Yakut vowel harmony: An Optimality Theory account

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This paper present an Optimality Theoretic (OT) account of Yakut vowel harmony. I argue that Kaun's 1995 analysis is empirically inadequate and that to overcome this inadequancy, her constraint UNIFORM [ROUND], which prohibits the feature [ROUND] from being linked to slots of different heights, must be split into two constraints: one prohibiting a sequence of high-low round vowels, and one prohibiting a sequence of low-high round vowels. I demonstrate that with these two constraints, Yakut does not require a spreading constraint that specifically refers to non-high vowels. I also consider the issues of Underspecification in OT. *

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1. Introduction

Yakut, a Turkic language of Russia, is spoken in the north eastern part of Siberia, and is estimated to have 240,000 speakers (Oe 1981: 116). As with other Turkic languages, Yakut is known for its vowel harmony. In this paper, I propose an analysis of Yakut vowel harmony in the framework of Optimality Theory (OT) (McCarhty & Prince 1993, 1995; Prince & Smolensky 1993). In addition, I show that Kaun's 1995 analysis of Yakut roundness harmony is inadequate. Specifically, I show that her constraint UNIFORM [ROUND] does not work for Yakut, and that it is not necessary to have an agreement or an alignment constraint that refers to non-high

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vowels, such as Kaun's EXTEND [ROUND] IF [-HIGH]. The outline of this paper is as follows. In Section 2, I give a brief outline of Optimality Theory. In Section 3, I present the data from Yakut to be analyzed in sections 4 and 5.

2. An overview of Optimality Theory

According to Optimality Theory, phonology is characterized by the three assumptions; that a set of constraints, not formal phonological rules, selects the correct output (constraint-based output selection), that constraints are violable, and that constraints are universal and ranked (constraint universality and ranking). Unlike other conceptions of grammar, there are no formal phonological rules in Optimality Theory. Instead of phonological rules, a set of constraints selects the best candidate from among the possible output candidates. Constraints state the relationships between input and output, or requirements on outputs, but there are no constraints that can be stated at the level of underlying representation in Optimality Theory.

OT has basically two kinds of constraints, markedness constraints and faithfulness constraints. Markedness constraints prohibit some marked structures. *FRONT ROUND VOWEL in (1) is an example of a markedness constraint.

(1) *FRONT, ROUND VOWEL
Front rounded vowels are prohibited.

The other basic constraint type, faithfulness constraints, require that input and output correspondents be identical. IDENTITY INPUT-OUTPUT [Back] and IDENTITY INPUT-OUTPUT [Round] are the examples of the faithfulness constraints.

(2) IDENTITY INPUT-OUTPUT [Back] (ID-IO [Bk])
Correspondent input and output segments have the identical specification for [back] (McCarthy & Prince 1995).

(3) IDENTITY INPUT-OUTPUT (ID-IO [Rd])
Correspondent input and output segments have the same specification for [round] (McCarthy and Prince 1995).

The table or "tableau" below is an example of how a set of constraints works to obtain the optimal output. Three constraints are ranked as *FRONT ROUND VOWEL >> ID-IO [BK] >> ID-IO [RD]. Three possible output candidates for an input, /püt/, are (a) *pit*, (b) *püt*, and (c) *put*.

/püt/	*FRONT ROUND V	ID-IO [Bk]	ID-IO [Rd]
☞ (a) pit			*
(b) püt	*!		
(c) put		*!	

(Asterisks (*) indicate violation of a constraint and ! marks a fatal violation.)

Since all the constraints are violable in OT, Candidate (a) is not excluded just because it violates ID-IO[Rd], even though candidate (a) and (b) do not violate this constraint. Candidate (b) violates *FRONT ROUND VOWEL, which is ranked highest, and Candidate (c) violates ID-IO[Bk], which is ranked higher than ID-IO[Rd]. These two candidates, (b) and (c), incur more serious violations than Candidate (a) does because *FRONT ROUND VOWEL and ID-IO[Bk] are ranked higher than ID-IO[Rd]. Therefore, Candidates (b) and (c) are excluded, and Candidate (a) is selected as the most harmonic and as the optimal output.

