

Oroch vowel harmony revisited*

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Abstract. This paper revisits Oroch vowel harmony previously analyzed in Tolskaya (2008) and propose a new analysis within the framework of *modified contrastive specification* (Dresher, 2009). In particular, I show that the vowel patterns in Oroch are better explained under a contrastive hierarchy [low] > [coronal] > [Retracted Tongue Root (RTR)] > [labial] than under Tolskaya's Stratal OT approach. The proposed hierarchy not just assigns proper feature specifications to each vowel in Oroch but also provides a simple, unified solution to the transparency and opacity in Oroch vowel harmony: The transparency of /i/ to RTR harmony is due to the lack of contrastive [-RTR] specification while the opacity of /i, ʊ/ is due to its contrastive height feature specification ([-low]). In addition, the putative simple vowel /æ/ receives a better treatment as a diphthong /ia/ and its peculiar behavior resembling /i/ is ascribed to its high front vowel portion /i/.

Keywords: Oroch, RTR harmony, labial harmony, contrastive hierarchy, transparency, opacity

1. Introduction

Oroch (or Orochi) is a Southeast Tungusic spoken in the Khabarovsk Krai, Russia, by about 250 speakers (Russian Census, 2002). Although

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there have been a handful of published descriptions (Avrorin & Boldyrev, 2001; Avrorin & Lebedeva, 1978), the phonology of Oroch has not been studied in the generative linguistics literature until recently (cf. Kaun, 1995; Tolskaya, 2008; Nevins, 2010). This paper critically reviews recent theoretical approaches to Oroch vowel harmony and provides a new analysis within the framework of *modified contrastive specification* (Dresher, 2009), also known as *contrastive hierarchy*.

The organization of this paper is as follows: Section 2 introduces the vowel system and phonological patterns in Oroch. Section 3 reviews Tolskaya (2008) and identifies the problems it encounters. Section 4 presents my contrastive hierarchy analysis and briefly compares it with an alternative analysis proposed by Nevins (2010). Finally, Section 5 concludes the paper.

2. Vowel Patterns in Oroch¹

Oroch has the following vowel inventory:

- (1) Vowel inventory (Avrorin & Boldyrev, 2001; Avrorin & Lebedeva, 1978)²

i	i:	u	u:
		ʊ	ʊ:
	ə	ə:	
æ:	a	a:	ɔ
			ɔ:

The above inventory seems fairly uncontroversial³ except the front

¹ The data presented here come from Avrorin & Boldyrev (2001) and Avrorin & Lebedeva (1978), as cited in Tolskaya (2008) and Kaun (1995, pp. 68–73), respectively.

² Vowel length is contrastive except for the case of [æ:] that always surfaces as a long vowel. However, it is not further considered in this paper because it does not affect vowel harmony patterns.

vowel /æ/ whose status as a distinct phoneme is doubtful. This issue will be discussed in detail later.

Oroch displays RTR harmony whereby all vowels in a word agree in terms of the feature [RTR]. The following examples show three different suffixes, accusative suffix *-və/va-*, dative suffix *-du/dʊ-*, and focus suffix *-də/da-*, all of which alternate depending on the [±RTR] value of the stem.

- (2) RTR harmony: $\overline{-və/va/və-}$, $\overline{-du/dʊ-}$, $\overline{-də/da/də}$ (Tolskaya, 2008, p. 5)
- | Non-RTR stem | RTR stem | | | |
|--------------|-----------------|------------|----------------|--|
| xuŋkə-və-də | ‘canoe-ACC-FOC’ | oɣda-va-da | ‘boat-ACC-FOC’ | |
| xuŋkə-du-də | ‘canoe-DAT-FOC’ | oɣda-dʊ-da | ‘boat-DAT-FOC’ | |

In addition to RTR harmony, Oroch exhibits another type of vowel harmony, i.e., labial harmony, whereby the low rounded vowel /ɔ/ propagates its roundness onto the suffix vowel.

- (3) Labial harmony: $\overline{-və/va/vɔ-}$, $\overline{-də/da/dɔ}$ (Tolskaya 2008, p. 5)
- | | |
|------------|----------------|
| omɔɔ-vɔ-dɔ | ‘lake-ACC-FOC’ |
|------------|----------------|

The neutral vowel /i/ can co-occur with either non-RTR or RTR vowels in a stem as in (4) and behaves as a transparent vowel with respect to RTR harmony, as in (5).

- (4) Neutral vowel /i/ (data from Kaun, 1995, p. 73; Tolskaya, 2008, p. 8)
- | Non-RTR stem | | RTR stem | |
|--------------|----------------------------|----------|----------|
| idu | ‘to roll thread into clew’ | idɔ | ‘where?’ |

³ Kazama (2003, p. 14) presents a slightly different vowel system with no distinction between /u/ vs. /ʊ/, as shown below:

i	u	‘neutral’
	ə	‘soft’
a	ɔ	‘hard’

ipəktə-	‘to laugh’	inda	‘dog’
ikə	‘to sing’	ikə	‘pot’
siiksə	‘evening’	dʒima	‘to stay with someone’
xidus	‘quickly’	dikto	‘thick’
niifku	‘quite small’	sindʒu	‘to knock out’

(5) /i/ is transparent to RTR harmony (Tolskaya, 2008, p. 5)

Non-RTR stem	RTR stem
xuŋkə-pi-də ‘canoe-3SG-FOC’	uɔda-pi-da ‘boat-3SG-FOC’

However, /i/-only-stems display idiosyncrasy when selecting a suffixal variant: some behave as if they were non-RTR stems, whereas others behave as if they were RTR stems.

