowels are found only in roots and suffixes.[4] In principle, a [+ATR] vowel may be derived anywhere in the word. As schematized in (2), underlying

[+ATR] spreads both right and left onto all vowels in its domain, the domain tentatively delimited by opaque [a] and by word boundary. If there is no [+ATR] feature in a domain, then all vowels in that domain surface as [-ATR]. Following Pulleyblank (1983), I will assume that the entire universal content of Goldsmith's (1976) well-formedness condition (wfc) is the clause in (3).

(2)

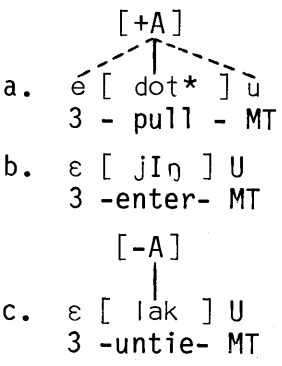


(3) Well-formedness condition (wfc)

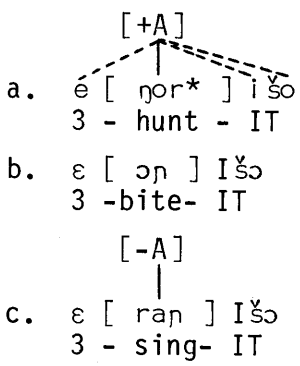
Association lines may not cross.

Vowel harmony initiated by a dominant vowel in the root is illustrated in (4a).[5] The invariant root dot* underlyingly contains a [+ATR] vowel. The affixes in (4a) consist of recessive vowels which are subject to spreading from the dominant vowel in the root. When occurring with a root not containing a dominant vowel, as in (4bc), these affixes surface as [-ATR]. The data in (5) illustrate the same phenomena.

(4) -u/-U MT
e-/ɛ- 3rd person

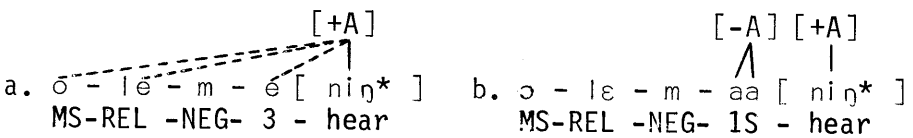


(5) -iš͡o/-Iš͡ɔ IT
e-/ɛ- 3rd person



The data in (6) show the blocking effect of the opaque vowel. In (6a), the [+ATR] feature spreads leftward through the prefix vowels, but in (6b), that spread is blocked by the lexically associated [-ATR] of the opaque vowel.

(6) o-/ɔ- MS
le-/lɛ- REL
e-/ɛ- 3rd person

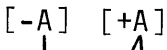


(7) illustrates vowel harmony initiated by a dominant vowel in a suffix. The applied suffix -ie* contains dominant [+ATR] vowels. The root ton/tɔn and the 2nd person prefix i-/I- contain recessive vowels subject to harmony. In (7a), the [+ATR] feature spreads leftward into the root and prefix. In the absence of a dominant vowel, as in (7b), the recessive vowels in the root and prefix surface as [-ATR]. (7c) shows that the spread of [+ATR] is blocked by an opaque vowel. The leftward spread of [+ATR] in (7a) is what distinguishes a dominance vowel harmony system such as that in Maasai from a root control system such as that in Turkish.

(7) ton/tɔn 'sit'
i-/I- 2nd person

a. i [tɔn] ie*
2 - sit -APPL

b. I [tɔn]
2 - sit



c. I [as] ie*
2 - do -APPL

(8) pɛrr/pɛrr 'split'
i-/I- II
-ki/-kI PASS

a. aa - i [pɛrr] ie* - ki
1S -II -split -APPL -PASS

b. a - I [pɛrr]
INF-II-split

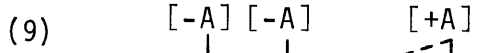
c. aa - tI [rIk] a - kI
1S -PAST-nauseate-PAST-PASS

As a last example of canonical spreading, (8a) above shows that [+ATR] in a suffix may spread both right and left. (8bc) substantiate the crucial vowels as being recessive.

