Paradoxical Strength Conditions in Harmony Systems[1]

Many harmony systems impose conditions on the triggers and targets of harmony that involve prosodic features such as stress, length, or peripherality in the prosodic word domain. Such conditions serve to distinguish a 'strong' anchor (SA) from a 'weak' anchor (WA) for a given feature, and are responsible for asymmetries in the class of segments that may trigger or undergo harmony. Yet, languages employ prosodic conditions on the strength of an anchor in different ways, deriving what appears to be a paradoxical typology of harmony systems, as in (1).[2]

(1) A partial typology of prosodic conditions on targets and triggers

WA's are good triggers: Mellieh'a Maltese round and palatal harmony.
SA's are good triggers: Tigre palatal harmony (Palmer 1956, 1962); Wolof RTR and
    ATR harmonies (Ka 1988); Pasiego and Tudanca Montañes vowel raising (Hualde
    1989).
WA's are good targets: Qormi Maltese palatal and round harmony (Peuch 1978); Wolea-
    ian raising (Poser 1982); Wolof ATR harmony; Standard Maltese palatal and round
    harmony (Peuch 1978).
SA's are good targets: Menomini ATR harmony (Bloomfield 1962); Coeur d'Alene pro-
    gressive RTR harmony (Reichard 1938); Lena Bable Spanish metaphony (Hualde
    1989).

1   Prosodic Transparency and Opacity

Transparency and opacity can arise in a prosodically-governed harmony system, when harmony encounters a segment that doesn't meet the prosodic condition on targets. For example, in the Lena Bable dialect of Spanish (Hualde 1989), a final high vowel causes raising of a stressed vowel. Stressed /á,é,ó/ raise to [é,í,ú], respectively, as shown in (2a). The vowel /a/ is transparent to harmony when it intervenes between the final vowel and the stressed antepenultimate vowel, as in (2b).

(2) Lena Bable Spanish height harmony
    (a)   stressed vowel target:

gétu	'cat' m.sg. (c.f., gátos m.pl.)
nínu	'child' m.sg. (c.f., nénos m.pl.)
kúku	'worm' m.sg. (c.f., kókos m.pl.)

    (b)   unstressed vowel:

burwíbanu	'wild strawberry' m.sg. (c.f., burwébanos)
kékabu	'wreck' m.sg. (c.f., kákabos)

Another instance of prosodically-determined transparency is seen in Menomini, discussed in section 4. Prosodically-determined opacity is found in Standard Maltese palatal/

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    [2] It is possible for a single harmony system to employ more than one of these prosodic conditions, as in Menomini, discussed below.

round harmony (Peuch 1978). The 3sg. person suffix undergoes harmony triggered by a stem vowel (3a), but only in word-final position. In medial position the 3sg. suffix does not undergo harmony, and is opaque; it prevents the following suffix from harmonizing with the stem vowel (3b).

(3) Standard Maltese palatal/round harmony

    a.   kitb-**et**[3]   'she wrote'
           ḥolm-**ot**   'she dreamed'
           kitib-l-**ek**   'he wrote to you'
           šorob-l-**ok**   'he drank from you'
    b.   šorb-it-l-**ek** 'he drank from you'

A different sort of prosodically-determined opacity exists in Qormi Maltese (Peuch 1978). Only short suffix vowels undergo harmony (4a), while long suffix vowels block (4b).

(4) Qormi Maltese palatal/round harmony

    a.   šurb-**ut-ok**   'she drank you'
           kitb-**it-ek**   'she registered you'
           i-b**u**ws-**ok**   'he kissed you'
           smaj-t-**ek**   'I heard you'
   b.   šurb-**ut**-i:-l-**em** 'she drank it-fem from them'

Wolof (Archangeli and Pulleyblank 1994, Ka 1988) displays a pattern similar to Qormi. Suffix vowels undergo tongue root harmony triggered by the root vowel (5a), but the long low vowel /aː/ is opaque to harmony (5b). (Dotted vowels are retracted in the following examples.)

