

Preservation of the Marked in Vowel Reharmonization*

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1. Introduction

Vowel reharmonization anomalies in Tuvan (a Turkic language of eastern Russia, near northwestern Mongolia) and Finnish may be successfully analyzed as instances of asymmetric preservation of marked structure, a phenomenon which de Lacy (2002) calls faithfulness to the marked. De Lacy proposes a system of conditions on the formation of faithfulness and markedness constraints such that, along a given phonological scale, the more marked elements are asymmetrically penalized by markedness constraints and asymmetrically preserved by faithfulness constraints. Phonological phenomena as diverse as stress placement, coda neutralization, and place assimilation are accounted for through the use of such constraints. Here I argue that de Lacy's system may be extended to the domain of vowel harmony.

In the Tuvan reduplication construction and the Finnish word game discussed below, the first-syllable vowel of a word is replaced with a fixed back vowel, triggering reharmonization of all subsequent vowels in front-harmonic words. In input words that contain a disharmonic front vowel, however, that front vowel fails to reharmonize. Harrison and Kaun (2000) propose that disharmonic vowels do not undergo reharmonization because they are underlyingly specified for their backness value, whereas harmonic vowels are underspecified and therefore subject to reharmonization. However, their account offers no deeper explanation for why only disharmonic vowels should be specified underlyingly; the solution is ad hoc.

I propose instead that we may assume full underlying specification and construct a markedness scale for the autosegmental links between vowels and their backness values, based on general principles of economy and the markedness of inputs (Keer 1999). Given such a scale, we may employ scale-referring constraints of the very

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restricted variety proposed by de Lacy to model the behavior of harmonic and disharmonic vowels under reharmonization. Thus, the reharmonization anomalies in Tuvan and Finnish provide evidence for de Lacy’s restrictive theory of markedness and its principle of faithfulness to the marked. Moreover, the analysis offered here suggests a new way of thinking about autosegmental representations in Optimality Theory.

2. Two Cases of Vowel Reharmonization

In this section I present the reharmonization data from Tuvan and Finnish. Throughout most of the paper, I limit my focus to front/back harmony, which is pervasive in both languages. Tuvan also shows a somewhat more restricted process of rounding harmony, which is discussed briefly in section 4.4.

2.1 Tuvan Jocular Reduplication

The first reharmonization process to be considered is Tuvan “jocular” reduplication, which is described by Harrison (2000). This is a pattern of suffixing reduplication with a fixed first-syllable vowel in the reduplicant. The vowel of the first syllable of the reduplicant is *a*, regardless of the corresponding vowel in the base (with the exception of base *a*, which becomes *u* in the reduplicant) (Harrison 2000:162). Examples are shown in (1).

- (1)

<u>Base</u>	<u>Base + reduplicant</u>	
seek	seek-saak	‘mosquito’
at	at-ut	‘horse’

Jocular reduplication falls into the morphological, or overwriting, half of Alderete et al.’s (1999) typology of reduplication with fixed segmentism: it is suffixing, total reduplication whose fixed segment is not the one that appears in processes thought to reflect the emergence of unmarked structure, such as epenthesis in older loanwords (where the high vowel /i/, in its four front/back and round/unround allophones, appears). Semantically, this form of reduplication expresses “intentional vagueness or a special, casual, informal jocular register” (Harrison 2000:160).

Like other Turkic languages, Tuvan has the eight-vowel inventory shown in (2). All vowels have long counterparts, written as orthographic doubles (Harrison 2000:10).

- (2) Tuvan vowel inventory

	Front		Back	
	Unround	Round	Unround	Round
High	i	ü	ɪ	u
Non-high	e	ö	a	o

For words containing more than one syllable, all vowels harmonize with the fixed first-syllable back vowel of the reduplicant, as shown in (3) (Harrison 2000:166–167).

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(3)	<u>Base</u>	<u>Base + reduplicant</u>	
a.	nom	nom-nam	‘book’
	arat	arat-urat	‘peasant’
b.	inek	inek-anak	‘cow’
	öörenip	öörenip-aaranıp	‘study’

The words in (3a) are back-harmonic, and so the only change observed between base and reduplicant is the alteration of the first-syllable vowel. The words in (3b), by contrast, are front-harmonic, and the change in the first-syllable vowel is accompanied by reharmonization of all subsequent vowels in the word.

