FEATURE IDENTITY AND ICY TARGETS IN MENOMINEE VOWEL HARMONY*

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Menominee exhibits a parasitic vowel harmony where [+ATR] harmony operates among non-low vowels. The behavior of low vowels is of particular interest. Low [+ATR] vowels block propagation of harmony and low [-ATR] vowels are transparent. This paper analyzes the pattern through the lens of surface correspondence. Feature identity is intrinsic to the mechanism of Agreement by Correspondence. This approach readily obtains both height-parasitic [+ATR] harmony and the transparent behavior of vowels that differ from non-low triggers in values for [low] and [ATR]. The lack of propagation of harmony by low [+ATR] vowels is analyzed as a case of blocking by correspondence, where these vowels function as icy targets for [+ATR] harmony. In this account, feature-value specific CORR constraints play a role in differentiating of the behavior of low vowels, contributing on a debate about the structure of constraints that drive surface correspondence.

In general terms, this study reveals that constraints that govern correspondence relations and correspondence-mediated identity provide a unified account of a complex system of parasitic vowel harmony. This approach contributes to a broad theoretical aim to maximize utilization of constraints within well-established families, with the potential to reduce complexity in Con.
Keywords: Vowel harmony, Menominee, Agreement by Correspondence, icy targets, feature identity

1 Introduction

In parasitic harmony patterns, harmony is restricted to segments that are identical for some feature. In analyses based on feature-geometric structure, spreading of the harmonizing feature is dependent on another tier or the presence of other multiply linked features (Archangeli 1985, Cole 1987, Cole & Trigo 1988, Mester 1988a, b). A strategy in more recent work employs constraints that penalize harmony between segments that differ in specification for a given feature (Cole & Kisseberth 1995a, b, Jurgec 2011a, 2013, Kaun 1995, 2004, Kimper 2011). However, in the Agreement by Correspondence approach (ABC; Walker 2000a, b, 2001, Hansson 2001, 2010, Rose & Walker 2004), feature identity is intrinsic to the mechanism that gives rise to surface correspondence, through which harmony is mediated. This property of ABC makes it particularly apt for the treatment of parasitic harmony (Rose & Walker 2004, Walker 2012).

In this paper, I revisit the case of [+ATR] harmony in Menominee in the ABC framework. This pattern has been characterized as a parasitic harmony (Nevins 2004, 2010).[1] Four types of vowel behavior are at issue: height-parasitic harmony, transparency, blocking, and height-specific non-harmony. The combination of these behaviors in the same system provides an important empirical test for any approach to harmony. The proposed analysis utilizes *feature-value specific* CORR constraints, which coerce surface correspondence among segments that are identical in a specific value of a given feature. This approach departs from an alternative where surface correspondence is driven by a constraint framed in the MAX constraint formalism, which lacks a counterpart of the feature-value specificity in CORR constraints (McCarthy 2010).

* I am grateful for comments and suggestions on this paper from Jennifer Smith and an anonymous reviewer. This research has also benefitted from comments from audience members at the 2009 Annual Meeting of the LSA, where a preliminary version of this work was presented.

[1] Cole (1987) and Cole & Trigo (1988) also described Menominee harmony as parasitic but with a different interpretation of the vowel contrast system and harmonizing feature.

In the ABC analysis, feature identity relationships play an essential role in characterizing vowel behavior in Menominee's harmony. First, height-parasitic harmony operates among vowels that are non-low. However, harmony is not enforced among low vowels. I characterize the lack of harmony in the latter context as "height-specific non-harmony," since [+ATR] harmony does not operate in the low stratum in contrast to the non-low stratum. The height-stratum differences follow from CORR-XX[αF] constraints that are ranked so as to enforce surface correspondence among non-low vowels but not among low vowels. The distinct behavior of low [-ATR] and [+ATR] vowels is of particular theoretical interest. Low [-ATR] vowels are transparent to harmony between non-low vowels. Transparent vowels differ from non-low [+ATR] triggers in their values for [low] and [ATR]. Owing to their lack of identity, surface correspondence is not enforced between these vowel classes, bringing about *transparency by lack of correspondence*. In contrast, low [+ATR] vowels behave as blockers of harmony. This arises through *blocking by correspondence* (Rhodes 2008, 2012, Walker 2009), where the low [+ATR] vowel is in surface correspondence with a non-low [+ATR] trigger by virtue of identity for [+ATR]. In this context, the low [+ATR] vowel functions as a type of *icy target* (Jurgec 2011a, b) by halting further harmony. In the account, feature-value specific CORR constraints contribute to differentiating the transparent versus blocking behavior of low vowels.

In the larger picture, this analysis contributes to extending the ABC approach to vowel harmony, showing that it is both viable and well suited for treating a complex parasitic pattern. It accomplishes this with a limited set of constraint families in Optimality Theory (OT; Prince & Smolensky 2004), specifically, CORR-XX[αF] and IDENT constraints. These constraints revolve around correspondence relations and correspondence-mediated feature identity, which are central constructs in OT (McCarthy & Prince 1995). A strength of the ABC analysis in contrast to alternatives that employ other constraints is that it maximizes the labor of correspondence-centered constraint families, with the potential to reduce complexity in Con. This achievement finds a parallel in work by Bennett (2013, 2015a, b) on the analysis of dissimilation. More broadly, it resonates with work by Itô & Mester (1994, 1999), which subsumes various phonotactic patterns in syllable structure under the work of a single constraint family.

This paper is organized as follows. Section 2 presents data illustrating the pattern of [+ATR] harmony in Menominee. Section 3 develops the ABC analysis. Section 4 considers alternatives in relation to issues of feature identity and maximizing the labor of limited constraint sets. Section 5 presents the conclusion.

2 [+ATR] Harmony in Menominee

Menominee, an Algonquian language, exhibits an intriguing pattern of parasitic vowel harmony that includes blocking and transparency. Bloomfield (1962, 1975) provided the original documentation and description of this language. Though Bloomfield had characterized Menominee harmony as involving raising, Archangeli & Pulleyblank (1994) and Milligan (2000) have since presented phonological and phonetic arguments that [+ATR] is the active harmonizing feature in this system, an interpretation that I adopt here. The Menominee vowel inventory is given in (1), following the transcription practice of Archangeli & Suzuki (1995). Vowels may be long or short.[2]

(1) Menominee vowels

Unround	Round		
i	u	[+ATR]	Non-low
ɪ	ʊ	[–ATR]	
ə		[+ATR]	Low
a		[–ATR]	

[2] Additional accounts adopting an interpretation of Menominee as involving an [ATR] contrast include Nevins (2004, 2010), Walker (2009) and Rhodes (2010). The harmony pattern was treated as involving height in earlier accounts (Cole 1987, Cole & Trigo 1988, Steriade 1987, and see more recent discussion by Oxford 2016), based on the characterization in Bloomfield 1962.

Non-low and low vowels pattern differently in Menominee harmony and are addressed in turn. In preview, regressive [+ATR] harmony operates in height-parasitic fashion among non-low vowels. Low [-ATR] vowels are transparent to harmony between flanking non-low vowels, while low [+ATR] vowels block harmony in this context. In addition, [+ATR] harmony is not witnessed among low vowels. Long and short non-low vowels are discussed separately because of a surface contrast neutralization in the latter.

2.1 Long non-low vowels

I begin with forms where the target of [+ATR] harmony is a long non-low vowel. The pattern we will see evidenced here is that these vowels undergo regressive harmony when the trigger is also non-low.

In the data in (2), alternations of the long non-low vowel in the first syllable are of primary interest. In (2c), this vowel is realized as [-ATR] when there is no [+ATR] vowel in the word. In (2a–b), this vowel is realized as [+ATR] in agreement with the [+ATR] non-low vowel in the following syllable. Notice in (2b) that [ə] does not trigger [+ATR] harmony in a preceding long non-low vowel. Sequences of vowels with different heights are discussed in section 2.3. Transcriptions of the data presented here follow Archangeli & Pulleyblank (1994) (A&P) and Archangeli & Suzuki (1995) (A&S), but they also incorporate the more recent interpretation of short non-low vowels by Milligan (2000), discussed below, and her treatment of postconsonantal glides as vocalic. For completeness, forms are also given in the orthographic transcription system of Bloomfield (1962 [B62], 1975 [B75]), which reflects his characterization of vowel harmony as involving raising. Note that Bloomfield used "•" to indicate long vowels.[3]

(2) a. [siːpiah] (A&P: 377) si•piah (B75: 240)
‘river (LOC)’
b. [siːpiahsɪːhsəh] (A&S: 6) si•piahse•hsєh (B75: 242)
‘creek (DIM)’
c. [sɪːpɪːw] (A&P: 377) se•pe•w (B62: §14.24, §14.158, B75: 240)
‘river’

The (a) examples in (3–9) show further evidence of [+ATR] harmony. The long non-low vowel that undergoes harmony is underlined. Triggers may be long or short, and the trigger and target vowels may be the same or different in rounding. Morphologically related (b) examples are provided to show that the long target vowel is otherwise [-ATR]. (Short non-low vowels in (4a) and (9a) are also shown as undergoing harmony here, but I defer discussion of short vowel targets to the next section.)

(3) a. [aːtəʔnuːhkuwəw] a•tєqnu•hkuwєw (B62: §4.66, B75: 40)
‘he tells him a sacred story’
b. [aːtəʔnʊːhkakan] a•tєqno•hkakan (B62: §14.68, B75: 40)
‘sacred story’

(4) a. [puːsituaʔ] pu•setuaq (B62: §4.66)
‘when they embark’
b. [pʊːsɪt] po•set (B62: §4.66)
‘when he embarks’

(5) a. [apiːsiːw] api•si•w (B62: §15.211, B75: 25)
‘he, it is black’

[3] Individual morpheme glosses and boundaries were not regularly notated in the sources and are not reconstructed here.

b. [apɪːs] ape•s (B62: §17.19, B75: 24)
'black'

(6) a. [niːmit] ni•mit (B62: §4.66)
'when he dances'

b. [nɪːmʊw] ne•mow (B62: §4.66)
'he dances'

(7) a. [kuːniak] ku•nyak (B62: §2.42, §4.66)
'snow, lump of snow (PL)'

b. [kʊːn] ko•n (B62: §2.42, §4.66)
'snow, lump of snow'

(8) a. [watuːhsiw] watu•hsiw (B62: §14.110, B75: 262)
'hot coal, ember'

b. [watʊːw] wato•w (B62: §14.110, B75: 262)
'ball'

(9) a. [ukiːmuːhkiw] (A&P: 381) oki•mu•hkiw (B62: §14.276)
'princess'

b. [ʊkɪːmaːw] oke•ma•w (B62: §14.276)
'chief'

The examples in (10) illustrate some contexts (underlined) where harmony does not occur with potential long non-low vowel targets. A non-low [+ATR] vowel does not trigger harmony in a long non-low vowel in a following syllable (10a), nor does a non-low [-ATR] vowel trigger harmony in a preceding long non-low vowel (10b).