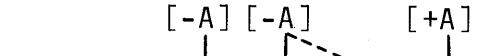
1.2 Precedence in spreading

The problem that must be addressed is how to predict that it is the dominant [+ATR] feature which always takes precedence in spreading. For example, in (9a), the [+ATR] feature on the past tense suffix vowel e* must spread leftward onto the intransitive suffix vowel before the [-ATR] feature on the root vowel has a chance to spread rightward onto that vowel, as it does incorrectly in (9b).

(9)

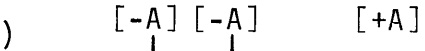


a. ɛ - ta [raŋ] iš - e*
3 -PAST-sing - IT -PAST

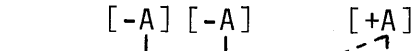


b.* ɛ - ta [raŋ] Iš - e*

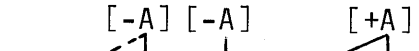
(10)



a. ɛ - ta [raŋ] Iš - e*



b. ɛ - ta [raŋ] iš - e*



c. ɛ - ta [raŋ] iš - e*
3 -PAST-sing - IT-PAST

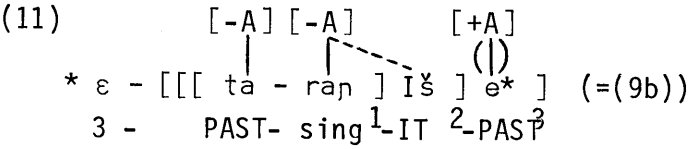
RULE GOVERNED VOWEL HARMONY AND THE STRICT CYCLE

In the standard autosegmental theory, one way that precedence in spreading can be achieved is by distinguishing bound from unbound autosegments and by stipulating that unbound autosegments spread first.[6] As in (10a) above then, the [+ATR] feature would be lexically unbound, and by stipulation, in (10b) it would spread before the [-ATR] in the root, just as desired. If, following Clements' (1981) analysis of a root control language, Akan, [-ATR] may spread, then after the unbound [+ATR] autosegment has spread in (10b), in (10c) the bound [-ATR] autosegment may spread leftward.

Two arguments will be given that indicate that [-ATR] should not be permitted to spread. These arguments are not dependent on any particular lexical representation of non-low vowels. First, if [-ATR] may spread, we would expect to find phonological rules that make crucial reference to this feature on vowels. In fact, I have found only rules that introduce the [+ATR] specification on vowels.[7]

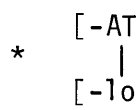
The statement of the second argument requires that I anticipate the results of Section 2. As I will argue, autosegmental spreading must apply cyclically. However, if [-ATR] can spread on the cycle, then it would be incorrectly predicted that [-ATR] may spread onto a vowel when that vowel is not in the cyclic domain of [+ATR]. For example, in (11), [-ATR] is incorrectly permitted to spread on cycle 2 because on that cycle, the intransitive suffix vowel is not in the cyclic domain of [+ATR], and thus [+ATR] never has a chance to take precedence in spreading onto that vowel. (9a) of course is the desired representation.

(11)

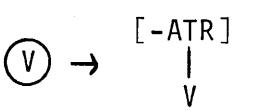


A mechanism that will prevent the cyclic spread of [-ATR] will avoid both of these objections. Kiparsky (1983), within the framework of lexical phonology, uses lexical marking conditions to prevent some feature from being specified on some class of segments in the lexicon and during the cyclic (lexical) phonology. The condition appropriate for Maasai is in (12). It does not allow a [-ATR] feature to be specified on non-low vowels in the lexicon or on the cycle. In the postlexical phonology, the spell-out rule in (13) specifies all unspecified vowels as [-ATR].

(12) Lexical marking condition (lexicon and cyclic phonology)



(13) Spell-out rule (postlexical)



These mechanisms account for precedence in spreading by ensuring that only [+ATR] can spread on the cycle. As there is no further need for the distinction between bound and unbound autosegments for the purpose of determining precedence, I will assume that all underlying dominant vowels are lexically associated with [+ATR].[8] Thus, the various vowels in Maasai are underlyingly represented as in (14), where all segments on the segmental tier are archisegments unspecified for [ATR].