Interestingly, the reharmonization observed in (3b) fails to occur when the base contains a disharmonic front vowel. Examples are given in (4), with the disharmonic vowels of the base and reduplicant forms in boldface (Harrison 2000:168–171).¹

(4)	<u>Base</u>	<u>Base + reduplicant</u>	
	ali	ali-uli	‘Ali’
	maš ina	maš ina -muš ina	‘car’
	radi yo	radi yo -rudi ya ²	‘radio’

Comparing (3b) with (4), we see that not all front vowels of the base are retained in reduplicants in Tuvan. Only those front vowels that are disharmonic in the base are retained; harmonic front vowels (i.e., those occurring in fully front-harmonic words) are reharmonized. This generalization constitutes the central problem for a formal account of Tuvan front/back harmony, to which we will turn below.

2.2 A Finnish Word Game

The Finnish word game *kontti kieli* (‘knapsack language’) exhibits the same reharmonization pattern seen in Tuvan: only disharmonic vowels of the base fail to be reharmonized.

The vowel inventory of Finnish and its behavior with respect to front/back harmony are shown in (5) (Vago 1988:186).

(5) Finnish vowel inventory

	High	Mid	Low
Front-harmonic	y	ö	ä
Back-harmonic	u	o	a
Neutral	i	e	

¹ As the examples in (4) demonstrate, disharmonic words in Tuvan tend to be foreign loanwords. An anonymous NELS reviewer suggests that the reharmonization anomalies may be treated by using special constraints for loanwords; however, as Harrison (2000) notes, in older stages of Tuvan, disharmonic loanwords were harmonized as they entered the language. Thus, any loanword constraint designed to deal with disharmonic words would have to incorporate an arbitrary historical cut-off point.

² The change of the final vowel in *radiyo-rudiya* is due to a general restriction in Tuvan according to which non-high round vowels are banned from post-initial syllables (Harrison 2000:74).

Kontti kieli involves taking any ordinary word of Finnish, adding the word *kontti* after it, and swapping the initial CV sequences of the two words.³ When the first word (hereafter, the “input”) contains back vowels, nothing more happens; but when the input contains front vowels, reharmonization occurs, as shown in (6) (Vago 1988:198).

(6)	<u>Input</u>	+	<u>kontti</u>	→	<u>Output of game</u>	<u>Input gloss</u>
	mitä		kontti		kota mintti	‘what’
	nähty		kontti		kohnut näntti	‘seen’
	pysähtyä		kontti		kosahtua pyntti	‘to stop’

In (6) we see the front vowels *ä* and *y* of the input reharmonize as the back vowels *a* and *u*, respectively, following the back vowel *o* of the new initial syllable of the word in which they occur. The neutral vowels *i* and *e* (not shown) remain unchanged.

As in Tuvan, reharmonization behaves differently with disharmonic words. Since *kontti kieli* always replaces the first CV of the input with a syllable (*ko*) containing a back vowel, disharmonic back vowels of the input are in harmony with the new initial syllable *ko* in the output and remain unchanged. However, when the input contains a disharmonic front vowel, that vowel fails to be reharmonized as a back vowel. Data are given in (7), with the disharmonic vowels in boldface (Vago 1988:198).

(7)	<u>Input</u>	+	<u>kontti</u>	→	<u>Output of game</u>	<u>Input gloss</u>
a.	man öö veri		kontti		kon öö veri mantti	‘maneuver’
	jongl öö ri		kontti		kongl öö ri jontti	‘juggler’
b.	hydros fää ri		kontti		kodros fää ri hyntti	‘hydrosphere’

In (7a) the disharmonic front vowels of the input are retained in the output of the game. This is in contrast to the harmonic front vowels seen in (6), which are reharmonized in the output. In (7b) the input contains two disharmonic vowels, as the left-to-right vowel sequence is front-back-front. In the output, the disharmonic back vowel *o* is retained, and it is now in harmony with the initial syllable, *ko*. The disharmonic front vowel is also retained, though it remains disharmonic in the output.