3. Yakut data

Yakut has the eight vowels as in (4) and four falling diphthongs as in (5). Examples of diphthongs are given in (6).

(4)		Front Unround	Front Round	Back Unround	Back Round
	High	*i*	*ü*	*ï*	*u*
	Non-High	*e*	*ö*	*a*	*o*

(Krueger 1962: 47)

(5)	Front Unround	Front Round	Back Unround	Back Round
	ie	*üö*	*ïa*	*uo*

(Kaun 1995: 20)

(6) (a) *bies* 'fire' (b) *kürüö* 'fence' (c) *tïal* 'wind' (d) *uon* 'ten'
(Krueger 1962: 53)

The quality of the vowels in a word depends on that of the first vowel in the word; whether it is front or back, whether round or unround as illustrated in (7). Backness harmony is always observed when a suffix is attached to a root.

(7)	Root	Plural	Accusative	Gloss
(a)	*kinige*	*kinige-ler*	*kinige-ni*	'book'
(b)	*aγa*	*aγa-lar*	*aγa-nï*	'father'

(Krueger 1962: 72-75, 80-82)

Roundness harmony can also be observed in Yakut. The data (8) show that the high suffix vowels are always round when the root has round vowels.

(8)		Root	Accusative	Gloss
	(a)	*oγo*	*oγo-nu*	'child'
	(b)	*börö*	*börö-nü*	'wolf'
	(c)	*murum*	*murum-u*	'nose'
	(d)	*tünnük*	*tünnük-ü*[1]	'window'
		(Krueger 1962: 80-82)		

In contrast, non-high vowels are round only when they are preceded by non-high round vowels, as illustrated in (9).

(9)		Root	Plural	Gloss
	(a)	*oγo*	*oγo-lor*	'children'
	(b)	*börö*	*börö-lör*	'wolves'
		(Krueger 1962: 72-75)		

When a suffix with a non-high vowel is preceded by high round vowels in the root, the vowels in the suffix are not round as illustrated in (10).

(10)	(a)	*tünnük*	*tünnük-ler* (**tünnük-lör*)	'window-plural'
	(b)	*tobuk*	*tobuk-ka* (**tobuk-ko*)	'knee-dative'
		(Kaun 1995: 23)		

Except for diphthongs, the high-round vowel and the low-round vowel co-occur only if the non-high one precedes the high one.

When a root is followed by two or more suffixes as in (11), the roundness of the vowel in the suffix is determined by the roundness of the vowel in the syllable which directly precedes the suffix. Therefore, the non-high vowels in the dative suffix in (11) are not round because the non-high vowels are preceded by the high round vowels.

[1] The nasal [n] of the accusative suffix is deleted if a root ends with a consonant.

(11)	Root	1st.pl.poss.	1st.pl.poss.dat.	Gloss
(a)	*tünnük*	*tünnük-püt*	*tünnük-püt-üger*	'window'
(b)	*kötör*	*kötör-püt*	*kötör-püt-üger*	'bird'
(c)	*ohox*	*ohox-put*	*ohox-put-ugar*	'stove'

(Krueger 1962: 104-105)

When a root is followed by the purposive suffix /(A)rI/, the first [-high] vowel of the suffix, not the root vowel, determines the roundness quality of the [+high] vowel of the purposive suffix. This [-high] vowel of the purposive suffix is called connective vowel, but this connective vowel does not always surface. In (12), for example, the [-high] connective vowel does not surface because the root ends with the [-high] long vowel. In (12), the [-high] long vowel of the root, which directly precedes the purposive suffix, determines the roundness quality of the [+high] vowel of the suffix.