(14)

dominant	recessive	opaque
[+ATR]		[-ATR]
V	(V)	a

Again anticipating the results of the next section, a sample partial cyclic derivation is given in (15). Crucially, in (15a), spread of [-ATR] is blocked by the lexical marking condition in (12), but in (15b) spread of [+ATR] is permitted. The marking condition also blocks spreading in (15c), but in (15d) the prefix vowel is postlexically specified as [-ATR] by the spell-out rule in (13).

(15)

a. [-A] [-A]
[[ta - raŋ] Iš͡ɔ]
1 2
(spreading blocked by (12))

b. [-A] [-A] [+A]
[[ta - raŋ - iš] e*]
2 3

c. [-A] [-A] [+A]
[ɛ [ta - raŋ - iš - e*]]
34
(spreading blocked by (12))

d. [-A] [-A] [-A] [+A]
ɛ - ta - raŋ - iš - e*
3 -PAST- sing- IT -PAST
(spell-out (13))

2.0 Spreading as an ordered rule governed by the SCC

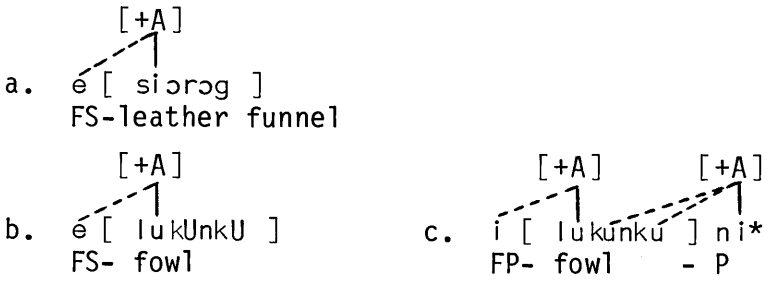
In this section, evidence will be presented that autosegmental spreading must be the result of an ordered rule that is governed by the SCC. To be able to predict the domain of spreading in disharmonic roots and in forms containing a derived [+ATR] autosegment, spreading must be governed by the SCC. However, the SCC alone cannot predict the spreading behavior of autosegments derived by rule. It will be shown that spreading must also be ordered

before these rules.

2.1 Disharmonic roots

Disharmonic roots are roots that contain both [+ATR] and [-ATR] vowels not separated by an opaque vowel. The examples in (16ab) are the only clear cases of disharmonic roots in Maasai, although some other roots are arguably disharmonic.

(16)



It must be ensured that the [+ATR] in a disharmonic root does not spread within the root. That [+ATR] in (16ab) spreads onto the prefix vowels shows that the [+ATR] cannot be prevented from spreading altogether. That the [+ATR] in the suffix on the disharmonic root in (16c) spreads onto the root vowels shows that the recessive root vowels are not somehow immune to being spread upon.

Rather, following Kiparsky (n.d.:19), an explanation for the existence of these roots comes from making spreading subject to a version of the SCC. The condition in (17), a modification of Mascaró's (1978) SCC, permits spreading by rule only in morphologically or phonologically derived domains. (That spreading is by rule will be argued directly below.) In (16), the SCC permits spreading across the morpheme boundaries, but it does not permit spreading within the underived environment of the roots.[9]

(17) Strict Cycle Condition (SCC)

A cyclic rule R may apply on cycle j iff either (a) or (b) is met:

(a) R crucially refers to some A and B in either

[...A...[...B...]...] or [...[...B...]...A...] or
j-1 j j-1 j

[...[...A...]...[...B...]...]
j-1 j-1 j

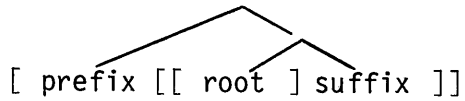
(b) R makes crucial use of information assigned on cycle j by a rule applying before R.

2.2 Derived [+ATR] autosegments

There are two rules which create [+ATR] autosegments. To predict when these derived autosegments may spread, spreading not only must be governed by the SCC, but it must also be the result of a rule ordered before these two rules in a counterfeeding order.