Thus, in both Tuvan and Finnish, reharmonization fails to apply to disharmonic vowels of the base or input. We must therefore explain what differentiates a harmonic vowel from a disharmonic vowel.

3. What Makes Harmonic and Disharmonic Vowels Different?

3.1 Harrison and Kaun’s Underspecification Analysis

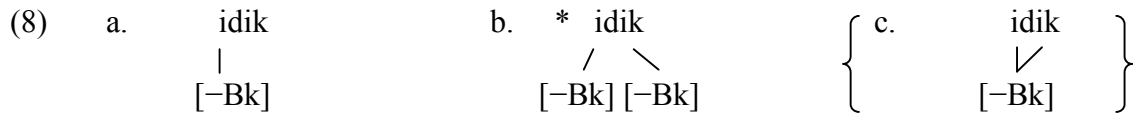
Harrison and Kaun (2000) argue that the difference between harmonic and disharmonic vowels can be traced to whether or not they are underlyingly specified for backness. They propose that, in harmonic words, only the first-syllable vowel is underlyingly specified for backness, with every subsequent vowel in the word underspecified. Those subsequent

³ This characterization of the game is slightly oversimplified (see McCarthy (1986) for a more complete description and analysis), but the details do not affect the analysis of harmony proposed here.

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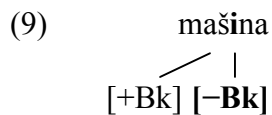
vowels then receive a backness specification via autosegmental spreading of the backness node linked to the vowel of the initial syllable. This spreading is driven by the alignment constraint ALIGN[BK].

On their view, a harmonic word like Tuvan *idik* ‘boot’ has the underlying representation in (8a), not the one in (8b). (Harrison and Kaun do not mention the possibility of a representation like that in (8c), to which we will turn below.)



As shown in (8a), only the first-syllable vowel is specified underlyingly; all subsequent harmonic vowels are underspecified.

Disharmonic vowels, according to Harrison and Kaun, are underlyingly specified for backness, as shown in (9).



The final vowel of this word is back-harmonic and therefore underspecified.

In the underspecification analysis, front/back harmony and reharmonization target only those vowels that are underspecified for backness. The ALIGN[BK] constraint that drives harmony cannot affect vowels that already have an underlying specification for backness. Harmonic vowels are therefore predictably reharmonized, while disharmonic vowels like the one in (9) remain unaffected by reharmonization. On this view, if both harmonic and disharmonic vowels were specified underlyingly, we would be left with no formal means of distinguishing them, and a ranking paradox would ensue when we tried to model the different behavior of harmonic and disharmonic vowels under reharmonization. Harrison and Kaun propose the ranking IDENT-I/R >> ALIGN[BK] >> IDENT-B/R, as shown in (10) (Harrison and Kaun’s (19)):

(10)

/idik, RED/ [-Bk]	IDENT-I/R	ALIGN[BK]	IDENT-B/R
a. idik-adik	*	*!	*
☞ b. idik-adik	*		**

Indeed, on such an analysis an input word with all of its harmonic vowels specified, as in (8b), would cause (10a) to surface as the winning candidate, since the back-harmonic reduplicant of (10b) would incur two violations of IDENT-I/R. However, if ALIGN[BK] were ranked above IDENT-I/R, then disharmonic input vowels would reharmonize in the reduplicant, contrary to fact. Thus, we have a ranking paradox.

This paradox can be overcome if we simply assume a different underlying representation for harmonic vowels. I argue below that harmonic vowels are represented underlyingly as fully specified for backness, with all vowels of the word linked to a single backness node, as shown in (8c), repeated here:

(8c) idik
 ✓
 [-Bk]

This representation, which Harrison and Kaun do not mention as a possibility, conforms to the obligatory contour principle (OCP) on autosegmental representations. In addition, I will show that it is easily modeled within the very restrictive theory of markedness proposed by de Lacy (2002). The central idea is that a representation like that in (8c) is less marked than representations like those in (8a) and (8b), and that faithfulness constraints are unable to single it out for preservation.