(5) Wolof tongue root harmony

    a.   d**oo**r-ant**e**   'to hit each other'
           x**ọọ**l-**ạ**nt**ẹ**   'to look at each other'
    b.   j**ạ**m-**ạạ**-l**ẹ**   'to pierce also'
           g**e**nn-**ạạ**-l**ẹ**   'to go out also'

The treatment of prosodically-determined transparency and opacity depends directly on the manner in which prosodic conditions are expressed. In the standard autosegmental theory, prosodic conditions are simply encoded on an ad-hoc basis, as explicit structural conditions on the trigger or target of spread rules, as in (6).[4]

(6) Prosodically-conditioned autosegmental rules

    a.   [+stress]   b.

         x ...   x   x ...   x]$_{PrWd}$

               [F]   [F]
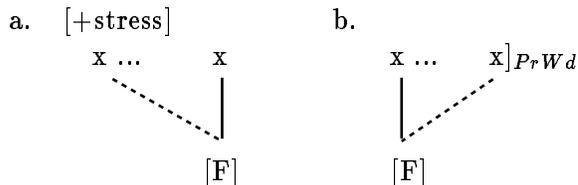
The autosegmental analysis of harmony relies on feature specification to distinguish transparent and opaque segments from segments that undergo harmony. Transparent segments

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[3]The 3 sg. suffix vowel is underlyingly high, and undergoes a regular process of lowering in a final syllable. The same lowering is observed in final syllables in Qormi, cf., (4).

[4]See also Flemming 1993 for an insightful discussion of prosodic conditions on autosegmental rules.

must be unspecified for the harmony feature, to avoid violation of the No Crossing Constraint. Prosodically-determined transparency is problematic for the autosegmental analysis because transparent segments are characterized by the absence of a prosodic structure, not by their featural composition (eg., Lena Bable Spanish (2)). Similarly, it is not a conflicting specification for the harmony feature that derives prosodically-determined opacity.

Despite the large literature on the autosegmental treatment of harmony systems, there is no principled account of the role prosodic conditions play in harmony systems, and no explanation for why mutually opposing conditions exist, as in (1). Similarly, there is no principled account of how prosodic conditions give rise to transparency and opacity. In this paper, we present an analysis of prosodically-governed harmony within the framework of Optimal Domains Theory (ODT). In doing so, we build on the constraint-based analysis of harmony systems proposed in Cole and Kisseberth 1994a, where it is shown that opacity and transparency in ordinary harmony systems can be modelled simply through the mechanism of constraint interaction.

2   The functional basis of harmony

The hypothesis of Optimality Theory (Prince and Smolensky 1993, McCarthy and Prince 1993) is that all phonological patterns result from universal conditions on phonological well-formedness. These conditions are expressed in the form of constraints on the internal composition of phonological structures, and their alignment with other phonological structures. Individual grammars can prioritize the set of universal constraints differently, through the formal mechanism of constraint ranking, giving rise to cross-linguistic variation in syllable, stress, and feature structures.

Adopting this hypothesis in the analysis of harmony requires identifying the universal principles of feature structure that motivate harmony. Under what criteria of well-formedness are the feature structures that define harmony more optimal than 'ordinary' feature structures? Cole and Kisseberth 1994a note two principles, Perceptibility (7) and Articulator Stability (8), each of which assigns a higher value to structures in which features extend over a broad domain.

(7) **Perceptibility:** features should be perceptible

(8) **Articulator Stability:** Minimize changes from the neutral, steady state of the articulators.

There is a tension between these two principles and the Optimality Theory principle of **Faithfulness**, which requires that all underlying contrasts be preserved. By Faithfulness alone, the domain of a feature should not extend beyond the single segment which sponsors that feature in underlying representation, to avoid neutralizing underlying contrasts. Our claim is that this tension is resolved in individual grammars by the ranking of the Faithfulness constraints with the constraints that enforce Perceptibility and Articulator Stability, thereby giving rise to a typology of harmony systems.

In this paper we claim that prosodic conditions on harmony systems arise as an individual language's response to Perceptibility. UG dictates that individual grammars be committed to enhancing the perceptibility of features, and thereby the perceptibility of contrast. The perceptibility of a feature is dependent on many different properties of its 'anchor' (loosely defined as the segment, root node, or skeleton position that realizes the feature), including its featural composition and its status in the syllable and higher order

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prosodic structures. The study of harmony systems reveal three basic methods that a language may employ to increase overall feature perceptibility, based on a distinction between strong and weak anchors:

1. Maximizing the strong: strong anchors trigger harmony, and do not undergo harmony.

2. Maximizing the weak: weak anchors trigger harmony (extending the proposal of Kaun 1994), and for optimal maximization, only strong anchors are targets.

