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A Contrastive Hierarchy Approach to Tungusic and Mongolic Labial Harmony

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1 Introduction

As observed in van der Hulst and Smith (1988), there is a minimal-pair-like contrast between Tungusic and Mongolic languages with respect to labial harmony: Tungusic /i/ is opaque, whereas Mongolic /i/ is transparent to labial harmony. This is illustrated in (1) with ‘Standard’ Ewenki (Tungusic) and Khalkha/Buriat (Mongolic) examples.

- (1) a. Ewenki
 ɔɔɔ- ɔɔɔ-ɔ (*-a) ‘deer-ABLATIVE’
 ɔɔɔ-igla (*-igla) ‘deer-DESTINATIVE’
 b. Khalkha/Buriat
 mɔɔɔin- mɔɔɔin-ɔɔs (*-aas) ‘horse-ABLATIVE’

This is a contrast, not just between these two particular languages, but between the two language families, since exactly the same pattern is found in all Tungusic and Mongolic languages known to have labial harmony (see Ko 2012 and references therein for further detail). Thus, a desirable analysis must be able to explain this ‘microvariation’ between the two closely-related language families.

The proposal in this paper is that the minimal contrast between Tungusic and Mongolic languages can be captured in terms of the minimal difference in the contrastive feature hierarchy (Dresher 2009): Tungusic [low] > [coronal] > [labial] > [RTR] (Zhang 1996) vs. Mongolic [coronal] > [low] > [labial] > [RTR]. Under these different hierarchies, Tungusic and Mongolic /i/ receive different feature specifications, which explains their different behaviors.

The organization of this paper is as follows: Section 2 introduces the previous analysis (van der Hulst and Smith 1988) and addresses the problems it faces. Section 3 introduces the frameworks adopted here. Section 4 presents the contras-

tive hierarchy analysis of Oroqen and Khalkha followed by explanation on the labial harmony patterns in these languages. Section 5 concludes the paper.

2 Previous Analysis: van der Hulst and Smith (1988)

The vowel systems of Ewenki and Khalkha are given below in the notation of a version of Dependency Phonology.¹

(2) Ewenki and Khalkha vowels (van der Hulst and Smith 1988)

a. Ewenki

/i/ = Iⁱ /u/ = Uⁱ

/ə/ = Aⁱ

/ɛ/ = AI /a/ = A /ɔ/ = A^u

b. Khalkha

/i/ = Iⁱ /u/ = Uⁱ

/ʊ/ = U

/e/ = AIⁱ /o/ = A^{i u}

/a/ = A /ɔ/ = A^u

To capture the minimal difference between the two languages, van der Hulst and Smith (1988) relies on the presence and the absence of a governing specification for [I] in Tungusic /i/ and Mongolic /i/ respectively. What is to be noted here is the different phonetic qualities of the ATR counterpart to /a/, i.e., /ə/ in Ewenki and /e/ in Khalkha. Unlike Ewenki /ə/, Khalkha /e/ is realized as a front vowel. Thus it differs from /a/ with respect not only to dependent feature [I] (ATR) but also to governing feature [I] (palatal constriction). Since Khalkha /e/ is the [+ATR] counterpart to /a/ (= |A|), its underlying representation must be |Aⁱ| and the feature [I] is introduced by a redundancy rule which derives governing [I] from dependent [I]. A consequence of this is that, since a [I]-introducing redundancy rule is already available, /i/ can also be represented simply as |.ⁱ|, not |Iⁱ|, underlyingly. Then, as illustrated below, the empty node of Khalkha /i/ does not count as a barrier to the ‘fusional harmony’ (Mester 1986).

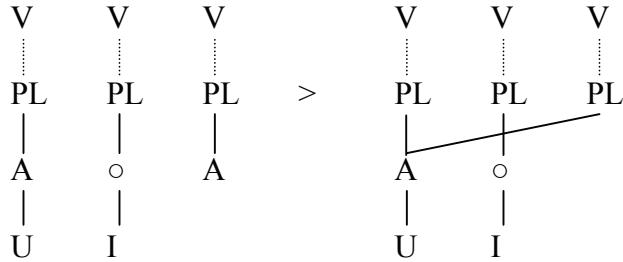
¹ The dual interpretation of vocalic features is as follows (van der Hulst and Smith 1988:82):

	<i>Governing Feature</i>	<i>Dependent Feature</i>
[I]	palatal constriction	expanded pharyngeal cavity (i.e., ATR)
[U]	velar constriction	expanded labial cavity (i.e., rounded)
[A]	pharyngeal constriction	expanded oral cavity (i.e., lowered jaw)

Governing values are indicated by upper-case letters while dependent values by lower-case superscripts.