Before going into further details of the analysis, I present a brief summary of de Lacy’s theory.

3.2 De Lacy’s Theory of Markedness

De Lacy’s (2002) main theoretical objective is to impose limits on the types of faithfulness and markedness constraints that may exist in grammars. Taking the idea of natural harmonic scales as central, de Lacy (following Kiparsky 1994) proposes that faithfulness and markedness constraints must always make reference to the most marked end of a scale, and that they may never refer to non-adjacent points on a scale. For two values M(arked) and U(nmarked) on a given scale, constraints may refer to M alone or to M and U together, but never to U alone. As a result, markedness constraints may penalize marked elements without penalizing unmarked elements, but never the reverse; likewise, faithfulness constraints may preserve marked elements without preserving unmarked elements, but never the reverse.

To illustrate this idea, consider the place of articulation scale. De Lacy (2002:167) claims that the dorsal place of articulation is universally more marked than labial, which is universally more marked than coronal, which is universally more marked than glottal. The capital letters K, P, T, and ? stand for these four places of articulation, respectively. With this universal markedness scale fixed, de Lacy’s theory allows only for the constraints listed in (11a), and not those in (11b). (A constraint like *{KP} means “penalize all dorsals and labials, wherever they occur.”)

(11) a.	<u>Markedness constraints</u>	<u>Faithfulness constraints</u> ⁴
	*{K}	IDENT {K}
	*{KP}	IDENT {KP}
	*{KPT}	IDENT {KPT}
	*{KPT?}	IDENT {KPT?}

⁴ De Lacy (2002) countenances only IDENT constraints in the faithfulness family, leaving out MAX and DEP.

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b. Impossible constraints

*{T}	IDENT{T}
*{P?}	IDENT{P?}
*{KP?}	IDENT{KP?}, etc.

The major effect of this theory of markedness is that constraints may single out marked structures for preservation or elimination, but unmarked structures are never singled out. This principle of asymmetry will guide us through the analysis of disharmonic vowels under reharmonization.

3.3 The Markedness of Autosegmental Linking

The central proposal of this paper is that scale-referring markedness constraints in the spirit of de Lacy (2002) can be used to refer to autosegmental representations of the links between vowels and backness nodes. First, we will explore the nature of the scale involved, and then see how this fits into a de Lacy-style theory of markedness to derive the reharmonization effects seen in section 2.

3.3.1 A Scale of Autosegmental Representations

For harmonic words, there are a number of possible ways to represent the vowel backness feature [α Bk]. Assuming an autosegmental framework, we can identify at least three possible representations of a harmonic word like Tuvan *idik*, as shown above in (8) and repeated here:

(i) a representation in which only one of the vowels is underlyingly linked to a backness node, as proposed by Harrison and Kaun (2000) and shown in (8a);

(ii) a representation in which each vowel is linked to a separate backness node, as shown in (8b);

(iii) a representation in which both vowels are linked to a single backness node, as proposed here and shown in (8c).

In order to define scale-referring constraints that will account for the reharmonization data, we must first define a scale along which these three representational possibilities may be evaluated. To begin, we adopt Prince and Smolensky's (1993) notion of lexicon optimization, which, as Harrison and Kaun (2000:328) describe it, "heavily favors fully specified inputs." If such a principle is operative in language acquisition and grammar, then we may reject (8a) above and remove it from consideration on our scale, as it fails to conform to this very basic force governing linguistic representations.

This leaves us with (8b) and (8c), both of which have fully specified underlying representations. I argue that (8c), with a single backness node multiply linked to all harmonic vowels in a word, is quantitatively more economical and formally less marked than (8b), in which each vowel is singly linked to a distinct backness node.

(8c) is more economical because it involves less formal structure than (8b). With only a single backness node instead of multiple ones, it incurs fewer violations of general structure-banning markedness constraints like *STRUC than does (8b). In addition, it conforms to the OCP, which bans tautomorphic adjacent autosegments that share a

featural specification. Thus, the structure with one multiply linked backness node shown in (8c) is in a very real sense more economical than the structure with two singly linked backness nodes shown in (8b).