(10) a. [nuːkɪːsɪk] (A&S: 6) nu•ke•sek (B62: §14.380)
'Mid Sky' (man's name)

b. [mianiːhsɪːhsak] (A&S: 6) miani•hse•hsak (B75: 133)
'tiny owl (DIM PL)'

To summarize, thus far [+ATR] harmony is seen to operate regressively among non-low vowels, but only long vowel targets have been examined.

2.2 Short non-low vowels

I turn next to the patterning of short non-low vowels. Again, we will see that these vowels are targets of regressive [+ATR] harmony from triggers of the same height.

In the history of study of Menominee vowel harmony, the understanding of the participation of short non-low vowels has been complicated by a surface contrast neutralization. As background on this issue, I review the insights brought by the careful analysis of Milligan (2000). Ambiguities about the target status of /ɪ/ and /ʊ/ in [+ATR] harmony arose from Bloomfield's system of orthography and phonetic mergers. Milligan's study brings to bear data and allophonic descriptions from Bloomfield (1962) and Miner (1975, 1979). The key conclusion emerging from her study is that [ATR] contrasts are not perceived in short non-low vowels except before a glottal stop. Furthermore, she hypothesizes that short non-low vowels fully participate in [+ATR] harmony, even in contexts where an [ATR] distinction is not perceived.

Phonological patterning provides evidence that underlying [±ATR] contrasts exist in short non-low vowels, even where a surface contrast is not apparently audible. One source of evidence is whether a short vowel triggers [+ATR] harmony and is therefore deduced to be [+ATR], as in (11a–b) (repeated from (2a–3a), see additional examples in section 2.1). If it does not trigger harmony in a possible triggering context, as in (12a–b), the vowel is inferred to be [-ATR].

(11)	a.	[siːpiah] 'river (LOC)'	(A&P: 377)	si•piah (B75: 240)
	b.	[aːtəʔnuːhkuwəw] 'he tells him a sacred story'		a•tєqnu•hkuwєw (B62: §4.66, B75: 40)
(12)	a.	[kɪːskɪnəːhcihəw] 'he cuts off his finger or hand'	(A&S: 14)	ke•skenє•hcihєw (B62: §18.175, B75: 92)
	b.	[kɪːpʊtəciːnəːw] 'he holds him, it in his hands and rubs him, it'	(Milligan 2000: 241)	ke•potєci•nє•w (B62: §18.171, B75: 90)

A second source of evidence for the underlying [±ATR] status of a short non-low vowel comes under circumstances of prosodically conditioned alternations with long vowels. The [-ATR] quality of the short non-low vowel in the second syllable in (13a) becomes unambiguous when lengthened in (13b). The [-ATR] quality is distinguished from a [+ATR] alternant derived when harmony applies in (13c).

(13)	a.	[nɪkʊt] 'one'	(A&P: 381)	nekot (B62: §17.5)
	b.	[nɪkʊːtəːyaw] 'one affair'	(A&P: 381)	neko•tє•yaw (B62: §17.78)
	c.	[nikuːtikatəːw][4] 'one-legged being'	(A&P: 381)	neku•tikatє•w (B75: 156)

As for the status of short non-low vowels as targets, Milligan (2000: 242) observed that in contexts where a contrast for [ATR] is perceptible (i.e. before [ʔ]), Bloomfield reported that short non-low vowels undergo [+ATR] harmony. This is illustrated in (14), where the short non-low vowel in the first syllable harmonizes with /u/ in the third syllable. The harmony operates across /a/, which is transparent to [+ATR] harmony, as discussed later.

(14)	a.	[kuʔnatuaʔ][5] 'if thou fearest them'	(Milligan 2000: 243)	kuqnatuaq (B62: §4.66)
	b.	[kʊʔnat] 'if thou fearest him'		koqnat (B62: §4.66)

When short non-low vowels occur in a syllable between a trigger and a perceptible target, such as a long non-low vowel, they do not obstruct harmony and plausibly undergo it, as shown in (15–16). Glosses flanked by "??" are constructed by Archangeli & Pulleyblank (1994). The transcriptions of the underlined vowels in (15a) and (16a) follow Milligan's hypothesis that short non-low vowels are targets of harmony in the same manner as their long counterparts. Forms in (15b) and (16b) show [-ATR] counterparts of a short non-low vowel in the paired (a) form in an environment where harmony does not apply.

[4] In the transcription of this word in A&P, the final vowel is short. I assume this was an unintended error and instead follow the length notated by Bloomfield (1975: 156).

[5] Milligan transcribes the final vowel of this word as long, but I have transcribed it as short, following Bloomfield (1962: 96).

(15) a. [niwiːnipim] (A&P: 378) newi•nepim (B75: 276)
‘??I dirty his (my?) mouth??’
b. [wɪːnɪpʊw] (A&P: 378) we•nepow (B62: §15.110, B75: 276)
‘he dirties his mouth by eating’
(16) a. [tuːhkupiahnəw] (A&P: 378) tu•hkopiahnɛw (B62: §15.240, B75: 258)
‘he walks with buttocks spread’
b. [tʊːhkʊpəːhsɪn] (A&P: 378) to•hkopɛ•hsen (B75: 258)
‘he lies with buttocks spread’

In target contexts for [+ATR] harmony where an [ATR] distinction is not perceptible, Bloomfield wrote short non-low vowels that are underlying [-ATR] with the symbol corresponding to the [-ATR] form. Milligan assumes this orthographic choice represented the absence of a perceived change in [ATR] quality, but her phonological interpretation is that these vowels undergo harmony. An alternative approach could treat short non-low vowels as transparent, except before [ʔ] (e.g. Archangeli & Pulleyblank 1994, 2007, Archangeli & Suzuki 1995). However, as Milligan effectively argues, treating these vowels as transparent complicates the analysis, and concrete evidence for interpreting them as transparent is lacking. I therefore adopt her interpretation that short non-low vowels are full participants in [ATR] harmony.

In summary, the pattern of harmony discussed to this point is that harmony for [+ATR] operates regressively among non-low vowels, both long and short.

2.3 Low vowels

Low vowels do not show overt participation in [+ATR] harmony, regardless of whether a neighboring vowel is the same or different in height. First, height-parasitic [+ATR] harmony is not witnessed among low vowels, as seen in (17). (The first three examples are repeated from (3a), (13c) and (16a).) The example in (17f) also shows that in low vowel sequences [+ATR] harmony does not operate progressively, nor does [-ATR] harmony occur in either direction.

(17) a. [aːtəʔnuːhkuwəw] a•tɛqnu•hkuwɛw (B62: §4.66, B75: 40)
‘he tells him a sacred story’
b. [nikuːtikatəːw] (A&P: 381) neku•tikatɛ•w (B75: 156)
‘one-legged being’
c. [tuːhkupiahnəw] (A&P: 378) tu•hkopiahnɛw (B62: §15.240, B75: 258)
‘he walks with buttocks spread’
d. [tʊːwahkəːkhʊw] to•wahkɛ•khow (B75: 258)
‘‘he beats the waterdrum’
e. [pahkəːsiːw] pahkɛ•si•w (B62: §16.162)
‘he cuts him, it off’
f. [aːpəːhtam] a•pɛ•htam (B62: §16.13)
‘he unravels it, he reads it’

Low [-ATR] vowels appear to be transparent to harmony among non-low vowels, as shown in (18–20). In the (a) examples, [+ATR] harmony operates across [-ATR] [a(ː)]; in (20a) there are two intervening syllables with [a(ː)]. The paired (b) forms verify that the non-low vowel in the syllable preceding transparent [a(ː)] has actually undergone harmony, because it is [-ATR] in other contexts.

(18) a. [wayiːtuːhkatituaʔ] (A&P: 378) wayi•tu•hkatituaq (B75: 278)
‘??they work together??’
b. [wɪːtʊːhkatʊwak] (A&P: 378) we•to•hkatowak (B75: 278)
‘they consort, play, work together’
(19) a. [niciːpaːhkim] (A&P: 379) neci•pa•hkim (B75: 43)
‘cook (NOM)’
b. [cɪːpaːhkʊw] (A&P: 379) ce•pa•hkow (B62: §14.69, B75: 43)
‘he cooks’
(20) a. [apiːsaːkamiw] api•sa•kamiw (B62: §18.178, B75: 24)
‘it is black liquid’
b. [apɪːs] ape•s (B62: §17.19, B75: 24)
‘black’

[+ATR] harmony across /a(ː)/ is plausibly a genuine case of assimilation at a distance, that is, it skips an intervening vowel. This interpretation is supported by the fact that [+ATR] low vowels ([ə(ː)]) are attested in Menominee and are perceptibly different from [-ATR] low vowels. There is therefore not reason to expect that the reported transparency of /a(ː)/ in harmony is caused by listener error. Instrumental verification of the transparency would nevertheless be valuable.

A low [+ATR] vowel does not induce harmony in a preceding non-low vowel, as shown in (21) with examples repeated from (2b) and (13b). Furthermore, [+ATR] harmony between non-low vowels is blocked by an intervening [+ATR] low vowel. In each of the forms in (22), non-low vowel(s) preceding [ə(ː)] are [-ATR], despite a [+ATR] non-low vowel in the syllable following [ə(ː)].

(21) a. [siːpiahsɪːhsəh] (A&S: 6) si•piahse•hsɛh (B75: 242)
‘creek (DIM)’
b. [nɪkʊːtəːyaw] (A&P: 381) neko•tɛ•yaw (B62: §17.78)
‘one affair’
(22) a. [pɪːhtəhkiːʔtaw] (A&P: 383) pe•htɛhki•qtaw (B62: §18.155, B75: 213)
‘he sticks his head in’
b. [mʊːnɪhpəniːw] (A&P: 383) mo•nehpɛni•w (B62: §15.175)
‘he digs potatoes’
c. [kɪːskɪnəːhcihəw] (A&P: 383) ke•skenɛ•hcihɛw (B62: §18.175, B75: 92)
‘he cuts off his finger or hand’

A summary of the [+ATR] harmony pattern characterized above is given in (23).

(23) i. Non-low [+ATR] vowels (/i, iː, u, uː/) trigger regressive [+ATR] harmony.
ii. Non-low [-ATR] vowels (/ɪ, ɪː, ʊ, ʊː/) are targets.
iii. Low [-ATR] vowels (/a, aː/) are transparent to harmony between flanking non-low vowels.
iv. Low [+ATR] vowels (/ə, əː/) do not trigger [+ATR] harmony in low or non-low vowels and they block harmony between flanking non-low vowels.

3 ABC Analysis

The approach to Menominee vowel harmony that I pursue here employs ABC (Walker 2000a, b, 2001, Hansson 2001, 2010, Rose & Walker 2004). A key formal property underlying this analysis is that constraints enforcing surface correspondence are sensitive to featural identity, including specific values of features. This restricts interacting vowels to those that are identical along some dimension, namely, vowels that are [-low] or those that are [+ATR]. The principal aims for this analysis are characterizing the basis for the sets of vowels that pattern together and making concrete the formal mechanisms that give rise to different behaviors.