I have not yet done a complete morphological analysis of Maasai, but in what follows I will assume that words have roughly the constituent structure in (18).[10] Not only is this structure plausible, but it is motivated by assuming that forms in which spreading behavior is similar have similar constituent structures.

(18)



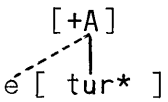
2.2.1 The 3rd person prefix rule

Maasai verbs fall into two lexical and morphological classes, Class I and Class II. The 3rd person marking on both classes is a prefix consisting of a front mid vowel. On the Class I verbs in (19), the vowel is recessive e/ɛ, the harmonic class determined by the usual spreading mechanism. However, on the Class II verbs in (20), the prefix is always [+ATR]. As illustrated by (21), it is not the case that all vowels in prefixes on Class II verbs are [+ATR]. Thus, the morphophonemic rule in (22) that determines the harmonic class of the Class II 3rd person prefix must make reference to both the identity of the prefix and the Class II verb stem.[11]

(19) Class I verbs

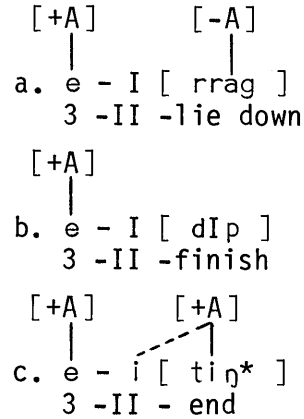
a. ɛ [raŋ]
   3 - sing

b. ɛ [rIp]
   3 - sew



c. e [tur*]
   3 - dig

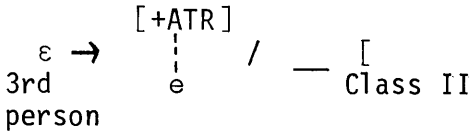
(20) Class II verbs



(21) a. nI - mI - k - I [rrag]
FUT-NEG -1P -II -lie down

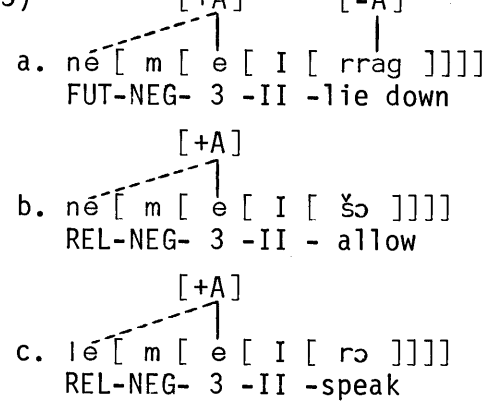
b. ɛ - m - I [rrag]
2P-NEG-II -lie down

(22) 3rd person prefix rule



It must be predicted that in (20ab) and (23), the autosegment derived by the rule in (22) does not spread rightward across the morpheme boundary, but in (23) it does spread leftward across the boundary. The [+ATR] in (23c) is derived on cycle 2, as in (24a). If spreading were the result of a condition applicable at all stages of a derivation (i.e. automatic), we would then expect the derived [+ATR] to spread rightward, since the SCC alone, in particular clause (a), would license its spreading rightward over the morpheme boundary. Note that spreading towards the root over a morpheme boundary must be licensed elsewhere, for example in (15b), to account for spreading from dominant vowels in suffixes.

(23)



(24) a. [ε [I-rɔ]] (22)→
2 1
[+A]
[e [I-rɔ]]
2 1
[+A]
b. [m [e-I-rɔ]]
3 2
[+A]
c. [lé [m-e-I-rɔ]]
4 3

(15b) and (23c) are minimally different, however, in that the [+ATR] in the suffix in (15b) is lexically associated, in (23c) it is derived. A principled way to predict the spreading behavior in (23c), then, is to exploit this difference. Spreading must then be a rule that is ordered before rule (22) on the cycle. By ordering the spreading rule and making it subject to the SCC, the rule itself is maximally simple: "spread", as in (25).

(25) Spreading rule: spread!