(12)	Root	Purposive	Gloss
(a)	*baraa*	*baraa-rï*	'go'
(b)	*oloroo*	*oloroo-ru*	'live'
(c)	*tölöö*	*tölöö-rü*	'cry'

(Krueger 140-141; 1962)

If a root ends with a consonant, as in (13), the [-high] connective vowel surfaces, and the roundness quality of the [+high] vowel of the purposive suffix is determined by the connective vowel. Connective vowels harmonize with the root vowel in roundness when a root has a [-high, round] vowel, as in (13a), and consequently, the [+high] suffix vowel is also round. In (13b), on the other hand, the [-high] connective vowel is not round because it is preceded by the [+high, round] vowel of the root. Since the connective vowel is not [round], the [+high] vowel of the purposive suffix is not [round] in (13b).

(13)	Root	Root + a connective vowel		Gloss
(a)	*kör-*	*kör-ö*	*kör-ö-bün* (1st.sg.pres.)	'see'
(b)	*tüs-*	*tüs-e-*	*tüs-e-ri* (purposive)	'fall'

(Krueger 1962: 124, 141)

As shown in (14), the first part of the diphthong determines the roundness of the vowel in the suffix, that is, as far as rounding harmony is concerned, diphthongs behave as if they were high vowels. Hence, a non-high round vowel is prohibited following a diphthong just as it is prohibited in the forms in (10).

(14)		Root	Accusative	Dative	Gloss
	(a)	*üör*	*üör-ü*	*üör-ge* (**üör-gö*)	'herd'
	(b)	*muos*	*muos-u*	*muos-ka* (**muos-ko*)	'horn'
		(Krueger 1962: 140-141)			

4. Kaun's 1995 analysis

Kaun 1995 proposes three constraints, EXTEND [ROUND], UNIFORM [ROUND], and EXTEND [ROUND] IF [-HIGH] to account for Yakut vowel harmony.

(15) Extend [Round] (Extnd [Rd])
The autosegment [round][2] must be associated to all available vocalic positions within a word.

(16) UNIFORM [ROUND] (Uni [Rd])
[Round] may not be multiply linked to slots if slots are different in height.

(17) EXTEND [ROUND] IF [-HIGH] (Extnd [Rd] if [-Hi])
[Round] must be associated to all available vocalic positions within a word when simultaneously associated with [-high].

In tableaux (18) though (21), (18b) is excluded by EXTND [Rd] because the roundness feature of the high vowel in the root is not associated with the following high vowel. (19b) and(21b) are excluded by EXTND [Rd] if [-Hi] because the suffix vowel is not [round] when a root has a non-high [round] vowel. (20b) is excluded by Uni [Rd] because three [round] vowels in (20b) do not agree in height. Tableau (20) shows that Uni [Rd] must be ranked higher than EXTND [Rd], and (21) shows that EXTND [Rd] if [-Hi] must be ranked higher than Uni [Rd].

EXTND [Rd] if [-Hi] >> Uni [Rd]
Uni [Rd] >> EXTND [Rd]

2 Kaun treats the feature [round] as binary, and uses [+round] in her definition of EXTND [Rd]. In this paper, I assume the feature [round] to be privative, and I use [round] in the definition rather than [+round], which Kaun uses.

	Extnd [Rd] if [-Hi]	Uni [Rd]	Extnd [Rd]
(18) /tünnük-pit/			
(a) ☞ *tünnük-püt*			
(b) *tünnük-pit*			*!
(19)/börö-ler/			
(a) ☞ *börö-lör*			
(b) *börö-ler*	*!		*
(20) /tünnük-ler/			
(a) ☞ *tünnük-ler*			*
(b) *tünnük-lör*		*!	
(21) /kötör-bit/			
(a) ☞ *kötör-böt*		*	
(b) *kötör-bit*	*!		*

However, the constraint, Uni [Rd] is problematic if it is assumed in Yakut. (22) shows that the ranking from (21) does not work. The correct candidate is (22b), but according to the ranking from (21), the optimal candidate is (22a). A bomb (💣) in tableaux indicates the candidate that is wrongly selected by the constraints and the ranking of the constraints.

