A Minimal Triplet in Altaic: Round Licensing, Harmony, and Bisyllabic Triggers*

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Abstract

This paper presents an optimality-theoretic comparison of three round vowel patterns in the Altaic family. At the core is an analysis of bisyllabic trigger round harmony, a pattern uncovered in recent investigation of Classical Manchu and Oroqen (Tungusic; Zhang 1996). In these languages round spreading takes place only when the first two syllables of a word are round. This study isolates two separate properties of round vowel distribution in bisyllabic trigger patterns: round licensing ([+round] must be linked to the initial syllable) and round spreading. Bisyllabic triggers are derived through a constraint interaction explored here, called 'Parasitic Constraint Satisfaction', in which a given constraint loses to satisfaction of a dominating constraint except when violation of that dominating constraint is independently induced by a third higher-ranked constraint. In the case of bisyllabic trigger round harmony, this kind of interaction is achieved by ranking licensing and spreading separately with respect to a tautosyllabicity constraint on features. More detailed examination of the spreading and licensing requirements finds that they can be analyzed solely in terms of markedness and faith constraints. Positional identity (Beckman 1997) and markedness of feature cooccurrences play a critical role, characterizing the special status of the initial syllable and realizing height stratification of rounding restrictions. The related patterns of simple round licensing and simple round harmony, exhibited in two other Altaic languages (Classical Mongolian and Ulcha), are produced by minimally distinct constraint hierarchies, bearing out the predictions of factorial ranking.

This paper presents a comparison of three round vowel patterns in the Altaic family. At the core is an analysis of a pattern of round harmony uncovered in recent investigation of Classical Manchu and Oroqen (Tungusic; also known as Manchu-Tungus). These languages complicate the usual pattern of Tungusic harmony by requiring round vowels in the first <u>two</u> syllables of a word to initiate round spreading (Zhang 1996; Zhang and Dresher 1996). The two-syllable trigger requirement simply expresses a descriptive generalization; the challenge for phonological analysis is understanding what underlies this outcome without stipulating a numeric threshold condition. This paper aims to <u>derive</u> the bisyllabic trigger effect through the ranking of optimality-theoretic constraints (Prince and Smolensky 1993). The analysis draws on familiar phonological demands in Altaic languages, such as round licensing (the requirement that [+round] have a link to the initial syllable) and round spreading, which produce multiple-linking of vowel features. In the bisyllabic trigger languages, both licensing and spreading are visibly active. These demands are shown to each conflict with a constraint prohibiting cross-syllable feature linkage. The innovative theoretical result is the *parasitic constraint satisfaction* that arises when the featural tautosyllabicity constraint is interleaved between them: the lower-ranked spreading constraint is satisfied only when it can feed off the tautosyllabicity violations produced by round licensing. This parasitic effect realizes the two-syllable trigger condition as a consequence — no reference is made to the number two.

The second theoretical goal of this study is to employ a minimal set of well-motivated constraints and explore how different rankings produce three Altaic round vowel patterns: round licensing, round harmony, and bisyllabic triggers. Only three kinds of constraints are drawn on in this analysis: faith, markedness, and edge constraints. The edge-based constraint is one of a

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family of constraints on featural tautosyllabicity, which I propose to derive from an extension of the crisp edge constraint of Itô and Mester (in press). This constraint proves to have applications to a wide range of syllable-bound spreading phenomena. The other constraints, faith and markedness, I argue, are sufficient to define the demands of round licensing and round spreading, lending support to markedness-driven analyses of cross-segment feature linking (after McCarthy and Prince 1994; Itô and Mester 1994; Beckman 1995, 1997, 1998; Alderete et al. 1996; among others). Developing the analytical program of Beckman (1995, 1997, 1998), positional faith constraints play a key role in the account, illuminating position-sensitive feature restrictions (other work in this line includes Alderete 1995, 1996; Lombardi 1995; McCarthy 1995; Padgett 1995a; Selkirk 1994 cited by Beckman 1998; Katayama in prep.) An important new result is the finding that height stratification in round harmony can be captured simply with markedness constraints on feature combinations. This analysis generates rounding and height spreading together as a feature cluster, reproducing the insight of Mester's (1986) tier structure without calling on any new theoretical assumptions.

The paper is organized as follows. First, section 1 establishes the description of canonical round harmony in Manchu-Tungus, with exemplification from Ulcha. Section 2 then presents data from Classical Manchu, with amplification from Oroqen, illustrating the two-syllable condition on triggers and the separate effects of round licensing and spreading. Section 3 turns to the analysis of the bisyllabic trigger condition, outlining the important function of the featural tautosyllabicity constraint and determining the ranking of this constraint in relation to the demands of round licensing and spreading. A comparison is drawn to the ranking structure for the canonical pattern without the bisyllabic trigger. Section 4 exhibits the pattern of round licensing in Classical Mongolian, minimally different from Ulcha and Classical Manchu. The content of round licensing and spreading constraints is examined more closely and it is established that these phenomena may be produced by the interaction of faith and markedness alone. A comparative account of the three languages finds that differences between patterns are derived straightforwardly by constraint reranking, bearing out a typological prediction of the theory. Section 5 presents the conclusion.

1 Canonical Tungusic round harmony

I begin by briefly reviewing the description of what I will call canonical round harmony, i.e. the core Tungusic pattern which does not exhibit the bisyllabic trigger condition (for cross-linguistic studies of Tungusic round harmony see Kaun 1995; Li 1996; Zhang 1996; and references therein). Three properties characterize the canonical pattern. First, round harmony is always initiated by a vowel in the initial syllable, a property apparent across the Altaic family. Second, round spreading propagates only amongst nonhigh vowels, that is, the triggers and targets of round harmony are limited to nonhigh vowels. Third, high vowels block round spreading from a preceding vowel. Round nonhigh vowels never occur after unrounded or high vowels, but round high vowels occur freely after unrounded vowels.

Tungusic languages exhibiting canonical round harmony include Ulcha, Oroch, and Negimal. The pattern is illustrated below for Ulcha. The Ulcha people, also known as the Ulchi or Ulch, number about 3,200 and live mainly on the middle and lower reaches of the Amur River in Russia. Data and description are based on Kaun (1995), who draws on Sunik (1985). The vowel inventory is given in (1). Vowel length is contrastive only in the initial syllable, and the vowel [ɛ] is limited to the first syllable. The boxed vowels, [a(ː)] and [ɔ(ː)], are the ones affected by round harmony. Like many Tungusic languages, Ulcha also exhibits a tongue root harmony. This harmony will be evident in much of the data in this paper but will not be the subject of analysis (on this see the studies cited above).

(1) Ulcha vowel inventory:

	Front		Central		Back		
High	i	iː			u	uː	-RTR
	ɪ	ɪː			ʊ	ʊː	+RTR
Nonhigh			ə	əː			-RTR
	ɛ	ɛː	a	aː	ɔ	ɔː	+RTR

(2a) shows examples of round harmony in Ulcha from [ɔ(ː)] in the initial syllable to subsequent nonhigh vowels. In this environment [ɔ] occurs, not [a].[1] (2b) gives forms showing that high vowels block round harmony and do not trigger it themselves. In (2c) round high vowels occur freely in postinitial syllables after unrounded vowels.

(2)a. bɔːnɔ ‘hail (weather)’ (*bɔːna, in general *[CɔCa])
gɔrɔ ‘far’
tɔŋdɔ ‘straight ahead’
tɔtɔŋgɔ ‘multi-colored’
kɔːrɔt͡ʃʊvʊ ‘to regret’
d͡ʒɔgbɔlɔvʊ ‘to prick, stab’

b. ɔjɪlavʊ ‘leggings’
kɔːvʊlavʊ ‘to raise a mast’
bʊqta ‘fragment’

c. baːpʊ ‘pack, bunch’
sɪlt͡ʃʊ ‘sack for tinder’

A schematic summary of the kinds of nonhigh round vowel patterns occurring in Ulcha is given in (3). <C> represents any consonant.

(3) Summary of Ulcha round harmony.

a. Nonhigh vowels are triggers and targets of round harmony; and round nonhigh vowels never occur after an unrounded vowel; round harmony is initiated by the first syllable:
[Cɔ(ː)Cɔ], *[Cɔ(ː)Ca], [Ca(ː)Ca], *[Ca(ː)Cɔ].

b. High vowels block round spreading; after a high vowel, a nonhigh vowel must be unrounded:
[Cɔ(ː)CɪCa], *[Cɔ(ː)CɪCɔ], [Cɔ(ː)CʊCa], *[Cɔ(ː)CʊCɔ].

[1] Kaun notes a small number of exceptions, discussed in her footnote 19 (p. 76).

2 Bisyllabic trigger round harmony

Some Tungusic languages complicate the core pattern of round harmony by requiring a bisyllabic trigger (Zhang 1996; Zhang and Dresher 1996). An example of this more complex harmony occurs in Classical Manchu.

2.1 Classical Manchu

Classical Manchu, also known as Written Manchu, is the language represented by the Manchu writing system. It was the language of the Manchu court from about the seventeenth century to the early twentieth century (Zhang and Dresher 1996 citing Ard 1984) and is considered to be based on the Jianzhou dialect of the seventeenth century (Li 1996). The following description and data are mainly from Zhang (1996) and Zhang and Dresher (1996) (drawing from Norman 1978 and Seong 1989) with some forms from Li (1996). The vowel inventory is given in (4); vowel length is not contrastive (Zhang 1996). The nonhigh vowels, [a] and [o], are the ones that alternate in round harmony.