The derivation of (23c) can then proceed as follows. In (24a), on cycle 2, the spreading rule is up first on the cycle, but there is no autosegment to spread. Rule (22) then applies, deriving [+ATR], and internal boundaries are erased. The next time the environment of spreading is met is on cycle 3, in

(24b), but the SCC prohibits spreading to the right in the underived environment. Spreading is again applicable on cycle 4 in (24c). The SCC permits spreading to the left into the morphologically derived environment, but again prohibits spreading to the right.

2.2.2 Vowel raising

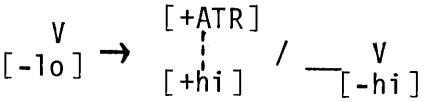
The phonological rule of V-raising in (27), a modification of a rule proposed by Wallace (1981), raises and makes [+ATR] a non-low vowel before non-high vowels, creating a new [+ATR] autosegment. V-raising may be fed by k-deletion in (26), also a variation of a rule proposed by Wallace.[12]

(26) k-deletion

[-hi] k [+lo] — 1 Ø 3 3
1 2 3

delete [k] between a non-hi vowel and [a]; lengthen [a]

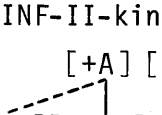
(27) V-raising



a non-lo vowel becomes hi and [+ATR] before a non-hi vowel

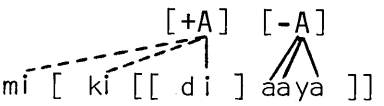
Some examples of the results of applying these rules are in (28bd). The analysis of (28d) is in (29). In (29a), k-deletion and V-raising apply on cycle 1. Spreading is applicable on cycles 2 and 3 in (29bc), and the SCC permits spreading to the left into each morphologically derived environment.

(28) a. a [I [nɔk]]
INF-II-kindle



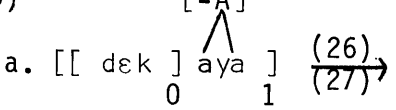
b. í [[nu] aa]
II-kindle-IMP

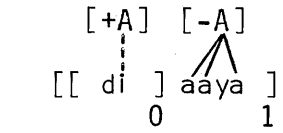
c. a [dɛk]
INF-curse

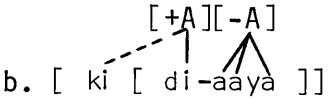


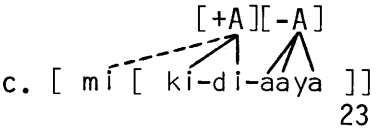
d. mí [kí [[di] áaya]]
SUBJ-3 -curse- MA

(29)









V-raising has also applied to the forms in (30bdf). The examples in (28bd) and (30bdf) are different in that the derived

autosegments in (28bd) are marginal on the cycle and spread, those in (30bdf) are not marginal on the cycle and do not spread.[13]

(30) a. ɔl [tɔmɛ]
MS-elephant

b. [+A][-A]
Il [[tɔmi] a]
MP- elephant-P

c. a [I [[ŋɔr] U]]
1S-II -look at-MT

d. [+A][-A]
a [I [[[ŋɔr] u] a]]
1S-II - look at-MT-PAST

e. ɔl [bɛnɛ]
MS - bag

f. [+A][-A]
Il [[bɛni] a]
MP - bag - P

(31) is the analysis of (30f). The [+ATR] is created in (31a) by V-raising on cycle 1. This makes cycle 1 a phonologically derived environment. If spreading were the result of a condition applicable at all stages of a derivation, then the SCC, in particular clause (b), could not prevent spreading within the phonologically derived environment of the root.

(31)

a. [-A]
[[bɛnɛ] a] —(27)→
0 1

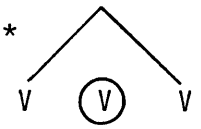
[+A][-A]
[[bɛni] a]
0 1

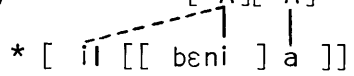
b. [+A][-A]
[Il [bɛni-a]]
12

However, by making spreading a rule ordered before V-raising on the cycle, the absence of spreading in (31a) is predicted. In (31a), the autosegment is derived on cycle 1. The next time spreading comes up on the cycle is in (31b) on cycle 2, but the SCC prevents spreading leftward within the underived environment of the root.