Although the originating studies for ABC focused on consonant harmony, an ABC approach has since been applied to patterns of vowel harmony (Hansson 2006a, Sasa 2009, Walker 2009, 2015, Rhodes 2012, Bowman & Lokshin 2014)[6] and tone assimilation across vowels (Shih & Inkelas 2014a, to appear), as well as a variety of other patterns (Shih & Inkelas 2014b). Originating ABC studies focused on harmonizing segments and transparent segments; however, the approach also predicts blocking effects (Hansson 2007, Rhodes 2008, 2012, Sasa 2009, Shih 2013). The ABC analysis of Menominee's harmony developed here revises and substantially elaborates on the account originally sketched in Walker 2009. Explication of the workings of the analysis and its generalized structure are wholly new here, and this account provides new constraint definitions and some new rankings.

3.1 Theoretical background and preview

An ABC analysis of harmony employs three basic types of constraints. Schematic versions are given in (24–26).

(24) CORR-XX[αF]
Let X_1 and X_2 be segments that belong to the same output and are both specified [αF]. If X_1 and X_2 are not in correspondence with each other, assign a violation.

(25) IDENT-XX[αF]
Let X_1 and X_2 be a pair of segments that are in correspondence with each other in the same output and that are chain-adjacent. If X_1 is [αF] and X_2 is [-αF], assign a violation.

(26) IDENT-IO[αF]
Let X be a segment in the input and Y be a correspondent of X in the output. If X is [αF] and Y is [-αF], assign a violation.

In the above constraints, [F] represents a binary feature.[7] I assume that these constraints may be restricted to a particular feature value α, specified as "+" or "–". The constraints in (24–25) are applicable to surface correspondence relations. CORR-XX[αF] enforces a surface correspondence relation between two segments that both have a given value α for [F], that is, two segments that are minimally similar along the dimension of the named feature and value. The format of this constraint definition follows Bennett (2013, 2015a, b) in some particulars. The next constraint, IDENT-XX[αF], enforces identity for [F] between two corresponding segments in an output when a correspondent is specified [αF]. In the definition of the IDENT constraints here, -α is taken to be the opposite feature value of [α], that is, if α is "+", -α is "–", and if α is "–", -α is "+". IDENT-XX is evaluated over chain-adjacent corresponding pairs; the correspondence chain is discussed below. In the next section, a version of IDENT-XX is introduced that is sensitive to precedence.

[6] Apart from ABC, vowel harmony has been extensively analyzed using identity constraints enforced over vowels in the output (Baković 2000, Krämer 2003). In addition, Syntagmatic Correspondence Theory (Krämer 2003) posits surface correspondence relations among segments. However, in that approach, surface correspondence is assumed rather than being enforced by violable constraints. A focus of the account here is the role of featural identity in coercing surface correspondence relations, as in ABC. I discuss alternatives in section 4.

[7] For an alternative formulation of IDENT constraints applicable to privative features, see Pater (1999).

IDENT-IO[αF], in (26), is familiar from the original Correspondence Theory proposal, defined here in a feature-value specific form (McCarthy & Prince 1995). For simplicity, where identity for each value of a feature is not differently enforced, I will use IDENT-IO[F] (or IDENT-XX[F], as appropriate), which could be interpreted as ranking IDENT constraints for [+F] and [-F] at the same place in the hierarchy.

As a shorthand for CORR constraints that operate over vowels only (i.e. specified [+vocalic], distinct from consonantal glides, after Padgett 2008), I will use the constraint name, CORR-VV[αF], following the practice of previous studies, and I will use IDENT-VV[αF] here to refer to the constraints that operate over surface-correspondence strings (though nothing explicitly limits IDENT-VV to vowels only). The core constraint ranking schema for vowel harmony in ABC is given in (27). IO-faithfulness is dominated both by the constraint that drives surface correspondence between vowels and the constraint that enforces featural identity between surface-corresponding segments. For clarity, a second feature variable, [G], is introduced in (27), because the feature specification(s) ([αF]) that give rise to surface correspondence, as enforced by CORR-VV, are generally different from those feature(s) ([G]) for which harmony is enforced. In addition, β and γ are introduced as furthur feature-value variables in this schema to indicate that the constraints are not all restricted to the same value.

(27) CORR-VV[αF], IDENT-VV[βG] >> IDENT-IO[γG]

Following Hansson (2006b, 2007), I assume that IDENT-XX[F] constraints are evaluated over segments that are adjacent in a surface correspondence chain. Krämer (2003) makes a similar claim in the context of Syntagmatic Correspondence Theory. A surface correspondence chain consists of an exhaustive sequence of segments that stand in a surface correspondence relation with one another in an output. Thus, in a chain of surface-corresponding vowels [… $V1_a$ … $V2_a$ … $V3_a$ …], where alphabetic coindexation ("a", "b", etc.) indicates surface correspondence, IDENT-VV[G] will enforce identity for [G] only between [V1, V2] and [V2, V3]. It will not evaluate identity of non-adjacent pairs in the chain, namely, [V1, V3]. Hansson has argued that this local evaluation of IDENT-XX constraints prevents unwanted typological predictions that arise under global evaluation across adjacent and non-adjacent pairs, such as majority rule effects.[8]

In preview, four configurations of surface (non-)correspondence will be discussed in the analysis of Menominee harmony.

(28) Height-parasitic harmony: Non-low vowels

[tu̲ːhku̲pi̲ahnəw] 'he walks with buttocks spread'

Input			Output			
/…V1…V2…V3…/			[…$V1_a$…$V2_a$…$V3_a$…]			
[-A]	[-A]	[+A]	**[+A]**	**[+A]**	**[+A]**	"[A]" = [ATR]
ʊː	ʊ	i	**uː**	**u**	**i**	

(29) Blocking by correspondence (BBC): Low [+ATR] vowels

[pɪ̲ːhtə̲hki̲ːʔtaw] 'he sticks his head in'

Input			Output		
/…V1…V2…V3…/			[…$V1_b$…$V2_a$…$V3_a$…]		
[-A]	[+A]	[+A]	[-A]	**[+A]**	**[+A]**
ɪː	ə	iː	ɪː	**ə**	**iː**

[8] Rhodes (2012) argues that CORR-XX constraints should also be evaluated in a type of local relation to avoid unwanted typological predictions. The definition in (24) could be modified to incorporate his proposal. However, this issue is at the periphery of the topics under focus of this paper.

(30) Transparency by lack of correspondence (TLC): Low [-ATR] vowels

[nici̲ːpa̲ːhki̲m] ‘cook (NOM)’

Input	Output
/…V1…V2…V3…/	[…V1ₐ…V2_b…V3ₐ…]
[-A] [-A] [+A]	**[+A]** [-A] **[+A]**
ɪː aː i	**iː** aː **i**

(31) Height-specific non-harmony: Low vowels

[tuːhkupia̲hnə̲w] ‘he walks with buttocks spread’

Input	Output
/…V1…V2 …/	[…V1_b…V2ₐ…]
[-A] [+A]	[-A] [+A]
a ə	a ə

The first configuration is for height-parasitic harmony, in (28), a classic ABC scenario of agreement among similar segments. The output here contains non-low vowels that are in the same surface correspondence chain. Through the activity of an IDENT-VV constraint, the rightmost [+ATR] vowel in this chain will trigger [+ATR] harmony in preceding vowels, with the potential to induce alternations for [ATR]. Corresponding and harmonizing vowels are bolded in the schematic illustration, and an applicable Menominee word displaying this pattern is given with the relevant vowel sequence underlined. The second configuration, in (29), is for Blocking by Correspondence (BBC). In this case, a low [+ATR] vowel intervenes between a non-low [+ATR] vowel, which is a potential harmony trigger, and a non-low [-ATR] vowel, which is a potential target. The low [+ATR] vowel corresponds with the potential trigger, because they show identity for [+ATR], but it does not correspond with the potential target, to which it is less similar. By terminating the correspondence chain, a low [+ATR] vowel blocks propagation of harmony beyond it. The third configuration, in (30), is for Transparency by Lack of Correspondence (TLC). Here a low [-ATR] vowel intervenes between a potential non-low trigger and target for harmony. Because the potential trigger and low vowel differ in height and [ATR] value, they do not correspond. This enables harmony between non-low vowels to operate across a low [-ATR] vowel. Finally, the fourth configuration, in (31), is height-specific non-harmony. Here, a sequence of low vowels that differ in value for [ATR] do not correspond, with the result that [+ATR] harmony does not operate between them.

In sequences of vowels with different heights, the key differences are that a low [+ATR] vowel blocks harmony because it is identical for [+ATR] with the non-low [+ATR] trigger, while a low [-ATR] vowel is transparent because it does not correspond with flanking non-low vowels. In the following sections I detail the constraint interactions that give rise to the surface correspondence configurations and the resulting vowel agreement patterns.

3.2 Height-parasitic harmony: [+ATR] harmony among non-low vowels

First, I address the core pattern of [+ATR] harmony among non-low vowels. The constraints in (32–34), pertaining to surface correspondence, are relevant for this system.

(32) CORR-VV[-low]
Let V_1 and V_2 be [+voc] segments that belong to the same output and are both specified [-low]. If V_1 and V_2 are not in correspondence with each other, assign a violation.

(33) IDENT-V_RV_L[+ATR]
Let V_R and V_L be a pair of segments that are in correspondence with each other in the same output and that are chain-adjacent, where V_R follows V_L in the sequence of output segments. If V_R is [+ATR] and V_L is [-ATR], assign a violation.

(34) IDENT-V_LV_R[+ATR]
Let V_L and V_R be a pair of segments that are in correspondence with each other in the same output and that are chain-adjacent, where V_L precedes V_R in the sequence of output segments. If V_L is [+ATR] and V_R is [-ATR], assign a violation.

CORR-VV[-low] will enforce correspondence between non-low vowels within a word, while IDENT-VV[+ATR] will drive [+ATR] harmony between corresponding segments. Directional versions of this constraint are defined in (33–34) (Rose & Walker 2004). IDENT-V_RV_L[+ATR] promotes regressive [+ATR] harmony and IDENT-V_LV_R[+ATR] promotes progressive [+ATR] harmony. Since harmony is only regressive in Menominee, IDENT-V_RV_L[+ATR] will be the IDENT-XX harmony-driver for this system.

IDENT-IO constraints for [ATR] will also be relevant. These are defined in (35–36) following the schema provided in (26).

(35) IDENT-IO[+ATR]
Let X be a segment in the input and Y be a correspondent of X in the output. If X is [+ATR] and Y is [-ATR], assign a violation.

(36) IDENT-IO[-ATR]
Let X be a segment in the input and Y be a correspondent of X in the output. If X is [-ATR] and Y is [+ATR], assign a violation.

In conformity with the ranking schema in (27), CORR-VV[-low] and IDENT-V_RV_L[+ATR] will dominate IDENT-IO[-ATR], as illustrated in (37). IDENT-IO[+ATR] will also be ranked over IDENT-IO[-ATR] to guarantee retention of [+ATR] in the trigger vowel. To facilitate demonstration of constraint interaction in this tableau, candidates are reduced to just the two underlined vowels in [aːtəʔnu̲ː̲hku̲wəw] ‘he tells him a sacred story’. The first of these two vowels is [-ATR] in the input.