(4) Classical Manchu vowel inventory:

	Unrounded	Rounded	
High	i	u	+ATR
		ʊ	-ATR
Nonhigh	ə		+ATR
	a	o	-ATR

(5a) illustrates round harmony in Classical Manchu from root to suffix in nonhigh vowels (compare unrounded suffix forms in (b) at right). As in the other Tungusic languages, high vowels block round spreading and their rounding is independent of round harmony (5b). (5c) gives examples of round harmony in trisyllabic roots. Note that in trisyllables, if the first two syllables contain nonhigh round vowels, a third nonhigh vowel must also be round.

(5)a.	dobo-no-	'go to offer'	b.	dosi-na-	'go to enter'
	dorolo-no-	'go to salute'		kofori-na-	'to become hollow'
	bot͡ʃo-ŋgo	'coloured'		gosi-ŋga	'loving'
	osoxo-ŋgo	'having claws'		arbu-ŋga	'image'
	moŋgo-ro-	'speak Mongolian'		mond͡ʒi-ra-	'wring the hand'
	obo-xo	'to wash'		nomula-xa	'to preach'
c.	dorolon	'rite'		(*dorol<u>a</u>n, in general *CoCoC<u>a</u>)	
	foxolon	'short'			
	osoxo	'claw'			

Surprisingly, when a root contains a nonhigh round vowel only in the initial syllable, round harmony does not occur. (6a) shows examples of round harmony failing to apply from root to suffix, and the data in (6b) show the failure of round harmony within a root.

(6)a.	to-ŋga	‘few, rare’
	do-na-	‘alight in swarm’
	jo-na-	‘form a sore’
	no-ta	‘younger sisters’
	go-xa	‘break a promise’ (perfective)
b.	t͡ʃoban	‘a lever’
	oxa	‘obedient’
	t͡ʃola-	‘to fry’
	doran	‘virgin land’
	pod͡ʒan	‘firecracker’
	t͡ʃot͡ʃara-	‘to act carelessly’

From these facts, Zhang (1996) and Zhang and Dresher (1996) establish the descriptive generalization that the first two syllables must contain nonhigh round vowels in order for [+round] to spread in Classical Manchu. I will call this *the bisyllabic trigger condition*. The implication of this generalization for the data in (5) is that the first two syllables in the forms in (5a, c) must underlyingly contain round vowels, because round harmony actually occurs, in contrast to the forms in (6).

There is a further point concerning the distribution of round vowels in Classical Manchu which must be taken into consideration. First it must be absolutely clear that the rounding quality of vowels in the second syllable is independent of round harmony. (7) gives some minimal pairs contrasting solely in terms of the round specification of the second vowel. These forms unambiguously show that rounding in a second syllable is contrastive after an initial round vowel (this data from Li 1996: 161, who draws on *Wuti Qingwenqian (A Quintolingual Manchu Dictionary,* translated and noted by Tamura et al. 1966), Zaharov 1975, Hauer 1952-1955, Norman 1978, Ji et al. 1986).

(7)	dola	‘barren land’	doxa	‘stick’
	dolo	‘inside’	doxo	‘lime’
	noran	‘a pile of wood’	oxa	‘obedient’
	noron	‘longing’	oxo	‘armpit’

On the basis of these forms, it may be expected that round nonhigh vowels occur freely in the second syllable. However, after an initial unrounded syllable, a round nonhigh vowel in the second syllable is prohibited, that is, *[CaCo] roots are ill-formed. This distribution cannot be attributed to round harmony, since the well-formedness of both [CoCo] and [CoCa] shows that round harmony does not carry from the first to the second syllable — there must be a bisyllabic trigger to initiate spreading of rounding.

The condition to be explained independent of round harmony is that round nonhigh vowels only occur in the second syllable when following an initial round nonhigh vowel. I suggest that this distribution is the result of a licensing effect, namely, a [+round] feature on a nonhigh vowel is only licensed when linked to the initial syllable, as in (8). [CaCo] forms are thus illformed because [+round] is unlicensed. Examples of unlicensed [+round] are shown in (9).

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(8)   a.      [+round]                  b.    [+round] [-round]
               /    \                             |        |
              C o C o                          C   o    C    a

(9)   a.  [+round] *[+round]            b.     [-round] *[+round]
               |          |                        |         |
            C   o    C   o                     C   a    C    o
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This concludes the data for Classical Manchu. A summary of the nonhigh round vowel patterns is given in (10).

(10) Summary of Classical Manchu round harmony and licensing.

a. Licensing: a postinitial round nonhigh vowel only occurs immediately following a round nonhigh vowel:
[CoCo], [CoCa], [CaCa], *[CaCo].

b. Bisyllabic trigger: [+round] spreads to subsequent nonhigh vowels when the first two syllables contain round nonhigh vowels. High vowels block round harmony.
[CoCo-Co], *[CoCo-Ca], [CoCa-Ca], *[CoCa-Co];
[CoCi-Ca], *[CoCi-Co], [CoCu-Ca], *[CoCu-Co].

2.2 Oroqen

Classical Manchu offered an example of round harmony requiring a bisyllabic trigger. Oroqen is a second Tungusic language which exhibits this kind of pattern, and I examine here the data it provides concerning the behavior of long vowels in bisyllabic trigger round harmony (for a complete description of Oroqen harmony and and vowel distribution, see Zhang 1996). The Oroqen people, also referred to as reindeer Tungus, Orochen, Orochon, and Elunchun, inhabit the northeast of China in the area extending from the south bank of the Heilongjiang River, across the Xiaoxing'anling (the Lesser Khingan) and the Daxing'anling (The Greater Khingan) and westwards to Inner Mongolia. The population of the Oroqen is about 6,900 and the number of native speakers is estimated to be less than half this quantity. Description and data are after Zhang et al. (1989), Zhang (1996), and Zhang and Dresher (1996).

The vowel inventory of Oroqen (in (11)) is greater than that of Classical Manchu; of particular interest is the contrast in vowel length.

(11) Oroqen vowel inventory:

	Front		Central		Back		
High	i	iː			y		(neutral)
					u	uː	-RTR
					ʊ	ʊː	+RTR
Nonhigh		eː	ə	əː	o	oː	-RTR
		ɛː	a	aː	ɔ	ɔː	+RTR

Round harmony in Oroqen produces alternations between a(ː) ~ ɔ(ː) and ə(ː) ~ o(ː). The examples in (12a) show round harmony taking place from root to suffix when the first two vowels of the root are round and nonhigh. The data at the right in (b) illustrate the occurrence of unrounded suffix alternants after unrounded or high vowels. It is apparent here that Oroqen round harmony is subject to the usual height stratification: only nonhigh vowels participate in round harmony.

(12)a.	ɔlɔ-wɔ	'fish' (obj.)	b.	tari-wa	'that-def.' (obj)
	t͡ʃoŋko-wo	'window' (obj.)		minə-wə	'me-def.' (obj.)
	ɔlgɔː-rɔ	'dry' (pres.)		d͡ʒabʊ-ra	'walk' (pres.)
	oloː-ro	'boil' (pres.)		sərə-rə	'awake' (pres.)
	mɔːt͡ʃɔn-mɔ	'difficulty' (obj.)		ʊrʊːn-ma	'hoof' (obj.)
	moːro-ro	'to moan' (pres.)		kuːmnə-rə	'hold' (pres.)

Like Classical Manchu, round harmony fails in Oroqen when just the initial syllable of the root contains a round vowel. As Zhang and Dresher (1996) observe, forms like those in (13) show that a bimoraic (long) round vowel is insufficient to trigger round harmony on its own.

(13)	mɔː-wa	'tree' (obj.)
	doː-rən	'to mince' (obj.)
	nɔːdaː-	'throw'
	koːrgə	'bridge'

Oroqen makes evident that the bisyllabic trigger effect in Tungusic round harmony is truly a bisyllabic condition not just a bimoraic one. It should also be noted that Oroqen exhibits a postinitial licensing condition for round like that in Classical Manchu: nonhigh round vowels occur in the second syllable of roots only when the initial syllable contains a nonhigh round vowel (i.e. *[CəCo], *[CaCɔ] roots are ill-formed).[2]

To review, across the canonical and bisyllabic trigger round harmony patterns it holds that round nonhigh vowels occur in a postinitial syllable only when the initial syllable is also round — this I have characterized as licensing. Further, in the canonical pattern, [+round] spreads to unrounded nonhigh vowels with no condition on the size of the trigger; while in the bisyllabic trigger pattern, rounding spreads only when there are two consecutive round vowels to initiate spreading.

3 Analysis: bisyllabic triggers

Zhang and Dresher (1996) point out that the two-syllable condition in Classical Manchu and Oroqen does not appear to be connected to the prosody of these languages.[3] In this section I develop the analysis of bisyllabic triggers, arguing that it derives from the interaction of spreading and licensing with an edge-based constraint on featural tautosyllabicity. The next section follows with a more in-depth analysis of round spreading and licensing.

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[2] A third Tungusic language exhibiting the bisyllabic trigger effect in round harmony is Ewenki, a language spoken in Inner Mongolia and by some scattered speakers in Heilongjiang Province in China (Zhang 1996: 199 drawing on Hu and Zork 1986). Ewenki contrasts long and short vowels, and these behave in the same way as Oroqen: an initial long vowel does not alone trigger round spreading; the first two syllables must be round (long or short) to initiate harmony.

[3] Stress in both of the bisyllabic trigger languages is essentially final. In Classical Manchu stress is word-final, except in nonimperative verbs, where it is penultimate (Li 1996: 20 citing Ji 1986). In Oroqen, primary stress is final and the initial syllable receives secondary stress (Li 1996: 20, citing Zhang et al 1989, Li 1991).

3.1 The constraints

In the analysis of bisyllabic triggers, it will be necessary to refer to the round spreading and licensing requirements apparent in Tungusic grammar. For expositional transparency, I begin by making use of two preliminary optimality-theoretic constraints which describe these demands. These are given below.

(14) SPREAD[+round]
‘Spread a [+round] feature to all vowels in a word.’