Evidence in favor of the second claim—that a multiply linked structure is less marked than a singly linked structure—comes from Keer’s (1999:ch. 2) work on geminates. Keer proposes that singly linked identical adjacent autosegments, like those involved in “fake” geminates, are unable to surface (within a single morpheme) because the universal constraint set CON contains no faithfulness constraint that can preserve them. Instead, he argues that general principles of markedness cause such structures to be neutralized with “true” geminates. The structure in (8b), with two singly linked nodes, is autosegmentally analogous to a fake geminate, as it contains identical adjacent autosegments. Thus, following Keer’s proposal, we may conclude that general principles of markedness dictate a scale in which structures with singly linked nodes like (8b) are more marked than structures with multiply linked nodes like (8c).

The economy and markedness considerations outlined above have two important consequences. First, underlying representations will contain multiple singly linked backness nodes only when no counterpart representation containing a single, multiply linked node is available.⁵ Cases where this occurs include disharmonic words, where multiple backness specifications exist in the same word and thus cannot be attributed to a single node. For harmonic words, however, it means that underlying representations like the one in (8b) are ruled out, as they are unmotivated by any independent consideration and are militated against by structure-banning markedness constraints. Second, it means that we may establish a markedness scale for autosegmental representations of vowel backness: *singly linked nodes are more marked than multiply linked nodes*.

We are now ready to examine the behavior of harmonic and disharmonic words under reharmonization. With the markedness scale described here and the restriction that harmonic words must be represented underlyingly as in (8c), and not as in (8a) or (8b), we may define scale-referring markedness and faithfulness constraints that will derive the reharmonization patterns.

3.3.2 Preservation of the Autosegmentally Marked

Following de Lacy (2002), we must define constraints that reflect the relative markedness of the items on our scale. Given the scale defined above, the licit constraints referring to autosegmental links are those in (12):

⁵ John McCarthy (personal communication) suggests that these markedness considerations and the operation of the constraints based on them (shown below in (12)) do not allow us to infer anything about underlying representations, as richness of the base compels us to consider inputs like (8b). Instead, the constraints in (12) must operate on outputs, as this is the level of derivation at which singly linked nodes are limited to disharmonic vowels in a principled way. If, on the other hand, speakers’ lexical entries are formed in accordance with the general markedness considerations outlined above, it then becomes more plausible to speak of the constraints in (12) applying to inputs and to suggest that underlying representations are constrained accordingly. In either case, the constraints in (12) are crucial to explaining the observed reharmonization data; the only question is where they apply.

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(12) Markedness constraints

- *{SG-LINK} Ban any node linked to a single vowel
- *{SG-LINK, MULT-LINK} Ban any node linked to a single vowel and ban any node linked to multiple vowels

Faithfulness constraints

- IDENT{SG-LINK} Preserve any node linked to a single vowel
- IDENT{SG-LINK, MULT-LINK} Preserve any node linked to a single vowel and preserve any node linked to multiple vowels

For the reharmonization phenomena discussed in section 2, we must assume some undominated constraint that forces the initial-syllable vowel of the Tuvan reduplicant and the *ko* syllable of the Finnish word *game* to surface unchanged. We may call this faithfulness constraint RED-VOWEL.

Harmonic inputs, which contain multiply linked (i.e., unmarked) backness nodes, predictably undergo reharmonization. For a word like Tuvan *idik*, the backness node copied from the base (with the value [-Bk]) can only possibly link to the second vowel in the reduplicant, since RED-VOWEL forces the backness value of the first vowel to change to [+Bk]. However, if the input backness node is linked only to a single vowel, then we have a marked autosegmental representation. We have observed that Tuvan prefers reharmonization over this outcome; this is due to what de Lacy calls “local harmonic bounding.” Since all markedness constraints that penalize unmarked structure must also penalize marked structure, there is no way for a marked structure to surface in the absence of some intervening faithfulness constraint. For harmonic words, no such constraint intervenes. The local harmonic bounding effect is shown in the tableau in (13):

(13)