(6) Idiosyncrasy of /i/ (Tolskaya, 2008, pp. 6–7)

Non-RTR stem	RTR stem
ippi-də (<PT *uppi) ‘to sew-FOC’	sikki-da (<PT *silko) ‘wash-FOC’
[PT = Proto-Tungusic (Starostin, Dybo, & Mudrak, 2003)]	

The vowel /æ/ shows remarkable similarities to the neutral, but sometimes idiosyncratic, vowel /i/. First, /æ/ is neutral, as in (7)a, and transparent to RTR harmony, as in (7)b.⁴

(7) Phonological behavior of /æ/ (Tolskaya, 2008, p. 7)

a. Neutral vowel /æ/	
Non-RTR stem	RTR stem
ŋənə-mdæ ‘walk-PART’	oʒa-mdæ ‘follow-PART’
b. /æ/ is transparent to RTR harmony	
ʒəŋgæ-ra	‘judge’

Second, if a stem contains only /æ/ (and another neutral vowel /i/), it can take either a non-RTR or RTR suffix:

⁴ Unlike Tolskaya (2008), Kaun (1995) assumes that /æ/ belongs to the [+RTR] harmonic set based on Avrorin & Lebedeva (1978).

(8) Idiosyncrasy of /æ/ (Tolskaya, 2008, pp. 6–7)

Non-RTR stem	RTR stem
isæ-mæçi (<PT *is) ‘to pull-Suffix’	gæki-va (<PT *giaxoa) ‘hawk-ACC’
[PT = Proto-Tungusic (Starostin et al., 2003)]	

As observed in other Tungusic languages (van der Hulst & Smith, 1988), high vowels such as /i/ and /ʊ/ block labial harmony.

(9) High vowels (/i, ʊ/) are opaque to labial harmony (Tolskaya, 2008, p. 6)

ɔtɔŋgɔ-ni-da (*ɔtɔŋgɔ-ni-də, *ɔtɔŋgɔ-ni-də)	‘kayak-3SG-FOC’
ɔtɔŋgɔ-dʊ-da (*ɔtɔŋgɔ-dʊ-də, *ɔtɔŋgɔ-dʊ-də)	‘kayak-DAT-FOC’

Notice that the stem *ɔtɔŋgɔ* ‘kayak’ takes an RTR suffix *-da* instead of *-də* after an intervening “neutral” suffix *-ni*. This indicates that Oroch /ɔ/ belongs to the [+RTR] harmonic set.⁵

Interestingly, /æ/ is also opaque to labial harmony.

(10) /æ/ is opaque to labial harmony (Tolskaya, 2008, p. 7)

sɔrɔdæ-da	‘greet-FOC’	(*sɔrɔdæ-də)
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To summarize, Oroch has RTR harmony whereby /i, æ/ are transparent

⁵ The low rounded vowel /ɔ/ shows a limited distribution (Kaun, 1995, pp. 71–72): in general, it can occur in initial syllables when a subsequent syllable contains high vowels, /i/, as in (i), or /ʊ/, as in (ii), or another instance of /ɔ/, as in (iii) below. Note that, unlike /ʊ/, /u/ is not allowed to follow /ɔ/. This also reveals the RTR-ness of /ɔ/.

The distribution of /ɔ/ in Oroch (Kaun, 1995, p. 71):

(i) dɔɔdip	‘to be heard’	(ii) mɔɔsɔ	‘cover, case’
ɖɔɔnisi	‘to yawn’	xɔɔsɔ	‘scraper’
(iii) dɔrɔ	‘law’	dɔɔlɔ	‘lame’
xɔŋɔ	‘other, another’	mɔŋɔksɔ	‘larynx’
tɔŋɔjɔŋkɔ	‘to come unscrewed’		

but sometimes idiosyncratic. Oroch also has labial harmony triggered only by /ɔ/ and blocked by /i, æ, ʊ/.

In the following section, we will critically review how the vowel patterns in Oroch we have seen so far are dealt with within a Stratal OT framework proposed by Tolskaya (2008).

3. Tolskaya (2008)

Tolskaya’s main concern is what she calls “neutral trigger vowels” /i, æ/ in Oroch. Based on Stratal OT (Kiparsky, 2000), Tolskaya assumes /ɪ/ (the [+RTR] counterpart to /i/), /o/ (the [-RTR] counterpart to /ɔ/), and /e/ (the [-RTR] counterpart to /æ/) in the “underlying” vowel inventory, which are neutralized as [i], [ɔ], and [æ], respectively, in the “surface” inventory.