(15) LICENSE ([+round], σ1)
‘Link each occurrence of a [+round] feature to the initial syllable.’

The constraint in (14) requires that any [+round] feature in an output be linked to all vowels within the word. This constraint follows the spreading constraint proposed and formalized by Padgett (1995a) (see also Kaun 1995 on EXTEND). (15) gives the constraint which mandates that [+round] be licensed by a link to the initial syllable (after Zoll 1996; formalized as COINCIDE). For the moment I abstract away from the matter of height stratification in round harmony. This issue is not directly relevant to the bisyllabic trigger effect, and I will return to it later. With the above constraints I will lay out the architecture of the conflicting requirements in the bisyllabic trigger languages. Once this larger structure is established, I will proceed to explore the atomic components of the spreading and licensing demands in section 4, demonstrating that spreading and licensing can be derived independently through the interaction of faith and markedness constraints. At this point what is important is how the mandates of spreading and licensing interact with another constraint to produce a bisyllabic trigger.

The constraint which will prove to critically interact with spreading and licensing to produce the bisyllabic trigger phenomenon is one on featural tautosyllabicity for [+round], a constraint violated in cases of cross-syllable round spreading or linkage. It is important to establish the precise content of this constraint. Informally, it must express the requirement in (16).

(16) Featural tautosyllabicity for [+round]: (informal)
‘Each syllable dominating an occurrence of a feature specification [+round] uniquely dominates that occurrence of [+round].’

Featural tautosyllabicity for [+round] demands of each [+round] feature that all of its associated segments be tautosyllabic. This corresponds to the notion of ‘crisp edges,’ outlined by Itô and Mester (in press) (see also Merchant 1995; and for a recent application Baker 1997). Itô and Mester’s CRISPEDGE[PCat] constraint requires that all material belonging to a given phonological category (PCat) be wholly contained within that PCat. For example, CRISPEDGE[σ] requires that all segments and features belonging to a syllable have no links to another syllable. I propose that the CRISPEDGE constraints be extended to capture feature-specific tautosyllabicity, as in (17) for [+round].

(17) CRISPEDGE(σ, [+round])
A syllable has crisp edges with respect to the feature specification [+round].

A more formal definition of CRISPEDGE(σ, F) is given in (18) (with straightforward extension to the more general CRISPEDGE[PCat, F]). This constraint resembles the formulation of a constraint proposed by Bird (1995: 62) banning ‘re-entrant’ structures, i.e. representations in which a node of the structure is immediately dominated by more than one node (besides itself). An innovation here is the specific characterization of the assessment of CRISPEDGE violations.

(18) CRISPEDGE(σ, F): definition

i. CRISPEDGE(σ, F) holds for the category *σ* of syllables with respect to the feature specification *F* if and only if for each occurrence *f* of the specification *F*, the following holds:
$\forall i\ [\sigma_i \text{ D } f \rightarrow \forall j\ [\sigma_j \text{ D } f \rightarrow j = i]]$
where ‘x D y’ expresses that x dominates y.

ii. A mark is incurred for each occurrence *f* for which (i) is false.

