1 Introduction

The ability of weighted constraints to model certain patterns that elude ranked constraints has often been taken to be typologically problematic (e.g., Prince & Smolensky 1993/2004, Legendre, Sorace & Smolensky 2006). This paper argues that the greater power of weighted constraints can actually be advantageous, permitting a smaller set of more general constraints to be employed in the analysis of attested languages. With limitations on the set of constraints, the predicted typology is restricted beyond what is possible in OT where more, and more specific, constraints are necessary. These principled revisions to CON mean that the languages generated by Harmonic Grammar need not be a superset of those generated by Optimality Theory (see also Pater [this volume], Potts et al. 2010).

The particular focus in this paper is upon constraints that govern patterns of featural licensing – i.e., patterns where a given marked feature surfaces only in specific phonological contexts. In OT these types of positional asymmetries have been captured using both positional faithfulness constraints and positional markedness constraints, and in many contexts there is little to discriminate between the two types of analysis. As this paper demonstrates, however, differences between the two approaches arise when featural licensing either requires a conjunction of contexts – i.e., being in context A and context B – or is possible in multiple (or disjoined) contexts – i.e., being in context A or context B. In OT conjunctive licensing patterns can only be modeled with positional markedness constraints, while disjunctive licensing patterns can only be modeled with positional faithfulness constraints. In HG, on the other hand, either set of constraints can account for both types of patterns. As a result, only positional markedness constraints are required in HG in order to capture a range of empirical phenomena that require both types of constraints in OT. I argue that this is a positive outcome, allowing the pathologies associated with positional faithfulness constraints to be avoided (cf. Jesney 2011), producing a more restrictive overall typology, and reducing duplication and redundancy within the theory.

The rest of this paper is structured as follows. Section 2 discusses the patterns of conjunctive and disjunctive licensing that are generated by the different constraint sets in the two theories, demonstrating that, given weighted constraints, positional markedness constraints are sufficient to the task. Two natural language case studies are presented: Konni vowel place licensing and English [h] licensing. Section 3 considers the resulting typology and demonstrates how the use of a smaller constraint set of HG narrows the set of predicted languages relative to what is expected in OT when alternations are considered. Section 4 addresses additional phenomena that have been argued to require analysis using positional faithfulness. Section 5 contrasts the typological effects of the HG approach with local constraint conjunction and other alternatives, and section 6 concludes.

2 Positional constraints and patterns of licensing

2.1. Conjunctive vs. disjunctive licensing

Two main types of constraints have been used to capture positional asymmetries in Optimality-Theoretic phonology: positional markedness constraints (Itô, Mester & Padgett 1995, Walker 2001a, 2005, 2011 Zoll 1996, 1998; see also Goldsmith 1989, 1990, Itô 1986,
Steriade 1995), and positional faithfulness constraints (Beckman 1997, 1998, Casali 1996, Lombardi 1999). Each of these constraint types references a structure and context. As illustration, we can consider the case of the feature [+voice] on obstruents in interaction with the licensing position of syllable onset. The resulting constraints are given in (1).

(1) Examples: Two types of constraints for capturing positional asymmetries
   a. VOICEDObs⇒ONSET: Assign a violation mark to any [+voice] obstruent that is not associated with syllable onset position.
   b. IDENT[±voice]/ONSET: Assign a violation mark to any output segment in onset position that differs in specification for [±voice] relative to its input correspondent.

As the following OT tableaux show, if these constraints dominate the relevant conflicting general faithfulness (2) or general markedness constraints (3), [+voice] obstruents are restricted to onset position. Given an input like /bæd/, the onset voiced /b/ maps faithfully while the coda /d/ devoices.

(2) The marked feature maps faithfully only in onset when positional markedness dominates faithfulness

<table>
<thead>
<tr>
<th>/bæd/</th>
<th>VOICEDObs⇒ONSET</th>
<th>IDENT[±voice]</th>
<th>*VOICEDObs</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. bæd</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>b. → bæt</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>c. pæt</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(3) The marked feature maps faithfully only in onset when positional faithfulness dominates markedness

<table>
<thead>
<tr>
<th>/bæd/</th>
<th>IDENT[±voice]/ONSET</th>
<th>*VOICEDObs</th>
<th>IDENT[±voice]</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. bæd</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. → bæt</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>c. pæt</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

With this small set of constraints and this input, ranked and weighted constraints make the same typological predictions. Voiced obstruents can be admitted in all positions, only in onset position, or in no position at all. Candidates that show the opposite pattern of devoicing are simply harmonically bounded and cannot be selected as optimal in either OT or HG.

In general the differences between positional markedness constraints and positional faithfulness constraints are relatively subtle, and primarily related to their ability to model patterns of directional spreading and other cases of derived structure. There are, however, also differences in the types of stable positional restrictions that these types of constraints can model in OT. These differences become evident when multiple contextual constraints that reference the same marked feature are included in the system. In particular, OT positional markedness constraints can only model conjunctive patterns of licensing and positional faithfulness constraints can only model disjunctive patterns of licensing.

To illustrate this we will add a second licensing context – word-initial syllables – for [+voice] obstruents. The two possible ways of encoding this restriction are given in (4).
(4) Example: Two types of constraints for capturing a second positional asymmetry
   a. VOICEDOBSTRUENT⇒INITIAL: Assign a violation mark to any [+voice] obstruent that is not associated with a word-initial syllable.
   b. IDENT[±voice]/INITIAL: Assign a violation mark to any output segment in a word-initial syllable that differs in specification for [±voice] relative to its input correspondent.

