VOWEL HARMONY AND DISHARMONY IN TUVAN AND TOFA

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1. Introduction

Harmony systems are often described in the linguistic literature in a highly schematic and somewhat idealized fashion. Further, instances of disharmony within harmony languages typically have been treated as exceptional or anomalous, rather than as a natural and expected part of the harmony system. In documenting several vowel harmony languages indigenous to Siberia, we found both highly patterned surface disharmony and rich level of variation (and optionality) in harmony application. Such variation occurs along two axes. First, considerable variation in the application of harmony may be found across and even within speakers of a single language or dialect. We found this to be the case, for example, in communities undergoing language shift with speakers at varying levels of fluency. Second, harmony systems along a language/dialect continuum show subtle gradations and minimal differences. Thus, while harmony systems may yield at first glance to a simplified, schematic description, theoretical models of harmony must accommodate more complex patterns of attested variation along both axes.

A goal of this paper is to illustrate harmony variation with new empirical data. Another goal is to enumerate instances of apparent disharmony in harmony languages, and to demonstrate that surface disharmony is a natural and expected component of such systems. Many harmony languages not only tolerate disharmony, but can also generate it in a productive manner. We propose that disharmony is not only pervasive, but also theoretically interesting in its own right. The idealized model of harmony that has prevailed

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since Trubetzkoy (1969) has tended to obscure the nature of disharmony, treating it as merely a defective or degraded manifestation of harmony. We suggest that disharmony is crucial for understanding the nature of the constraint system that governs harmony. Aspects of the harmony system that are not otherwise apparent may emerge in the context of disharmony.

In §3 we develop a preliminary typology of disharmony within harmony systems. Most of the data presented here come from Altai-Sayan Turkic languages (primarily Tuvan and Tofa) that have been only minimally documented in the literature. Due to space constraints, we do not develop a theoretical model of harmony herein. For models of harmony within Optimality Theory (Prince & Smolensky 1993), the reader is referred to Kaun (forthcoming) and Cole & Kisseberth (1994). For a fuller discussion of Tuvan harmony, see Harrison (1999, 2000).

2. Vowel harmony

Vowel harmony may be most simply described as a requirement that certain vowels agree with other vowels in the same word in terms of some particular feature. Harmony may be based, for example, on backness (Finnish), ATR (as in Even, a Tungus language of Siberia) or rounding (Turkish). Tuvan and Tofa, like most Turkic languages, exhibit both backness harmony (BH) and rounding harmony (RH). The two systems can be seen to interact in complex ways, and their interaction sometimes gives rise to patterns of disharmony. We examine a number of those patterns herein.

The symmetry of the Tuvan and Tofa vowel systems allows segments to pattern together according to height, backness and rounding. These natural classes provide the basis for vowel harmony.

(1)

		front		***back***	
		unround	***round***	***unround***	***round***
short	***high***	i	ü	ɨ	u
	non-high	e	ö	a	o
long	***high***	ii	üü	ɨɨ	uu
	non-high	ee	öö	aa	oo

2.1 Backness harmony

Backness harmony requires that all vowels in a word belong to either the front [i ü ö e] or back class [u ɨ o a]. It applies robustly, both root internally and in affixal

morphology. Post-initial root vowels and suffix vowels take their cue from the vowel to their left, whether it is in a root or another suffix. The backness value is thus fully predictable for all post-initial vowels in a word. We briefly describe the backness harmony system here, then discuss a number of cases in which disharmony arises (§3).