(37) [aːtəʔnu̲ː̲hku̲wəw] ‘he tells him a sacred story’

/… ʊː • u …/	IDENT-IO [+ATR]	CORR-VV [-low]	IDENT-V_RV_L[+ATR]	IDENT-IO [-ATR]
→ a. $uː_a$ • u_a				1
b. $ʊː_a$ • u_a			1W	L
c. $ʊː_b$ • u_a		1W		L
d. $ʊː_a$ • $ʊ_a$	1W			L

In (37), candidate (a) is the winner, where the non-low vowels correspond and regressive [+ATR] harmony is enforced between them, at the cost of IDENT-IO[-ATR]. Competing non-harmonizing candidates either have corresponding non-low vowels that violate IDENT-V_RV_L[+ATR], as in (37b), or their non-low vowels do not correspond, violating CORR-VV[-low], as in (37c). Candidate (d) shows progressive [-ATR] harmony, which violates IDENT-IO[+ATR].

[+ATR] harmony is regressive only. In contexts where harmony is not exhibited in a sequence of non-low vowels, ambiguity can arise about surface correspondence relations in the output. In one option, the non-harmonizing vowels are in surface correspondence but violate IDENT-VV[αF], as in [$V_{[+ATR]a}$ • $V_{[-ATR]a}$]. In a second option, the non-harmonizing vowels do not correspond, violating CORR-VV, as in

[$V_{[+ATR]b}$ • $V_{[-ATR]a}$]. Both sequences would be pronounced the same. I will make the simplifying assumption that the first option is optimal. This means that surface correspondence among non-low vowels – owing to CORR-VV[-low] – will be enforced, even at the cost of IDENT-VV for [ATR]. The absence of progressive harmony for [+ATR] will then result from ranking IDENT-IO[-ATR] over IDENT-V_LV_R[+ATR], as shown in (38). Again, for expositional reasons, candidates are reduced in this tableau to the two underlined vowels, here for the word [nu̲ːkɪ̲ːsɪk] 'Mid Sky' (man's name).

(38) [nu̲ːkɪ̲ːsɪk] 'Mid Sky' (man's name)

/… uː • ɪː …/	IDENT-IO [+ATR]	CORR-VV [-low]	IDENT-V_RV_L[+ATR]	IDENT-IO [-ATR]	IDENT-V_LV_R[+ATR]
→ a. $uː_a$ • $ɪː_a$					1
b. $uː_a$ • $iː_a$				1W	L
c. $uː_b$ • $ɪː_a$		1W			L

In (38) the winner is candidate (a), where the non-low vowels correspond but do not show progressive [+ATR] harmony, violating IDENT-V_LV_R[+ATR]. Candidate (b), with progressive [+ATR] harmony is ruled out by IDENT-IO[-ATR], and CORR-VV[-low] rules out (c), where the vowels do not correspond.

The absence of [-ATR] harmony comes about under the ranking of IDENT-IO[+ATR] >> IDENT-IO[-ATR] (supported in (37)). IDENT-VV[-ATR] is also relevant in corresponding pairs containing a [-ATR] vowel. IDENT-VV[-ATR] is dominated by IDENT-IO[+ATR], CORR-VV[-low] and IDENT-IO[-ATR], as shown in (39) for an input where a [+ATR] non-low vowel precedes a [-ATR] non-low vowel (same as in (38)). IDENT-IO[-ATR] eliminates progressive [+ATR] harmony as a solution to satisfy IDENT-VV[-ATR], as in (33d). CORR-VV[-low] rules out (39c), which lacks the assumed surface correspondence between non-low vowels, and IDENT-IO[+ATR] eliminates (39b), where harmony for [-ATR] is witnessed in surface-corresponding vowels. Since unidirectionality is not involved here, bidirectional IDENT-VV[-ATR] is assumed.[9]

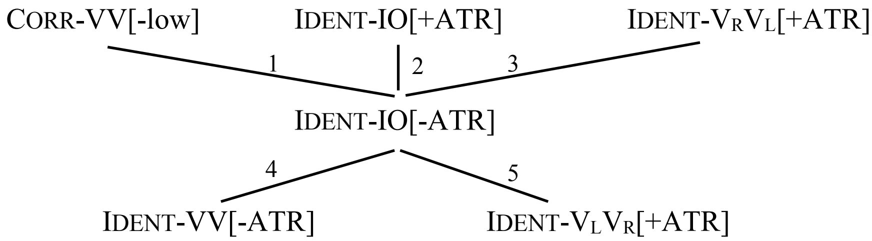
(39) [nu̲ːkɪ̲ːsɪk] 'Mid Sky' (man's name)

/… uː • ɪː …/	IDENT-IO[+ATR]	CORR-VV[-low]	IDENT-IO[-ATR]	IDENT-VV[-ATR]
→ a. $uː_a$ • $ɪː_a$				1
b. $ʊː_a$ • $ɪː_a$	1W			L
c. $uː_b$ • $ɪː_a$		1W		L
d. $uː_a$ • $iː_a$			1W	L

A Hasse diagram summarizing the constraint rankings established in this section is given in (40). Each ranking is indexed to a supporting winner-loser pair from the above tableaux.

[9] Alternatively, bidirectional effects could be obtained by ranking two unidirectional constraints in the same tier.

(40) Ranking summary for height-parasitic [+ATR] harmony among non-low vowels



1. (37a) ≻ (37c)
   uː$_a$ • u$_a$ ≻ ʊː$_b$ • u$_a$
2. (37a) ≻ (37d)
   uː$_a$ • u$_a$ ≻ ʊː$_a$ • ʊ$_a$
3. (37a) ≻ (37b)
   uː$_a$ • u$_a$ ≻ ʊː$_a$ • u$_a$
4. (39a) ≻ (39d)
   uː$_a$ • ɪː$_a$ ≻ uː$_a$ • iː$_a$
5. (38a) ≻ (38b)
   uː$_a$ • ɪː$_a$ ≻ uː$_a$ • iː$_a$

3.3 BBC: Blocking low vowels

Next, I discuss rankings relevant for vowels that block regressive [+ATR] harmony from a non-low vowel. Within the hierarchy in (40), the ranking IDENT-IO[+ATR], IDENT-V$_R$V$_L$[+ATR] >> IDENT-IO[-ATR] will enforce regressive [+ATR] harmony in sequences of corresponding vowels that contain a [+ATR] vowel. This means that where harmony is blocked, a non-harmonizing [-ATR] vowel is not in correspondence with a following [+ATR] vowel.

In the BBC account proposed here, [+ATR] low vowels are in surface correspondence with a non-low [+ATR] harmony trigger. However, [+ATR] low vowels are not in correspondence with a preceding non-low vowel, which prevents harmony from propagating beyond them. The BBC configuration from (29) is recapitulated in (41). Under this analysis, blockers of harmony are actually a kind of *icy target* (Jurgec 2011a), where a vowel participates in harmony but "freezes" propagation to targets beyond it.[10] Previous work on icy targets has focused on segments that potentially alternate in harmony but fail to propagate the harmonizing feature (Jurgec 2011a, b). However, in this instance, the icy target bears the harmonizing feature underlyingly and does not violate IO faithfulness. The aim of constraint rankings discussed in this section is to generate a surface correspondence chain like that in (41), leaving it to the previously established ranking to enforce [+ATR] harmony from a [+ATR] vowel to any corresponding vowels that precede it.

(41) Blocking by Correspondence: Low [+ATR] vowels

Input			Output		
/…V1$_{[-low]}$ •	V2$_{[+low]}$ •	V3$_{[-low]}$…/	[…V1$_{[-low]b}$ •	V2$_{[+low]a}$ •	V3$_{[-low]a}$…]
[-A]	[+A]	[+A]	[-A]	**[+A]**	**[+A]**
ɪː	ə	iː	ɪː	**ə**	**iː**

Obtaining the BBC configuration involves two additional constraints: CORR-VV[+ATR] and IDENT-VV[low]. CORR-VV[+ATR] drives correspondence between any pair of [+ATR] vowels, as defined in (42). In the context of BBC, this constraint will instigate correspondence between a non-low [+ATR] trigger and low [+ATR] vowel. IDENT-VV[low] functions as a *limiter* of surface correspondence (Bennett 2013, 2015a, b), by penalizing corresponding segments that differ in their value for [low]. This constraint will be ranked so as to prevent a correspondence chain that contains [ə(ː)] adjacent to a non-low [-ATR]

[10] Low [+ATR] vowels are analyzed as sharing [+ATR] with a non-low trigger, due to the OCP, in the account of Archangeli & Pulleyblank (1994). This feature sharing is also derived in the account of Archangeli & Suzuki (1995), due to best satisfaction of an ALIGN constraint. In this respect, low [+ATR] vowels could be considered an icy target in those analyses.

vowel. For simplicity, in (43) it is defined without a specific value for [low]. As mentioned in section 3.1, it could alternatively be defined as two separate constraints, IDENT-VV[+low] and IDENT-VV[-low]. IDENT-IO[low], in (44), will also be employed to rule out an alternative candidate that alters height.

(42) CORR-VV[+ATR]
Let V_1 and V_2 be [+voc] segments that belong to the same output and are both specified [+ATR]. If V_1 and V_2 are not in correspondence with each other, assign a violation.

(43) IDENT-VV[low]
Let V_1 and V_2 be a pair of segments that are in correspondence with each other in the same output and that are chain-adjacent. If V_1 is [αlow] and V_2 is [-αlow], assign a violation.

(44) IDENT-IO[low]
Let X be a segment in the input, and Y be a correspondent of X in the output. If X is [αlow] and Y is [-αlow], assign a violation.

The activity of these constraints in deriving the BBC pattern is shown in (45), for the sequence of underlined vowels in [pɪːhtəhkiːʔtaw] 'he sticks his head in'. The aim of the rankings here is to cause vowels that differ in height to correspond only if they are both underlying [+ATR]. The logic is as follows, with discussion of specific candidates below. First, IDENT-IO[+ATR] and IDENT-IO[low] are ranked in the top tier to prevent changes to a [+ATR] specification or height. CORR-VV[+ATR] dominates IDENT-VV[low] to compel a non-low [+ATR] vowel to correspond with [ə(ː)]. IDENT-VV[low] in turn dominates CORR-VV[-low] to otherwise block correspondence between [ə(ː)] and a non-low vowel even if this inhibits correspondence between flanking non-low vowels. The primary constraint interactions of interest for BBC are in the highlighted region, involving the first three candidates. Note that the previously established ranking IDENT-V_RV_L[+ATR] >> IDENT-IO[-ATR] will rule out candidates where a [+ATR] vowel is preceded by a [-ATR] vowel in the same correspondence chain, so they are not considered here; all candidates shown in (45) obey IDENT-V_RV_L[+ATR].