(11) “Underlying” vs. “surface” vowel inventory in Oroch (Tolskaya, 2008, p. 12)

a. Underlying inventory

Non-RTR	i i:	u u:	ə ə:	o o: ⁶	e
RTR	ɪ ɪ:	ʊ ʊ:	a a:	ɔ ɔ:	æ

b. Surface inventory

Non-RTR	i i:	u u:	ə ə:		
RTR		ʊ ʊ:	a a:	ɔ ɔ:	æ

The input of a neutral-vowel-only root at the “stem” level is assumed to be specified for [±RTR] value and thus trigger RTR harmony (p. 17). Then, at the “word” level, a neutralization process eliminates the underlying distinction between /i/ and /ɪ/, /o/ and /ɔ/, and /e/ and /æ/, leaving only [i], [ɔ], and [æ], respectively. This is illustrated in the tableaux (12) below with examples *isæ-məči* ‘rope pulling game’ and *gæki-va* ‘hawk-ACC.’

⁶ These vowels /o, o:/ seem to be mistakenly omitted in Tolskaya’s underlying inventory and thus added by the author.

(12) Tableaux for *isæ-məči* and *gæki-va* (Tolskaya, 2008, p. 23)

a. /*isæ-mAčI*/ → *iseməči* → [*isəməči*] ‘rope pulling game’

Stem Level			
<i>isæ-mAčI</i>	ExtendRTR	IdentRTR	*LowFront[-RTR](<i>*e</i>)
a. → <i>iseməči</i>			*
b. <i>isəmači</i>		*!	
c. <i>isəmači</i>	*!		
Word Level			
<i>iseməči</i>	*LowFront[-RTR](<i>*e</i>)	IdentRTR	ExtendRTR
a. <i>iseməči</i>	*!		
b. <i>isəmači</i>		**!	*
c. → <i>isəməči</i>		*	*

b. /*gæki-vA*/ → *gækiva* → [*gækiva*] ‘hawk-ACC’

Stem Level			
<i>gæki-vA</i>	ExtendRTR	IdentRTR	*HiFront[+RTR](<i>*i</i>)
a. → <i>gækiva</i>			*
b. <i>gəki-və</i>		*!	
c. <i>gəki-və</i>	*!		
Word Level			
<i>gækiva</i>	*HiFront[+RTR](<i>*i</i>)	IdentRTR	ExtendRTR
a. <i>gækiva</i>	*!		
b. <i>gəki-və</i>		**!	*
c. → <i>gækiva</i>		*	*

The two stems in the above tableaux, *isæ* and *gæki*, have as their input forms /*isæ*/ and /*gæki*/ with all the vowels bearing a [\pm RTR] value. At the stem level, those candidates satisfying both a harmonizing constraint (ExtendRTR) and a faithfulness constraint (IdentRTR) are selected as optimal outputs. Then, at the word level, the RTR contrast between /*i*/ vs. **i*/ and **e*/ vs. /*æ*/ is neutralized due to higher-ranked markedness constraints such as *LowFront[-RTR] (= ‘**e*’) and *HiFrontRTR (= ‘**i*’).

However, this approach to Oroch RTR harmony faces both theoretical and empirical problems. First, as the above summary makes clear, Tolskaya’s analysis exploits abstract underlying representations and rules of absolute neutralization⁷ that are “typically not postulated unless a good deal of language-internal motivation can be mustered”

(Kenstowicz, 1994, p. 112). In a similar vein, it is undesirable to employ extra machinery such as the distinction between stem vs. word level to deal only with the exceptional behavior of /i, æ/. It should also be noted that an abstract analysis raises a question about the learnability of abstract phonemes. See Cole & Hualde (2010) for a general overview on the issue of abstractness in underlying representations.

Second, since the surface [ɔ] has two underlying sources, namely /o/ and /ɔ/, it is expected that the surface [ɔ] patterns together with the surface [i] and [æ] with respect to RTR harmony, taking both RTR and non-RTR suffixes depending on the lexical item when it is the only stem vowel. However, as revealed in cases in (9) and (10) where labial harmony is blocked, [ɔ] invariantly takes an RTR suffix.

Alternatively, in favor of surface-true representations, the basic intuition that the neutral-vowel-only roots should be marked underlyingly for their [±RTR] value can be achieved by treating them as true exceptions. This means that lexical items such as *isæ* and *gæki* should bear information on their behavior with regard to vowel harmony. Note that such an approach would cost no more: in Tolskaya's approach we need the same information to correctly postulate */i/ or */ɪ/ in the underlying representations.

Next, to explain the opacity of certain vowels in labial harmony, Tolskaya adopts Kaun's (1995) constraint-based approach which exploits the following constraints and their ranking.