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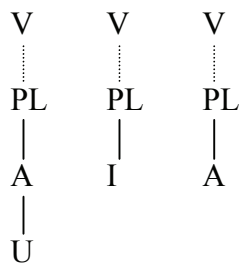
(3) Transparency: Khalkha /i/ (van der Hulst and Smith 1988:84)



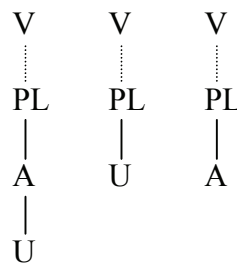
To the contrary, /i/ in Ewenki and /u, ʊ/ in both languages are all opaque to labial harmony, as they have either [I] or [U] as a governing feature which obstructs the fusion of another governing feature [A].

(4) Opacity (van der Hulst and Smith 1988:84-5)

a. Ewenki /i/



b. Ewenki/Khalkha /u, ʊ/



However, this analysis faces several problems. First, it offers a bipartite analysis on the blocking effect of the opaque vowels, assuming two different blocking features: [I] for /i/ and [U] for /u, ʊ/. Second, these proposed blocking features seem to lack phonetic and typological plausibility. To my best knowledge, there is no known phonetic principles as to why frontness or roundness would block the spreading of roundness. Rather, as Kaun (2004) concludes from a typological survey over thirty-three languages, height plays a crucial role in labial harmony as summarized below:

(5) The effects of height on labial harmony (Kaun 2004:88)

- a. The trigger must be nonhigh.
- b. The target must be high.
- c. The trigger and target must agree in height.

Of particular interest is the third principle in (5c), since it has recently been regarded as the cause of the blocking effect in labial harmony by Kaun (1995) and Nevins (2010). Also, it is phonetically grounded: cross-height harmony is avoided “because the lip rounding gesture is not equivalent for high and nonhigh rounded vowels” (Kaun 2004:98ff).

Third, van der Hulst and Smith’s analysis cannot properly handle the palatalizing effect of Mongolic /i/ evidenced by palatalized consonants and vowel umlaut. Since the palatalizing feature [I] of /i/ is not specified underlyingly but introduced later by a redundancy rule, we must assume that a redundant value can operate in phonology proper, which is undesirable.

Finally, but more than anything else, the analysis cannot be applied to other Mongolian varieties such as Shuluun Hōh Chakhar, a Southern Mongolian, with a richer inventory but the same harmony patterns.

(6) Chakhar vowel inventory (Svantesson et al. 2005:144)

i	y	u	
ɪ	ʏ	ʊ	
e	ø	ə	o
ɛ	œ	a	ɔ

Unlike Khalkha but rather like Ewenki, Chakhar has /ə/ instead of /e/ as the ATR counterpart to /a/. This means that there is no redundancy rule which would later introduce governing feature [I] to /i/. Without this redundancy rule, the underlying representation of /i/ must bear the specification for [I]. Then, the prediction is that /i/ (as well as its RTR counterpart /ɪ/) would be opaque, not transparent, to labial harmony. However, this prediction is not borne out: Chakhar /i/ is just as transparent as Khalkha /i/.

3 Framework

The present study is based on *contrastive hierarchy* (Dresher 2009) as a theory of feature specification and *fusional harmony* (Mester 1986) as a model of “height-stratified” vowel harmony.

3.1 Contrastive Hierarchy Theory (Dresher 2009)

Under the contrastive hierarchy theory, the contrastive specifications of phonemes are considered to be governed by language-particular feature hierarchies. Instead of traditional feature matrices (7a), we will use hierarchically ordered feature specifications (7b).