Part (i) of (18) expresses that a syllable has crisp edges with respect to a feature specification *F* if for each syllable *i* dominating an occurrence of that feature specification, any other syllable *j* dominating it is identical to syllable *i*, i.e. a feature occurrence may be dominated by no more than one syllable. Zoll (1996) notes that the mode of assessment of violations needs to be made explicit in a constraint (see also Beckman 1997, who utilizes this assumption in her formulation of ‘feature-driven markedness’). Part (ii) expresses the interpretation of featural tautosyllabicity gradiently by feature and not by syllable. Every occurrence of a feature linked to more than one syllable will incur a violation, and one mark is assessed if a feature occurrence is linked to two syllables or if it is linked to three or more syllables. The syllable-wise categorical assessment of marks will prove to be critical in producing the parasitic constraint satisfaction that explains bisyllabic triggers. (19) and (20) illustrate the evaluation of CRISPEDGE(σ, [+round]) in relation to various structures. CRISPEDGE(σ, [+round]) is violated in each of the structures in (20), because an occurrence of a [+round] feature specification belongs to more than one syllable; otherwise it is satisfied, as in the representations in (19).

```
(19)  a.   σ        σ        σ                 b.     σ       σ
          / \      / \      / \                      / | \    / \
          C  V  .  C  V  .  C  V                     C  V C . C  V
             |        |        |                     \  |  /
        [+round] [+round] [+round]                   [+round]

(20)  a.   σ       σ      σ                    b.   σ       σ
          / \     / \   /  \                        / \     / \
          C  V . C  V. C  V                         C  V . C  V
              \      |     /                         \  |   /
              *[+round]                             *[+round]
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More generally, members of the family of CRISPEDGE(σ, F) constraints will be violated by feature spreading in vowel harmony and they will be respected in cases of syllable-bound spreading. Feature spreading restricted to the syllable provides independent evidence for this set of constraints: the syllable-bound domain is defined by CRISPEDGE(σ, F). Examples of this sort include tautosyllabic nasalization in Kaingang (Weisemann 1972; van der Hulst and Piggott 1996), Cairene Arabic emphasis harmony (Lehn 1963, Broselow 1979), and Turkish palatalization and velarization of velar stops (Clements and Sezer 1982). The Turkish case is illustrated in (21) (Turkish belongs to the Turkic branch of the Altaic family). The data in (a) show examples of bidirectional palatalization within the syllable conditioned by a front vowel, and the data in (b) show velarization in the context of a tautosyllabic back vowel.

(21)a	k^{j}ir	‘dirt’	b.	k^{ɣ}ɯr	‘meadows’
	tek^{j}	‘single’		g^{ɣ}az	‘gas’
	g^{j}yr	‘abundant’		k^{ɣ}ul	‘slave’

døk^j	'pour'	ok^ɣ	'arrow'
k^{j}yrk^j	'fur'	k^{ɣ}ɯrk^ɣ	'forty'
nek^{j}tar	'nectar'	bok^{ɣ}sit	'bauxite'
rak^{j}et	'racket'	ik^{ɣ}on	'icon'
hak^{j}ik^{ɣ}at	'truth'	mik^{ɣ}a	'mica'

These data illustrate a second application of the CRISPEDGE(σ, F) constraint within the Altaic family, in this case, an instance where the constraint remains unviolated.

3.2 Analysis of canonical round harmony

With the set of preliminary constraints in place, I now turn to the structure of the rankings needed for Tungusic round harmony, first establishing those for canonical round harmony and then comparing the bisyllabic trigger languages. To focus on the differences between the two patterns of round harmony, in this section I restrict attention to forms with nonhigh vowels.

In the canonical pattern (Ulcha), [+round] spreads from the initial syllable with no condition on trigger size. The outcome of this spreading violates the crisp edge constraint for [+round], because [+round] can belong to more than one syllable. The spreading constraint thus outranks CRISPEDGE(σ, [+round]):

(22) SPREAD[+round] >> CRISPEDGE(σ, [+round])

	gɔra	SPREAD[+round]	CRISP(σ, [+round])
☞	a. $[gɔrɔ]_{+rd}$		*
	b. $[gɔ]_{+rd}$ra	*!	

Representations are condensed in tableaux by labelling candidates with a bracket notation which defines the domain of segments to which a subscripted feature is linked. (22a) represents a candidate in which an occurrence of [+round] is linked to both syllables, while (22b) has [+round] linked only to the first syllable.

In languages with canonical round harmony, where spreading outranks CRISPEDGE(σ, [+round]), any selection of an output with a multiply-linked [+round] feature may be attributed to the force of the spreading constraint, as it has been formulated. Although it is the case that the distribution corresponding to round licensing also holds in these languages (a [+round] feature never occurs linked to a postinitial syllable when it is not also linked to the initial syllable), this result falls under the set of cases captured with the high-ranked spreading constraint. That is, spreading demands a stronger requirement than licensing, so licensing is violated in a subset of the cases that spreading is violated. (23) shows the multiply-linked outcome for an input containing two round vowels. The licensing constraint is given in the tableau, but it is not crucially ranked with respect to the spreading constraint or CRISPEDGE(σ, [+round]), as indicated by the bold line separating licensing from the other constraint columns.

(23) LICENSE([+rd], σ1) is freely ranked with respect to the other constraints

	tɔŋdɔ	SPREAD[+rd] >>	CRISP(σ, [+rd])	LIC([+rd], σ1)
☞	a. [tɔŋdɔ]$_{+rd}$		*	
	b. [tɔŋ]$_{+rd}$[dɔ]$_{+rd}$	*(!)*		*(!)
	c. [tɔŋ]$_{+rd}$da	*!		

For canonical Tungusic round harmony, then, we simply need the ranking, SPREAD[+round] >> CRISPEDGE(σ, [+round]).

3.3 Analysis of bisyllabic trigger round harmony

Next I examine the rankings for bisyllabic trigger round harmony (Classical Manchu). Recall that in this pattern [+round] spreads to subsequent syllables only when the first two syllables contain round nonhigh vowels. In addition, a licensing effect is apparent for round vowels in the second syllable, i.e. in Classical Manchu, [CoCo], [CaCa], and [CoCa] words are well-formed but *[CaCo] is excluded.

I suggest that the primary difference between the bisyllabic trigger languages and the canonical ones lies in the ranking of spreading and tautosyllabicity. In canonical harmony languages, spreading dominates the crisp edge constraint. In the case of bisyllabic triggers, the reverse ranking holds. Round harmony is thus unable to spread [+round] from a single round syllable:

(24) CRISPEDGE(σ, [+round]) >> SPREAD[+round]

	t͡ʃoban	CRISP(σ, [+round])	SPREAD[+round]
☞	a. [t͡ʃo]$_{+rd}$ban		*
	b. [t͡ʃobon]$_{+rd}$	*!	

On the other hand, the demand of licensing can force violations of round tautosyllabicity. This is clear from an example where the first two syllables are underlyingly round, e.g. /bot͡ʃo/. This kind of form will surface with a single [+round] feature linked to both syllables, satisfying licensing and violating CRISPEDGE(σ, [+round]). Note that in contrast to the canonical harmony cases, the multiply-linked outcome here cannot be attributed to the spreading constraint (note ranking in (24)), because licensing of [+round] in the second syllable is independent of round harmony in bisyllabic trigger languages.

(25) LICENSE([+round], σ1) >> CRISPEDGE(σ, [+round])

	bot͡ʃo	LICENSE([+round], σ1)	CRISP(σ, [+round])
☞	a. [bot͡ʃo]$_{+rd}$		*
	b. [bo]$_{+rd}$[t͡ʃo]$_{+rd}$	*!	

The ranking pattern that has been established at this point for the bisyllabic trigger languages is one in which licensing dominates CRISPEDGE(σ, [+round]), which in turn outranks spreading. Putting this together in (26), we achieve a remarkable result: the bisyllabic trigger effect arises simply from constraint interaction. In a form where the first two syllables are underlyingly

[+round], the force of licensing causes a single [+round] feature to be linked to the first two syllables, as in (a) and (b) — alternatives lose to higher-ranked constraints. Candidates (a) and (b) both satisfy licensing but violate CRISPEDGE(σ, [+round]) (see highlighted box). With tautosyllabicity violated in order to satisfy licensing, the question is will [+round] spread to the suffix vowel? The answer is yes. The winner is (a), which satisfies spreading, rather than (b), which violates it.

(26) LICENSE([+round], σ1) >> CRISPEDGE(σ, [+round]) >> SPREAD[+round]

	botʃo-ŋga	LIC([+rd], σ1)	CRISP(σ, [+rd])	SPREAD[+rd]
☞	a. $[\text{botʃoŋgo}]_{+rd}$		*	
	b. $[\text{botʃo}]_{+rd}\text{ŋga}$		*	*!
	c. $[\text{bo}]_{+rd}[\text{tʃo}]_{+rd}\text{ŋga}$	*!		****

What (26) shows is that spreading can occur only when tautosyllabicity violations are independently caused by some higher-ranked constraint, namely licensing. Because the minimal conditions under which licensing violates CRISPEDGE(σ, [+round]) are when the first two syllables are underlyingly round, we actually derive the bisyllabic trigger condition. Note that to achieve this result it is essential that CRISPEDGE(σ, [+round]) is formulated with the 'in for a penny, in for a pound' kind of assessment with respect to syllables, i.e. it is violated equally by a [+round] feature linked to two syllables or to three (see formulation in (18)). Otherwise, candidate (a) would lose to (b) on crisp edge violations, yielding an undesirable outcome. This point supports Zoll's (1996) observation that assessment of constraint violation needs to be made explicit.

The kind of ranking configuration that produces the two-syllable threshold on trigger size I call *parasitic constraint satisfaction*, described in (27). It arises when there are two constraints, α and β, each of whose satisfaction involves violating a third constraint, γ, and γ is ranked in between α and β. In this situation, provided that β incurs no violations of the intermediate constraint beyond those of α (e.g. the constraint is violated categorically), then the lowest-ranked constraint, β, is satisfied only when violations of γ are independently forced by α.

(27) Parasitic constraint satisfaction

Let α and β be optimality-theoretic constraints whose satisfaction in some word, ω, causes violation of a constraint γ.

Then satisfaction of β is *parasitic* on satisfaction of α if the constraints are ranked α >> γ >> β, and β is satisfied in ω only when α is satisfied in ω, and the number of marks *i* incurred in γ for satisfaction of α is equal to the number of marks *j* incurred for satisfaction of α and β together.

Parasitic constraint satisfaction suggests a possible solution to another threshold effect in spreading, namely the case of 'high vowel reduplication' in the Petit Diboum dialect of Feʔfeʔ-Bamileke (Hyman 1972, 1973).[4] Feʔfeʔ exhibits a reduplicative CV construction whereby a copy of the first consonant of a verb stem is prefixed along with a high vowel. In the general case this vowel is high, back and unrounded, the 'unmarked' or 'default' vowel quality for this language (28a); however, there are two exceptions: the prefix vowel is realized as [i] if the first CV of the base agree in coronality (the consonant is alveolar or palatal and the vowel is front) (28b), and the

[4] Thanks to Scott Myers for bringing this case to my attention.

prefix vowel is realized as [u] if the first CV agree in peripherality (the consonant is velar or labial and the vowel is back and round, qualities characterized by Hyman 1972 as [+grave]) (28c).

(28)	Base		Reduplication construction
a.	peː	'to hate'	pɯ-peː
	pɛn	'to accept'	pɯ-pɛn
	paʔ	'to commit suicide'	pɯ-paʔ
	to	'to punch'	tɯ-to
	tɔh	'to pass'	tɯ-tɔh
	zɑ	'to eat'	zɯ-zɑ
	co	'to fall'	cɯ-co
	cɔh	'to be severe'	cɯ-cɔh
	keː	'to refuse'	kɯ-keː
	kaʔ	'to fry'	kɯ-kaʔ
	ɣɛn	'to go'	ɣɯ-ɣɛn
b.	siː	'to spoil'	si-siː
	teː	'to remove'	ti-teː
	tɛn	'to stand up'	ti-tɛn
	tæʔ	'to bargain'	ti-tæʔ
	jeː	'to see'	ji-jeː
	cɛn	'to moan'	ci-cɛn
	cæʔ	'to trample'	ci-cæʔ
c.	pɔh	'to be afraid'	pu-pɔh
	mo	'to kill time'	mu-mo
	ko	'to take'	ku-ko
	kɔh	'to be small'	ku-kɔh
	kuː	'to carve'	ku-kuː

The distributional generalization is that the prefix vowel agrees in color with the base vowel only when the first consonant and vowel of the base agree in color. This can be analyzed as the result of spreading of color from the base to the default prefix vowel: a spreading that is only initiated when color features are linked to two segments, i.e. there must be a bisegmental trigger. A parallel analysis to the bisyllabic trigger one immediately suggests itself. A constraint prohibiting cross-segmental linkage dominates a constraint driving spreading from root to prefix, preventing spreading from taking place (hence the default prefix vowel). The spreading constraint can only be satisfied when the cross-segmental linkage constraint is independently violated, as in the case where the base CV shares color. This is a case of parasitic constraint satisfaction: spreading is able to feed off of the linkage constraint violations forced by some higher-ranked constraint.

The basic analysis is sketched below in (29-30). The high-ranked constraint promoting CV linkage when segments agree in color is an OCP constraint which forbids the occurrence of separate instances of matching color features in adjacent segments. This constraint, or the combination of constraints that derive this outcome, I have called OCP(color) (see Itô and Mester

1996, Alderete 1997 for proposals that OCP effects may be derived by conjunction of markedness constraints; reference to the class of color features follows Feature Class Theory, Padgett 1995b). OCP(color) is satisfied by a CV representation in which a single instance of a color feature is linked to both segments, as in candidates (a) and (b) in (29). It is violated in (29c), where two separate [+coronal] feature specifications occur on adjacent segments in the CV root.[5] Cross-segmental linkage for color features is prohibited by the constraint, CRISPEDGE(segment, color), for which a violation is incurred by each instance of a color feature linked to more than one segment. One mark is accrued by each of candidates (a) and (b) for a multiply-linked instance of [+coronal]. Thus far, (a) and (b) are tied. The last constraint, SPREAD(color), is the deciding one. It selects candidate (a), in which [+coronal] has spread to the prefix vowel, over (b), where spreading to the prefix has failed.