(22) /kötör-bit-iger/ – kötör-büt-üger

/kötör-bit-iger/	Extnd [Rd] if [-Hi]	Uni [Rd]	Extnd [Rd]
(a) 💣 *kötör-büt-ügör*		**	
(b) *kötör-büt-üger*	*!		*

Tableau (22) shows that Uni [Rd] needs to be ranked higher than EXTND [Rd] if [-Hi] to select the correct candidate, (22b). (21) shows, however, EXTND [Rd] if [-Hi] has to dominate Uni [Rd] to select the correct candidate, (21a). Therefore, as seen in 21 and in 22, there is a ranking paradox if EXTND [Rd] if [-Hi] and Uni [Rd] are used in Yakut.

5. Analysis

5.1. Constraints on rounding harmony

I suggest that Kaun's Uni [Rd] should be split into two constraints, *H-L ROUND in (23) and *L-H ROUND in (24), and in Yakut, the half of Uni [Rd] which is *H-L ROUND is ranked higher than *L-H ROUND. I also suggest that Kaun's EXTND [Rd] if [-Hi] can be replaced by a more general constraint such as AGREE or SPREAD [ROUND]. In the analysis, I assume SPREAD [ROUND], but nothing crucial depends on this assumption.[3]

(23) NO HIGH-LOW ROUND (*H-L Round)
If the feature [round] is linked to a high vowel, it may not be linked to a non-high vowel in the following syllable (No *u-ö* / *u-o*).

(24) NO LOW-HIGH ROUND (*L-H Round)
If the feature [round] is linked to a non-high vowel, it may not be linked to a high vowel in the next syllable (No *ö-u* / *o-u*).

(25) SPREAD [ROUND] (SPR [Rd])
The feature [Round] must be linked to all vowels (Padgett 1995).

Tableaux (26) though (29) show how these two constraints, *H-L ROUND and SPR [Rd], work to select the correct candidates.

	*H-L Round	SPR [Rd]	*L-H Round	ID-IO Round]
(26) /tünnük-pit/				
(a) ☞ *tünnük-püt*				*
(b) *tünnük-pit*		*!		
(27) /börö-ler/				
(a) ☞ *börö-lör*				*
(b) *börö-ler*		*!		
(28) /tünnük-ler/				
(a) ☞ *tünnük-ler*		*		
(b) *tünnük-lör*	*!			*
(29) /kötör-bit/				
(a) ☞ *kötör-büt*			*	*
(b) *kötör-bit*		*!		

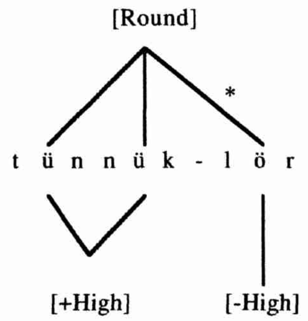
Candidates (26a), (27a), and (29a) do not violate *H-L ROUND because they do not have a high round vowel followed by a non-high round vowel. *H-L ROUND only excludes the combination of a high round vowel followed by a non-high round vowel.

[3] I doubt the universality of Agree [Round] since the Agree constraint does not work if a language has a neutral vowel. See Kallestinova 2001 for an argument from Bashkir vowel harmony, showing that Spread is superior to Agree.

Note also that (29a) would have been excluded by Kaun's Uni [Rd]. (26), (27), and (29) also show that the forms (26b), (27b), and (29b) can be excluded by SPR [Rd].

Candidate (28b) incurs a violation under *H-L ROUND because, as the figure (30) shows, the non-high round vowel in the suffix is preceded by the high round vowel in the root. The roundness feature of the high vowel in the root is associated with the non-high vowel in the suffix.

(30) *tünnük-lör*



For the same reason, (31b), which was problematic in Kaun's analysis, can be excluded by *H-L ROUND as tableau (31) shows.

(31) /kötör-bit-iger/ – *kötör-büt-üger*

/kötör-bit-iger/	*H-L Round	SPR [Rd]	*L-H Round
(a) *kötör-büt-üger*		*	**
(b) *kötör-büt-ügör*	*!		**

Tableaux (28) and (31) show that in Yakut, *H-L ROUND must be ranked higher than SPR [Rd].

Since the combinations, [ö-u] and [o-u], are allowed in Yakut, *L-H ROUND has to be low-ranked in Yakut. Tableau (29) shows that *L-H ROUND has to be ranked lower than SPR [Rd], otherwise, candidate (29b) is selected as optimal.