(7) Feature matrix vs. feature hierarchy

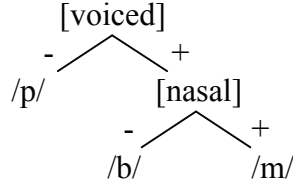
a. feature matrix

	/p/	/b/	/m/
[voiced]	-	+	+
[nasal]	-	-	+

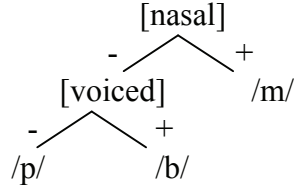
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b. feature hierarchy (Dresher 2009:15-6)

i. [voiced] > [nasal]



ii. [nasal] > [voiced]



As seen in (7b), the same inventories with the same set of features can have different feature hierarchies, allowing for variability (Avery et al. 2008:1). This characteristic of contrastive hierarchy approach is crucial in my analysis, since I will show that the microvariation between Tungusic and Mongolic can be captured in terms of the minimal difference in feature hierarchy.

In Dresher’s contrastive hierarchy theory, it is hypothesized that only contrastive features are active in the phonology. The corollary of this with respect to vowel harmony is that a harmony trigger must bear a contrastive specification for the harmonic feature. The Successive Division Algorithm (SDA hereafter) given below is proposed as an algorithm that assigns all and only contrastive features to phonemes.

(8) The Successive Division Algorithm (Dresher 2009:16)

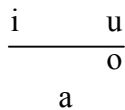
- a. Begin with no feature specifications: assume all sounds are allophones of a single undifferentiated phoneme.
- b. If the set is found to consist of more than one contrasting member, select a feature and divide the set into as many subsets as the feature allows for.
- c. Repeat step (b) in each subset: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

3.2 Fusional Harmony (Mester 1986)

Fusional harmony (Mester 1986) is proposed as a model of ‘height-stratified’ labial harmony found in, e.g., Yawelmani Yokuts, whereby labial harmony applies only when the trigger and the target share the same height as shown below:

(9) Yawelmani Yokuts (Mester 1986)

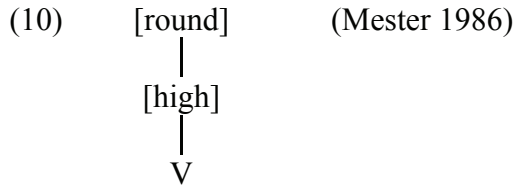
a. vowel inventory



b. vowel harmony

- | | |
|---|--------------------------------|
| i. /u/ rounds a following /i/ | $u C_0 i \rightarrow u C_0 u$ |
| ii. /o/ rounds a following /a/ | $o C_0 a \rightarrow o C_0 o$ |
| iii. /u/ does not round a following /a/ | $u C_0 a \nrightarrow u C_0 o$ |
| iv. /o/ does not round a following /i/ | $o C_0 i \nrightarrow o C_0 u$ |

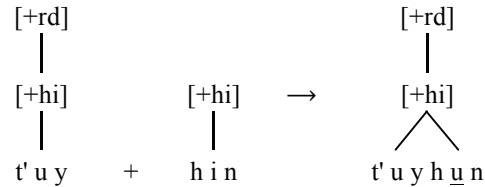
Mester assumes that the [round] tier is dependent on the [high] tier as follows:



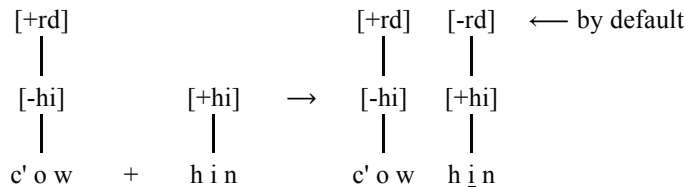
In this model, the effect of [round] spreading is achieved by the fusion of the [high] tier. If the trigger and the target vowels share the same height, fusional harmony applies. If the vowels have a different height, then fusional harmony fails to apply and a default value for [round] is assigned.

(11) Fusional harmony in Yawelmani Yokuts (Mester 1986)

a. same height: harmony applies.



b. different height: harmony fails and a default value is assigned.