(13) Constraints (Kaun, 1995)

a. Extend^Rif^H

The autosegment [+round] must be associated to all available vocalic positions within a word when simultaneously associated with [-high]

⁷ This approach constitutes a violation of the well known Alternation Condition (Kiparsky, 1968). I will not dwell on the controversy over abstractness in phonology in 1970s (Hyman, 1970; Kenstowicz & Kisseberth, 1979; Kiparsky, 1968), which still remains unresolved today.

b. Uniform^R

The autosegment [+round] may not be multiply linked to slots bearing distinct feature specifications (for height).

Not listed in (13) is a faithfulness constraint Ident[hi] which requires a faithful mapping between the input and the output.

The following tableau illustrates how labial harmony is blocked by the high rounded vowel /ʊ/ in Oroch. The constraint ranking, Ident[hi], Uniform^R >> Extend^Rif^{HI}, selects the non-harmonized, first candidate as an optimal output. The other two harmonized candidates are suboptimal. The second candidate violates the Uniform^R constraint because the [+round] feature is multiply linked to the [+high] rounded vowel [ʊ] and the [-high] rounded vowel [ɔ]. The third candidate violates the Ident[hi] constraint because the [+high] vowel [ʊ] in the input has changed into the [-high] vowel [ɔ] in the output.

(14) Blocking of labial harmony by a high rounded vowel (Tolskaya, 2008, p. 20)

/ikɔ-dʊ-dA/	Ident[hi]	Uniform ^R	Extend ^R if ^{HI}
a. → ikɔ-dʊ-da RD RD			*
b. ikɔ-dʊ-dɔ \ / RD		*!	
c. ikɔ-dɔ-dɔ \ / RD	*!		

However, Tolskaya (2008) does not provide any account for the opacity of /i, æ/ to labial harmony, which makes it difficult to evaluate the overall adequacy of her analysis.⁸

⁸ Kaun (1995) provides a solution to the opacity of /i/ in Tungusic in general based on ad hoc *transparency continuum* (p. 214). Nevins (2010) specifically deals with Oroch under his parametrized search-and-copy model of harmony. Due to space limitations, I will not discuss these alternative approaches in detail. However, let me point out that both Kaun and Nevins treat the opacity of high

In the following section, I will propose a contrastive hierarchy analysis for Oroch as an alternative to Tolskaya's approach.

4. Proposal

4.1. Framework

The framework I adopt in this paper is *modified contrastive specification* (Dresher, 2009), also known as *contrastive hierarchy theory*,⁹ which holds in its core that only contrastive features are phonologically active. This idea is formulated as follows:

(15) The Contrastivist Hypothesis (Hall, 2007, p. 20):

The phonological component of a language L operates only on those features which are necessary to distinguish the phonemes of L from one another.

All and only contrastive features are identified and ordered hierarchically by the Successive Division Algorithm.

(16) The Successive Division Algorithm (Dresher, 2009, p. 16)

- a. Begin with no feature specifications: assume all sounds are allophones of a single undifferentiated phoneme.
- b. If the set is found to consist of more than one contrasting member, select a feature and divide the set into as many subsets as the feature allows for.
- c. Repeat step (b) in each subset: keep dividing up the inventory into sets, applying successive features in turn, until every set has only one member.

“rounded” vowels such as /u/ and /ʊ/ and that of other vowels such as /i/ and /æ/ separately.

⁹ For a brief introduction to this theory in Korean and its application to the vocalic history of Korean, see Ko (2010).

Tolskaya (2008, pp. 24–27) rejects any contrastive hierarchy analysis for Oroch, claiming that the idiosyncrasy of neutral-vowel-only stems in (6) and (8) is “an unsolvable problem” within contrastive hierarchy approach (p. 26). However, this problem is not intrinsic to the contrastive hierarchy theory. Rather, idiosyncratic stems require special treatment regardless of what kind of approach we adopt. As we have already seen, Tolskaya’s own approach is not free from this requirement.

4.2. Contrastive hierarchy for Oroch

The vowel patterns in Oroch described in §2 and their implications for feature specifications can be summarized as follows:

(17) Summary of Oroch vowel patterns

- a. /i/ is neutral to RTR harmony and thus lacks contrastive [-RTR]. ← (4), (5)
However, /i/-only stems act either as non-RTR stems or RTR stems. ← (6)
- b. /i/ must be specified for [coronal], considering the origin of “/æ/”¹⁰
- c. There is no evidence that /u/ and /o/ bear contrastive [+labial], although they are phonetically [+labial]: they do not trigger labial harmony. ← (3)
- d. /ɔ/ triggers labial harmony, thus bears a [+labial] specification. ← (3)
- e. /ɔ/ triggers RTR harmony even when labial harmony is blocked. Thus, it must bear a [+RTR] specification. ← (9), (10)
- f. A height distinction is contrastive: (i) labial harmony is confined