(45) [pɪːhtəhkiːʔtaw] 'he sticks his head in'

/… ɪː • ə • iː …/	IDENT-IO [+ATR]	IDENT-IO [low]	CORR-VV [+ATR]	IDENT-VV [low]	CORR-VV [-low]
→ a. ɪː$_b$ • ə$_a$ • iː$_a$				1	1
b. iː$_a$ • ə$_a$ • iː$_a$				2W	L
c. iː$_a$ • ə$_b$ • iː$_a$			2W	L	L
d. iː$_a$ • i$_a$ • iː$_a$		1W		L	L
e. iː$_a$ • a$_b$ • iː$_a$	1W			L	L

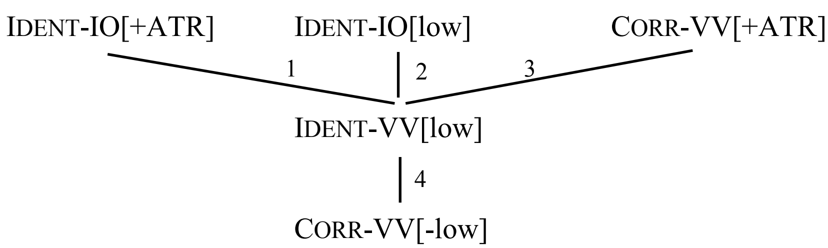
In the winning candidate, in (45a), [+ATR] harmony halts at /ə/ and does not reach the preceding non-low vowel. Here, the two vowels that are underlyingly [+ATR] are in surface correspondence in the output, despite being of different height. This earns a violation of IDENT-VV[low]. Furthermore, the non-low vowels flanking [ə] do not correspond, violating CORR-VV[-low]. Competing candidates in (45b-c) both show [+ATR] harmony that affects the first non-low vowel. The candidate in (45b) forms a correspondence chain that includes all three vowels. This option fails, because it incurs an extra violation of IDENT-VV[low], due to correspondence between the first non-low vowel and [ə]. In (45c), a surface correspondence chain is formed between the two non-low vowels, skipping intervening [ə]. However, excluding [ə] from the surface correspondence chain earns fatal violations of CORR-VV[+ATR]. Finally, candidates (d-e), which change the specifications of /ə/ to [-low] or [-ATR] are ruled out by IO-faithfulness constraints.

A conceivable alternative output would create two distinct surface correspondence chains that both contain the underlying non-low [+ATR] vowel, as in […iː$_b$ • ə$_a$ • iː$_{a,b}$…]. While this candidate would incur only a single violation of IDENT-VV[low], it would lose to (45a) by virtue of a violation of CORR-VV[+ATR], because the first two vowels do not correspond. Furthermore, it is doubtful that such a correspondence configuration is even viable. Bennett (2013, 2015a, b) has proposed that surface correspondence relations are transitive. Correspondence of the third vowel with each of the others would thus imply a correspondence relation between the first two vowels so that […iː$_b$ • ə$_a$ • iː$_{a,b}$…] would actually have the same surface correspondence relations as (45b).

To review, in BBC, /ə/ patterns as a non-alternating icy target in [+ATR] harmony. The reason for this is two-fold. First, surface correspondence among [+ATR] vowels is prioritized over correspondence among [-low] vowels. This favors correspondence between [… ə … iː …] over [… ɪː … iː …]. Second, the surface correspondence limiter, IDENT-VV[low], prevents correspondence between [ə] and a chain-adjacent non-low vowel, except when mandated by both vowels being [+ATR]. As a result, an input sequence /… ɪː • ə …/ will remain as such in the output, without surface correspondence between the vowels, and thus, without [ə] propagating [+ATR] harmony. This configuration, where a vowel blocks harmony because it bears the harmonizing feature and corresponds with a trigger but not a target, parallels that proposed by Rhodes (2008, 2012) for blocking in Khalkha Mongolian round harmony.

The constraint rankings established in this section to obtain the surface correspondence relations needed for BBC are given in (46), together with associated supporting winner/loser pairs.

(46) Ranking summary for BBC: Low [+ATR] vowels



1. (45a) ≻ (45e)	2. (45a) ≻ (45d)	3. (45a) ≻ (45c)	4. (45a) ≻ (45b)
ɪː$_b$ • ə$_a$ • iː$_a$ ≻ iː$_a$ • a$_b$ • iː$_a$	ɪː$_b$ • ə$_a$ • iː$_a$ ≻ iː$_a$ • i$_a$ • iː$_a$	ɪː$_b$ • ə$_a$ • iː$_a$ ≻ iː$_a$ • ə$_b$ • iː$_a$	ɪː$_b$ • ə$_a$ • iː$_a$ ≻ iː$_a$ • ə$_a$ • iː$_a$

3.4 TLC: Transparent low vowels

I turn now to transparent vowels. Low [-ATR] vowels are transparent to [+ATR] harmony among non-low vowels. In ABC, transparent segments do not correspond with potential triggers or targets. This TLC configuration arises when the class of transparent segments lack featural identity with triggers and targets along some dimension, causing them to fall outside the scope of the CORR-VV[αF] constraints that are enforced in the system. The aim of the constraint rankings discussed in this section is to generate a surface correspondence chain like that in (47), where non-low vowels are in surface correspondence to the exclusion of an intervening low [-ATR] vowel.

(47) Transparency by Lack of Correspondence: Low [-ATR] vowels

Input			Output		
/…V1$_{[\text{-low}]}$ •	V2$_{[\text{+low}]}$ •	V3$_{[\text{-low}]}$…/	[…V1$_{[\text{-low}]\text{a}}$ •	V2$_{[\text{+low}]\text{b}}$ •	V3$_{[\text{-low}]\text{a}}$…]
[-A]	[-A]	[+A]	**[+A]**	[-A]	**[+A]**
ɪː	a	i	**iː**	a	**i**

Non-low [+ATR] vowels and low [-ATR] vowels differ at least in their values for [low] and [ATR]. They are thus not impacted by CORR-VV[+ATR] and CORR-VV[-low], which are the CORR constraints identified as active in Menominee's [+ATR] harmony.

The desired output violates IDENT-IO[-ATR], as in /ɪː/ → [iː] in (47). It also violates CORR-VV, the constraint that requires correspondence between any [+vocalic] segments, because [a] does not correspond with flanking non-low vowels. The previously established ranking CORR-VV[-low], IDENT-V$_R$V$_L$[+ATR] >> IDENT-IO[-ATR] will drive surface correspondence and harmony between non-low vowels. The transparency of [a(ː)] is achieved by adding IDENT-VV[low] >> CORR-VV, which inhibits surface correspondence between non-low [+ATR] vowels and [a(ː)].

These rankings are illustrated in (48) with the sequence of underlined vowels in [niciːpaːhkim] 'cook (NOM)'. This tableau reflects previously determined IDENT-VV[low] >> CORR-VV[-low] (from (45)).

(48) [niciːpaːhkim] 'cook (NOM)'

/… ɪː • aː • i …/	IDENT-V$_R$V$_L$ [+ATR]	IDENT-IO [+ATR]	IDENT-VV [low]	CORR-VV [-low]	CORR-VV	IDENT-IO [-ATR]
→ a. iː$_a$ • aː$_b$ • i$_a$					2	1
b. iː$_a$ • əː$_a$ • i$_a$			2W		L	2W
c. ɪː$_c$ • aː$_b$ • i$_a$				1W	3W[11]	L
d. ɪː$_a$ • aː$_b$ • ɪ$_a$		1W			2	L
e. ɪː$_a$ • aː$_a$ • i$_a$	1W		2W		L	L
f. ɪː$_b$ • aː$_b$ • i$_a$			1W	1W	2	L

The constraint interactions of primary interest are highlighted in (48), involving the elimination of candidates (b–c). The input contains a low [-ATR] vowel that is followed by a non-low potential trigger for [+ATR] harmony and preceded by a non-low potential target. In the winner, in (48a), the two non-low vowels belong to the same correspondence chain to the exclusion of intervening [aː]. This correspondence chain satisfies CORR-VV[-low], but it violates CORR-VV twice. Harmony affecting the first non-low vowel incurs a violation of IDENT-IO[-ATR]. In the competing candidate in (48b), all vowels are in surface correspondence, satisfying CORR-VV but violating IDENT-VV[low] twice for correspondence between [ə] and each of the non-low vowels. In this form, [+ATR] harmony affects the first two vowels, which incurs two violations of IDENT-IO[-ATR].[12] The remaining candidates in (48) do not show [+ATR] harmony. These are ruled out by constraints that dominate IDENT-IO[-ATR]. In (48c), none of the vowels correspond with each other. The lack of correspondence between the two non-low vowels in this candidate is ruled out

[11] If CORR-VV were evaluated locally according to the method that Rhodes (2012: 165) proposes, candidate (c) would incur only two violations of this constraint. In that case, the tableau in (48) would provided further support for CORR-VV[-low] >> IDENT-IO[-ATR], a ranking already established in (37).

[12] Either IDENT-VV[low] or IDENT-IO[-ATR] could be ranked above CORR-VV to rule out (48b). However, IDENT-VV[low] dominates IDENT-IO[-ATR] (by transitivity), so IDENT-VV[low] would still dominate CORR-VV under either scenario.

by CORR-VV[-low] >> IDENT-IO[-ATR], a ranking already supported in section 3.2. Though CORR-VV could be ranked over IDENT-IO[-ATR] to eliminate (48c), it is not necessary to posit this additional ranking.

Candidates (48d-f) are ruled out by a violation of IDENT-VV[low] or higher-ranked constraints. Candidate (d) establishes surface correspondence between the two non-low vowels, but it shows progressive [-ATR] harmony, violating IDENT-IO[+ATR]. In (48e), all vowels belong to the same surface correspondence chain, but regressive [+ATR] harmony is not enforced between [i] and its closest preceding correspondent [aː], incurring a violation of IDENT-V_RV_L[+ATR]. Candidate (f) incurs a violation of IDENT-VV[low] by containing a correspondence chain that includes a low vowel and a non-low vowel.

The TLC configuration in Menominee supports a single additional constraint ranking beyond what has already been established: IDENT-VV[low] >> CORR-VV. Two key rankings relevant for the first three candidates of (48) are shown in (49) with associated winner/loser pairs. The combined effect in the analysis is to mandate surface correspondence between non-low vowels but inhibit it among vowels that differ for [low] and [+ATR].

(49) Core rankings for TLC: Low [-ATR] vowels

IDENT-VV[low]	CORR-VV[-low]
| 1	| 2
CORR-VV	IDENT-IO[-ATR]

1. (48a) ≻ (48b) iː$_a$ • aː$_b$ • i$_a$ ≻ iː$_a$ • əː$_a$ • i$_a$

2. (48a) ≻ (48c) iː$_a$ • aː$_b$ • i$_a$ ≻ ɪː$_c$ • aː$_b$ • i$_a$

3.5 Height-specific non-harmony: No [+ATR] harmony among low vowels

The final component of the [+ATR] harmony pattern is that it does not operate among low vowels. This is handled by ranking IDENT-IO[-ATR] over CORR-VV[+low], which will prevent surface correspondence between [ə(ː)] and a preceding [a(ː)]. A tableau supporting this ranking is given in (50).