(2) Tuvan back harmonic roots

a.	ivi	‘deer’
b.	xülümzüreer-	‘smile-P/F’
c.	xöömey	‘throat singing’
d.	eeren	‘totem’
e.	idegel	‘hope’
f.	ayɨɨl	‘danger’
g.	ɨrak	‘far’
h.	ulu	‘dragon’
i.	oruk	‘road’

(3) Tuvan back harmonic roots with harmonic suffixes

a.	is-ter-im-den	‘footprint’-PL-1-ABL
b.	at-tar-ɨm-dan	‘name'-PL-1-ABL
c.	esker-be-di-m	‘notice’-NEG-PAST.II-1
d.	udu-va-dɨ-m	‘sleep’-NEG-PAST.II-1

Tuvan suffixes have at minimum two vowel allophones, a front one and a back one:

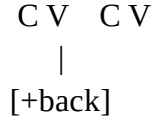
(4)

underlying	surface	
/-LAr/	-lar ~ -ler	PLURAL

2.2 Formal analysis of BH

Following Chomsky and Halle (1968), we assume [back] is an equipollent feature. In Tuvan, there no evidence that either [+back] or [-back] is more active. Following Steriade (1995) we assume an underspecification analysis for the harmonic feature [back] in post-initial syllables. Given assumptions of lexical minimality (Chomsky & Halle 1968), the fully predictable feature [back] may be eliminated from underlying representations for all post-initial vowels.

(5)



Backness harmony can be easily described in terms of feature spreading:

(6) C V C V
| - - - -
[+back]

Within the framework of Optimality Theory, we follow Smolensky (1993) in construing BH as alignment. This constraint aligns the feature [+/-back] with the edge of the word domain.

(7) *Align [αback] with edge of word* **ALIGN[αBACK]-WD**

BH does not typically extend beyond the domain of the word. Tuvan enclitics, in contrast to suffixes, may fail to undergo BH (8), even when they do undergo other local assimilatory processes triggered by the phonological shape of the host.

(8) a. tool=dʒe story=ALL
b. sook=tʃe cold=ALL

Backness harmony, though robust, permits regular exceptions in the form of disharmonic segments and morphemes, as enumerated in §3.0.

2.3 Rounding harmony

Rounding harmony (RH) follows backness harmony as the second most pervasive harmony system attested across Turkic languages. RH can be easily represented in a model that takes as its primitives harmony triggers, harmony targets, and the possible trigger/target combinations (e.g. Kaun 1995). In a schematic representation of the typology, **U** represents any high rounded vowel, and **O** any low rounded vowel. Harmony triggers are shown on the left, harmony targets on the right (see Figure 1 below).

(9) Schematic of Tuvan rounding harmony

Trigger	***Target***
U	**U**
O	

The above schematic represents the fact that both high and non-high rounded vowels obligatorily trigger RH, but only high vowels undergo it. A useful comparison is provided

by neighboring languages and peripheral dialects of Tuvan. On the map (Figure 1), RH systems of the Altai-Sayan area are shown to differ minimally by their possible combinations of harmony triggers and targets (Anderson & Harrison 2000). Systems can also differ, though to a lesser extent, in whether they enforce RH optionality or obligatorily for a given trigger/target combination. Optionality is indicated by parentheses.