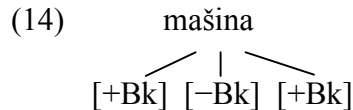
idik-RED ∨ [-Bk]	*{SG-LINK}	*{SG-LINK, MULT-LINK}
a. idik- adik ∨ ∖ [-Bk] [+Bk] [-Bk]	*!*	***!
b. idik- adik ∨ ∖ [-Bk] [+Bk]		**

The two constraints shown in (13) may be ranked in either order, but (13b) will always be the winner. Since the violations of *{SG-LINK} always constitute a proper subset of the violations of *{SG-LINK, MULT-LINK}, candidates that minimize the number of singly linked nodes will be selected by both constraints. As these are the only markedness constraints available to us, it follows that the unmarked, multiply linked representation will always surface unless some faithfulness constraint intervenes.

As shown in (12), two faithfulness constraints are available. The faithfulness constraint IDENT{SG-LINK, MULT-LINK} preserves all underlying autosegmental links,

penalizing reharmonization in all environments. As reharmonization nonetheless occurs in Tuvan and Finnish, we may infer that this constraint is ranked below the scale-referring markedness constraints shown in (12) and (13). The remaining constraint, IDENT{SG-LINK}, preserves only singly linked autosegments, i.e., only those that are most marked. In order to observe the effects of this constraint, therefore, we must have an input form that contains a singly linked node.

Disharmonic words are examples of such forms. The Tuvan word *mašina*, for example, must contain the underlying autosegmental representation shown in (14):



As seen above in (4), the disharmonic front vowel of this word fails to reharmonize in the reduplicant; the full form is *mašina-mušina*. This is easily modeled in our system by ranking the faithfulness constraint IDENT{SG-LINK} above the two markedness constraints that penalize singly linked nodes, as shown in (15). (For simplicity, only the reduplicant candidates are shown in this tableau.)

(15)

mašina-RED / \ [+Bk] [-Bk] [+Bk]	IDENT{SG-LINK}	*{SG-LINK}	*{SG-LINK, MULT-LINK}
a. mušina / \ [+Bk] [-Bk] [+Bk]	*	***	***
b. mušina ∇ [+Bk]	**!*		*
c. mušine / \ [+Bk] [-Bk]	**!*	*	**

Each candidate in (15) incurs at least one violation of IDENT{SG-LINK} because of the changed first vowel (base *a* corresponding to reduplicant *u*, as dictated by the undominated constraint RED-VOWEL). However, with IDENT{SG-LINK} outranking the autosegmental markedness constraints, all other singly linked nodes in the base are preserved in the reduplicant. Thus, for Tuvan and Finnish, the four scale-referring constraints identified in (12) must be ranked as in (16):

(16) Tuvan and Finnish ranking of constraints on autosegmental representations

IDENT{SG-LINK} >> *{SG-LINK}, *{SG-LINK, MULT-LINK} >> IDENT{SG-LINK, MULT-LINK}

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Looking back at the data from section 2, we now can explain why only disharmonic vowels fail to undergo reharmonization: it is because only they contain singly linked backness nodes in their underlying representations. The reharmonization phenomena seen here are an example of de Lacy's principle of faithfulness to the marked. The scale-referring markedness constraints in (12) always prefer an unmarked representation (i.e., a reharmonized, multiply linked one) over a marked one; however, we see in (15) that it is possible for a faithfulness constraint to intervene and preserve only the most marked input structures (the singly linked nodes), preventing reharmonization in only those cases.

The data examined here conform nicely to one of de Lacy's major predictions about the preservation of marked structure. De Lacy claims that no faithfulness constraint may exist that preserves unmarked structures without simultaneously preserving marked structures. For the constraints on autosegments examined here, this means that there is no constraint $\text{IDENT}\{\text{MULT-LINK}\}$. The reharmonization data from Tuvan and Finnish provide empirical support for this claim; it would be worthwhile to conduct a wider cross-linguistic survey in order to test it further.

4. Further Issues

4.1 The Autosegmental Typology

We may now briefly consider the typology of harmony and reharmonization systems predicted by the scale-referring constraints in (12). We have already seen what happens in a system where $\text{IDENT}\{\text{SG-LINK}\}$ is ranked highest: reharmonization occurs but does not affect singly linked nodes.