(50) [tuːhkupiahnəw] 'he walks with buttocks spread'

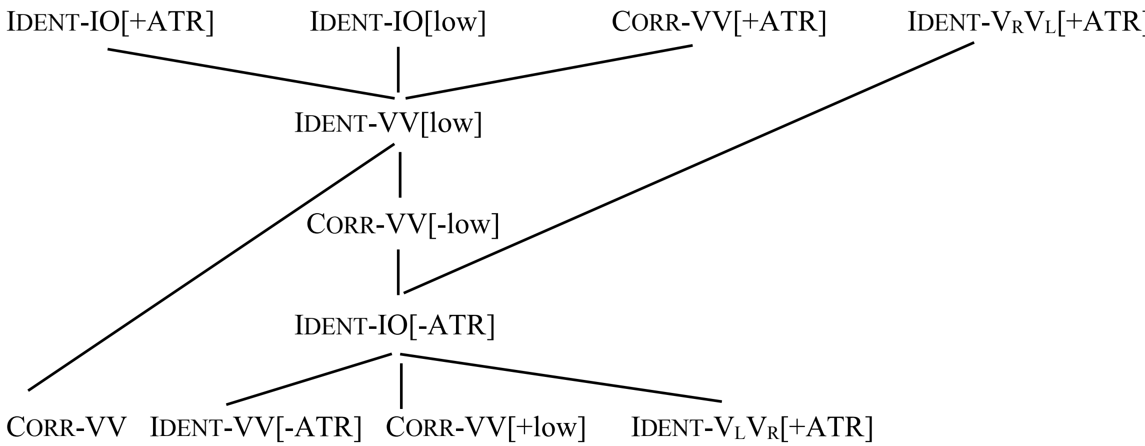
/… a • ə …/	IDENT-IO[-ATR]	CORR-VV[+low]
→ a. a$_b$ • ə$_a$		1
b. ə$_a$ • ə$_a$	1W	L

Alternative candidates in which /ə/ becomes [a] or the two non-low vowels are in surface correspondence but do not show [+ATR] harmony are ruled out by higher-ranked constraints, IDENT-IO[+ATR] and IDENT-V_RV_L[+ATR], respectively.

3.6 Summary

A Hasse diagram that combines the rankings discussed in the preceding sections is given in (51).

(51) Combined ranking for Menominee [+ATR] harmony



To review, the primary claims made in this account are that surface correspondence configurations shape vowel participation in the [+ATR] harmony of Menominee, and these configurations are sensitive to feature identity, including specific feature values. In this pattern, the vowels that alternate in harmony are non-low. This interaction is obtained by CORR-VV[-low], which forms the basis for height-parasitic [+ATR] harmony in ABC. However, [+ATR] harmony does not occur in the low height tier. CORR-VV[+low] is therefore dominated by IDENT-IO[-ATR] to yield non-harmony among low vowels.

Low vowels show different behaviors in harmony, depending on their value for [ATR]. Low [-ATR] vowels do not share featural identity with non-low vowels for any actively enforced CORR constraint in the system ([+ATR], [-low]). They therefore do not correspond with non-low vowels and behave transparent to harmony.

Blocking in Menominee [+ATR] harmony involves the most complex interaction. Low [+ATR] vowels that are flanked by non-low vowels block harmony from reaching a [-ATR] target. This behavior arises because low [+ATR] vowels are in surface correspondence with non-low [+ATR] triggers, due to their identity for [+ATR], but they do not correspond with non-low targets that are underlyingly [-ATR]. The limiter constraint IDENT-VV[low] interacts with other constraints to inhibit alternation-inducing harmony among vowels that differ in height. This causes low [+ATR] vowels to terminate a surface correspondence chain for [+ATR] vowels, in a BBC configuration.

The ranking structure for this system gives rise to the relationships between harmony behavior and featural similarity to triggers outlined in (52), both specific to Menominee and generalized. The feature specifications characterized here refer to underlying representations.[13]

(52) Underlying specifications: Harmony for [αF] parasitic on [βG]

	Schematic		*Menominee*	
	[αF]	[βG]	[αF]: [+ATR]	[βG]: [-low]
Originating trigger	✓	✓	[+ATR] ✓	[-low] ✓
Alternating target	✗	✓	[-ATR] ✗	[-low] ✓
Icy target	✓	✗	[+ATR] ✓	[+low] ✗
Transparent segment	✗	✗	[-ATR] ✗	[+low] ✗

As sketched in (52), in the ABC model of harmony for [αF] parasitic on [βG] with transparent segments and icy targets, the possible combinations of values for [F] and [G] result in four categories of segment behavior, each with a particular relationship of feature (non-)identity to triggers. Where a check is

[13] It is also possible for these feature specifications to be not underlying but derived independent of the harmony system.

marked in a table cell, the segment type in question is identical to a trigger for the indicated feature; otherwise an "X" is marked. Originating triggers form one category; these segments are underlyingly [αF] and [βG]. In Menominee, [αF] is [+ATR] and [βG] is [-low]. Alternating targets are identical to triggers along the parasitic dimension [βG], but they differ underlyingly in value for [F].[14] Icy targets and transparent vowels are both [-βG], distinguishing them from triggers and alternating targets along the parasitic dimension. In Menominee, these segments are the class of [+low] vowels. Icy targets are identical to triggers for [αF], while transparent segments differ from triggers in values for both [F] and [G].

4 Alternatives

4.1 Feature identity in harmony

I next consider the role of feature identity in harmony in connection with two alternative approaches. The first replaces CORR constraints with a MAX-XX constraint that does not reference feature identity. The second is an approach to icy targets that is not sensitive to feature identity, for which I discuss a different prediction from the BBC account.

4.1.1 A correspondence driver without feature identity

The structure of the surface correspondence relations among vowels with different behaviors in Menominee harmony has implications for the formalism of constraints that drive correspondence. To differentiate icy targets and transparent vowels within the class of low vowels, the account developed here relies on feature-value specific CORR-XX constraints. This departs from a proposal that CORR constraints be replaced with a MAX formalism without reference to feature identity (McCarthy 2010). In the MAX-XX formalism, all segments in the output are required to be in surface correspondence with each other, and a penalty is assigned to every pair of segments that do not correspond (following specifics elaborated by Shih 2013). IDENT-IO and IDENT-XX constraints limit the effects of MAX-XX (cf. Walker 2015). IDENT-XX punishes surface-corresponding segments that are not featurally identical, and IDENT-IO punishes segments that change their feature values from the input, which is a means of satisfying IDENT-XX among surface-corresponding segments. McCarthy (2010) points out that a difference between the MAX and CORR approaches to surface correspondence is that CORR constraints may be feature-value specific, but MAX-XX does not have this capacity. In other words, through its interactions with IDENT-IO and IDENT-XX constraints, MAX-XX can drive correspondence between segments that agree in [F], but it cannot directly dictate correspondence only between segments that agree in a specific value for [F].

McCarthy's examination of this issue focuses on consonant harmony, with a consonant-centered version of the MAX constraint, MAX-CC. However, the expansion of ABC beyond consonants alone opens up the empirical domain. In this regard, Menominee's parasitic harmony with blocking and transparency offers a new kind of configuration for testing feature-value specific surface correspondence. The behavior of low vowels, which remain faithful, depends on their value for [ATR]: [+ATR] /ə(ː)/ blocks harmony as an icy target by corresponding with a trigger, while [-ATR] /a(ː)/ is transparent by not corresponding with a trigger. In the feature-value specific analysis, this difference is achieved by the ranking CORR-VV(+ATR) >> IDENT-VV[low] >> CORR-VV ((45) and (48), which enforces harmony between a trigger /i(ː)/ and [+ATR] /ə(ː)/ but not [-ATR] /a(ː)/.

In the MAX-XX approach, surface correspondence is expected to be enforced with equal priority over both values of a feature. Capturing transparent /a(ː)/ and icy target /ə(ː)/ in the same system presents a challenge, as illustrated in (53). The ranking here is constructed as follows. First, because harmony causes

[14] Note that an alternating target could become a derived trigger for another target further down the line in the correspondence chain based on its acquired surface [αF] specification.

[-ATR] vowels to become [+ATR], IDENT-IO[-ATR] is dominated by MAX-XX. IDENT-IO[+ATR] is assumed to be in the top tier and only candidates respecting it are shown. An IDENT-XX constraint that dominates MAX-XX is capable of inhibiting correspondence between transparent /aː/ and trigger /i/. In (53), two possible constraints are considered: IDENT-XX[low] and IDENT-XX[ATR]. IDENT-XX[low] rules out any candidates where a low vowel corresponds with a non-low vowel, enabling harmony to operate across /aː/, as in (53i-a). While this ranking is successful for /aː/, it yields the wrong result for /ə/, which is erroneously also predicted to be transparent. The unwanted selection of candidate (53ii-c) is indicated by "←". The ranking needed to select the desired winner, (53ii-a), requires IDENT-IO[-ATR] >> IDENT-XX[low]. However, this would cause unwanted selection of (53i-d), with blocking by /aː/.[15] IDENT-XX[ATR] does not resolve the problem; it is violated only by candidate (i-e).

(53) MAX-XX: Problem differentiating behavior among low vowels

Input	Candidate outputs	IDENT-XX [low]	IDENT-XX [ATR]	MAX-XX	IDENT-IO [-ATR]
i. /… ɪː • aː • i …/	→ a. iː$_{a}$ • aː$_{b}$ • i$_{a}$			2	1
	b. ɪː$_{b}$ • aː$_{b}$ • i$_{a}$	1W		2	L
	c. iː$_{a}$ • əː$_{a}$ • i$_{a}$	2W		L	2W
	d. ɪː$_{c}$ • aː$_{b}$ • i$_{a}$			3W	L
	e. ɪː$_{a}$ • aː$_{a}$ • i$_{a}$	2W	1W	L	L
ii. /… ɪː • ə • iː …/	→ a. ɪː$_{b}$ • ə$_{a}$ • iː$_{a}$	1		2	
	b. iː$_{a}$ • ə$_{a}$ • iː$_{a}$	2W		L	1W
	← c. iː$_{a}$ • ə$_{b}$ • iː$_{a}$	L		2	1W

The separation of low vowel behavior into [+ATR] icy targets versus [-ATR] transparent segments is problematic in (53) because MAX-XX does not directly enforce feature-value specific correspondence. McCarthy (2010: 9, footnote 5) notes the possibility of falling back on a feature-value specific constraint of MAX, a modification that Menominee seems to warrant. Along these lines, MAX-XX could be replaced with a constraint schema MAX-XX[αF], which would be violated by any segment specified [αF] that is not in surface correspondence. This would essentially match the CORR-XX[αF] formalism but emphasize a parallel with the function of MAX constraints. Whether another surface correspondence based solution for the Menominee pattern is possible and what complexities it would introduce into the theory remain to be seen. To be sure, the rich set of relationships between harmony behavior and feature identity in Menominee will make it an important case to consider in evaluating any proposals that depart from a feature-value specific version of constraints that enforce surface correspondence.

4.1.2 Feature identity and icy targets

In the analysis proposed here, feature identity plays a role both in conditioning parasitic harmony and blocking by an icy target. This predicts that a segment's role as an icy target could be sensitive to feature identity in its context, a topic that I turn to now.

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[15] McCarthy (2010) adopts IDENT-IO constraints that are relativized to a specified class of sounds defined by [G], expressed in a formalism IDENT-IO[F]/[G]. Non-low vowels alternate in [+ATR] harmony but not low vowels, which is consistent with a ranking IDENT-IO[-ATR]/[+low] >> MAX-XX >> IDENT-IO[-ATR]/[-low]. However, that will not solve the problem in (53), because only candidate (i-c) is violated by IDENT-IO[-ATR]/[+low]. This constraint does not discriminate between (53i-a) and (53i-d), both of which are faithful to /a/.