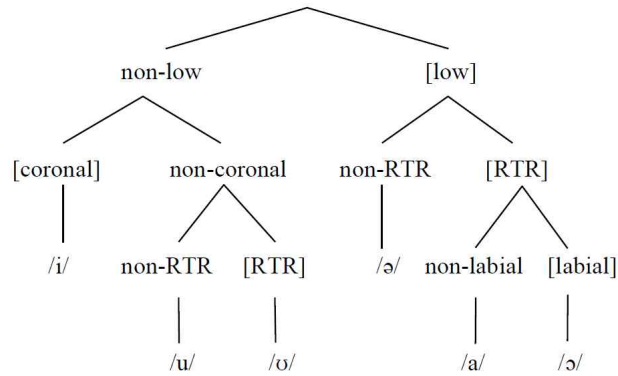
¹⁰ There is not much discussion in the literature on the palatalizing effect of /i/ in Oroch. But, as we will see later, the existence of the putatively distinct vowel “/æ/” indicates that [coronal] is contrastive for /i/ in Oroch since the vowel quality can be understood as the surface realization of the underlying /i+a/, i.e., as a result of (synchronic) vowel contraction (cf. Kim, 1996).

to low vowels and (ii) all high vowels block labial harmony. ←
(3), (9)

The contrastive hierarchy I propose for Oroch vowels is given in (18):

(18) Contrastive hierarchy for Oroch

a. SDA: [low] > [coronal] > [RTR] > [labial]¹¹



b. Output specifications

/i/ = [-lo, +cor]

/u/ = [-lo, -cor, -RTR]

/ʊ/ = [-lo, -cor, +RTR]

/ə/ = [+lo, -RTR]

/a/ = [+lo, +RTR, -lab] /ɔ/ = [+lo, +RTR, +lab]

First, a height contrast ([low]) applies to all the vowels and creates two sets of vowels, high vs. low vowels, which captures the fact that low vowels /ə, a, ɔ/ trigger/undergo labial harmony, whereas high vowels /i, u, ʊ/ block it.

The second cut is made by [coronal] which distinguishes /i/ from all other high vowels /u, ʊ/. Then, /i/ requires no further feature specifications including that of [±RTR], which explains its neutrality to RTR harmony. If [RTR] took scope over [coronal], /i/ would receive a

¹¹ In selecting vocalic features, I follow the articulator-based feature theory that has been proposed by Sagey (1986), Halle (1995), and Halle et al. (2000). However, the choice of [coronal] and [labial] over more traditional features [back] and [round] is orthogonal to the analysis presented here.

[-RTR] specification, which makes it difficult to understand the neutrality of /i/ with respect to RTR harmony. Similarly, /u/ and /ʊ/, which have already been distinguished from /i/ (and from low vowels as well), require no [+labial] specification despite their phonetic roundedness. Therefore, they cannot trigger labial harmony.

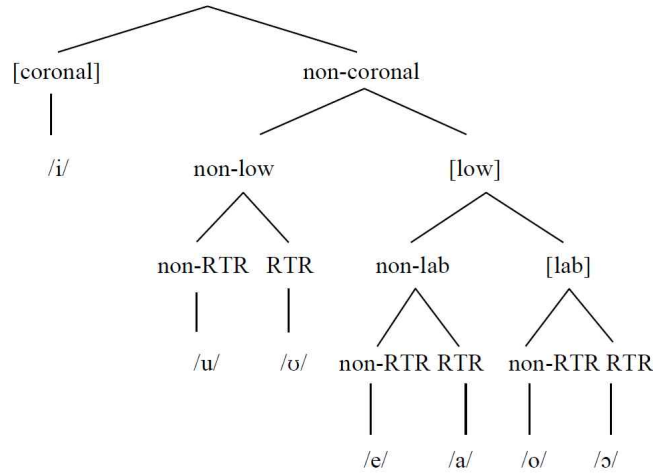
The next feature, [RTR], applies to distinguish /u, ə/ and /ʊ, a, ɔ/. The last feature, [labial], identifies /ɔ/ as the only contrastively rounded vowel. Therefore, /ɔ/ receives specifications for both [±RTR] and [±labial]. Note that if, on the contrary, [labial] took scope over [RTR], /ɔ/ would first be specified as [+labial]. Then it would require no further specification for [±RTR], which makes the harmony pattern in (9) unexplained.

The relative ordering between the first two features, i.e., [low] > [coronal], is crucial in explaining the behavioral difference of /i/ in Tungusic and Mongolic labial harmony (van der Hulst & Smith, 1988). We have seen that in Oroch (and other Tungusic languages as well) all high vowels (/i, u, ʊ/) are opaque to labial harmony. By contrast, in Mongolic languages only /u, ʊ/ are opaque, but /i/ is transparent to labial harmony. Adopting Mester's (1986) height-stratified fusional harmony whereby labial harmony operates only on the same height tier,¹² Ko (2011) ascribes the difference between Tungusic /i/ and Mongolic /i/ to the presence and absence of a contrastive height specification ([-low]) which is the result of different feature orderings: Tungusic /i/ is assigned [-low, +coronal] under the hierarchy [low] > [coronal], whereas Mongolic /i/ is assigned [+coronal] under a reverse ordering [coronal] > [low], as shown below:

¹² Note that the modified contrastive specifications in (18)b would be compatible with many other models of vowel harmony as long as they can account for the blocking of labial harmony in terms of the height difference between the trigger/target vowels and the intervening vowels.