As pointed out to me by John Goldsmith, although the SCC prevents spreading in an underived domain, without the condition in (32), the non-marginal [+ATR] in (31b) would be incorrectly

permitted to associate to the prefix vowel, as it does in (33). I will assume that (32) is universal, and that languages having neutral vowels have a stipulation overriding (32).

(32) 

(33) 

2.3 Summary

In summary then, the existence of disharmonic roots provides evidence that the domain of spreading must be defined by the SCC. The behavior of [+ATR] derived by the 3rd person prefix rule in (22) showed that clause (a) of the SCC cannot prevent incorrect spreading in a morphologically derived environment. The behavior of [+ATR] derived by V-raising in (27) showed that clause (b) of the SCC cannot prevent incorrect spreading in a phonologically derived environment. Both failures of spreading expected under the SCC alone were predicted by making spreading a rule ordered in a counterfeeding order before these rules. The analysis based on spreading being an ordered rule then provided further support for spreading being governed by the SCC.

2.4 Other processes affecting vowel quality

There are two rules affecting vowel quality that are not included in this analysis because I believe them to be unrelated to the rule of spreading. The first is noted by Tucker and Mpaayei (1955:241). The quality of the first prefix vowel in a word is "doubtful" under certain circumstances,[14] reflected by the inconsistency in Tucker and Mpaayei's transcriptions in (34). I take this doubtful quality to be formally the result of a low level process affecting the first vowel rather than a variation in the application of the spreading rule.

(34) a. Il [meut] i*
il [meut] i*
MP-giraffe- P

b. ɛm [bu] ata
ɛm [bu] ata (←bɔl)
FS-extract-GER

The other process has applied to the forms in (35). The [+ATR] derived by V-raising appears to spread in an underived environment. However, in these cases, spreading appears to be limited to one vowel, rather than being unbounded in principle. I do not understand what triggers this, but it is reasonable to assume that it is the result of a binary spreading rule, rather than the unbounded spreading rule in (25).

(35)

a. kUlɛ
milk

b. [kúli] arei
milk - COLL
[+A][-A]

c. ɔl [ŋɔjInɛ]
MS - hyena

d. Il [[ŋɔjini] aa]
MP - hyena - P
[+A] [-A]

e. a [rɔ]
INF-kick

f. ɛn [[tó-ru] a]
2P - IMP-kick-IMP
[+A][-A]

3.0 Conclusion

The machinery needed for Maasai vowel harmony is listed in (36). The wfc and SCC, in some form or another, have of course been proposed as universals. The condition in (32) is also claimed to be universal. The lexical marking condition and the spell-out rule are part of the grammar of Maasai (unless of course it can be shown that they too are universal).

(36) Maasai vowel harmony machinery

universal:
- a. the wfc in (3)
- b. the condition in (32)
- c. the SCC in (17)

grammar of Maasai:
- d. the lexical marking condition in (12)
- e. the postlexical spell-out rule in (13)

yet to be determined:
- f. the spreading rule in (25), which must be cyclic, subject to the wfc and SCC, and ordered before the rules in (22) and (27)

It must be determined which restrictions on the spreading rule in (36f) need to be stipulated and which fall out from independent principles. It is reasonable to assume that all autosegmental manipulation is subject to some form of the wfc, including the spreading rule.

A more interesting problem is how to predict that spreading is subject to the SCC. In this analysis of Maasai vowel harmony, spreading is non-structure changing in the sense of Kiparsky (1983). Under Kiparsky's version of the SCC, which is an attempt to predict which rules are and are not strict cyclic, non-structure changing rules, in particular the Maasai spreading rule, may apply in non-derived environments. Thus, under Kiparsky's assumptions, it

is very must an open question why Maasai spreading should be subject to the SCC.

We also want to be able to predict that spreading is ordered before the two rules deriving [+ATR]. Assuming the correctness of this analysis in Maasai, and assuming that a similar analysis is required in other languages, we would want the ordering to fall out from the theory. If the ordering is not to be predicted under the principles of UG, then it is unclear how the ordering can be predicted within the grammar of Maasai.