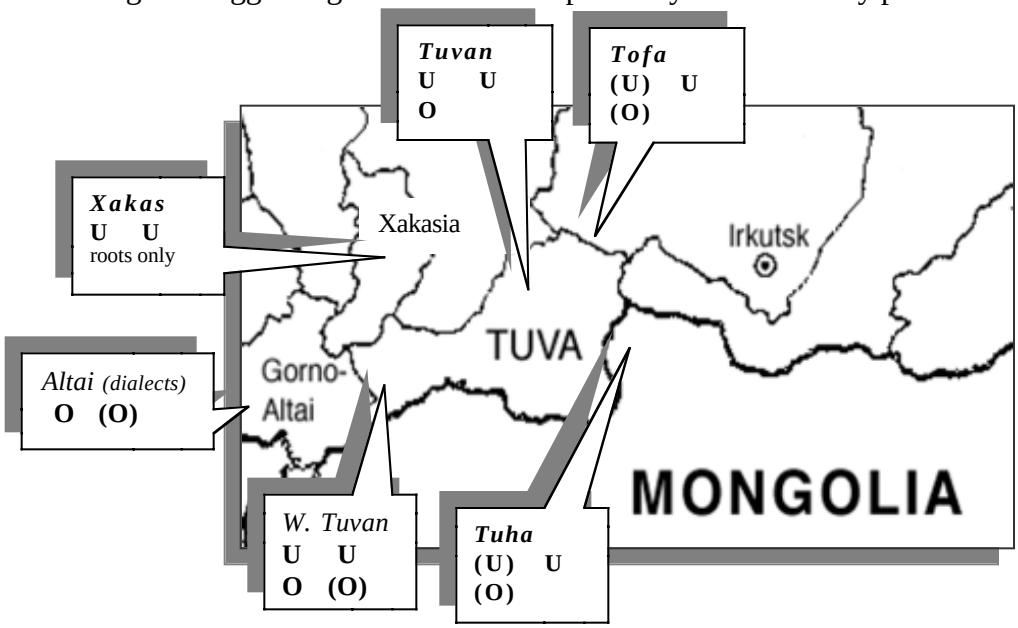


Figure 1. Variation in rounding harmony along the Altai-Sayan language/dialect continuum

Tuvan rounding harmony requires that any high vowel following a round vowel must also be round. It may be construed as spreading or aligning the feature [round] rightward from any round vowel to any high vowel. Rounding harmony thus targets [i] and [ɨ] and yields [ü] and [u] as outputs.

The operation of Tuvan rounding harmony is most apparent in affixes that contain a high vowel, e.g. the 3-POSS suffix /-(z)I/, shown in (10a-c). Non-high vowels are not subject to RH (10 d-e). In the absence of a RH trigger, high suffix vowels never surface as [+round] (11).

(10)	a.	ög-ü	'glottis-3'
	b.	xol-u	'hand-3'
	c.	suur-u	'village-3'
	d.	olar	'they'
	e.	ulam	'much'
(11)	a.	er-i	'man-3'
	b.	xar-ɨ	'snow-3'
	c.	ava-zɨ	'mother-3'

RH within roots is apparent as a co-occurrence pattern among root vowels. For example, sequences of [round vowel] / [high unrounded vowel] are never attested in the native lexicon, as the second vowel in such a sequence would be targeted by RH. Nor do native words contain the sequence [unrounded vowel] / [rounded vowel], because a rounded vowel may appear only after another rounded vowel. High round vowels [ü] [u] appear in post-initial syllables only when a trigger (a round vowel) is present in the preceding syllable: *pörü* 'wolf' *pürü* 'leaf' *udu* 'sleep'-IMPER *oruq* 'road', *oožum* 'slow'. Since Tuvan RH involves only high vowels as targets, the mid-rounded vowels [ö] [o] can never occur post-initially in native words.[2]

2.4 Rounding harmony in loanwords

The diachronic operation of rounding harmony is apparent in the phonology of Mongolian loanwords in Tuvan. Three basic assimilation patterns are attested. First, high vowels that *follow* a round vowel have undergone RH (vowels targeted by RH are underlined):

	Tuvan word	(Old) Mongolian source	
(12)	möl.č<u>ü</u>k.č<u>ü</u>	möl.žig.či	'exploiter'

Secondly, some borrowings also show *regressive* RH (targets underlined):

	Tuvan word	(Old) Mongolian source	gloss
(13)	a. č<u>u</u>.ru.mal	ži.ru.mal	'pattern'
	b. b<u>ü</u>.d<u>ü</u>.güü.lük	bi.de.güü.lig	'primitive'
	c. š<u>ü</u>.güm.č<u>ü</u>.lel	ši.güm.ži.lel	'criticism'

Thirdly, rounded vowels not motivated by RH undergo de-rounding (de-rounded vowels are underlined).