(29) OCP(color) >> CRISPEDGE(seg, color) >> SPREAD(color)

	RED-siː	OCP(color)	CRISPEDGE(seg, color)	SPREAD(color)
☞	a. [si-siː]$_{+cor}$		*	
	b. sɯ-[siː]$_{+cor}$		*	*!*
☐	c. sɯ-[s]$_{+cor}$[iː]$_{+cor}$	*!		******

Crucially, the CRISPEDGE violations in (29) are forced by OCP(color), enabling parasitic satisfaction of spreading. In forms where the OCP constraint is satisfied without violation of CRISPEDGE, spreading will fail, yielding a default prefix vowel, as in (30) (only violations of root [+coronal] spreading are shown here).

(30) Spreading fails:

	RED-to	OCP(color)	CRISPEDGE(seg, color)	SPREAD(color)
☞	a. tɯ-[t]$_{+cor}$[o]$_{-cor}$			***
	b. [ti-t]$_{+cor}$[o]$_{-cor}$		*!	*

3.4 Summary

This section has focused on the bisyllabic trigger effect in round harmony. A summary of the rankings for bisyllabic trigger languages versus those for canonical languages is given in (31). The important difference is that spreading is ranked above tautosyllabicity in the canonical languages, but for bisyllabic trigger patterns, it has moved below CRISPEDGE(σ, [+round]. A second point is that given these particular constraints, the ranking of licensing is immaterial in canonical systems, where spreading outranks tautosyllabicity, but the licensing constraint must dominate CRISPEDGE in bisyllabic trigger languages. It is the demotion of spreading that makes the force of licensing apparent and produces the ranking for parasitic constraint satisfaction, explaining the bisyllabic trigger condition in Tungusic round harmony.

[5] For ease of exposition, I simply assume that the feature specification shared by [s] and [iː] is [+coronal], but this particular choice of feature characterization is not crucial to the analysis.

(31)

Canonical round harmony	**Bisyllabic trigger round harmony**
LICENSE([+round], σ1)	LICENSE([+round], σ1)
	|
SPREAD[+round]	CRISPEDGE(σ, [+round])
|	|
CRISPEDGE(σ, [+round])	SPREAD[+round]

4 Analysis: round spreading and licensing

The analysis of the different kinds of round harmony can be advanced by more closely examining the constituent elements of the spreading and licensing requirements. Before doing this, I present data from Classical Mongolian, which displays a round vowel patterning relevant to the investigation.

4.1 Classical Mongolian

Classical Mongolian belongs to the Mongolian branch of the Altaic family. It represents the Mongolian written language from about the thirteenth century and is considered the language from which modern Mongolian languages developed. Data and description for Classical Mongolian are based on Poppe (1964) and Svantesson (1985). The vowel inventory is given in (32). Each of the unrounded nonhigh vowels is paired with a rounded counterpart.

(32) Classical Mongolian vowel inventory:

	Front		Back	
High	i	y		u
Nonhigh	e	ø	a	o

Although Modern Mongolian is known for its round harmony, this property is not active in Classical Mongolian. However, Classical Mongolian does limit the distribution of round vowels such that round nonhigh vowels only occur in a postinitial root syllable when the initial syllable also contains a round nonhigh vowel (i.e. *[CaCo], *[CuCo]).[6] This distribution is indicative of licensing without round harmony. Examples of round nonhigh vowels occurring in a syllable following an initial round nonhigh vowel are given in (33a). These are cases where postinitial [+round] is licensed by a link to the initial syllable; note that vowels must agree in backness because of a front/back harmony. (33b) gives forms in which an unrounded nonhigh vowel occurs in a syllable following rounded nonhigh, showing that round harmony (spreading to unrounded vowels) does not take place.

(33)a. nøkør 'friend' (*nekør, in general *[CeCø])
børø 'kidney'

[6] Svantesson (1985: 284) gives this as the generalization for root vowels only; rounded nonhigh vowels never occur in Classical Mongolian suffixes.

monɣol 'Mongol' (*manɣol, in general *[CaCo])

b. køke 'blue'
dørben 'four'
kødel 'to move'
qola 'far'
qota 'town'
olan 'many'
doloɣan 'seven'

A summary of the distribution of round vowels in Classical Mongolian is given in (34).

(34) Summary of Classical Mongolian round licensing.

a. Licensing: a postinitial round nonhigh vowel in a root occurs only immediately following a round nonhigh vowel:
[CoCo] [CøCø] *[CaCo] *[CeCø] *[CuCo]

b. No round harmony: rounded or unrounded nonhigh vowels may occur after an immediately preceding nonhigh rounded vowel:
[CoCo] [CøCø] [CoCa] [CøCe]

Classical Mongolian completes the set of round vowel patterns to be analyzed here. The three patterns form a graduated series of conditions on rounding, as outlined in (35).

(35)a. Licensing without round harmony. (Classical Mongolian)
[+round] may only be linked to a nonhigh vowel in a postinitial syllable if it is also linked to a nonhigh vowel in the initial syllable.

b. Bisyllabic trigger round harmony. (Classical Manchu)
[+round] may only be linked to a nonhigh vowel in a postinitial syllable if it is also linked to a nonhigh vowel in the initial syllable, and if the first <u>two</u> syllables contain round nonhigh vowels, [+round] will spread to subsequent nonhigh vowels.

c. Canonical round harmony. (Ulcha)
[+round] may only be linked to a nonhigh vowel in a postinitial syllable if it is also linked to a nonhigh vowel in the initial syllable, and [+round] spreads to subsequent nonhigh vowels with no condition on trigger size.

4.2 Revised set of constraints

A finer-grained analysis of round harmony and licensing involves re-examining the formulation of constraints on round spreading and licensing. Building on analyses of feature spreading and linking as markedness-driven (e.g. McCarthy and Prince 1994; Itô and Mester 1994; Alderete et al. 1996; Beckman 1995, 1997, 1998), I propose to realize these demands in the grammar by calling only on markedness and faith constraints. Faith and markedness are widely motivated by a variety of phonological phenomena — they are indeed basic in Optimality Theory — and an economical account of licensing and spreading would be one which calls only on this limited set of constraints (see Prince 1997 on the endogeny of faith/markedness with foundations in McCarthy and Prince 1993, 1995; Prince and Smolensky 1993). This analysis also proves illuminating from a typological perspective, bringing clarity to the correspondences between licensing and spreading and the relation between patterns of round vowel distribution in languages of the Altaic family.

Assuming a correspondence theory of faith (McCarthy and Prince 1995), the basic faith constraints I will make use of are the IDENT constraints in (36a). The first of these requires that if a segment is [+round] in the input, its correspondent segment in the output must also be [+round]. The second constraint makes the same demand for [-round]. The generalized formulation of IDENT[F] is given in (36b) (after McCarthy and Prince 1995).

(36)a. IDENT[+round], IDENT[-round]

b. IDENT[F(eature)]
Let α be a segment in S_1 (an input) and β be any correspondent segment of α in S_2 (an output). If α is [γF], then β is [γF]. (Correspondent segments are identical in feature F).

I also assume that faith may be position sensitive (after Beckman 1995, 1997, 1998; Alderete 1995, 1996; Lombardi 1995; McCarthy 1995; Padgett 1995b; Selkirk 1994 cited by Beckman 1998; Katayama in prep.). Drawing on observations of Steriade (1993), Beckman proposes that the availability of such positions is defined by perceptual facilitation. Privileged faith positions will be those in which contrasts are most perceptible by virtue of enhancing phonetic factors, some examples include peripheral syllables, stressed syllables, and root (rather than affix) syllables. In the rounding patterns of Altaic, it is the root-initial (peripheral) syllable that is assigned a special status in the grammar. The faith constraint expressing this position-sensitivity for [+round] is that in (37).

(37) IDENTσ1[+round]
Let α be a segment in the root-initial syllable of an input and β be any correspondent segment of α in an output. If α is [+round], then β is [+round].[7]

In the three Altaic languages examined here, the asymmetry between initial and postinitial syllables with respect to faithfulness to underlying [+round] specifications motivates ranking the initial-syllable faith constraint on [+round] over the general IDENT[+round] (following Beckman 1997):

(38) IDENTσ1[+round] >> IDENT[+round]

Faith constraints preserve identity of feature specification between input and output, yet not all inputs are faithfully mapped to an output. Markedness constraints penalizing specific feature specifications can produce this result. Following Prince and Smolensky (1993) and extensions proposed by Beckman (1997), the interaction of markedness and faith constraints can be used to derive inventories and positional neutralization of constrasts. The basic markedness constraints on [round] are given in (39a). Markedness constraints can also penalize certain combinations of feature specifications. In the Altaic languages, it is specifically nonhigh vowels which undergo round harmony and round nonhigh vowels are the ones limited to the licensing distribution. This calls for constraints against the cooccurrence of [-high] with round feature specifications, as in (39b).[8] For ease of exposition, binary feature specifications are assumed here. I adopt [-high] to

[7] The initial-syllable IDENT constraint could alternatively be expressed as IDENTσ1[round], applying to [+round] or [-round] in the initial syllable. The constraint is formulated as in (37) in order to focus on forms with initial syllables containing [+round] vowels.

[8] Injunctions against combinations of feature specifications are formalized here as feature cooccurrence constraints (after, for example, Beckman 1997 on combinations of [±high] and [±low]). Local conjunction (Smolensky 1997) of markedness constraints would be an alternative way of expressing this (e.g. *[-high] & *[+round]).

describe the height of nonhigh vowels undergoing round harmony and licensing, but this characterization is intended to be independent of specific theories of vowel height features.

(39)a. *[+round], *[-round]
b. *[+round, -high], *[-round, -high]

Given the preference for unrounded nonhigh vowels in Altaic, as well as the general cross-linguistic rarity of rounded low vowels (Maddieson 1984, Kaun 1995) and the unrounded character of 'default' vowels, I assume that the markedness constraints are intrinsically ranked as in (40).

(40) *[+round, -high] >> *[-round, -high]

For the Mongolian and Tungusic languages in question, this ranking is what encodes the preference for the vowels [a], [e], and [ə] over [o] and [ø], and [ɔ].[9]

The faith and markedness constraints are what will be responsible for the requirements of spreading and licensing. The outcomes of cross-syllable linkage will violate the edge-based featural tautosyllabicity constraint, CRISPEDGE(σ, [+round]), which is retained to capture the bisyllabic trigger effect. These three kinds of constraints, faith, markedness, and edge crispness encompass the full set to be drawn on in the analysis.

4.3 Rankings common to all three patterns

The goal of the faith and markedness analysis of spreading and licensing is to derive three patterns: round licensing, round harmony, and bisyllabic trigger round harmony. As a starting point I examine the rankings common to all three cases.

I begin with the status of the initial syllable. In each of three patterns, round vowels occur freely in the initial syllable. This distribution is achieved with an undominated faith constraint for [+round] segments in the initial syllable. In particular, IDENTσ1[+round] must outrank the markedness constraint *[+round], which penalizes each occurrence of [+round]. The outcome of this ranking is shown in (41), where the input is a candidate with an initial round vowel.

(41) IDENTσ1[+round] >> *[+round]

	t͡ʃoban	IDENTσ1[+round]	*[+round]
☞	a. [t͡ʃo]$_{+rd}$ban		*
	b. t͡ʃaban	*!	

The winning candidate in (41) is the faithful one in (a), which satisfies IDENT by retaining the [+round] specification. The rival candidate in (b) fairs better with respect to the markedness constraint, but its initial syllable faith violation is fatal.

The next property the three patterns share builds on the privileged status of the first syllable: each language exhibits a round licensing distribution, that is, a [+round] vowel in a postinitial syllable must be dependent on a [+round] specification in the initial syllable. For this result, *[+round] must outrank the general IDENT[+round] constraint. This licensing ranking is illustrated first for an input with two round vowels in (42).

9 The preference for [e] and [a] over [ø] and [o] is also apparent in Turkish, where the rounded low vowels are limited to the initial syllable in native words (Lewis 1967: 16).

(42) IDENTσ1[+round] >> *[+round] >> IDENT[+round]

	tɔŋdɔ	IDENTσ1[+round]	*[+round]	IDENT[+round]
☞	a. [tɔŋdɔ]$_{+rd}$		*	
	b. [tɔŋ]$_{+rd}$[dɔ]$_{+rd}$		**!	
	c. [tɔŋ]$_{+rd}$da		*	*!
	d. taŋda	*!		**

The winning candidate (a) has a single [+round] feature specification linked to both vowels. This satisfies both of the correspondence constraints and incurs a single mark for *[+round]. Candidates (c) and (d) each lose on the basis of faith violations, (d) for an unrounded vowel in the first syllable and (c) for loss of rounding in the second syllable.[10] Like (a), candidate (b) fully satisfies the IDENT constraints; however, it incurs an extra violation on *[+round], because it has two specifications for [+round]. *[+round] thus drives outputs in which [+round] is linked to multiple segments rather than appearing separately on adjacent syllables. For this result, it is crucial that *[+round] is interpreted as violated by each occurrence of a [+round] feature specification and <u>not</u> by each [+round] segment (see (43)), an assumption about featural markedness constraints that is well-established in the theory (see Beckman 1997, who formalizes this as the principle of 'feature-driven markedness'; other examples include McCarthy and Prince 1994; Itô and Mester 1994; Alderete et al. 1996).

(43) One violation of *[+round] Two violations of *[+round]