Some of the results of this analysis are strikingly similar to recent claims about spreading in tonal phenomena. Pulleyblank (1983) argues that spreading is cyclic and rule governed, and states that all of his lexical spreading rules apply in derived environments, although apparently not crucially so (Pulleyblank (1983:316)).

Under this analysis of Maasai vowel harmony, then, it appears possible to come closer to an autosegmental theory that unifies all prosodic phenomena.

FOOTNOTES

*I want to thank John McCarthy for allowing me unlimited access to his guidance, advice, and most importantly, his insightful criticism. I would also like to thank Don Churma, Larry Hyman, David Pesetsky, and especially Diana Archangeli, G.N. Clements, John Goldsmith, Harry van der Hulst, and Doug Pulleyblank for valuable comments on earlier versions of this paper. Of course, all errors are my own.

[1]G.N. Clements helped me to clarify some of these points.

[2]In fact, there is evidence that opaque [a] should be formally represented in this way. The roots in (1a) and (1b) contain only opaque [a] but take [+ATR] prefixes and [-ATR] suffixes. To my knowledge, there are no other roots, in particular, no roots containing only recessive vowels, which have this property.

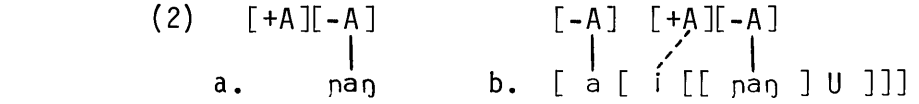
(1) a. a - i [ɲaŋ] U
INF-II-buy from-MT

b. a - i [ɲal] Ita
1S-II -annoy-CONT

Following Clements (1981:147), the lexical representation of these roots can be analyzed as in (2a), with a floating [+ATR] to the left of the opaque vowel which associates to the prefix vowel

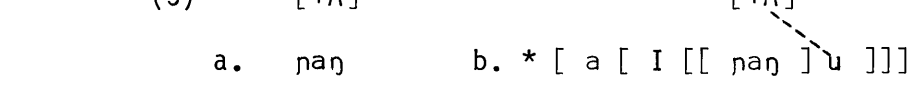
in (2b).

(2) [+A][-A] [-A] [+A][-A]



If this analysis based on the floating [+ATR] is correct for Maasai, and if opaque [a] were not lexically associated with or dominated by [-ATR], as in (3a), then the floating [+ATR] would incorrectly be expected to associate to the suffix vowel, as in (3b). (This is because, under the cyclic analysis presented in Section 2, the suffix is a sister to the root, and thus the floating autosegment associates first to the right.)

(3) [+A] [+A]



That is, the lexical association of [-ATR] to opaque [a] creates a boundary that the floating [+ATR] to its left cannot cross, ensuring that [+ATR] finally associates to a vowel to the left of the root, not to the right.

[3]This [a] is lexically unassociated to distinguish it from the invariant opaque [a]. Briefly, the facts are as follows. Lexically unassociated /a/ surfaces as [o] when preceded by a dominant vowel ((1b) and (2b)) and as [a] when not preceded by a dominant vowel ((1a) and (2a)).

(1) -akI/-oki Dative

a. a [I [[sUj] akI]]
1S-II - wash - DAT

b. a [[bol*] oki]
1S- open - DAT

(2) -ar/-or MA

a. ɛ [[[[nUk] ar] ie*] ki]
3 - bury - MA -APPL - PASS

b. e [i [[[[buk*] or] ie*] ki]]
3 -II - pour - MA -APPL - PASS

[4]That underlying dominant vowels are not found in prefixes is a fact that should be predicted, assuming that it is not an accidental gap. However, it is not predicted under this analysis.