	Tuvan word	(Old) Mongolian source	gloss
(14)	a. al.ž<u>ɨɨ</u>r	al.čuur	'napkin'
	b. ter.g<u>ü</u>.leg.či	ter.güü.leg.či	'director'

[2] The only exceptions to this are a few words that appear to be derived from compounds: *xorjoq* 'impossible'. Also, in older sources from the dialects of Western Tuva, where Altai influence is pronounced, one could find Altai-like forms such as *söglöbözöŋ* 'if you don't say' (instead of *söglevezeŋ*) with a spread of [+round] from the initial-syllable (Radloff 1882).

c.	o.v<u>aa</u>	o.boo	‘shrine’
d.	ay.<u>ɨɨ</u>l	ay.uul	‘danger’

The dynamic application of RH constraints may be observed in contemporary Tuvan in the output of full reduplication (Harrison 1999a). When the reduplication process has the effect of de-rounding a vowel in an initial syllable, any round vowels that follow it are automatically de-rounded.

		<u>base</u>	<u>base + reduplicant</u>	
(15)	a.	ulu	ulu-al<u>ɨ</u>, (*ulu-alu)	‘dragon-REDUP’
	b.	ar<u>ɨ</u>	ar<u>ɨ</u>-uru, (* ar<u>ɨ</u>-ur<u>ɨ</u>)	‘bee-REDUP’

We interpret this as evidence that [-round] participates as an active feature in the harmony system.

2.5 Epenthesis-driven harmony

Tuvan speakers often break up consonant clusters in loanwords by epenthesizing a high vowel (underlined in the data below) which conforms to backness harmony (16a-c). Epenthetic high vowels may be targeted by progressive rounding harmony (17a-b). However, rounding harmony does not appear to operate leftwards to target epenthetic vowels (underlined) (18a-b).

		<u>Tuvan word</u>	<u>Russian source word</u>	
(16)	a.	p<u>ɨ</u>lan	p[ˌ]an	‘plan’
	b.	tex<u>i</u>naar	texˈnar	‘pure grain alcohol’
	c.	seek<u>i</u>s	sjeks	‘sex’
	d.	giip<u>i</u>s	gips	‘plaster cast’
	e.	ač<u>ɨ</u>ki	ačˈki	‘eye-glasses’
(17)	a.	booq<u>u</u>s	boks	‘boxing’
	b.	sun<u>uu</u>pqa	ˈsumka	‘bag’
(18)	a.	q<u>ɨ</u>lup	klup	‘club’
	b.	p<u>ɨ</u>lof ~ p<u>ɨ</u>lop	p[ˌ]of	‘rice pilaf’

3. Disharmony

Since the time of Prague school linguistics, harmony has been somewhat idealized as a neat, symmetrical system where a harmonic feature spread from one vowel to the next, creating harmony, ease of perception, or ease of articulation (Trubetzkoy 1969). Languages where harmonic feature spread appeared to be irregular, unmotivated, or otherwise restricted came to be typically described within the Russian linguistic tradition as having 'defective' or 'degraded' harmony (Baskakov 1958). We claim that such cases where the harmonic feature fails to spread—even though conditions for harmony appear to be present—are best regarded as an expected part of the harmony system not an exception to it. We propose that instances of productive disharmony should fall out from a theoretical model of harmony.

Apart from fossilized lexical items which may fail to conform to harmony, disharmony may arise as a result of productive morphological processes that remain active in a given language. We present a preliminary typology here, then provide examples from a number of Altai-Sayan and other languages. Disharmony may arise under at least the following scenarios:

- Optional application
- Pre-specified segments (including loanwords)
- Consonant interference
- Morphological conditioning
- Transparency
- Co-articulation
- Abstractness (arising from vowel shift)
- Opacity (including opacity arising from harmony shift)
- Prosodic blocking of harmony (not discussed herein)

3.1 Optional application

Harmony systems of Siberian Turkic form a dialect continuum (see map, figure 1). Speakers of transitional or peripheral dialects frequently exhibit optionality in the application of harmony. A few such cases have been documented in the literature. In Tofa (Rassadin 1971) rounding harmony is schematically U-U and O-U. Both intra- and inter-speaker optionality has been documented, indicating state of flux in the harmony system:

(19) Tofa

a.	čoru-	+ /Ir/	→	čor<u>uu</u>r ~ čor<u>ɨɨ</u>r	'go'-P/F
b.	ol-	+ /Ir/	→	ol<u>u</u>r ~ ol<u>ɨ</u>r	'sit'-P/F

c. ool- + /čžIk/ → oolčžuk ~ oolčžɨk ‘boy’-DIM

(20) Kuu Kiži (Altai dialect) (Baskakov 1958)
ool-ok-ka ~ ool-ok-ko ‘orphan.boy’-DIM-DAT

(21) N. Altai dialect (Baskakov 1958)
molat ~ molot ‘steel’

Finally, in a fully productive process of reduplication in Tuvan, we found that speakers optionally applied RH when the triggering vowel was long (22a-b). When they trigger was short, by contrast, they applied harmony obligatorily (23) (Harrison 1999a).

(22)

	base	base+reduplicant	
a.	aazɨ	aazɨ-uuzu ~ aazɨ-uuzɨ	‘mouth’-3
b.	aarɨ	aarɨ-uuru ~ aarɨ-uurɨ	‘burden’-3

(23)

a.	azɨ	azɨ-uzu, * azɨ-uzɨ	‘if’
b.	arɨ	arɨ-uru, * arɨ-urɨ	‘bee’-3

3.2 Pre-specified disharmonic segments

The phonology of Russian loanwords in Tuvan reveals many cases of disharmonic segments that fail to conform to the harmony systems. Likewise, loanwords yield a number of examples of re-harmonization, by which disharmonic segments are changed to conform to harmony. A fuller discussion of why some disharmonic segments defy harmony while others conform to it is beyond the scope of this paper (see Harrison & Kaun 1999). Here, we simply give some examples of each type to show that both types do co-exist within a single harmony system.

Tuvan has borrowed and continues to borrow a great many words from Russian. Lexical exceptions to backness harmony may be found in numerous Russian loanwords. While speakers do occasionally alter the shape of borrowings to make them conform to backness harmony (cf. ‘television set’), they allow most to remain disharmonic.

(24)

a.	ɨraketa	‘rocket’
b.	roolik	‘rollerskate’

(25)

a.	teleVizor ~ teleVizer	‘television set’
b.	kinoo	‘cinema’
c.	generaatár	‘generator’

d.	sizoo	‘jail’
e.	piiva	‘beer’
f.	sudija	‘judge’
g.	igar ~ igor	‘Igor’
h.	padeš	‘case’ (grammatical)

Many loanwords, regardless of their source language, happen to be accidentally harmonic, even though they diverge from native phonotactics in other ways. It is not therefore the case that the native / non-native distinction coincides with harmonic / disharmonic classes in any regular way.

(26)	a.	fidik	< Rus. < Eng.	‘video cassette, film’
	b.	pleyer	< Rus. < Eng	‘video player’.
	c.	lama	< Sanskrit	‘lama’ (Buddhist)

3.3 Consonant-induced disharmony

In Tuvan (Tozha dialect) a glide triggers assimilation of [a] [e] [ü] [u] [ɨ] to [i]. (Chadamba p.c., 1974)

(27)	a.	udu-	+ [j]	→	udij	‘sleep’-Cv
	b.	döɣü-	+ [j]	→	döɣij	‘approach’-Cv
	c.	bar-	+ /Ajn/	→	bariijn	‘go’-1SG-IMPER
	d.	čoru-	+ /AjIn/	→	čoru-ujun	‘go’-1SG-IMPER

In Dolgan, a Turkic language of the far north, [j] triggers a fronting effect that yields disharmonic segments (underlined) (Ziker 1997).

(28)	a.	urdukü̲j	‘upper’
	b.	boikoje̲	‘spoiled’

Other consonant induced (dis)harmony effects have been discussed in Clements and Sezer (1982) and Kaun (2000).