```
a.     [+round]              b.  [+round]  [+round]
         /   \                       |        |
       C  o  C  o                  C  o    C  o
```

The licensing ranking is also responsible for explaining the ill-formedness of postinitial round vowels following an unrounded vowel. This is shown in (44) for a hypothetical [CaCo] input. Forms such as this never surface in any of the three languages; however, given 'richness of the base' (Prince and Smolensky 1993: 191), which hypothesizes that all inputs are possible, we must ensure that the analysis produces an appropriate output for any possible combination of root vowel round feature specifications.[11]

(44) IDENTσ1[+round] >> *[+round] >> IDENT[+round]

	CaCo	IDENTσ1[+round]	*[+round]	IDENT[+round]
☞	a. CaCa			*
	b. Ca[Co]$_{+rd}$		*!	
	c. [CoCo]$_{+rd}$		*!	

---

[10] Unlike postinitial root vowels, suffixes never behave as if they came underlyingly with a nonhigh rounded vowel to be licensed by the initial syllable. This outcome can be achieved by drawing on the metaconstraint Faith Root >> Faith Affix (McCarthy and Prince 1995: 364) in combination with the featural tautosyllabicity constraint, but I will not pursue the details of the ranking here.

[11] Of course, by Lexicon Optimization (Prince and Smolensky 1993: 192; Itô et al. 1995), not all possible inputs for a given output will correspond to the underlying representations (inputs) the learner actually posits, but this is a separate matter.

The ranking of *[+round] over IDENT[+round] is apparent by comparison of the first candidate with its competitors. Candidate (a), which violates IDENT[+round] (the general constraint) wins by virtue of incurring fewer markedness violations for [+round] than either (b) or (c). As a consequence, the [CaCo] input surfaces not faithfully, but with loss of the unlicensed [+round] feature specification.[12] The licensing ranking thus achieves the licensing distribution without need for a formal *positional licensing* constraint, rather this result is derived through the interaction of *positional faith* and general faith and markedness constraints.

A third property shared by the three rounding patterns is height stratification: round spreading and licensing are demands holding only of nonhigh vowels and [+round] linkage occurs only between nonhigh vowels, not across vowels of different heights. In the analysis of round licensing above (in (42)), it was force of the markedness constraint *[+round] that promoted the linked structure in the output. However, since this constraint simply penalizes rounding, licensing is expected to apply equally across vowel heights. What markedness must in fact specifically prohibit is the feature cluster [+round, -high]. In the same way that *[+round] produces dependent linking of [+round] on noninitial segments to the initial syllable, *[+round, -high] yields multiple linking of the combination of feature specifications [+round] and [-high]. If this feature cluster cannot together be licensed by linking to the initial syllable, then licensing will fail, corresponding analytically to a fatal mark incurred with respect to the markedness constraint.

The point is illustrated by the representations in (45). (45a) contains an example where both [+round] and [-high] are licensed, since they belong to the initial syllable. On the other hand, in (45b) [+round] is linked to both the initial and noninitial syllable, but [-high] is not; this will be a case where the noninitial vowel does not get [+round] and [-high] for free by borrowing off of the same specification in the initial syllable. Licensing will fail, and [+round] will be lost.

(45) a. [+round, -high] is licensed