*H-L Round >>SPR [Rd]
SPR [Rd] >> *L-H [Rd]

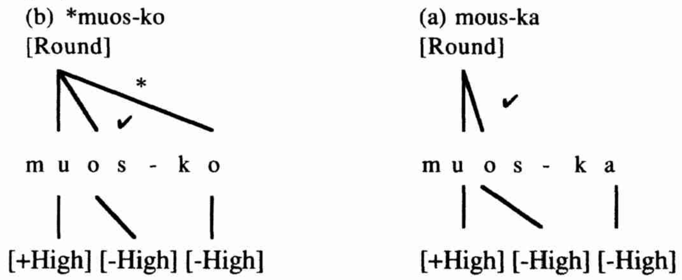
The established ranking, *H-L Round >> SPR [Rd] also works when a root has a round diphthong as seen in tableau 32. Although the combination of a [+high, round] vowel followed by a [non-high round] vowel is prohibited in Yakut, that combination is allowed in diphthongs, as pointed out in 14, in Section 3.

(32) /muos-ka/ – muos-ka

/muos-ka/	*H-L Round	SPR [Rd]
(a) ☞ *muos-ka*		*
(b) *muos-ko*	*!	
(c) *muas-ka*		**!

Candidate (32c) incurs more violations under SPR [Rd] than candidate (32a), and therefore, is excluded by SPR [Rd]. Candidate 32a does not violate *H-L ROUND because the rounding feature of [u] is linked only to the non-high vowel in the same syllable. Candidate (32b), on the other hand, violates *H-L ROUND since the rounding feature of [u] is linked not only to the non-high vowel in the same syllable but also to another non-high vowel in the different syllable. This is shown in figure (33).

(33)



5.2. Constraints on backness harmony

Besides SPR [Rd], another spread constraint, SPREAD [BACK] is also assumed because regardless of the height or the roundness, all the vowels in a word must have the same backness as the first vowel of the root.

(34) SPREAD [BACK] (SPR [Bk])
The feature [Back] must be linked to all vowels in a word (Padgett 1995).

5.3. Faithfulness constraints

When the backness feature or the roundness feature are associated with all vowels in a word to satisfy SPR [Rd] and SPR [Bk], some segments in the output may not be exactly the same as their input correspondents. In such cases, the identity constraint, ID-IO[Back] or ID-IO[Round] is violated. Therefore, the occurrence of harmony shows that segments must be unfaithful, that is either ID-IO[Back] or ID-IO[Round][4] is violated in actual forms.

In addition to ID-IO[Back] and ID-IO[Round], another faithfulness constraint, ID-IO σ1[5] is necessary because the first vowel of a word determines the quality of the following vowels in Yakut. The faithfulness constraint ID-IOσ1 guarantees that the first vowel in the input is the same as in the output.

(35) IDENTITY INPUT-OUTPUT σ1 (ID-IO σ1)
Segments in the first syllable of a word must have the same specifications for all the features as their input correspondent (Beckman 1997, 1998).

Tableau (36) shows how ID-IOσ1,SPR [Bk], and ID-IO[Bk] work to select a correct candidate.

In (36), I assume that the input for the high suffix vowel is /i/ and that for the non-high suffix vowel it is /e/. However, nothing depends on this assumption.

(36) /bar-ee-ri/ – *bar-aa-rï*

/bar-ee-ri/	ID-IOσ1	SPR [Bk]	ID-IO [Bk]
(a) ☞ *bar-aa-rï*			***
(b) *bar-ee-ri*		*!**	
(c) *ber-ee-ri*	*!		*

Tableau (36) shows that both ID-IOσ1 and SPR [Bk] must be ranked higher than ID-IO[Bk].

ID-IOσ1 , SPR [Bk]>> ID-IO [Bk]

Tableau (37) also shows that ID-IOσ1 should be ranked higher than *H-L ROUND, and that *H-L ROUND and SPR [Rd] have to be ranked higher than ID-IO[Rd].