(19) Contrastive hierarchy for Khalkha Mongolian (Ko, 2011, pp. 169–70)

a. SDA: [coronal] > [low] > [labial] > [RTR]



b. Output specifications

/i/ = [+co]

/u/ = [-co, -lo, -RTR]

/ʊ/ = [-co, -lo, +RTR]

/e/ = [-co, +lo, -lab, -RTR] /o/ = [-co, +lo, +lab, -RTR]

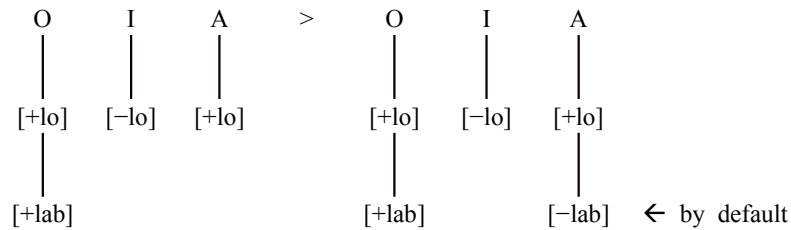
/a/ = [-co, +lo, -lab, +RTR] /ɔ/ = [-co, +lo, +lab, +RTR]

Tungusic /i/ with the contrastive [-low] specification blocks the fusion of the height tier as shown in (20). In contrast, Mongolic /i/ with no height specification is invisible to the fusional harmony process as shown in (21).¹³ Note that the opacity of the high rounded vowel /ʊ/

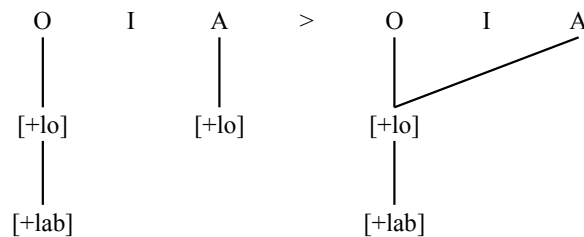
¹³ As pointed out by an anonymous reviewer, a piece of evidence that is independent of the different behavior of /i/ would strengthen my analysis for the feature hierarchy reversal in Tungusic and Mongolic languages. Unfortunately, I was unable to find direct evidence in Oroch. However, some other Southeast Tungusic languages such as Udihe (Nikolaeva & Tolskaya, 2001; Tsumagari, 2010) and Nanai (Kim, 1988) show an unconditioned alternation between /i/ and /u/, which implies that /i/ and /u/ (and possibly their [+RTR] counterparts where available) are grouped together to the exclusion of low vowels (e.g., /ə, a, o/ in case of Udihe). This grouping is achievable under the relative hierarchy [low] > [coronal], but not under [coronal] > [low]. In Mongolic languages, on the other hand, nothing suggests such grouping.

is treated in the same manner as that of /i/: since /ʊ/ bears a contrastive [-low] specification, it blocks the fusional harmony. Thus, this analysis provides a unified solution to both /i/ and /ʊ/.

(20) Tungusic /i/ = [-low, +cor]: opaque (Ko, 2011, p. 172)



(21) Mongolic /i/ = [+cor]: transparent (Ko, 2011, p. 173)



I excluded the vowel /æ/ from the contrastive hierarchy proposed for Oroch in (18), treating it as a diphthong.¹⁴ The peculiarities of “/æ/,” i.e., the transparency with respect to RTR harmony, the idiosyncrasy in selecting a suffix variant, and the opacity with respect to labial harmony, all receive plausible explanation when we postulate the underlying representation of the surface vowel [æ:] as /ia/,¹⁵ or /iə/ in

¹⁴ Similarly, Kazama (2003, p. 14) also excludes /æ/ from the inventory of Oroch short vowels, treating it as /ia/ (or /ja/ in case there is no other onset consonant), as in the following examples. (Note he assumes only 5 vowel phonemes, /i, ə, a, u, o/, without distinguishing /u/ and /ʊ/):

Kazama (2003)	cf. Avrorin & Boldyrev (2001, p. 19)	Gloss
/kulia/ (31), p. 34	/kʊlæ/	‘worm, insect’
/bia/ (55), p. 47	/bæ/	‘moon’
/nia/ (96), p. 66	/ɲæ/	‘person, man’
/jaanami/ (114), p. 75	/jæmi/	‘why’

¹⁵ This analysis is partly consistent with Kim’s (1996) observation that the long

marginal cases. For some lexical items, “/æ/” is indeed in free variation with /ia/, /iə/, and /i/ (Tolskaya, 2008, p. 7).

(22) Free variation of /æ/ with /iə/, /ia/, and /i/ (Tolskaya, 2008, p. 7)			
bæskə	~	biəskə	‘after all’
bæ-va	~	bia-va	‘moon-ACC’
badæ	~	badi	‘more’

The underlying /ia/ (or marginally /iə/) thus explains the idiosyncrasy of the surface vowel [æ:] in RTR harmony. The source of the “hidden” [±RTR] value is the /a/ or /ə/ portion that is obscured by the vowel contraction at the phonetic level.¹⁶ The high vowel portion /i/ is, then, the source of other aforementioned peculiarities: transparency/opacity in RTR/labial harmony.