4 Analysis

In this section, I present a contrastive hierarchy analysis of Oroqen (a Tungusic) and Khalkha (a Mongolic). Oroqen is selected in place of Ewenki, because Ewenki vowel inventory is rather controversial (de Boer 1996). In contrast, Oroqen has already been analyzed within the framework of contrastive hierarchy (Zhang 1996). Furthermore, Oroqen has almost the same vowel inventory as Khalkha as follows:

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(12) Vowel inventory

a. Oroqen

i u
 ʊ
 ə o
 a ɔ

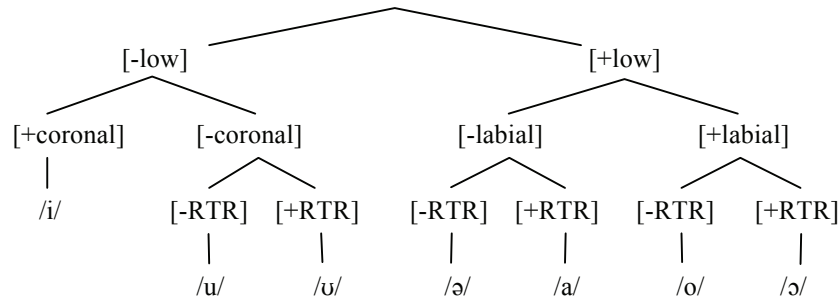
b. Khalkha

i u
 ʊ
 e o
 a ɔ

The contrastive hierarchies I propose for Oroqen and Khalkha are given in (13) and (14) below, respectively.

(13) Contrastive hierarchy for Oroqen (Zhang 1996)

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



b. Output specifications

/i/ = [-low, +cor]

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

/ʊ/ = [-low, -cor, +RTR]

/ə/ = [+low, -cor, -lab, -RTR]

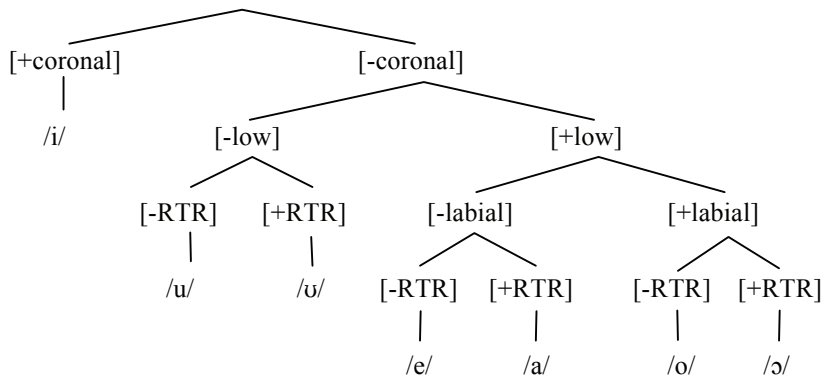
/o/ = [+low, -cor, +lab, -RTR]

/a/ = [+low, -cor, -lab, +RTR]

/ɔ/ = [+low, -cor, +lab, +RTR]

(14) Contrastive hierarchy for Khalkha (Ko 2011)

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



b. Output specifications

/i/ = [+cor]	/u/ = [-cor, -low, -RTR]
	/ʊ/ = [-cor, -low, +RTR]
/e/ = [-cor, +low, -lab, -RTR]	/o/ = [-cor, +low, +lab, -RTR]
/a/ = [-cor, +low, -lab, +RTR]	/ɔ/ = [-cor, +low, +lab, +RTR]

The only difference between the two contrastive hierarchies lies in the relative ordering between [low] and [coronal]: [low] > [coronal] in Oroqen vs. [coronal] > [low] in Khalkha. As a result, /i/ receives different feature specifications in the two languages: [-low, +cor] in Oroqen vs. simply [+cor] in Mongolic. Since the latter lacks a height specification, it is invisible to the ‘height-stratified’ harmony process.

The evidence for the contrastive status of the proposed features [coronal], [RTR], [labial], and [low] can be summarized as follows:

- (15) Summary of evidence for the contrastive status of features
- | feature | evidence |
|--------------|---|
| a. [coronal] | consonant palatalization, vowel umlaut
Oroqen [j]-formation |
| b. [RTR] | RTR harmony |
| c. [labial] | labial harmony, Oroqen [w]-formation |
| d. [low] | height restriction on the trigger/target of labial harmony
trigger restriction in Oroqen [w]-formation |

First, the contrastive status of [coronal] is evidenced by palatalization in both languages. In Oroqen, /i/ palatalizes preceding /s/, resulting in [ç]. In Khalkha, consonant palatalization is more pervasive. These are illustrated in (16) below.