3. Minimizing the weak: weak anchors are targets of harmony (resulting in neutralization of contrast).[5]

In ODT, Maximization can be modeled by the extension of a feature domain, as expressed by constraints on the alignment of feature domains. Minimization is modeled by constraint ranking: any underlying contrast for the harmony feature is neutralized on target segments, which means that the Faithfulness constraint Parse[F], as it applies to target segments, is ranked below the harmony-inducing constraints. The specifics of the ODT analysis are spelled out in the next section, which begins with a short overview of ODT, as stated in Cole and Kisseberth 1994a.[6]

3 Optimal Domains Theory

3.1 An overview

The basis of the ODT analysis of harmony is the claim that phonological features are parsed in **domains**, abstract structures which are explicitly encoded in phonological representation. Feature domains (F-domains) are phonological structures which have the same status as other structural domains, such as the foot or syllable. Like other prosodic domains, feature domains are subject to alignment constraints. Harmony results from a feature domain with wide-scope that extends beyond the segment that sponsors the harmony feature in underlying representation. The wide-scope domain is a necessary but not sufficient condition for harmony; it is also necessary that the harmony feature be realized on anchors in that domain.[7]

No critical assumptions are made about the underlying specification or underspecification of elements in the F-domain. If an element in a F-domain bears *any* feature specification that is incompatible with the realization of [F], that feature may be underparsed to satisfy the constraint requiring realization of the harmony feature in its domain. The result is that both underspecified and specified segments can undergo harmony (i.e., a single harmony system can be both feature-changing and feature-filling).

The basic constraints on feature domains in ODT are listed below:

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[5]A fourth possibility, Minimizing the strong, is not observed as a primary strategy in harmony systems, which follows under the present analysis because it would reduce rather than enhance Perceptibility. Strong anchors do undergo harmony in some systems (eg., Menomini), but only when the harmony trigger is itself a weak anchor. In those cases, the goal of maximizing the weak anchor is achieved through spreading onto a strong anchor, at the expense of neutralizing an underlying contrast on strong anchors.

[6]See also Cole and Kisseberth 1994b for an application of the ODT analysis to nasal harmony.

[7]The phonological feature domain is more abstract than the related notion of the articulatory gestural domain of Browman and Goldstein 1986. Whereas the articulatory gesture is continuous throughout its domain, it may be discontinuous within the domain of the phonological feature. See the discussion of transparency below.

(9) **Basic Alignment:**
    BA-left   Align(F-domain, L; Sponsor, L)
    BA-right   Align(F-domain, R; Sponsor, R)
(10) **Wide-Scope Alignment:**
    WSA-left   Align(F-domain,L; P-Cat/M-Cat,L)
    WSA-right   Align(F-domain,R; P-Cat/M-Cat,R)

(11) **Expression**: The phonetic feature $[F]$ must be expressed on every element in an F-domain.

In order for harmony to arise in a language, it is necessary that the relevant Wide Scope Alignment constraint dominates Basic Alignment, which is violated by the extended feature domain, and that Expression dominates the Faithfulness constraint *Insert[F], which is violated when the harmony feature gets inserted on a target.

(12) Deriving harmony
    WSA >> BA
    Expression >> *Insert [F]

Transparency and opacity in harmony systems arise through the interaction of the above constraints with constraints on feature distribution, which prohibit the realization of the harmony feature on a potential target. Well-known constraints of this sort include the Grounding Conditions of Archangeli and Pulleyblank 1994, which limit certain feature combinations, such as *[ATR,Low], and favor others, such as [ATR, High]. Transparency occurs when Expression is dominated by both Wide Scope Alignment and a constraint on feature distribution. In contrast, opacity occurs when Wide Scope Alignment is the low-ranking constraint. The tableau below illustrates constraint interaction in a grammar with rightward F-harmony. The feature co-occurrence constraint *[F,G] affects the realization of [F] on a vowel specified for [G]. (13a) has a narrow F-domain, and therefore no harmony. (13b) has a wide F-domain, but the harmony feature is not uniformly expressed. (13c) has a wide F-domain and full harmony. (13d) has a wide F-domain, but the medial vowel is transparent, and in (13d) the medial V is opaque.

(13) Constraint interaction

input:	$V_F...V_G...V$	*[F,G]	WSA -rt[F]	Express [F]	*Insert [F]	BA -rt[F]
a.	$(V_F)...V_G...V$		*			
b.	$(V_F...V_G...V)$			**		*
c.	$(V_F...V_{F,G}...V_F)$	*			**	*
d.	$(V_F...V_G...V_F)$			*	*	*
e.	$(V_F...)V_G...V$		*			*

3.2   Prosodic conditions in ODT

We propose an extension to the set of basic constraints (9-11) in order to express prosodic conditions on targets and triggers of harmony. Prosodic strength distinctions are incorporated by exploding the WSA and Expression constraints.