It should be noted that this is not an abstract analysis since there is phonetic evidence. First, the analysis is supported by the fact that “/æ/” always surfaces as a long vowel and is phonetically “slightly diphthongal, starting with an ultra-short [i]” (Tolskaya, 2008, p. 30). Figure 1 shows the spectrogram of the Oroch word /kolia/ [qoʎja:] ‘worm’¹⁷ which is transcribed as /kɔlə/ in Avrorin & Boldyrev (2001, p. 19). Note the conspicuous “rising” (F1) and “lowering” (F2) transitions of the first two formants at the beginning and the long duration overall of the /ia/ (= “/æ/”) portion in the spectrogram.

vowel \bar{e} emerges as a result of the contraction of /aj/ or /ja/ (p. 29).

¹⁶ Similarly, [ee] and [εε] in Oroqen (Northern Tungusic) seem to block labial harmony, e.g., *əmɔlɛɛ-sal* ‘grandson-PI’ (Zhang, 1996, p. 180), cf. *kɔrɔgɔ-sɔl* ‘pheasant-PI’ (Zhang, 1995, p. 171). This also receives a straightforward explanation when we assume /iə/ and /ia/ for the underlying representation of [ee] and [εε], respectively.

¹⁷ It was recorded in Habarovsk, Russia, in December 2008 by the fieldworkers of the project ASK REAL (the Altaic Society of Korea, Researches on Endangered Altaic Languages). I am very grateful to the principal investigator Prof. Juwon Kim who allowed me to use the ASK REAL materials. More information on the fieldwork research can be found at the ASK REAL Digital Archives (http://altaireal.snu.ac.kr/askreal_v25/).

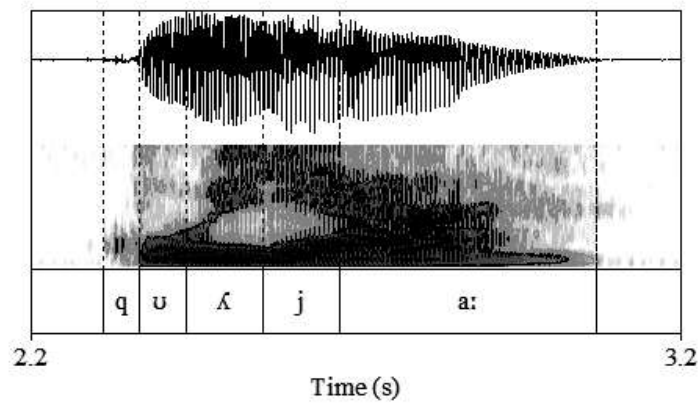


Figure 1 Spectrogram of the Oroch word /kolia/ [qʊɬja:] ‘worm.’

4.3. A note on Nevins (2010)

Nevins (2010) claims that any possible ordering of the four features [\pm high, \pm back, \pm round, \pm ATR] (which correspond to [\pm low, \pm coronal, \pm labial, \pm RTR] in my analysis) would fail to generate the right specifications for Oroch vowels (p. 114-5). Specifically, he argues that Oroch /i, æ/ are invisible to RTR harmony and therefore must lack [RTR] specification, while they are visible to labial harmony and therefore must bear [labial] specification (p. 114).

- (23) [Allegedly] desired outcomes of underspecification in Oroch, given an underspecification approach to harmonic participation (Nevins, 2010, p. 114, with features modified accordingly)
- a. Desideratum 1 (D1): /i, æ/ must lack specification for [\pm RTR], all other vowels must have it.
 - b. Desideratum 2 (D2): /i, æ/ must bear specifications for [\pm labial].

The contrastive hierarchy in (18) satisfies the first condition (/i, æ/ lacking a [\pm RTR] value) by giving /i, æ/ only the specifications for [low] and [coronal]. However, the second condition (/i, æ/ bearing a

[-labial] specification) cannot be satisfied by any of the possible orderings. This is inevitable: since there is no [+labial] counterpart to /i, æ/, there is no way to assign [-labial] value to them. This is shown in (24) where all the logically-possible feature orderings fail to satisfy both desiderata.