[5]Notational conventions:

a. Although all vowels are formally archisegments unspecified for [ATR], vowels are redundantly represented as they would appear on the surface. Such representations are without theoretical significance.

b. Morphemes containing an underlying dominant vowel are starred for ease of reading.
c. The innermost brackets not in a cyclic derivation surround the root.
d. (V) : unbound vowel
e. abbreviations:

II	Class II	FUT	future	MT	motion towards
M/F	masculine/feminine	GER	gerund	NEG	negative
S/P	singular/plural	IMP	imperative	PASS	passive
APPL	applied	INF	infinitive	REL	relative
COLL	collective	IT	intransitive	SUBJ	subjunctive
CONT	continuous	MA	motion away		

[6]G.N. Clements has suggested another analysis of some of the data presented in this paper. To allow spreading to be the result of Goldsmith's (1976) version of the wfc, he proposes a language particular rule and a language particular priority clause. As I am not clear on the details of Clements' analysis, in particular, how it would deal with the cases of non-canonical spreading in (28) and (30), I am not prepared to discuss it further. However, as the analysis works quite well for the cases of canonical spreading, it will be interesting to see whether the machinery needed in the analysis to be proposed in Section 2 can be dispensed with under a different set of assumptions.

[7]In Bari, a language closely related to Maasai, Hall and Yokwe (1979:291) report that "with only one minor exception (a rule of height dissimilation of a prefix), there are no phonological rules other than Vowel Harmony itself which affect [-ATR] vowels."

As pointed out to me by Doug Pulleyblank, under the assumption that opaque [a] is lexically associated to [-ATR], we would expect to find rules that refer to this [-ATR]. I have found no rule of this sort. However, the following analysis of opaque vowels suggested by Pulleyblank certainly deserves investigation in this regard, taking the data in footnotes 2 and 3 into consideration. Kiparsky (n.d.) makes a similar proposal.

underlying: (a)

lexical marking condition: $*\begin{matrix}[+\text{ATR}] \\ | \\ [+\text{lo}]\end{matrix}$

condition in (32)

late spell out rule: $a \rightarrow \begin{matrix}[-\text{ATR}] \\ | \\ a\end{matrix}$

[8]Doug Pulleyblank and Diana Archangeli have correctly pointed out that under the evaluation metric of, for instance, Clements (1980), it is costly for [+ATR] to be lexically associated

to dominant vowels. To reduce the cost, Pulleyblank has suggested that this feature is floating in the lexicon and that association conventions (not subject to the SCC (cf. Section 2)) might be used to associate [+ATR] to the vowel(s) it lexically dominates, while the spreading rule (subject to the SCC) associates it to other vowels. I believe that Pulleyblank's suggestion can be easily incorporated into this analysis, but since the issue that motivates it is not the subject of this paper, I will assume the representation of dominant vowels in (14). Nothing crucial to the analysis to be presented hinges on this decision.

[9](16c) is the only clear example that I have found in Tucker and Mpaayei of a disharmonic root vowel being spread upon from [+ATR] in a suffix. Hohenberger (1975:87) cites

o-lukuŋgu	i-lukuŋgu-ni
MS-fowl	FP-fowl -P

but also states (Hohenberger (1975:1)) "The vowel quality (close or open) [...] may not always be completely enumerated." However, even if (16b) should prove to be an incorrect transcription, that spreading is governed by the SCC is a good explanation for the existence of disharmonic roots. Other arguments for spreading being governed by the SCC follow in Section 2.2.

[10]The prefix ta- seems to be the only affix which requires an exceptional constituent structure. Since its vowel is not typically spread upon by the [+ATR] derived by V-raising, although a prefix, it must be a sister to the root under the analysis to be presented. There is some independent support for this structure for ta-.

[11]There is not enough consistent evidence in Tucker and Mpaayei (1955) to justify generalizing (22) to include all vowels, the 3rd person prefix being only a special case. The rule, as stated, appears to be exceptionless.

[12]The k-deletion rule in (26) is included for expository purposes only. I am aware that this rule as formulated is odd in that deletion of an onset lengthens the following vowel.

[13]That the examples in (28) but not in (30) involve k-deletion is an accident. Other examples are available, but due to the facts of Maasai morphology, their explanation involves issues orthogonal but not crucial to the analysis presented here.

[14]Tucker and Mpaayei (1955:241) state that the high front vowel, when it is the first prefix vowel, is of

> doubtful quality (somewhere between "I" and "i") before stem vowels "e" and "o", also before "i" and "u" when the latter represent sound change from "open" ["I" and "U"-BL].

No special sign is employed here, and more research is needed.

Note that the mid front vowel in (34b) also seems to be of doubtful quality.

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