```
    [+round, -high]
          /    \
      C  o  C  o
```

b. [+round, -high] is unlicensed

```
    [+hi] [+round] [-hi]
        \   /     \  /
      C   u     C   o
```

The optimality-theoretic outcomes for these cases are shown in (46) and (47). The same ranking structure established for licensing above is maintained, but the markedness constraint is elaborated as *[+round, -high].

(46) IDENTσ1[+round] >> *[+round, -high] >> IDENT[+round]

	tɔŋdɔ	IDENTσ1[+round]	*[+round, -high]	IDENT[+round]
☞	a. [tɔŋdɔ]$_{+rd}$		*	
	b. [tɔŋ]$_{+rd}$[dɔ]$_{+rd}$		**!	

[12] Since /CaCo/ inputs never surface faithfully, we have no direct evidence for how they are resolved in the grammar other than that they must be made to conform to some grammatical structure. It is conceivable that these forms are either realized as [CaCa], with loss of rounding in the second syllable (as I have proposed), or as [CoCo], with round spreading regressively from the second syllable into the first. I have opted for the former alternative, because it is generally true of the languages in question, and true across the Altaic family, that properties of the initial syllable are maintained, while those on postinitial syllables are susceptible to neutralization or loss: a generalization that is also consistent with the spirit of the positional faith constraints.

(47)

	CʊCɔ	IDENTσ1[+round]	*[+round, -high]	IDENT[+round]
☞	a. [Cʊ]$_{+rd}$Ca			*
	b. [CʊCɔ]$_{+rd}$		*!	

While *[+round] in combination with the faith constraints would realize a round licensing effect without sensitivity to vowel height, *[+round, -high] serves to derive the limitation of licensing to the nonhigh vowels.[13] It achieves an optimality-theoretic equivalent of the height-parasitic analysis of round spreading proposed by Mester (1986) for Yawelmani Yokuts, which posits round and height features spreading together.

To conclude this section, we have established that the hierarchy in (48) holds across the rounding patterns of Ulcha (round harmony), Classical Manchu, (bisyllabic trigger harmony) and Classical Mongolian (round licensing).

(48) IDENTσ1[+round] >> *[+round, -high] >> IDENT[+round]

This ranking is responsible for the privileged status of [+round] segments in the initial syllable, and it generates the round licensing distribution along with the height stratification evident in this phenomenon.

4.4 Rankings for canonical round harmony

In addition to the shared rankings, each of the three rounding patterns has distinctive properties of its own. In the canonical round harmony pattern of Ulcha, not only does the licensing distribution hold, requiring underlying round nonhigh vowels to link [+round] and [-high] to the initial syllable, but also [+round] actively spreads to unrounded vowels. To capture this spreading of [+round], we must call on the markedness constraint against nonhigh unrounded vowels, *[-round, -high]. In the same way that *[+round, -high] produced unrounded vowels when [+round] could not be dependent on the first syllable, *[-round, -high] will cause postinitial unrounded vowels to become rounded after a [+round] nonhigh initial syllable. This will result in an IDENT violation, so *[-round, -high] must outrank IDENT[-round]. Recall also the intrinsic markedness ranking, *[+round, -high] >> *[-round, -high] (40). The outcome for a hypothetical input with an initial round nonhigh vowel and postinitial unrounded vowel is shown in (49). For completeness, the *[+round, -high] >> IDENT[+round] ranking is included (the licensing ranking). In this and subsequent tableaux I omit the undominated initial syllable faith constraint, and only candidates respecting this constraint will be considered.

(49) *[+round, -high] >> IDENT[+round], *[-round, -high] >> IDENT[-round]

	gɔra	*[+round, -high]	IDENT[+rd]	*[-round, -high]	IDENT[-rd]
☞	a. [gɔrɔ]$_{+rd}$	*			*
	b. [gɔ]$_{+rd}$ra	*		*!	

It is apparent from (49) that the ranking of the markedness constraint against nonhigh unrounded vowels over the IDENT[-round] constraint is what achieves round <u>spreading</u>, that is, spreading of [+round] to underlying [-round] vowels. The other faith/markedness ranking,

[13] In (47), I assume that an alternative candidate, [CʊCʊ], is ruled out by an undominated IDENT[-high] constraint.

*[+round, -high] >> *IDENT[+round], is what produces round licensing, the dependent linkage of underlying [+round] vowels to initial round (46). The two separate components, spreading and licensing, were subsumed for round harmony languages under the preliminary SPREAD[+round] constraint, with the LICENSE([+round], σ1) rendered redundant in just these languages (see (23)). The atomic analysis of round spreading and licensing eliminates this redundancy and actually eliminates the need to call on a formal spreading constraint. In addition, by positing an active licensing ranking in each case, it captures the shared licensing property across the three languages, a generalization missed in using the spreading constraint.

In the analysis of round licensing, the markedness constraint *[+round, -high], was sufficient to capture the restriction to nonhigh vowels. Similarly, the combinative markedness constraint, *[-round, -high] realizes the height restriction for spreading. This result is shown first in (50) for a schematic form with an initial nonhigh round vowel followed by a high unrounded vowel.

(50) [+round] does not spread to high vowels.

	CɔCɪ	*[+round, -hi]	IDENT[+rd]	*[-round, -hi]	IDENT[-rd]
☞	a. [Cɔ]$_{+rd}$Cɪ	*			
	b. [CɔCʊ]$_{+rd}$	*			*!

In (50), the low rounded vowel in the initial syllable incurs a mark for *[+round, -high] in both candidates. Yet the second vowel is high, so it does not incur a mark with respect to either of the markedness constraints, since these specifically prohibit the combination of [±round] with [-high]. Candidates (a) and (b) thus tie on markedness in relation to this constraint set. Candidate (a), without spreading, wins on the basis of faith; candidate (b) incurs a gratuitous violation of IDENT[-round]. Comparing this tableau to (49), where spreading does take place, it is apparent that round spreading is driven by the need to incur fewer marks with respect to *[-round, -high]. If spreading will not affect the number of violations of this constraint, then it will not occur (as enforced by faith).

(51) presents the case of [+round] failing to spread from a high round vowel to a following nonhigh vowel. Here the importance of the intrinsic markedness ranking, *[+round, -high] >> *[-round, -high], becomes apparent. Once again, the high vowel incurs no violations with respect to either markedness constraint; however, the postinitial nonhigh vowel must violate one of these constraints. With a high initial vowel, the postinitial vowel cannot be parasitic on a markedness violation forced by initial syllable faith — the [-high] component of markedness prevents this. The realization of the postinitial nonhigh vowel must fall to the ranking of the markedness constraints themselves. Since round nonhigh vowels are posited to be more marked than unrounded ones, the vowel is realized as [-round]. This result is achieved regardless of the input rounding specification of the nonhigh vowel. The high-ranked *[+round, -high] is decisive in both cases (compare tableau in (47)).

(51) [+round] does not spread from high vowels.

	bʊqta	*[+round, -hi]	IDENT[+rd]	*[-round, -hi]	IDENT[-rd]
☞	a. [bʊq]$_{+rd}$ta			*	
	b. [bʊqtɔ]$_{+rd}$	*!			*

This analysis of height stratification builds the height restriction directly into the markedness constraints which drive licensing and spreading. The economy of this strategy is theoretically desirable: no new constraints need to be posited and the constraints that are called on perform a range of functions. A previous analysis of height stratification in Altaic round harmony incorporates limitations on the height of the trigger into the spreading constraint (Kaun 1995). In that analysis the constraint EXTEND[rd]if[-hi] requires that [+round] be associated to all vowels in a word when simultaneously associated with [-high], whether or not [-high] is multiply-linked (Kaun 1995: 178). This captures initiation of round harmony by a nonhigh trigger. The condition on agreement of height between trigger and target is handled separately with the constraint UNIFORM[rd], which prohibits [+round] from being linked to vowels differing in height (Kaun 1995: 142). While these constraints are sufficient to realize the restriction of round harmony to vowels agreeing in height, they complicate the theory by adding two constraints to the universal set. The faith/markedness analysis requires no new types of constraints — round harmony and height restrictions come for free.[14, 15]

The final ranking to be established for canonical round harmony is that of the featural tautosyllabicity constraint. Since the markedness constraints drive cross-syllable feature linkage, which violates tautosyllabicity, *[+round, -high] and *[-round, -high] must both outrank CRISPEDGE(σ, [+round]). The evidence for this ranking is given in (52).

(52) *[+round, -high] >> *[-round, -high] >> CRISPEDGE(σ, [+round])

	gɔra	*[+round, -high]	*[-round, -high]	CRISP(σ, [+rd])
☞	a. $[\text{gɔrɔ}]_{+rd}$	*		*
	b. $[\text{gɔ}]_{+rd}\text{ra}$	*	*!	
	c. $[\text{gɔ}]_{+rd}[\text{rɔ}]_{+rd}$	**!		

The complete constraint hierarchy for the pattern of canonical Tungusic round harmony is shown in (53). Annotated at the right is the primary analytical function of groups of rankings. The ranking generalization that holds here is that each of the markedness constraints takes precedence over its relevant nonpositional IDENT constraint. In short, the slogan for round harmony could be 'markedness dominates general faith'.

14 This account makes this point for a subset of the harmonies that Kaun examines. It is a question for further research whether the broader range of round patterns Kaun analyzes can be handled strictly with faith and markedness constraints.

15 It should be noted that the height stratification analysis captures exactly that, cases where trigger and target agree in height (in this case strictly [-high]). A case that does not fall into this category is the well-known example of Turkish round harmony, where round spreads from vowels of any height only to high vowels (see, for example, Mester 1986, Kaun 1995, who treat this pattern separately from height-stratified harmony). Analysis of the Turkish system will be different, requiring implementation of a markedness constraint prohibiting the occurrence of round low vowels, but this goes beyond the range of the present investigation.

(53) **Canonical Round Harmony**

Ranking	
IDENTσ1[+round] | *[+round, -high] | IDENT[+round]	(Licensing) [+round] must be licensed
*[-round, -high] | IDENT[-round]	(Spreading) [+round] spreads to [-round]
CRISPEDGE(σ, [+round])	

For verification of this complete hierarchy, the outcomes for three key inputs (represented schematically) are derived in (54-56) with the full array of constraints.

(54)

	CoCo	IDENTσ1 [+round]	*[+round, -high]	IDENT [+round]	*[-round, -high]	IDENT [-round]	CRISP (σ,[+round])
☞	a.[CoCo]$_{+rd}$		*				*
	b.[Co]$_{+rd}$Ca		*	*(!)	*(!)		
	c.[Co]$_{+rd}$[Co]$_{+rd}$		**!				

(55)

	CoCa	IDENTσ1 [+round]	*[+round, -high]	IDENT [+round]	*[-round, -high]	IDENT [-round]	CRISP (σ,[+round])
☞	a. [CoCo]$_{+rd}$		*			*	*
	b. [Co]$_{+rd}$Ca		*		*!		

(56)

	CaCo	IDENTσ1 [+round]	*[+round, -high]	IDENT [+round]	*[-round, -high]	IDENT [-round]	CRISP (σ,[+round])
☞	a. CaCa			*	*		
	b. Ca[Co]$_{+rd}$		*!		*		
	c. [CoCo]$_{+rd}$		*!			*	*

4.5 Rankings for round licensing

In the hierarchy for canonical round harmony, markedness constraints, driving multiply-linked structures, outranked the nonpositional IDENT constraints. In the licensing distribution without round harmony (Classical Mongolian), the licensing ranking holds, placing *[+round, -high] over IDENT[+round] (as determined earlier for all three rounding patterns). However unlike the full round harmony pattern of Ulcha, [+round] does not actively spread to unrounded vowels.