- (24) Possible outcomes of the Successive Division Algorithm for Oroch given [\pm low, \pm coronal, \pm labial, \pm RTR] (Nevins, 2010, pp. 114–115, with features modified accordingly)
- a. Choose [\pm RTR] first: fails, since it will assign [\pm RTR] to /i, æ/, contra D1
 - b. Choose [\pm coronal] first: fails, since /i/ will not be later assigned [-labial], contra D2
 - c. Choose [\pm low] first: assigns [-low] to /i, u, ʊ/, [+low] to /æ, ə, a, ɔ/
 - i. If [\pm RTR] chosen next: fails, since it will assign [\pm RTR] to /i, æ/, contra D1
 - ii. If [\pm coronal] chosen next: fails, since /i/ will not be later assigned [-labial], contra D2
 - iii. If [\pm labial] chosen next: only /ɔ/ will have [+low, +labial], and as /ɔ/ will not be later assigned [\pm RTR], contra D1, fails
 - d. Choose [\pm labial] first: assigns [+labial] to /u, ʊ, ɔ/ and [-labial] to /i, æ, ə, a/
 - i. If [\pm RTR] chosen next: fails, since it will assign [\pm RTR] to /i, æ/, contra D1
 - ii. If [\pm low] chosen next: only /ɔ/ will have [+low, +labial], and as /ɔ/ will not be later assigned [\pm RTR], contra D1, fails
 - iii. If [\pm coronal] chosen next: assigns [-coronal] to /u, ʊ, ɔ, ə, a/ and [+coronal] to /i, æ/
 - If [\pm low] chosen next: only /ɔ/ will have [+low, -coronal,+labial], and as /ɔ/ will not be later assigned [\pm RTR], contra D1, fails
 - iv. If [\pm RTR] chosen next: fails, since it will assign [\pm RTR] to /i, æ/, contra D1

Instead of going into the details of Nevins's approach to Oroch vowel harmony, it would suffice here to point out that a contrastive hierarchy

analysis is not impossible, as I have already shown, and that the alleged problem of not assigning [-labial] to /i, æ/ is not really a problem but rather should be viewed as a virtue in our contrastive hierarchy analysis: The [±labial] specification for the intervening vowels is not contrastive, and thus irrelevant to the phonological computation. Recall that the blocking effect is explained solely by contrastive “height” difference between the low trigger/target vowels and the high intervening (and thus blocking) vowels.

On the contrary, the [±labial] specification for the intervening vowels is crucial in Nevins’s approach. He views the blocking of labial harmony as what he calls *defective intervention* effects.¹⁸ Simply put, in Nevins’s scenario, /i, u, ʊ/ in Oroch are visible in labial harmony due to the *all-value* relativization of labial harmony,¹⁹ but they are only “defectively” so because they do not satisfy an additional restriction on the same height specification between the value seeker (e.g., an underspecified suffix vowel) and the value giver (e.g., a prespecified stem vowel). It is this defectiveness that halts the search process and hence forces the high vowels to block labial harmony. Notice, however, that this does not explain the blocking effect of “/æ/” since it is a low vowel and is expected to undergo labial harmony.²⁰

Once we discard the validity of Desideratum 2, however, we can safely dismiss Nevins’s objection to the contrastive hierarchy approach

¹⁸ The notion of *defective intervention*, which was developed in minimalist syntax for Agree (Chomsky, 2000), seems to be highly controversial even in the field of syntax. See for example Bruening (2012) who claims that there is “no such thing.”

¹⁹ Following Calabrese’s Visibility Theory (Calabrese, 2005), Nevins assumes three ways of relativization: some rules may target all feature values, others target only *contrastive* values, and still others target only *marked* values. In his analysis, for example, Oroch labial harmony is sensitive to all values ([±labial]) whether contrastive or not, whereas Khalkha labial harmony is only sensitive to marked values ([+labial]).

²⁰ See Ko (2012) for more extensive criticisms of Nevins’s analysis of Oroch, Khalkha, and Written Manchu vowel harmony.

not assigning [±labial] value to the blocking vowels.

5. Conclusion

In this paper I revisited the Oroch vowel harmony patterns described and analyzed previously in Tolskaya (2008) and proposed a more adequate and thorough analysis within the framework of contrastive hierarchy theory. In particular, I showed that the vowel patterns in Oroch are best explained under a contrastive hierarchy which ranks [low] > [coronal] > [RTR] > [labial]. The proposed hierarchy not just assigns proper feature specifications to each vowel in Oroch but also provides a simple, unified solution to the transparency and opacity in vowel harmony, which can be summarized in a general statement as follows: The *transparency* of a vowel in harmony is due to the *absence* of the *harmonic* feature specification in the underlying representation of the vowel, whereas in parallel, the *opacity* of a vowel in harmony is due to the *presence* of the *blocking* feature specification in the underlying representation of the vowel. Finally, the putative simple vowel “/æ/” received a proper treatment: it is now reanalyzed as a diphthong /ia/ (or /iə/) and its peculiarities are ascribed to the peculiarities of its constituents.

Finally, the current approach is desirable from genetic/typological perspectives as well. The proposed Oroch contrastive hierarchy is largely consistent with the previous contrastive hierarchies proposed for other Tungusic languages: [low] > [coronal] > [labial] > [RTR] for Oroqen (Zhang, 1996) and [low] > [coronal] > [labial] > [ATR] for Written Manchu (Dresher & Zhang, 2005; Zhang, 1996). However, the minor dissimilarities, i.e., the reverse ordering between [labial] and [RTR] in Oroqen and the choice of [ATR] rather than [RTR] as a dominant feature in Written Manchu, need to be reexamined.

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