If $\text{IDENT}\{\text{SG-LINK}, \text{MULT-LINK}\}$ is ranked highest, reharmonization will never occur, as all nodes of the input (or base) will be preserved in the output (or reduplicant). Such a language might simply have total reduplication without the fixed segmentism seen in Tuvan and Finnish, with the reduplicant corresponding exactly to the base.

If $\ast\{\text{SG-LINK}\}$ or $\ast\{\text{SG-LINK}, \text{MULT-LINK}\}$ is ranked highest, harmony will be pervasive throughout the language. No singly linked nodes will be allowed to surface, and foreign loanwords will be fully harmonized, as Harrison (2000) claims was the case in earlier stages of Tuvan.

4.2 Agreement by Correspondence

The scale-referring constraints in (12) have been defined with respect to autosegmental representations; however, we may ask whether they can be translated into the agreement by correspondence formalism (Hansson 2001, Rose and Walker 2004), which provides a different way of modeling such relationships. The translation key in (17) maps the major components of the autosegmental analysis onto their agreement by correspondence equivalents.

(17)	<u>Autosegmental term</u>	<u>Agreement by correspondence term</u>
	Node	Correspondence relation
	Singly linked node	Segments not in correspondence
	Multiply linked node	Segments in correspondence

The scale-referring constraints that correspond to those in (12) are shown in (18).

(18)	<u>Markedness constraints</u>	
	*{NO-CORR}	Penalize segments not in correspondence
	*{NO-CORR, CORR}	Penalize segments not in correspondence and penalize segments in correspondence
	<u>Faithfulness constraints</u>	
	IDENT{NO-CORR}	Preserve non-correspondence between segments
	IDENT{NO-CORR, CORR}	Preserve non-correspondence between segments and preserve correspondence between segments

The predictions made under this modified system depend in large part on how the correspondence relation is defined. If correspondence between vowels is limited to those contexts in which multiple linking of a single autosegment is allowed, then the predictions of the agreement by correspondence system will be the same as those of the autosegmental one. If, on the other hand, vowels can be in correspondence across an intervening vowel (a configuration generally disallowed in autosegmental theory), the predictions about reharmonization become quite different. For example, in the hypothetical Tuvan word *mišani*, it matters a great deal whether the two *i*'s are in correspondence or not, as shown in (19).

(19) a. Agreement by correspondence tableau (the two *i*'s are in correspondence)

$mi_xšayni_x$ -RED	IDENT{NO-CORR}	*{NO-CORR}	*{NO-CORR, CORR}
i. $mu_zšayni_x$		***!	***
☞ ii. $mu_zšayni_z$		**	***
iii. $mu_zši_xni_x$	*!*	**	***

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b. Autosegmental tableau (the two *i*'s do not share a node)

mišani-RED [-Bk] [+Bk] [-Bk]	IDENT{SG-LINK}	*{SG-LINK}	*{SG-LINK, MULT-LINK}
☞ i. mušani [+Bk] [+Bk] [-Bk]	*	***	***
ii. mušani [+Bk]	**!*	*	*
iii. mušini [+Bk] [-Bk]	**!*	*	**

In the hypothetical situation where the two front vowels of *mišani* are in correspondence, as shown in (19a), reharmonization of the final vowel is the preferred outcome, as the faithfulness constraint IDENT{NO-CORR} cannot preserve the final *i*. With the autosegmental representation in (19b), by contrast, the final *i* must be singly linked, and so it is preserved in the reduplicant. Thus, the two approaches make different predictions in this case.⁶ The available evidence from both Tuvan and Finnish appears to favor the autosegmental approach, as shown in (20), where boldface shows front vowels that could potentially be in correspondence across an intervening back vowel.

- (20) a. **zi**guli **zi**guli-**za**guli (Harrison and Kaun 2000:334)
 b. hydros**fä**äri + kontti → kodros**fä**äri hyntti (repeated from (7b))

As seen in these two examples, the final-syllable front vowels fail to be reharmonized, suggesting that no correspondence relation exists between them and the first-syllable front vowels in these words. The autosegmental approach, which predicts that these vowels should not share a backness node, derives the right outcome (cf. the tableau in (19b)).