4 See 2 and 3 in 2. An overview of OT.

5 From the data I have, there is no basis for using ID-IOσ1 rather than ID-IO root. ID-IOσ1 suggests no disharmonic roots while ID-IO root allows disharmonic roots. I have no relevant data for disharmonic roots.

(37) /üör-i/ – *üör-ü*

/üör-i/	ID-IOσ1	*H-L Round	SPR [Rd]	ID-IO [Rd]
(a) ☞ *üör-ü*		*		*
(b) *üör-i*		*	*!	
(c) *üer-i*	*!		**	*

ID-IO >> *H-L Round, SPR [Rd] >> ID-IO (Rd)

5.4. Input with round vowels

Because of the assumption of the Richness of the Base in OT, a possible output must result no matter what input is assumed. In (38), for example, the suffix of the input has a non-high round vowel. (38a) and (38b) are different in that in (38a), the roundness of the non-high vowel is independent of the roundness of the high round vowel in the root as the figure (39) shows.

(38) /tünnük-lör/ – *tünnük-ler*

/tünnük-lör/	*H-L Round	SPR [Rd]	ID-IO [Rd]
(a) *tünnük-lör* (1)		**!*	
(b) *tünnük-lör* (2)	*!		
(c) ☞ *tünnük-ler*		*	*

(39)

tünnük-lör (1) *tünnük-lör* (2)

Candidate (38a) does not incur a violation under *H-L ROUND since the roundness feature of the non-high vowel is independent of that of the high vowels in the root. However, (38a) is excluded by SPR [Rd] because (38a) incurs more violations than 38c does under SPR [Rd].

SPR [Rd] also excludes (40a), which has a high round vowel in the suffix in input.

(40) /dʒie-nü/ – *dʒie-ni*

/d dʒie-nü/	*H-L Round	SPR [Rd]	ID-IO [Rd]
(a) dʒie-nu		*!*	
(b) ☞ dʒie-ni			*

Tableaux (38) and (40) show that SPR [Rd] must be ranked higher than ID-IO[Rd].

SPR [Rd] >> ID-IO [Rd]

5.5 Input with unspecified vowels

Many have suggested that input vowels in Turkic languages, including Yakut, are unspecified. Krueger 1962 uses *A* for [-high] vowels and *I* for [+high] vowels unspecified for backness and roundness. Given the Richness of the Base of OT, the inputs with unspecified vowels need also to be considered.

Stanley 1967 discusses two conventions for applying a rule to the representation specified for a feature F when that representation is unspecified for F. On one interpretation, the rule applies to F (distinctness), and on the other, the rule does not apply (submatrix). In considering a constraint that refers to a feature F unspecified in a candidate, there are two possibilities; a candidate unspecified for F satisfies the constraint (Convention A) or violates the constraint (Convention B). For example, if there is an identity constraint to require that input and output have the same specification for F, and the input is unspecified for F ([øF]), then, that identity constraint is either satisfied or violated by the output candidate [αF]. This is shown in 41.

(41)

(Convention A)	ID-IO (F)
/ø F/ (input)	
α F (output)	✔ (satisfied)

(Convention B)	ID-IO (F)
/ø F/ (input)	
α F (output)	* (violated)

There are two possible assumptions about GEN; either GEN produces only fully specified outputs, or GEN allows unspecified outputs. Consider first the possibility that no [øF] is allowed in an output. If GEN does not produce unspecified vowels in output, the two conventions, A and B, do not a make difference, that is, the same result occurs, as illustrated in (42) and (43).

(42) /kInIgA/ (Convention A)

/kInIgA/	ID-IO σ1	SPR [Bk]	ID-IO [Bk]
(a) *kinige*	✔	✔	✔
(b) *kïnïga*	✔	✔	✔

(43) /kInIgA/ (Convention B)

/kInIgA/	ID-IO σ1	SPR [Bk]	ID-IO [Bk]
(a) *kinige*	*	✔	***
(b) *kïnïga*	*	✔	***

Under the Convention A, [back] vowels are not considered to be different from [+back] or [-back] vowels, and hence, in (42), neither (42a) nor (42b) violates ID-IO σ1. They also tie under ID-IO [Bk], and consequently, there is no way to determine which one is the optimal candidate.