(14) Expressing prosodic strength distinctions

1. Strong F-domain (F-domain$^+$): A domain for a feature [F] whose underlying sponsor is *strong*.

2. Strong WSA (WSA$^+$): Align-L/R(F-domain$^+$; M-Cat/P-Cat)

3. Strong Expression (Express$^+$): Express [F] on a *strong* anchor in an F-domain.

The notion of strength that is needed here is definable in terms of several dimensions of phonological representation, including weight, prominence in stress foot, sonority, and peripherality in prosodic or morphological category. Strength is relative within each of these dimensions, and absolute values of strength (or strength thresholds) are determined by individual grammars. So, while a long vowel may serve as an appropriately strong anchor for Menomini ATR harmony, only a vowel in a word-final syllable is a strong anchor for Qormi Maltese palatal/round harmony. By incorporating this notion of strength into the definition of the F-domain, as in (14.1), it is possible to distinguish between the optimal feature domains for weak anchors and those for strong anchors. Strong WSA (14.2) gives rise to the extended feature domains of harmony, just like ordinary WSA, but only for strong F-domains. It expresses a prosodic condition on the harmony trigger. Similarly, Strong Expression (14.3) governs the realization of the harmony feature only on strong anchors within the F-domain. It expresses a prosodic condition on targets of harmony. A similar set of definitions for *Weak* elements, (F-domain$^-$, WSA$^-$, and Express$^-$) can restrict harmony triggers and targets to weak anchors.

With this much of the analysis in place, we can see how prosodically-determined transparency and opacity arise from constraint interaction. We limit our focus here to the feature 'strong' (strong anchors, strong F-domains, etc.), although parallel examples can be constructed with 'weak'.

Consider first a language where harmony targets are restricted to strong elements. In order for the strong elements to undergo harmony, it is necessary that Strong Expression dominate the faithfulness constraint *Insert[F]. But since 'neutral' (i.e., not strong) elements do not undergo harmony, it follows that the same *Insert[F] constraint dominates the neutral Expression constraint, as in (15a). Furthermore, if the neutral elements are transparent to harmony, then it is also necessary for WSA to dominate neutral Expression (15b), so that the harmony domain can include the transparent neutral segments. More generally, the ranking of WSA >> Expression is required for transparency arising from any set of conditions, as discussed in section 3.1. Finally, if the neutral elements are opaque to harmony, then the neutral Expression constraint must dominate whichever WSA constraint is responsible for the extended feature domain, as in (15c).

(15) Ranking of prosodically-governed constraints
a. Express$^+$[F] >> *Insert[F] >> Express[F]   *targets must be strong*
b. WSA >> Express[F]   *neutral segments transparent*
c. Express[F] >> WSA   *neutral segments opaque*

The next section illustrates constraint interaction in the prosodically-governed harmony systems of Menomini and Standard Maltese.

4 Applications of the ODT analysis

4.1 Menomini transparency

In the regressive ATR harmony of Menomini (Archangeli & Pulleyblank 1994, citing Bloomfield 1962), only the long non-low vowels /U:,I:/ are targets, surfacing as [i:, u:] when followed by an ATR harmony trigger. The short vowels /U,I/ intervening between the trigger (a high ATR vowel) and target are transparent, as shown in (16). (Transparent vowels are circled, and the triggers (the final /i/ in both examples) are in boldface. The targets are the long vowels /i:,u:/ in surface forms.)

(16) Menomini ATR harmony

underlying	*surface*	
tU:ckInihAw	tu:ckⓘnihaw	'he nudges him in body/belly'
nIwI:nIpim	nⓘwi:nⓘpim	'I dirty his mouth'

This harmony system restricts targets to strong anchors, which is accomplished with the ranking: Express$^+$[ATR] >> *Insert[ATR] >> Express[ATR] (cf., 16a). The leftward direction of harmony is due to the ranking: WSA-left[ATR] >> BA-left[ATR]. The tableau in (17) shows the evaluation of a form with a medial transparent vowel, like the examples in (16). (17c) is the optimal surface form, with the harmony feature realized on the strong anchor but not on the medial neutral vowel. (Note that the trigger for harmony is the rightmost vowel, V_A in the input.)