4.3 An Empirical Problem for Underspecification

It is noteworthy that Harrison and Kaun's underspecification analysis makes the same incorrect prediction as the hypothetical agreement by correspondence analysis in the cases discussed in (19) and (20). Tuvan *ziguli* is a front-harmonic word with a disharmonic back vowel in its second syllable; thus, the word-final *i* should be underspecified for backness, its backness value acquired instead via alignment-driven spreading from the vowel of the initial syllable. Under this assumption, however, we should expect the word-final *i* to reharmonize under reduplication, contrary to fact.

⁶ Of course, this is simply a thought experiment; we would need independent evidence that correspondence between two vowels could be established across an intervening vowel before the hypothetical model shown here could be taken seriously.

Thus, in addition to providing at best an ad hoc solution to the problem of reharmonization and violating the principle of full specification of inputs, the underspecification analysis makes the incorrect prediction that vowels should be able to harmonize across an intervening disharmonic vowel. The alternative solution proposed here appeals instead to general, independently motivated principles of the type articulated by de Lacy, and makes correct predictions about the data in (20).

4.4 Rounding Harmony

Rounding harmony in Tuvan may also in principle be analyzed with scale-referring constraints of the type used here to model front/back harmony. However, some basic questions about the proper analysis cannot be answered without more data on rounding harmony and rounding reharmonization. First and foremost, should the constraints on the autosegmental representations of rounding nodes be independent of those used for backness nodes, or is there simply one set of scale-referring constraints on autosegmental representations that applies to all autosegments in a given language? The data pertaining to this point are contradictory, as shown in (21) (Harrison 2000:168; Harrison and Kaun 2000:334).

(21)	<u>Base</u>	<u>Base + reduplicant</u>	
a.	ʒiguli	ʒiguli-ʒaguli	‘(brand of car)’
b.	dersu	dersu-darsɪ	‘hunter’

(21a) suggests that IDENT{SG-LINK} is ranked highest, as the singly linked [+Round] of the base is preserved in the reduplicant. This in turn suggests that there might be a single set of constraints on autosegmental representations for the language, as the ranking is the same as that seen above for front/back reharmonization. However, in (21b) we see that the vowel linked to the singly linked [+Round] node is reharmonized in the reduplicant, suggesting that one of the scale-referring markedness constraints outranks IDENT{SG-LINK}. This leaves us with a ranking paradox. Moreover, this paradox cannot be overcome simply by assuming that constraints referring to front/back autosegments are independent of those referring to rounding autosegments; the paradox is internal to the analysis of rounding reharmonization.

Though no solution is proposed here, it is possible that some other constraint intervenes in one of the examples in (21) to force an unexpected outcome. Harrison (2000) notes that Tuvan severely restricts the distribution of non-high rounded vowels in the language in general. It is possible that the difference between word-final and word-medial position plays a role in the reharmonization in (21). Absent further data, it is difficult to go beyond speculation on this point.

5. Conclusion

I have argued that the apparent anomalies in vowel reharmonization seen in Tuvan jocular reduplication and the Finnish word game *kontti kieli* are best analyzed as examples of faithfulness to the marked, as articulated by de Lacy (2002). I have proposed a harmonic scale of autosegmental representations based on very simple and general

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considerations of lexicon optimization, economy of formal representation, and general principles of markedness. As each of these considerations is independently motivated, I believe that the scale-referring constraints proposed here do not complicate the grammar in any way. The existence of these constraints follows naturally from the general principles giving rise to the harmonic scale of autosegmental representations. As noted above, the constraints conform to de Lacy's very stringent conditions on the well-formedness of scale-referring constraints. Adopting this analysis allows us to reject the ad hoc and otherwise unmotivated underspecification account of Harrison and Kaun (2000), and thereby to gain some greater understanding of what these reharmonization phenomena can tell us about markedness and the more basic nature of Optimality-Theoretic grammars.

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