Even though unspecified vowels are treated differently from fully specified vowels under Convention B, the two candidates in tableau (43) also tie. Both (43a) and (43b) incur the same number of violations under ID-IOσ1 and ID-IO[Bk], and neither one of them is excluded. This suggests that if unspecified vowels are not allowed in outputs, markedness constraints will choose the optimal candidate.

(44) **ï*
[+high, +back, -round] vowels are prohibited.

(45) **e*
[-high, -back, -round] vowels are prohibited.

In (46), **ï* is assumed to be higher-ranked than **i*, and in (47), **e* is assumed to be higher-ranked than **a* because the vowel [ï] is more marked than [i], and [a] is assumed to be less marked than [e], but nothing depends on this assumption here.

(46) /kInIgA/ (Convention A)

/kInIgA/	ID-IO σ1	SPR [Bk]	**ï*	**e*	ID-IO [Bk]
(a) ☞ *kinige*				*	
(b) *kïnïga*			*!*		
(c) *kiniga*		*!**			

(47) /AγA/ (Convention A)

/AγA/	ID-IO σ1	SPR [Bk]	**ï*	**e*	ID-IO [Bk]
(a) ☞ *aγa*					
(b) *eγe*				*!*	
(c) *aγe*		*!*		*	

With the markedness constraints, **ï* and **e*, a relatively unmarked candidate, *kinige* is selected in (46) and *aγa* is selected in (47).

Even when [back] is considered to be distinct from [+back] or [-back], the result is the same, as illustrated in (48).

(48) /kInIgA/ (Convention B)

/kInIgA/	ID-IO σ1	SPR [Bk]	*ï	*e	ID-IO [Bk]
(a) ☞ *kinige*	*			*	***
(b) *kïnïga*	*		*!*		***
(c) *kiniga*	*	*!**			***

Based on the reasonable assumption that [ï] is more marked than [e], it is assumed that the markedness constraint, **ï*, is ranked higher than **e*.

*ï >> *e

Keating (1988), Cohn (1990), and Ringen & Heinämäki (1999) have suggested that unspecified segments may occur in outputs. If unspecified vowels are allowed in outputs, and Convention A is assumed, then, an incorrect output results. As illustrated in (49), an input with unspecified vowels will never result in an output with fully specified vowels for Yakut.

(49) /kInIgA/ (Convention A)

/kInIgA/	ID-IO σ1	SPR [Bk]	*ï	*e	ID-IO [Bk]
(a) 💣 *kInIgA*					
(b) *kinige*				*!	
(c) *kïnïga*			*!*		

Both candidates (49b) and (49c) are excluded by the markedness constraints and the candidate with unspecified vowels is selected as optimal.

Another problematic case with Convention A is feature deletion. In tableau (50), all the vowels in the input are specified for all binary features. Since [øF] and [αF] are not distinct under Convention A, candidate (50b), with unspecified vowels, does not violate any faithfulness constraints. Consequently, (50b) is selected over (50a), the actual surface form, because (50a) violates the markedness constraint **e*.

(50) /kinige/ – kinige (Convention A)

/kinige/ ID-IO σ1	SPR [BK]	*ï	*e
(a) *kinige*			*!
(b) 💣 *kInIgA*			

As seen in tableau (51), feature deletion does not cause a problem under Convention B because (51b), with unspecified vowels, violates ID-IO σ1,and this candidate is excluded by this faithfulness constraint.

(51) /kinige/ – kinige (Convention B)

/kinige/	ID-IO σ1	SPR [BK]	*ï	*e
(a) ☞ *kinige*				*
(b) *kInIgA*	*!			

Under Convention B, [øF] and [αF] are distinct and the unspecified vowel in the first syllable of candidate (51) is not faithful to its input correspondent segment. Thus, this candidate is excluded by the faithfulness constraint ID-IO σ1 .