- (16) Evidence for [coronal]
- a. Oroqen: palatalization of /s/ by /i/ (Zhang 1996:171)
- | | |
|---------------------------------|------------------------------|
| i. [s] before a non-front vowel | ii. [ç] before a front vowel |
| sukə [suxə] ‘axe’ | asi [açi] ‘now’ |
| səkə- [səxə] ‘fill’ | |
| sarbu [sarbu] ‘chopsticks’ | |
- b. Khalkha: palatalized consonants (Svantesson et al 2005:26ff)
- | | |
|------------------------------|----------------------------|
| i. non-palatalized Cs | ii. palatalized Cs |
| p ^h aɣ̚ ‘splash!’ | p ^h aɣ̚ ‘plate’ |
| ag ‘tight’ | ag ^j ‘wormwood’ |
| cam ‘road’ | čam ‘law’ |
| am ‘mouth’ | am ^j ‘life’ |

The palatalizing effect of /i/ indicates that /i/ is specified for [+cor].

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The contrastive status of [RTR], [labial], and [low] is evidenced by the vowel harmony patterns presented below. [RTR] and [labial] are identified by RTR and labial harmony given in (17a) and (17d), respectively. The fact in (17c) and (17d) that only low rounded vowels trigger labial harmony suggests that /u/ and /ʊ/, albeit phonetically rounded, lack specification for [±labial].² [low] is evident from the fact that the allomorphic alternations of both the definite object particle (/wə, -wa, -wo, -wə/) in Oroqen and the instrumental case marker (/eer, -aar, -oor, -oor/) in Khalkha are confined only to low vowels.

- (17) Vowel harmony in Oroqen and Khalkha
- | | Oroqen (Zhang 1996) | | Khalkha (Ko 2011) | |
|----|---|------------------|-------------------|-----------------|
| a. | RTR harmony | | | |
| | bəjun-mə | ‘moose-DEF.OBJ’ | et-eer | ‘item-INST’ |
| | ɬaaka-wa | ‘thing-DEF.OBJ’ | at-aar | ‘devil-INST’ |
| b. | If /i/ is the only stem vowel, non-RTR suffix is selected | | | |
| | irgi-wə | ‘tail-DEF.OBJ’ | it-eer | ‘strength-INST’ |
| c. | high rounded Vs: RTR harmony, but no labial harmony | | | |
| | kuwun-mə | ‘cotton-DEF.OBJ’ | ut-eer | ‘day-INST’ |
| | ʊruun-ma | ‘hoof-DEF.OBJ’ | ʊt-aar | ‘willow-INST’ |
| d. | low rounded Vs: labial harmony | | | |
| | təŋko-wo | ‘window-DEF.OBJ’ | ot-oor | ‘feathers-INST’ |
| | ɔlɔ-wə | ‘fish-DEF.OBJ’ | ɔt-oor | ‘star-INST’ |

/i/ is transparent to RTR harmony in both languages, which indicates that /i/, albeit phonetically advanced, lacks specification for [±RTR].

- (18) /i/ is transparent to RTR harmony
- | | | | | |
|----|--|--------------------------|--------------------------|------------------|
| a. | Oroqen (Zhang 1996) | | | |
| | nəkin-nə | ‘sweat-PAST’ | tari-wa | ‘that-DEF.OBJ’ |
| | ulin-mə | ‘betrothal gift-DEF.OBJ’ | mürin-ma | ‘horse-DEF.OBJ’ |
| b. | Khalkha (data from Svantesson et al. 2005) | | | |
| | te:ɣ-ig-e: | ‘gown-ACC-REFL’ | ç ^h a:s-ig-a: | ‘paper-ACC-REFL’ |
| | su:ɣ-ig-e: | ‘tail-ACC-REFL’ | mü:r-ig-a: | ‘cat-ACC-REFL’ |

With these four contrastive features, we have twenty four logically possible feature orderings. Recall, however, that a legitimate ordering must satisfy all the

² [w]-formation in Oroqen (Zhang 1996:163ff) shows the same contrast between high and low rounded vowels: it is triggered by /oo/ and /ɔɔ/ (i), but not by /uu/ and /ʊʊ/ (ii).