(17) Evaluation: Menomini transparency

input:	$V^+...V...V_A$	WSA-lf	Express$^+$	*Insert	Express	BA-lf
a.	$(V^+...V...V_A)$		*!		*	*
b.	$(V_A^+...V_A...V_A)$			**!		*
→c.	$(V_A^+...V...V_A)$			*	*	*
d.	$V^+...V(...V_A)$	*!				*

There are additional factors that complicate the ATR harmony system in Menomini, including a featural restriction on triggers, which is discussed as an instance of prosodic conditioning in the Appendix.

4.2 Standard Maltese opacity

Standard Maltese (Peuch 1978) presents a case of prosodically-determined opacity, as noted in section 1. A suffix vowel in word-final position harmonizes with the stem vowel in palatality (and roundness, for back vowels) (18b,c). A suffix vowel in word-medial position does not undergo harmony, and blocks harmony from affecting the vowel of the final suffix (18d). (The opaque vowel is circled and harmonizing vowels are in boldface in the following examples.)

(18) Standard Maltese palatal/round harmony
  a. šor**o**b   'he drank'
  b. šor**o**b-**ot**   'she drank'
  c. šor**o**b-l-**ok**   'he drank from you'
  d. šor**o**b-ⓘt-l-ek   'she drank from you'

The prosodic condition in this harmony system limits targets to weak anchors, where weakness is defined in terms of position in the Prosodic Word. Thus, harmony restricts the neutralization of contrast to prosodically weak positions, and is a case of "minimizing the weak".[8] The distinction between weak and neutral anchors is captured by the ranking: Express⁻[Bk] >> *Insert[Bk] >> Express[Bk], where Weak Expression dominates. The fact that neutral elements are opaque requires further that neutral Expression dominate the rightward Wide Scope Alignment that is responsible for the extended F-domain: any element that does not qualify as an anchor for the harmony feature cannot be in the harmony domain. These interactions are illustrated in the tableau in (19), where Back harmony triggered by the stem vowel (the leftmost vowel in the schematic example) is blocked by a medial vowel that lacks the weak condition on targets. (19d) is the optimal form, with a smaller harmony domain.

(19) Evaluation: Standard Maltese opacity

input:	$V_B...V...V^-$	Express⁻	*Insert	Express	WSA-rt	BA-rt
a.	$(V_B...V...V^-)$	*!		*		*
b.	$(V_B...V_B...V_B^-)$		*!*			*
c.	$(V_B...V...V_B^-)$		*!	*		*
→d.	$(V_B...)V...V^-$				*	*

5   Summary and discussion

To summarize, a list of prosodic conditions on the triggers and targets of harmony is provided in (20), where the constraint rankings necessary to distinguish the behavior of weak and strong anchors is shown.

(20) Summary of constraint rankings

Strong triggers :

WSA⁺ >> BA⁺   optimal wide domain for strong anchor
BA >> WSA   optimal narrow domain for neutral anchor

 Weak triggers :

WSA⁻ >> BA⁻   optimal wide domain for weak anchor
BA >> WSA   optimal narrow domain for neutral anchor

Strong target :

Express⁺ >> *Insert   strong element undergoes harmony
Insert >> Express   neutral element doesn't undergo harmony

Weak target :

Express⁻ >> *Insert   weak element undergoes harmony
Insert >> Express   neutral element doesn't undergo harmony

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[8]It is somewhat of an arbitrary decision at this point to call the final position in the Prosodic Word weak, rather than strong. However, it seems to be true that word-final elements are more likely to undergo deletion or neutralization than word-initial elements. Similarly, the non-finality (or final extrametricality) condition apparent in many stress systems suggests that grammars avoid marking prominence on a final unit in the Prosodic Word (or larger domain).

We have seen that based on the constraints and constraint rankings introduced in this paper, there is a grammar for each kind of prosodically-governed harmony system investigated here. But the question arises, if we consider the complete set of *possible* constraint rankings, would we derive grammars for systems that do not exist? We have not yet introduced any principles limiting the relative ranking of Strong, Weak or neutral constraints on feature domains, and so many possible rankings are thus far unexplored. It's possible that some of the logically possible rankings will never be instantiated in actual harmony systems, but this cannot be determined until the full range of prosodically-governed harmony systems have been analyzed.