Since there is no reason to assume that any unspecified vowel occurs in Yakut,[6] the constraint, SPECIFY, has to be high-ranked in Yakut so that the candidates with unspecified vowels be excluded.

(51) SPECIFY (SPEC)
Segments must be specified for all the binary features (Kaun 1995).

The constraint, SPEC, which requires that outputs be fully specified, only works with Convention B. If Convention A is assumed, then, a candidate with [øF] will incorrectly satisfy any constraint referring to F, such as SPEC. Consequently, if GEN allows unspecified vowels in outputs, Convention B has to be assumed, otherwise, SPEC will not exclude unspecified vowels.

Tableau (52) shows how SPEC and the markedness constraint *ï work to select a less marked candidate.

(52) /kInIgA/ (Convention B)

/kInIgA/	SPEC	ID-IO σ1	SPR [Bk]	*ï	*e	ID-IO [Bk]
(a) ☞ *kinige*		*			*	***
(b) *kInIgA*	*!**					
(c) *kïnïga*		*		*!*		***

Since [+back] and [-back] are distinct from [back], candidates (52a) and (52c) incur violation under ID-IO σ1. Candidate (52b) incurs three violations under SPEC because (52b) has three unspecified vowels. Thus, as tableau (52) shows, SPEC has to be ranked higher than ID-IO σ1; otherwise, (52b), with unspecified vowels, would be selected as an optimal candidate.

SPEC >> ID-IO σ1

6 Neutral vowels is one of the reasons for assuming unspecified output vowels. See Ringen & Vago (1998), and Ringen & Heinämäki (1999).

These constraints as well as the ranking from (48) and (52) also work when the input has unspecified vowels in suffixes.

(53) /aγa-bIt/IgAn/ (Convention B)

/aγa-bIt-IgAn/	SPEC	ID-IO σ1	SPR [Bk]	*ï	*e	ID-IO [Bk]
(a) ☞ *aa-bït-ïγan*				**		***
(b) *aγa-bIt-IgAn*	*!**		**			
(c) *aγa-bit-igan*			*!***			***

(54) /kinige-lAr/ (Convention B)

/kinige-lAr/	SPEC	ID-IO σ1	SPR [Bk]	*ï	*e	ID-IO [Bk]
(a) ☞ *kinige-ler*					**	*
(b) *kinige-lAr*	*!		****		*	
(c) *kinige-lar*			*!***		*	*

Candidates (53b) and (54b) are excluded by SPEC. Although candidate (53c) does not have any marked vowels, it is excluded by SPR [Bk] because the vowels do not share the same backness feature. For the same reason, candidate (54c) is excluded, even though (54c) has only one marked vowel while (54a) has two marked vowels.

Tableaux (53) and (54) show that the markedness constraints *ï and *e have to be dominated by SPR [Bk].

SPR [Bk] >> *ï, *e

6. Conclusion

In this paper, I have outlined an account for the vowel harmony of Yakut in OT. The ranking of these eight constraints is; SPEC >> ID-IO σ1 >> *H-L ROUND >> SPR[Bk], SPR[Rd] >> *ï / *e >> ID-IO[Bk], ID-IO[Rd].

Most of the constraints used in this paper have been suggested in other OT analyses, but I have shown that Kaun's Uni [Rd] needs to be split into *H-L ROUND and *L-H ROUND. I have shown that *H-L ROUND is higher ranked than *L-H ROUND in Yakut. Once *H-L ROUND is adopted, it becomes apparent that Yakut does not require a spreading constraint that specifically refers to non-high vowels, such as Kaun's EXTND [RD] IF [-HI].

I have also shown how inputs with unspecified vowels can be handled depending on whether or not unspecified vowels are allowed in output. If GEN does not produce any unspecified vowels in outputs, markedness constraints select a relatively unmarked candidate. If, on the other hand, unspecified vowels are allowed in outputs, the constraint, SPEC, has to be high ranked in Yakut so that outputs with unspecified features are excluded. However, SPEC works only if a constraint which refers to F is violated by a candidate with F unspecified, that is Convention B.

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