Parasitic harmony can be restricted to segments that are identical for either value of a binary feature [G], which I will refer to as a *dual-value* system, or it can be restricted to segments that are identical for a specific value of [G]. In Menominee, [+ATR] harmony is parasitic on a specific value: harmony operates among [-low] vowels but not among [+low] vowels.[16] [+ATR] harmony among [+low] vowels is blocked by the ranking IDENT-IO[-ATR] >> CORR-VV[+low] (see (50)). If this ranking were reversed, [+ATR] harmony would operate among vowels that are identical for either value for [low]. An example of a dual-value parasitic system is found in the well-known case of round harmony in the Yowlumne dialect of Yokuts. In Yowlumne, suffix vowels agree in rounding (and backness) with a stem vowel when the trigger and target are identical in height (Newman 1944, Kisseberth 1969, Kenstowicz & Kisseberth 1979).

Dual-value parasitic harmony is relevant to a prediction of the BBC account that a segment could potentially serve as an icy target for harmony from one kind of trigger but as a propagating target from another kind of trigger. For example, in a height-parasitic system of [+ATR] harmony, [ə] could be an icy target for harmony from a [+ATR] non-low vowel. IDENT-VV[low] would prevent it from propagating harmony to a non-low vowel that is underlyingly [-ATR], as in Menominee. However, [ə] could serve as a trigger and propagating target for [+ATR] harmony between low vowels in the same system. The latter is not the case in Menominee, but it is possible under a dual-value parasitic harmony with the opposite ranking of IDENT-IO[-ATR] and CORR-VV[+low] mentioned above. In this hypothetical pattern, the behavior of [ə] in harmony depends on its featural identity with a prospective target. If it has the same value for [low], it will trigger harmony, but if it differs in value for [low], it will not trigger an alternation.

This prediction contrasts with that of a head-based approach to icy targets in Binary Domains Theory, proposed by Jurgec (2011a, b). In Binary Domains Theory, segments to which features are associated function as heads or non-heads for that feature, but only a head can propagate feature spreading. In this approach, an icy target is analyzed as a non-head, which causes it to terminate spreading. This representation is achieved using head-sensitive featural markedness constraints, which prohibit a segment from being a head for [αF] when it is specified [βG]. In the head-based account, the status of a segment as an icy target is context independent, because it is attributed to a property of the segment on its own. This contrasts with the BBC analysis, where the status of a segment as an icy target is related to the feature identity relationship between the segment and a contextual prospective target to which it might propagate harmony.

Further research is needed to assess which of these approaches is better supported empirically. In a related vein, in patterns discussed by Jurgec (2011a, b), icy targets potentially exhibit alternations in harmony. These icy targets differ from the Menominee case, because the target is not necessarily already identical with the trigger for the harmonizing feature. In future work, it would be valuable to examine whether a treatment of alternating icy targets is available in the ABC approach.

4.2 Maximizing the Labor of Constraint Families

I focus next on what kinds of constraints enter into sequencing restrictions associated with vowel harmony. Two alternative approaches to the proposed ABC account are considered: (i) a surface correspondence approach where transparent segments correspond with triggers, and (ii) an analysis of Menominee harmony that employs sequential segmental markedness constraints. An advantage of the ABC account highlighted here is that diverse segment behaviors – harmony, transparency, and blocking – receive a unified explanation in terms of feature identity and correspondence, which aids in reducing the constraint families in Con. Maximal utilization of these constraint sets finds a parallel in Bennett's (2013, 2015a, b) proposal to extend them to dissimilation, and it resonates with a goal of research by Itô & Mester (1994, 1999) to consolidate a variety of segmental sequencing effects under established constraint families in OT.

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[16] This type of feature-value specificity is not necessarily a problem for MAX-XX if IDENT-IO constraints that are relativized to a specific class are adopted, as McCarthy (2010) proposes. The ranking IDENT-IO[-ATR]/[+low], IDENT-XX[ATR] >> MAX-XX >> IDENT-IO[-ATR]/[-low] would drive [-ATR] non-low vowels to alternate in [+ATR] harmony but not [-ATR] low vowels.

4.2.1 Transparency as Balance

Syntagmatic Correspondence Theory (Krämer 2003) offers a surface correspondence account of vowel harmony that is distinct from ABC. Like ABC, harmony in Syntagmatic Correspondence is achieved using IDENT[F] constraints that operate over corresponding segments in an output. A difference is that surface correspondence in ABC is enforced by violable constraints, while in Syntagmatic Correspondence Theory, surface correspondence among segments is assumed. This distinction has implications for the analysis of transparent segments. In ABC, transparent segments do not agree with a potential trigger because a surface correspondence relation does not exist between them. However, in Syntagmatic Correspondence, surface correspondence relations exist over all segments in the output, necessitating a different strategy to prevent transparent segments from undergoing or blocking harmony.

In Syntagmatic Correspondence Theory, transparency is understood in terms of balancing surface disagreement relations between a vowel and its flanking neighbors. This is implemented using BALANCE, a local conjunction of a constraint enforcing surface agreement for [F] between adjacent elements (S-IDENT[F]) with one enforcing disagreement for [F] (*S-IDENT[F]).[17] BALANCE is violated by a vowel that undergoes harmony and blocks further propagation, because it incurs a violation of *S-IDENT[F] for harmonizing with a neighboring vowel and a violation of S-IDENT[F] for not propagating harmony to a neighboring vowel. A transparent vowel obeys BALANCE, because it disagrees with both flanking vowels in its value for [F], and a harmonizing vowel satisfies BALANCE, because it agrees with its flanking vowels.

The BALANCE account of transparency involves adding a constraint that penalizes identity between corresponding segments. This constraint can also be used to capture dissimilation (Krämer 2001, 2003). However, Bennett (2013, 2015a, b) has shown that the constraints involved in Agreement by Correspondence (CORR-XX, IDENT-XX, IDENT-IO) can interact to obtain dissimilation, without requiring an anti-identity constraint. Dissimilation can arise as a means of satisfying CORR-XX[αF] by causing segments to not be identical for [αF]. This scenario enables segments to escape being subject to constraints enforced over surface-corresponding segments, such as IDENT-XX. Assimilation and dissimilation patterns receive a unified treatment using CORR-XX[αF] constraints. Furthermore, in ABC, CORR-XX[αF] is instrumental in characterizing both the classes of segments that participate in harmony and those that are transparent.

The ABC account of transparency thus aids in maximizing the scope of application of the CORR and IDENT constraint families. Nevertheless, transparency in vowel harmony is a rich empirical domain. A comparative study of the typological predictions for transparency made by Syntagmatic Correspondence Theory versus ABC would contribute further understanding on where constraint set economies are possible in a surface correspondence approach.

4.2.2 Sequential markedness

A different approach to harmony in Menominee utilizes sequential segmental/featural markedness constraints to obtain transparent and blocking behavior. In the analysis of Menominee proposed by Archangeli & Suzuki (1995), /ə(:)/ does not propagate regressive [+ATR] harmony due to the sequential segmental markedness constraint *ATR…LO. This constraint assigns a penalty to a [+ATR] vowel that precedes a [+low] vowel (though details of this constraint's implementation in the account are revised below with a local conjunction). A higher-ranked IDENT-IO constraint will preserve a preceding [+ATR] vowel that was specified as such in the input. A featural alignment constraint functions as the harmony driver.

As to transparency, Archangeli and Suzuki suggest that /a(:)/ is not a target of harmony because of the constraint ATR/LO, which prohibits a [+ATR] vowel that is [+low] (after Archangeli & Pulleyblank 1994). Again, a higher-ranked IDENT-IO constraint will prevent this constraint from altering features that

[17] For discussion of local conjunction and the domain in which it is evaluated, see Smolensky (1993, 1997), Baković (2000), Łubowicz (2002, 2005), and Itô & Mester (2003).

are specified in the input, but ATR/LO will dominate the harmony-driving alignment constraint to inhibit [+ATR] harmony from deriving low [+ATR] vowels.

Yet there is a hitch, because *ATR…LO predicts that both /ə(:)/ *and* /a(:)/ will block harmony, rather than /a(:)/ being transparent. Accordingly, the account appeals to a local conjunction of *ATR…LO and ATR/LO to block [+ATR] harmony from /ə(:)/. The local conjunction is interpreted as violated when the same [+low] feature is involved in the violation of both constraints, as when [+ATR] spreads from /ə(:)/ (which violates ATR/LO) to a preceding vowel (violating *ATR…LO). Transparent /a(:)/ will not violate this constraint, because in this context ATR/LO is not violated.

The table in (54) presents a comparison of the approaches to transparent and blocking segments in Menominee in the ABC account versus sequential markedness.

(54) Comparison of two theoretical treatments

	ABC	Sequential markedness
/ə(:)/ is not a trigger	Lack of feature identity with [-low], [-ATR] targets	Sequential markedness: *ATR…LO
/a(:)/ is not a target	Lack of feature identity with [-low], [+ATR] triggers	Markedness: ATR/LO
/a(:)/ is transparent	Lack of feature identity with [-low], [+ATR] triggers	Local conjunction: *ATR…LO & ATR/LO

As seen in (54), ABC uniformly calls on aspects of feature identity for treating segments that do not alternate in Menominee's [+ATR] harmony, enforced through CORR-XX and IDENT constraints. Correspondence relations and enforcement of identity between correspondents are fundamental concepts in OT (McCarthy & Prince 1995). In the ABC account, sequential segmental markedness constraints and local conjunction are not required. In other work, an approach to vowel harmony has been proposed that employs sequential markedness constraints as the harmony driver (Mahanta 2008, see also Baković 2000, Pulleyblank 2002). This function, too, is potentially subsumed under the role of CORR-XX and IDENT constraints in ABC. These points underscore a strength of the ABC analysis: its core constraint families have a broad reach with prospects to simplify the inventory of constraint types. A parallel is found in the proposal by Itô & Mester (1994, 1999) that segmental sequencing effects in syllables can be subsumed under the umbrella of Alignment constraints, obviating diverse markedness constraints such as ONSET, NOCODA, NODIPHTHONG, *COMPLEX and CODACOND. Collectively, this work emphasizes finding multi-purpose applications for constraints, with concentration of the labor in a limited set of constraint families.

5 Conclusion

The account of parasitic harmony in Menominee proposed here suggests that the intrinsic role of featural identity in ABC is advantageous in the analysis of vowel harmony. The analysis of vowels with different roles in this complex system coheres in employing constraints that govern correspondence relations and identity among correspondents. This approach contributes to a larger theoretical mission where the application of constraints within well-established families is maximized with potential to reduce complexity in Con.

Menominee's complex harmony pattern affords a valuable test for proposals about ABC formalism. It is noteworthy that this account exploits the feature-value specific version of CORR-XX[αF] constraints in capturing the distinct patterning of low vowels as icy targets versus transparent segments. Yet blocking is an empirical area that warrants further attention in the ABC framework. While some research has been brought to predictions about blocking in ABC that are either desirable or unwanted (Hansson 2007, Rhodes 2008, 2012, Sasa 2009, Shih 2013, and the present study), it is important for future work to investigate the theory's predictions about blocking more comprehensively.