If further study does in fact reveal gaps in the attested rankings, we need not view this as a shortcoming of the ODT analysis. Constraints on feature domains and constraint ranking are simply the formal mechanisms employed by the theory to demonstrate that harmony systems do succumb to formal analysis. The domains-based approach allows us to see that harmony shares certain core properties in common with other aspects of phonology, expressed in the current analysis through the use of alignment constraints, together with the Faithfulness constraints Parse and Fill (or, *Insert). But we recognize that meta-grammatical functional constraints like Perceptibility play an important role in defining the typology of phonological systems. While a wide range of prosodically-governed harmony systems can be imagined, not all of them would serve to improve overall well-formedness, eg., by enhancing Perceptibility. The overall typology can be effectively constrained by requiring that every actual grammar be *grounded* (in the sense of Archangeli and Pulleyblank 1994), in the higher-order physical and functional principles governing phonological systems.

In conclusion, this paper has demonstrated that prosodically-determined transparency and opacity follow from the encoding of prosodic conditions on triggers and targets in ODT. These conditions, in turn, reflect an individual language's efforts to enhance the perceptibility of individual features and feature contrasts. The analysis succeeds in unifying the treatment of transparency and opacity in prosodically-governed systems with similar phenomena in 'ordinary' harmony systems. In all cases, it is the relative ranking of the Expression and Wide Scope Alignment constraints that determine the behavior of segments that are prevented from expressing the harmony feature. Under the ODT analysis, harmony falls within the more general class of phonological phenomena involving alignment, and shows that alignment theory can be fruitfully extended to govern featural domains.

6 Appendix: Prosodically-determined opacity in Menomini

Returning to the analysis of Menomini tongue root harmony, we note that not only does harmony restrict the class of targets, but it also restricts the class of triggers. Following Archangeli and Pulleyblank 1994, the vowel inventory includes the ATR vowels /i,u,a̧/ and the RTR vowels /I,U,a/. Only the high ATR vowels /i,u/ trigger ATR harmony. Low ATR /a̧/ does not trigger harmony, and is opaque to harmony triggered by a high ATR vowel to the right, as shown in (21). (The opaque vowel is circled, and the trigger in each example is the rightmost /i/, in boldface.)

(21) Opacity in Menomini ATR harmony
  sU:wA:nⓐhki:qsIw 'he has his hair blown back by the wind'
  mU:nIpⓐni**:w**   'he digs potatoes'

In this case, the trigger condition derives opacity. The trigger condition on ATR harmony can be viewed as a condition limiting triggers to strong anchors, and can be derived

from the grounding constraint for ATR: *If ATR, then NOT Lo.* Since a [Lo, ATR] vowel violates the grounding constraint, it does not qualify as a strong anchor for ATR, and therefore cannot trigger ATR harmony. But it is still necessary to account for why the weak [Lo, ATR] vowel blocks harmony that is triggered by a strong anchor to its right. The overall generalization is that the [Lo, ATR] vowel is never in a wide scope ATR-domain. This can be expressed by ranking the neutral Basic Alignment constraint governing /a̧/ above all the Wide Scope Alignment constraints, as in (22a,b). On the other hand, in order for strong anchors to trigger harmony, Strong Wide Scope Alignment must be ranked over Strong Basic Alignment (22c).

(22) Constraint rankings
    a.   BA-left[ATR] $>>$ WSA-left[ATR]   *neutral anchor doesn't trigger*
    b.   BA-left[ATR] $>>$ WSA$^+$-left[ATR]   *neutral anchor blocks harmony*
                                                triggered by strong anchor
    c.   WSA$^+$-left[ATR] $>>$ BA$^+$-left[ATR]   *strong anchor triggers harmony*

Note that in this system, the strength condition imposed on triggers (WSA$^+$-left[ATR]) is different than the strength condition imposed on targets of harmony (Express$^+$[ATR]), discussed in section 4.1. Triggers must be strong on the basis of the grounding of ATR, while targets must be prosodically strong on the basis of vowel length. The result of the rankings in (22) is that only strong (ie., high) vowels can trigger ATR harmony, and a neutral ATR vowel is prohibited from appearing in a wide ATR domain. The following tableau illustrates evaluation of ATR harmony, with a strong trigger and a strong target, but with an opaque weak ATR vowel in the middle, as in the example *mU:nIpa̧ni:w* (21). The optimal candidate is (23b), where harmony is blocked, and the opaque vowel parses its ATR feature in a narrow domain.

(23) Evaluation: Menomini opacity

input:	$V^+...V_{A,L}...V_A^+$	BA-lf	WSA-lf	WSA$^+$-lf	BA$^+$-lf
a.	$(V_A^+...V_{A,L}...V_A^+)$	*!			*
#b.	$V^+...(V_{A,L})(...V_A^+)$		*	*	*
c.	$(V^+...V_{A,L})(...V_A^+)$	*!		*	*

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