3.4 Morphology-conditioned disharmony

The observed optionality of RH in Tofa (19) does not extend to all affixal morphology. Speakers who tolerate disharmony in verbal or diminutive affixes (above)

preferred to harmonize nominal case affixes. This suggests morpho-syntactic conditioning of harmony variation.

(29)	a.	ulus + /-NIŋ/	→	ulus-t**u**ŋ, (*ulus-t**ɨ**ŋ)	'country'-POSS
	b.	on + /-NIŋ/	→	on-n**u**ŋ, (*on-n**ɨ**ŋ)	'she/he/it'- POSS

Tuvan has a few suffixes containing non-alternating vowels (underlined in the data below). These non-harmonizing suffixes constitute the class of morphological exceptions to harmony. They may be classified as enclitics (ALL), or fused elements (DUR).

(30)	a.	aas-če	'mouth'-ALL
	b.	diis-če	'cat'-ALL
	c.	ɨrla-vɨšaan	'singing'-DUR
	d.	čemnen-mišaan	'still eating'-DUR

In Tofa (Rassadin 1978) and in the Tozha dialect of Tuvan, the intensive degree is formed by replacing the second syllable vowel of any disyllabic adjective. The replacement vowel is usually a front vowel, e.g. [ee] or [ii] (underlined below). For [-back] adjectives (31 a-d), this productive morphological rule yields disharmonic forms.

		adjective	intensified form	
(31)	a.	čɨlɨg	čɨl<u>ee</u>g	'warm'
	b.	kɨrgan	kɨrg<u>ee</u>n	'old'
	c.	bàhay	bàh<u>ee</u>y	'bad'
	d.	čaraš	čar<u>ii</u>š	'little'
	e.	biče	bič<u>i</u>i	'small'
	f.	ninge	ningii	'thin'
	g.	ulu	ulee	'big'

A similar case of morphologically-conditioned disharmony may be found in Orkhon Turkic (see Anderson 1996). Vowels in VC suffixes are harmonic (32), but the second vowel in a CVCV suffix does not harmonize (33)

(32)	a.	1 Sg. suffix	-ɨm ~ -iŋ ~ -um ~ -üm
	b.	2 Sg. suffix	-ɨŋ ~ -iŋ ~ -uŋ ~ -üŋ

(33)	a.	1 Pl. suffix -ɨmɨz ~ -imiz ~ -ümi<u>z</u> (-umɨ<u>z</u> is unattested)
	b.	2 Pl. suffix -ɨŋɨz ~ -uŋɨ<u>z</u>

In some compound words, backness and rounding harmony pattern differently within the same domain. The fusion of *on* 'ten' with number stems in Tozha Tuvan has given rise to two-way vowel alternations that exemplify a distinct domain for backness harmony vis-a-vis rounding harmony:

(34)	a.	üčž + on	→	üčž-**en** ~ üčž-**ön**	'thirteen'
	b.	bečž + on	→	bečž-**en** ~ bečž-**ön**	'fifteen'

Compounding may also result in morphologically conditioned disharmony, as these Tuvan compounds illustrate:

(35)	a.	eŋmežok	(< eŋme + čok)	'countless'
	b.	öksoolok	(ök + süz + ool + ok)	'orphan boy'-DIM
	c.	epčoɣum	(< ep čok-um)	'discomfort'-1

3.5 Transparency

Instances of transparency resulting in surface disharmony are well-documented, e.g. for Mongolian and Finnish. Transparent segments, which do not participate in harmonic alternations but allow harmony to obtain across them, are also attested in Altai-Sayan. Kuu Kiži, an Altai dialect, (Baskakov 1953) has RH in which low vowels function as both triggers and targets (schematically O-O). But front vowels often fail to trigger/undergo harmony, or do so optionally, while back vowels consistently do so.