i.	oorin	[^w oorin]	‘all’	ii.	uu-	[uu]/* ^w [uu]	‘blow’
	ɔɔ-	[^w ɔɔ]	‘do’		ʊʊn-	[ʊʊn]/* ^w [ʊʊn]	‘saw’

following desiderata given in (19).³

- (19) Desiderata for desired outcome for both Oroqen and Khalkha
- a. D1: /i/ must bear [+coronal] specification.
 - b. D2: /i/ must lack specification for [±RTR].
 - c. D3: /u, ʊ/ must lack specification for [±labial].
 - d. D4: /e(ə), a, o, ɔ/ must form a natural class⁴ (excluding /i, u, ʊ/) with respect to labial specification.

(20) shows a step-by-step procedure whereby SDA is being applied to all logically possible orderings.

- (20) Applying SDA to Oroqen and Khalkha
- a. If [±RTR] first: fails, since it assigns [-RTR] to /i/, contra D2.
 - b. If [±lab] first: fails, since it assigns [+lab] to /u, ʊ/, contra D3.
 - c. If [±low] first: assigns [+low] to /e(ə), a, o, ɔ/ and [-low] to /i, u, ʊ/.
 - i. If [±RTR] second: fails, since it assigns [-RTR] to /i/, contra D2.
 - ii. If [±lab] second: fails, since it assigns [+lab] to /u, ʊ/, contra D3.
 - iii. If [±cor] second: assigns [+cor] to /i/ and [-cor] to /u, ʊ/.
 - d. If [±cor] first: assigns [+cor] to /i/ and [-cor] to all other vowels.
 - i. If [±RTR] second: fails, since it assigns [+RTR] to /u, a, ɔ/ and [-RTR] to /u, e(ə), o/, contra D4.
 - ii. If [±lab] second: fails, since it assigns [+lab] to /u, ʊ/, contra D3.
 - iii. If [[±low] second: assigns [+low] to /e(ə), a, o, ɔ/ and [-low] to /u, ʊ/.

Only (20c iii) and (20d iii) satisfy all the desiderata and generate four legitimate orderings which, assuming a fixed ordering [labial] > [RTR],⁵ will be reduced to the following two:

- (21) a. [low] > [coronal] > [labial] > [RTR]
 b. [coronal] > [low] > [labial] > [RTR]

³ The particular way of demonstration in (19) and (20) is borrowed from Nevins (2010:114-5), although Nevins uses it to show that any possible ordering fails to assign the right specifications for Oroch, a Tungusic language. In my view, Oroch vowel harmony can be explained under the contrastive hierarchy [low] > [coronal] > [RTR] > [labial] (cf. Tolskaya 2008). I will not go into further detail, since it would be a digression from the topic of the present paper.

⁴ A natural class is defined here as a set of daughters of the terminal nodes sharing the same node in a given contrastive hierarchy.

⁵ This fixed ordering is used only for an expository purpose, since the relative ordering between [labial] and [RTR] is irrelevant to the main topic, the contrast between Tungusic and Mongolic. However, it is not a trivial matter, since it can be viewed as a key to understand intra-Tungusic and/or intra-Mongolic variation (Ko 2012).

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As of now, the above two orderings are equally plausible for both Oroqen and Khalkha. Zhang (1996) and Dresher and Zhang (2005) choose (21a) (at least for Tungusic languages) based on an observation that a two-height distinction is stable throughout the history of the Tungusic languages.

Now we consider the data showing the minimal contrast between Oroqen and Khalkha labial harmony.

(22) Oroqen: a Tungusic (Zhang 1996)

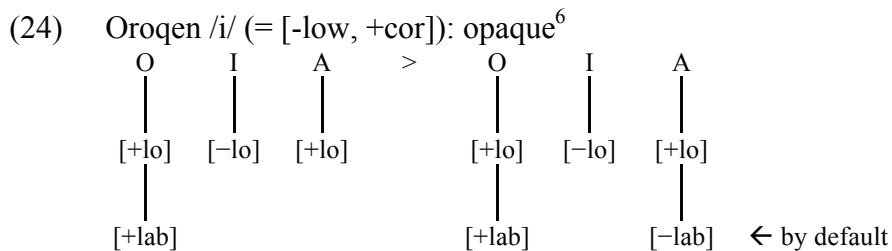
- a. /i/: opaque
 - tɔŋgorin-tɕəɾə (*-tɕoro) ‘round-DIM’
 - təɾəki-wa (*-wə) ‘boar-DEF.OBJ’
- b. /u, u/: opaque
 - tɕoŋko-duləək (*-dulook) ‘window-PLACE.OF.ORIGIN’
 - ɕɔɔɔ-dulaak (*-dulɔək) ‘stone-PLACE.OF.ORIGIN’