References

Archangeli, D. 1985. Yokuts harmony: Evidence for coplanar representation in nonlinear phonology. *Linguistic Inquiry* 16, 335–372.

Archangeli, D. & D. Pulleyblank. 1994. *Grounded Phonology*. Cambridge, MA: MIT Press.

Archangeli, D. & D. Pulleyblank. 2007. Harmony. In P. de Lacy, ed., *The Cambridge Handbook of Phonology*, 353–378. Cambridge: Cambridge University Press.

Archangeli, D. & K. Suzuki. 1995. Menomini vowel harmony: O(pacity) & T(ransparency) in OT. In K. Suzuki & D. Elzinga, eds., *South Western Optimality Theory Workshop 1995* (Arizona Phonology Conference Volume 5), 1-17. Coyote Papers, University of Arizona.

Baković, E. 2000. *Harmony, Dominance and Control.* PhD dissertation, Rutgers University.

Bennett, W. G. 2013. *Dissimilation, Consonant Harmony, and Surface Correspondence*. PhD dissertation, Rutgers University.

Bennett, W. G. 2015a. Assimilation, dissimilation, and surface correspondence in Sundanese. *Natural Language & Linguistic Theory* 33, 371–415.

Bennett, W. G. 2015b. *The Phonology of Consonants*. Cambridge: Cambridge University Press.

Bloomfield, L. 1962. *The Menomini Language*. New Haven, CT: Yale University Press.

Bloomfield, L. 1975. C. F. Hockett, ed., *Menominee Lexicon*. Milwaukee, WI: Milwaukee Public Museum Press.

Bowman, S. R. & B. Lokshin. 2014. Idiosyncratically transparent vowels in Kazakh. *Proceedings of the Annual Meeting on Phonology 2013*.

Cole, J. 1987. *Planar Phonology and Morphology*. PhD dissertation, MIT.

Cole, J. & C. Kisseberth. 1995a. An optimal domains theory of vowel harmony. *Formal Linguistics Society of Mid-America V*, 101–114.

Cole, J. & C. Kisseberth. 1995b. Restricting multi-level constraint evaluation: Opaque rule interaction in Yawelmani vowel harmony. In K. Suzuki & D. Elzinga, eds., *South Western Optimality Theory Workshop 1995* (Arizona Phonology Conference Volume 5), 18–38. Coyote Papers, University of Arizona.

Cole, J. & L. Trigo. 1988. Parasitic harmony. In H. van der Hulst & N. Smith, eds., *Features, Segmental Structure, and Harmony Processes (Part II)*, 19–38. Dordrecht: Foris.

Hansson, G. Ó. 2001. *Theoretical and Typological Issues in Consonant Harmony*. PhD dissertation, University of California, Berkeley.

Hansson, G. Ó. 2006a. Locality and similarity in phonological agreement. Paper presented at the PhonologyFest Workshop, Indiana University, Bloomington, June 23, 2006.

Hansson, G. Ó. 2006b. Understanding harmony as agreement. Paper presented at the Annual Meeting of the Linguistic Society of America, Albuquerque, NM, January 2006.

Hansson, G. Ó. 2007. Blocking effects in agreement by correspondence. *Linguistic Inquiry* 38, 395–409.

Hansson, G. Ó. 2010. *Consonant Harmony: Long-Distance Interaction in Phonology*. Berkeley: University of California Press.

Itô, J. & A. Mester. 1994. Reflections on CodaCond and Alignment. In J. Merchant, J. Padgett & R. Walker, eds., *Phonology at Santa Cruz* 3, 27–46.

Itô, J. & A. Mester. 1999. Realignment. In R. Kager, H. van der Hulst & W. Zonneveld, eds., *The Prosody-Morphology Interface*, 188–217. Cambridge: Cambridge University Press.

Itô, J. & A. Mester. 2003. *Japanese Morphophonemics: Markedness and Word Structure*. Cambridge, MA: MIT Press.

Jurgec, P. 2011a. *Feature Spreading 2.0: A Unified Theory of Assimilation*. PhD dissertation, University of Tromsø.

Jurgec, P. 2011b. Icy targets. Ms., Meertens Instituut.

Jurgec, P. 2013. Two types of parasitic assimilation. In S. Blaho, M. Krämer & B. Morén-Duolljá, eds., *X Years of CASTL Phonology and L Years of Curtness. Nordlyd* 39.2, 1–28

Kaun, A. 1995. *The Typology of Rounding Harmony: An Optimality Theoretic Approach*. PhD dissertation, UCLA.
Kaun, A. 2004. The phonetic foundations of the rounding harmony typology. In B. Hayes, R. Kirchner & D. Steriade, eds., *Phonetically Based Phonology*, 87–116. Cambridge: Cambridge University Press.
Kenstowicz, M. & C. Kisseberth. 1979. *Generative Phonology*. San Diego: Academic Press.
Kimper, W. 2011. *Competing Triggers: Transparency and Opacity in Vowel Harmony*. PhD dissertation, University of Massachusetts, Amherst.
Kisseberth, C. 1969. *Theoretical Implications of Yawelmani Phonology*. PhD dissertation, University of Illinois.
Krämer, M. 2001. Yucatec Maya vowel alternations – Harmony as Syntagmatic Identity. *Zeitschrift für Sprachwissenschaft* 20.2, 175–217.
Krämer, M. 2003. *Vowel Harmony and Correspondence Theory.* Berlin: Mouton de Gruyter.
Łubowicz, A. 2002. Derived environment effects in Optimality Theory. *Lingua* 112, 243–280.
Łubowicz, A. 2005. Locality of conjunction. *WCCFL* 24, 254–262.
Mahanta, S. 2008. *Directionality and Locality in Vowel Harmony: With Special Reference to Vowel Harmony in Assamese*. PhD Dissertation, Utrecht University.
McCarthy, J. J. 2010. Agreement by Correspondence without Corr constraints. Ms, University of Massachusetts, Amherst. (Available as ROA-1089.)
McCarthy, J. J. & A. Prince. 1995. Faithfulness and reduplicative identity. In J. Beckman, L. Walsh-Dickey, & S. Urbanczyk, eds., *University of Massachusetts Occasional Papers: Papers in Optimality Theory* 18, 249–384. Amherst, MA: GLSA.
Mester, A. 1988a. *Studies in Tier Structure*. New York: Garland. [University of Massachusetts, Amherst dissertation, 1986.]
Mester, A. 1988b. Dependent tier ordering and the OCP. In H. van der Hulst & N. Smith, eds., *Features, Segmental Structure, and Harmony Processes (Part II)*, 127–144. Dordrecht: Foris.
Milligan, M. 2000. A new look at Menominee vowel harmony. *Papers of the 31st Annual Algonquian Conference*, 237–254.
Miner, K. L. (ed.). 1975. *Omaeqnomenew-kiketwanan: A Basic English-Menominee and Menominee-English Word List*. Madison: Wisconsin Department of Public Instruction.
Miner, K. L. 1979. Theoretical implications of the great Menominee vowel shift. *Kansas Working Papers in Linguistics* 4(1), 7-25.
Nevins, A. 2004. *Conditions on (Dis)Harmony*. PhD dissertation, MIT.
Nevins, A. 2010. *Locality in Vowel Harmony*. Cambridge, MA: MIT press.
Newman, S. 1944. *Yokuts Language of California*. New York: Viking Fund Publications in Anthropology 2.
Oxford, W. 2016. Menominee vowel harmony revisited: A height-based underspecification account. *Toronto Working Papers in Linguistics* 35.
Padgett, J. 2008. Glides, vowels, and features. *Lingua* 118, 1937–1955.
Pater, J. 1999. Austronesian nasal substitution and other NC̥ effects. In R. Kager, H. van der Hulst & W. Zonneveld, eds., *The Prosody-Morphology Interface*, 310–343. Cambridge: Cambridge University press.
Prince, A. & P. Smolensky. 2004. *Optimality Theory: Constraint Interaction in Generative Grammar*. Malden, MA: Blackwell. (Revision of 1993 technical report RUCCS.)
Pulleyblank, D. 2002. Harmony drivers: No disagreement allowed. *BLS* 28, 249–267.
Rhodes, R. 2008. Vowel harmony as Agreement by Correspondence: the case of Khalkha Mongolian rounding harmony. Paper presented at Trilateral Linguistics Weekend (TREND), University of California, Santa Cruz, May 10, 2008.
Rhodes, R. 2010. A survey of vowel harmony with special focus on neutral segments, glides and diphthongs. Ms., University of California, Berkeley.
Rhodes, R. 2012. Vowel harmony as Agreement by Correspondence. *UC Berkeley Phonology Lab Annual Report*, 138–168. University of California, Berkeley.

Rose, S. & R. Walker. 2004. A typology of consonant agreement as correspondence. *Language* 80, 475–531.

Sasa, T. 2009. *Treatments of Vowel Harmony in Optimality Theory*. PhD dissertation, University of Iowa.

Shih, S. S. 2013. Consonant-tone interaction as Agreement by Correspondence. Ms., Stanford University and University of California, Berkeley.

Shih, S. S. & S, Inkelas. 2014a. A subsegmental correspondence approach to contour tone (dis)harmony patterns. *Proceedings of the Annual Meeting on Phonology 2013.*

Shih, S. S. & S. Inkelas (eds). 2014b. Agreement by correspondence archive & bibliography. http://linguistics.berkeley.edu/phonlab/annual_report/documents/2014/annual_report_2014_ABCC.html

Shih, S. S. & S, Inkelas. To appear. Autosegmental aims in surface optimizing phonology. *Linguistic Inquiry.*

Smolensky, P. 1993. Harmony, markedness, and phonological activity. Paper presented at the First Rutgers Optimality Workshop (ROW 1), Rutgers University, New Brunswick, New Jersey.

Smolensky, P. 1997. Constraint interaction in generative grammar II: Local conjunction. Paper presented at the Hopkins Optimality Theory Workshop/Maryland Mayfest 1997, Baltimore, MD.

Steriade, D. 1987. Redundant values. *Papers from the 23rd Regional Meeting of the Chicago Linguistic Society (Vol. 2)*, 339–362. Chicago Linguistic Society, University of Chicago.

Walker, R. 2000a. Long-distance consonantal identity effects. *WCCFL 19,* 532–545.

Walker, R. 2000b. Yaka nasal harmony: Spreading or segmental correspondence? *BLS 26,* 321–332.

Walker, R. 2001. Consonantal correspondence. In R. Kirchner, J. Pater & W. Wikeley, eds., *Proceedings of the Workshop on the Lexicon in Phonetics and Phonology*, 73-84. Papers in Experimental and Theoretical Linguistics 6. University of Alberta, Department of Linguistics.

Walker, R. 2009. Similarity-sensitive blocking and transparency in Menominee. Paper presented at the Annual Meeting of the Linguistic Society of America, San Francisco, CA, January 9, 2009.

Walker, R. 2012. Vowel harmony in Optimality Theory. *Language and Linguistics Compass*, 575–592.

Walker, R. 2015. Surface correspondence and discrete harmony triggers. *Proceedings of the Annual Meeting in Phonology 2014*.