(36)	a.	božo-t-p<u>o</u> (*-pe)	'allow'-CAUS-NEG
	b.	közö-t-p<u>e</u> (*-po)	'see'-CAUS-NEG

RH fails to target all high vowels in the Tuha dialect of Tuvan (spoken in Hövsgöl region of Western Mongolia) (*qud<u>ɨ</u>s* 'mattress') (*ul<u>u</u>s* 'people'). Partial opacity may arise in the context of harmony shift.

		Tuha Dialect	Standard Tuvan	
(37)	a.	qud<u>ɨ</u>s	qudus	mattress
	b.	on-<u>ɨ</u>ŋ	ooŋ	his, hers
	c.	ulus-t<u>ɨ</u>ŋ	ulus-tuŋ	people-GEN
	d.	poq-s<u>ɨ</u>V<u>̀</u>s	poq-suVus	trash-1PL
	e.	xol-d<u>ɨ</u>ŋ	xol-duŋ	hand-GEN
	f.	ok-t<u>ɨ</u>ɣ	ok-tuɣ	bullet-ADJ

3.6 Co-articulatory disharmony

Co-articulatory exceptions to backness harmony may be found in fluent Tuvan speech, where the backness value of an enclitic auxiliary verb may spread leftward to the final vowel of a converb, thus yielding a disharmonic form. Note that harmony does not spread leftward across the entire word span. Only the final stem vowel (underlined) is targeted.

(38) careful speech—harmonic

a.	piʒip aar	'write'-CV SBEN-P/F
b.	čemnenip aar	'eat'-CV SBEN-P/F

(39) rapid speech—disharmonic

a.	piʒi̲vaar	'write'-CV SBEN-P/F
b.	čemneni̲vaar	'eat'-CV SBEN-P/F

3.7 Abstractness (vowel shift)

A unique case of vowel shift in Vidin Turkish (Vago 1973) reveals that segments may be surface-disharmonic while maintaining an underlying harmonic value. In the case of vowel shift, this underlying value reflects the earlier phonetic value of these segments. Abstractness poses a particular challenge for output-constraint based models, because it appeals crucially to an underlying representation. We do not yet know of any similar cases in Altai-Sayan Turkic.

(40)

a.	uš-te̲	[u] < *[ü]	'three'-loc
b.	buz-ta		'ice'-loc
c.	dort-te̲	[o] < *[ö]	'four'-loc
d.	oq-ta		'arrow'-loc

3.8 Opacity

Opaque vowels fail to undergo harmony and also block harmony in following vowels. Opacity arises in many contexts, either morphologically conditioned (§3.5) or featurally conditioned (e.g. low vowels in Tuvan, see 10d-e). The majority of harmony systems have opaque or non-participating vowels. Partial opacity often arises when a

harmony systems is in a state of flux or change. For example, [+high] segments *optionally* undergo RH in dialects of Tuvan (38).

We note that opacity is relative with respect to different harmony systems: a segment can be opaque with respect to one harmony system while participating in another. This can result in non-overlapping domains for backness vs. rounding harmony within the same word (see 34). In Manchu, for example, [i] is opaque to RH, but transparent to BH (Li 1996). BH and RH may thus share the same harmony span (*doro-nggo*) or have different harmony spans (*kooli-ngga*).

4. Summary

By presenting a wide range of new data on harmony and disharmony in Tuvan, Tofa, and related languages, we hope to expand the empirical basis for theoretical models of harmony. Many harmony languages (e.g. Uzbek, Turkish) tolerate a relatively high degree of disharmony in the lexicon while still maintaining active phonological harmony processes. Other languages (e.g. Tofa, Xakas) enforce strict harmony yet employ productive morphological rules that produce disharmonic forms. Theoretical models should be able to fully account for the both the presence and active status of disharmony in such systems. Instances of disharmony should be viewed as an integral and expected part of harmony systems. Constraint-based models should be constructed so that productive disharmony falls out from the application of the constraint hierarchy to the candidate set.

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