(23) Khalkha: a Mongolic (Svantesson et al. 2005)

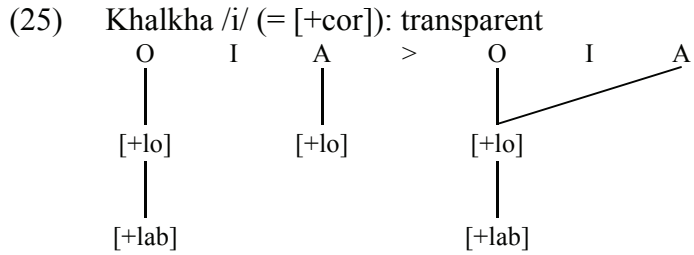
- a. /i/: transparent
 - poor-ig-o ‘kidney-ACC-REFL’
 - xɔɔɕ-ig-o ‘food-ACC-REFL’
- b. /u, u/: opaque
 - og-uɕ-ɕe (*-ɕo) ‘to give-CAUS-DIR.PAST’
 - or-uɕ-ɕa (*-ɕo) ‘to enter-CAUS-DIR.PAST’

Once we assign the hierarchy in (21a) to Oroqen and that in (21b) to Khalkha, respectively, the difference between the two follows in a straightforward manner. Given the hierarchy [low] > [coronal] > [labial] > [RTR], Oroqen /i/ receives the specification [-low, +coronal]. On the contrary, given the hierarchy [coronal] > [low] > [labial] > [RTR], Khalkha /i/ receives the specification [+coronal]. (Recall the output specifications given in (13) and (14).)

Adopting Mester’s (1986) fusional harmony for a height-stratified harmony, the opacity and transparency of Oroqen and Khalkha /i/ can be represented as in (24) and (25), respectively.



⁶ The opacity of /u, u/ in both languages can be explained in the same way.



The analysis presented in this paper provides better explanations than the previous analysis. First, it offers a unified explanation of the opaque vowels assuming difference in contrastive height specification as the sole cause of the blocking effect by both /i/ (in Oroqen) and /u, u/. Second, the choice of [-low] as the blocking feature fits better for the phonetically and typologically based generalizations on labial harmony (Kaun 2004). Third, /i/ in both languages receives the right specifications with respect to its palatalizing effect. Finally, the same analysis can be applied to other Tungusic and Mongolic languages. For example, the Chakhar vowel system in (6), given the same phonological patterns, would be analyzed to have exactly the same contrastive hierarchy as that of Khalkha. Thus, the minimal difference in the relative ordering between [low] and [coronal] is not just a contrast between Oroqen and Khalkha, but one between Tungusic and Mongolic language families: thus, Tungusic [low] > [coronal] vs. Mongolic [coronal] > [low]. No counterexamples have been found in previous analyses on Tungusic and Mongolic languages (Zhang 1996, Drescher and Zhang 2005; Ko 2011).

5 Conclusion

This paper has shown that the microvariation between Tungusic and Mongolic labial harmony (van der Hulst and Smith 1988) can be modeled in terms of the minimal difference in the contrastive hierarchy (Dresher 2009), i.e., Tungusic [low] > [coronal] > [labial] > [RTR] (Zhang 1996) vs. Mongolic [coronal] > [low] > [labial] > [RTR] (Ko 2011). These hierarchies assign the right specifications for the Tungusic ‘opaque’ /i/ and the Mongolic ‘transparent’ /i/. Since Mongolic /i/ receives no contrastive height specification, it is invisible, thus transparent, to the ‘height-stratified’ labial harmony (cf. Mester 1986). The result is a strong piece of empirical support for the contrastive hierarchy approach, as well as a better solution to a well-known problem in the theory of harmony systems.

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