Analytically, this means that faith to unrounded vowels is always respected at the cost of markedness, that is, IDENT[-round] takes precedence over *[-round, -high]. The consequence of this ranking is shown in (57). There is now a stronger imperative to maintain the [-round] quality of the vowel in the second syllable, so the faithful candidate wins over one in which [+round] spreads from the initial syllable.

(57) IDENT[-round] >> *[-round, -high]

	olan	IDENT[-round]	*[-round, -high]
☞	a. $[o]_{+rd}$lan		*
	b. $[olon]_{+rd}$	*!	

The reversal in ranking of markedness and faith constraints for [-round] is sufficient to capture the difference between canonical round harmony and licensing. The complete constraint hierarchy for round licensing is given in (58) alongside those for round harmony; the point of contrast is framed.[16]

(58) **Canonical round harmony** / **Licensing**

Canonical round harmony		Licensing	
IDENTσ1[+round] | *[+round, -high] | IDENT[+round]	(Licensing) [+round] must be licensed	IDENTσ1[+round] | *[+round, -high] | IDENT[+round]	(Licensing) [+round] must be licensed
*[-round, -high] | IDENT[-round]	(Spreading) [+round] spreads to [-round]	IDENT[-round] | *[-round, -high]	(No spreading) [+round] does not spread to [-round]
CRISPEDGE (σ, [+round])		CRISPEDGE (σ, [+round])	

While round harmony is distinguished by markedness outranking faith, round licensing is characterized by enforcing faith to [-round]. This contrast reflects the historical development of Mongolian. Classical Mongolian exhibited just round licensing, but in Modern Mongolian (e.g. Khalkha), this developed into full round harmony among the round vowels. From the point of view of analysis, faith for [-round] was demoted below markedness in the transition from Classical to Modern Mongolian: the language change involves reranking of a single constraint.

Again, to verify the hierarchy, derivations for three key forms are given in (59-61) with the full array of constraints for licensing shown.

[16] In the licensing constraint hierarchy, the featural tautosyllabicity constraint must crucially be ranked below the complex of constraints producing licensing, since licensing is what yields multiply-linked representations. Whether this constraint is ranked above or below the [-round] faith and markedness constraints is not crucial; I have assumed here that it is ranked below them since this is uniform with the round harmony ranking needed for other Altaic languages.

(59)

	CoCo	IDENTσ1 [+round]	*[+round, -high]	IDENT [+round]	IDENT [-round]	*[-round, -high]	CRISP (σ, [+round])
☞	a.[CoCo]$_{+rd}$		*				*
	b.[Co]$_{+rd}$Ca		*	*!		*	
	c.[Co]$_{+rd}$[Co]$_{+rd}$		**!				

(60)

	CoCa	IDENTσ1 [+round]	*[+round, -high]	IDENT [+round]	IDENT [-round]	*[-round, -high]	CRISP (σ, [+round])
☞	a. [Co]$_{+rd}$Ca		*			*	
	b. [CoCo]$_{+rd}$		*		*!		*

(61)

	CaCo	IDENTσ1 [+round]	*[+round, -high]	IDENT [+round]	IDENT [-round]	*[-round, -high]	CRISP (σ, [+round])
☞	a. CaCa			*		*	
	b. Ca[Co]$_{+rd}$		*!			*	
	c. [CoCo]$_{+rd}$		*!		*		*

4.6 *Rankings for bisyllabic trigger round harmony*

Finally, I examine the rankings needed for bisyllabic trigger round harmony (Classical Manchu). This is the pattern which exhibits licensing for [+round], and also [+round] spreads to [-round] when the first two syllables contain round vowels. Because bisyllabic trigger systems show evidence of both round licensing and spreading, markedness must outrank the relevant general faith constraints, just as in canonical round harmony. Where the systems differ is in the ranking of the tautosyllabicity constraint, a generalization established in deriving the bisyllabic trigger effect in section 3.

Recall that in the bisyllabic trigger languages [+round] does not spread to unrounded vowels from a single syllable, so round spreading is not strong enough to induce violations of CRISPEDGE(σ, [+round]). This means that CRISPEDGE(σ, [+round]) must be ranked above the markedness constraint which drives round spreading, *[-round, -high]. The mark incurred for a postinitial unrounded vowel is thus insufficient to induce multiple linkage of [+round].

(62) CRISPEDGE(σ, [+round]) >> *[-round, -high]

	t͡ʃoban	CRISP(σ, [+round])	*[-round, -high]	IDENT[-round]
☞	a. [t͡ʃo]$_{+rd}$ban		*	
	b. [t͡ʃobon]$_{+rd}$	*!		*

In contrast, linked representations do occur to license a [+round] vowel in the second syllable. CRISPEDGE(σ, [+round]) must thus be ranked below the constraints producing the licensing outcome: *[+round, -high] >> IDENT[+round].

(63) *[+round, -high] >> IDENT[+round] >> CRISPEDGE(σ, [+round])

	botʃ͡o	*[+round, -high]	IDENT[+round]	CRISP(σ, [+rd])
☞	a.[botʃ͡o]$_{+rd}$	*		*
	b.[bo]$_{+rd}$tʃ͡a	*	*!	
	c.[bo]$_{+rd}$[tʃ͡o]$_{+rd}$	**!		

The important analytical result for bisyllabic trigger languages can now be reconstructed (compare the tableau in (26)). The combination of constraints *[+round, -high] >> IDENT[+round] have replaced LICENSE over the tautosyllabicity constraint and *[-round, -high] >> IDENT[-round] have replaced SPREAD below tautosyllabicity. With CRISPEDGE(σ, [+round]) independently violated by the constraints driving licensing, [+round] can spread to subsequent syllables, thereby deriving the two-syllable threshold for round harmony through parasitic constraint satisfaction.

(64) The bisyllabic trigger effect

	botʃ͡o-ŋga	*[+round, -high]	IDENT [+round]	CRISP (σ, [+round])	*[-round, -high]	IDENT [-round]
☞	a.[botʃ͡oŋgo]$_{+rd}$	*		*		*
	b.[botʃ͡o]$_{+rd}$ŋga	*		*	*!	
	c.[bo]$_{+rd}$[tʃ͡o]$_{+rd}$ŋga	**!			*	

Comparing the full constraint hierarchies for canonical round harmony and bisyllabic trigger harmony, it is apparent that the difference between these patterns continues to lie solely in the ranking of CRISPEDGEσ[+round], maintaining this result from section 3.

(65)

Canonical round harmony		**Bisyllabic trigger round harmony**	
IDENTσ1[+round]	(Licensing)	IDENTσ1[+round]	(Licensing)
*[+round, -high]	[+round] must be licensed	*[+round, -high]	[+round] must be licensed
IDENT[+round]		IDENT[+round]	
		CRISPEDGE (σ, [+round])	licensing violates tautosyllabicity
*[-round, -high]	(Spreading)	*[-round, -high]	(Spreading)
IDENT[-round]	[+round] spreads to [-round]	IDENT[-round]	[+round] spreads to [-round]
CRISPEDGE (σ, [+round])	harmony violates tautosyllabicity		

The concluding summary tableaux for the bisyllabic trigger pattern are exhibited below:

(66)

	CoCo	Identσ1 [+round]	*[+round, -high]	Ident [+round]	Crisp (σ, [+round])	*[-round, -high]	Ident [-round]
☞	a. $[CoCo]_{+rd}$		*		*		
	b. $[Co]_{+rd}Ca$		*	*!		*	
	c. $[Co]_{+rd}[Co]_{+rd}$		**!				

(67)

	CaCo	Identσ1 [+round]	*[+round, -high]	Ident [+round]	Crisp (σ, [+round])	*[-round, -high]	Ident [-round]
☞	a. CaCa			*		*	
	b. $Ca[Co]_{+rd}$		*!			*	
	c. $[CoCo]_{+rd}$		*!		*		*

(68)

	CoCa	Identσ1 [+round]	*[+round, -high]	Ident [+round]	Crisp (σ, [+round])	*[-round, -high]	Ident [-round]
☞	a. $[Co]_{+rd}Ca$		*			*	
	b. $[CoCo]_{+rd}$		*		*!		*

(69)

	CoCo-Ca	Identσ1 [+round]	*[+round, -high]	Ident [+round]	Crisp (σ, [+round])	*[-round, -high]	Ident [-round]
☞	a. $[CoCoCo]_{+rd}$		*		*		*
	b. $[CoCo]_{+rd}Ca$		*		*	*!	
	c. $[Co]_{+rd}CaCa$		*	*!		*	

4.7 Extensions to other rounding distributions in Altaic

An important analytical result of this section has been to derive the three related height-stratified patterns of round licensing, canonical harmony, and bisyllabic trigger harmony by simple constraint reranking within a limited set of constraints. Pursuing the boundaries of factorial constraint ranking (Prince and Smolensky 1993) proves to have desirable analytical outcomes for other round patterns found in the Altaic family, a few of which I will briefly outline. In Ola Lamut (Tungusic, Li 1996), nonhigh rounded vowels are entirely limited to the initial syllable. This is a case like the others where initial syllable faith outranks the constraint againt nonhigh round vowels (*[+round, -high]), which in turn outranks general faith for [+round]. Ola Lamut is unlike the others in that postinitial round vowels may not be saved by dependency on [+round] in the initial syllable. Here the constraint against featural tautosyllabicity, CrispEdge(σ, [+round]) is always respected, so the different pattern of Ola Lamut is captured by ranking this constraint at the top of the hierarchy. West-Siberian Tatar (Turkic; Korn 1969: 103) is even more conservative: nonhigh round vowels are excluded in all positions — historically nonhigh round vowels have raised to their high counterparts. In this case it is the markedness constraint against the combination of [+round] and [-high] which is top-ranked, taking precedence even over initial syllable identity. Sanziani Manchu, one of the Modern Manchu dialects, represents the other extreme: round harmony has virtually disintegrated, so round nonhigh vowels occur postinitially after round or unround vowels (Li 1996; 180, see this source for tracing of the historical remnants of harmony). This distribution derives from the rise of faith over markedness, producing a free distribution of rounding in nonhigh vowels; the opposite of the canonical round harmony pattern, in which markedness outranks nonpositional faith. The ranking pattern of each of these languages exhibits a further variation on the possible hierarchies of the established set of constraints, and clearly, this set of constraints is a productive one, even within the domain of the Altaic family alone. The three additional patterns and their implications for the constraint hierarchy are summarized in (70).

(70)a. Ola Lamut
Pattern: Nonhigh round vowels are limited to the initial syllable.
Ranking: IDENTσ1[+round] >> *[+round, -high] >> IDENT[+round]
CRISPEDGE(σ, [+round]) is undominated.

b. West-Siberian Tatar
Pattern: Nonhigh round vowels are excluded in all positions.
Ranking: *[+round, -high] >> IDENTσ1[+round], IDENT[+round]

c. Sanziani Manchu
Pattern: Nonhigh round vowels occur freely in all positions.
Ranking: IDENTσ1[+round], IDENT[+round] >> *[+round, -high]

5 Conclusion

This paper has made two important analytical findings. The first of these is that the bisyllabic trigger pattern can be derived simply by ranking a constraint on featural tautosyllabicity in between the constraints producing licensing and those producing spreading. This ranking configuration yields parasitic satisfaction of spreading when the demands of licensing force violations of tautosyllabicity. It emerges that it is nonaccidental that bisyllabic trigger languages exhibit both round licensing and harmony: licensing plays a critical role in producing the two-syllable threshold for round spreading. The second result is that the bisyllabic trigger pattern and two related Altaic systems, licensing and canonical round harmony, can be captured with minimal theoretical apparatus through the interaction of three kinds of constraints: faith, markedness, and edge crispness, all constraints with considerable independent motivation. This account finds new support for markedness as the theoretical implement driving spreading and other multiply-linked featural representations — A brute-force spreading constraint is not required. In addition, new evidence is accrued for positional identity constraints, which make an important contribution to explaining the special licensing and trigger status of the initial syllable. The analysis is novel in drawing on markedness as feature cooccurrence constraints to derive height stratification in vowel harmony. It also is unique in extending edge crispness to specific featural specifications to derive featural tautosyllabicity. The outcome is an account which elegantly captures the correspondences between different but related patterns of rounding distributions: the patterns of round licensing and bisyllabic trigger harmony are distinguished from canonical round harmony by reranking of a single constraint, a consequence bearing out the predictions of ranking as the source of cross-linguistic variation. From a broader theoretical perspective, this account contributes to the growing body of evidence for the wide extent of application of markedness constraints in combination with faith amplified by positional sensitivity. This must provoke a careful examination of the analysis of other spreading and licensing effects and the motivation for constraints proposed specifically for these phenomena, part of a continuing program of research on these issues.

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