The following sections provide natural language examples of how multiple constraints like these interact. The table in (5) previews the conclusions. The first column lists languages composed of members of a set of four possible forms: [da], where the [+voice] obstruent is simultaneously in onset and the initial syllable, [sad], where the [+voice] obstruent is in the initial syllable but not in onset, [so.da] where the [+voice] obstruent is in onset but not in the initial syllable, and [so.nad], where the [+voice] obstruent is in neither onset nor the initial syllable. The following columns indicate whether each of these languages can be modeled in OT and HG systems where positional restrictions are encoded using positional markedness constraints or positional faithfulness constraints. In each case the positional constraints from are supplemented by the general markedness constraint *VOICEDOBSTRUENT and the general faithfulness constraints IDENT[±voice].

(5) Possible patterns of licensing in OT and HG with different types of positional constraints

<table>
<thead>
<tr>
<th></th>
<th>OT positional markedness (1a, 4a)</th>
<th>OT positional faithfulness (1b, 4b)</th>
<th>HG positional markedness (1a, 4a)</th>
<th>HG positional faithfulness (1b, 4b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>{da, sad, so.da, so.nad} voiced obstruents everywhere</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>{} voiced obstruents nowhere</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>{da, sad} voiced obstruents in σ1</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>{da, so.da} voiced obstruents in onset</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td>{da, sad, so.da} voiced obstruents in σ1 or onset</td>
<td>✗</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>f.</td>
<td>{da} voiced obstruents in σ1 and onset</td>
<td>✓</td>
<td>✗</td>
<td></td>
</tr>
</tbody>
</table>

The most important observation here concerns the fact that in OT there is a primary distinction between the types of patterns that can be modeled using positional markedness and the types of patterns that can be modeled using positional faithfulness. Either markedness or faithfulness constraints can be used to model patterns (5a-d). The two patterns (5a) and (5b) are non-positional, relying simply upon the relative ranking or weighting of the general markedness and general faithfulness constraints. The patterns (5c) and (5d) are basic positional patterns of the type illustrated in (2) and (3). These too are easily accounted for in either system. The patterns in (5e) and (5f), on the other hand, reveal differences between the ranked-vs. weighted-constraint systems.

The language in (5e) shows a pattern of disjunctive licensing: [+voice] obstruents appear faithfully in either of the licensing environments – i.e., if they are in the initial syllable or if
they are in onset. Only when neither of these conditions are met, as with the form *[so.nad],
are voiced obstruents disallowed. This type of disjunctive licensing pattern can be modeled in
OT with positional faithfulness constraints but not with positional markedness constraints. The
language in (5f) shows a pattern of conjunctive licensing: [+voice] obstruents appear just when
they are simultaneously in both licensing environments – i.e., when they are in the initial
syllable and the onset. If both of these conditions are not met, as with the forms *[sad],
*[so.da] and *[so.nad], voiced obstruents cannot appear. This type of pattern can be modeled
in OT with positional markedness constraints, but not with positional faithfulness constraints.

As indicated in (5), both positional markedness and positional faithfulness constraints can
model patterns of conjunctive and disjunctive licensing in Harmonic Grammar. This ability is
a consequence of cumulative constraint interaction, as will be illustrated in the following
sections. I argue that this greater power of constraints in HG is a considerable benefit,
allowing the set of positional constraints employed by the grammar to be reduced, thereby
creating a more elegant system that is nonetheless consistent with the types of patterns
observed across languages.

We turn now to two case studies. The first case study – Kɔnni vowel place licensing – is
used to demonstrate how, in OT, patterns of disjunctive licensing elude positional markedness
constraints and patterns of conjunctive licensing elude positional faithfulness constraints. Both
types of pattern can be straightforwardly modeled using only positional markedness constraints
in Harmonic Grammar. The second case study – licensing of English [h] – extends this
illustration, further considering how conjunctions and disjunctions of contexts interact.

2.2. Kɔnni vowel place licensing

Kɔnni is a Gur language spoken in the Northern Region of Ghana; all data and
generalizations described here come from Cahill (2007). Kɔnni contrasts short and long
vowels, with long mid vowels typically realized as diphthongs. Within a non-complex
word, all vowels agree for the feature [±ATR], and when a suffix is added, it adopts the [±ATR]
value of the root vowels. We will abstract away from this vowel harmony pattern, and focus
instead upon the disjunctive licensing restrictions. The vowel inventory is summarized in (6).\(^4\)

(6) Vowel inventory of Kɔnni (Cahill 2007: 175)

\begin{verbatim}
[+ATR] vowels          [-ATR] vowels
i ii u uu i ii o oo
e ee~ie o oo~uo e ee~ia e ca~ua a aa
\end{verbatim}

There are two distinct environments in which the full range of contrastive vowel features
are admitted in Kɔnni. The first licensing environment is the morpheme-initial syllable – a
strong position discussed at length by Beckman (1998). As the verbs in (7) attest, all vowel
qualities are represented in this context. In non-initial syllables, however, only high vowels –
specifically [i] and [i] – are found.\(^5\)

(7) All vowel qualities are admitted in the initial syllable (Cahill 2007: 90)

\begin{verbatim}
[bati] ‘trap’     [kpegi] ‘snap’
[jesi] ‘carve’     [surisi] ‘rub’
[bobi] ‘tie’      [garisi] ‘pass’
[fogi] ‘take apart’ [kuri] ‘pound’
\end{verbatim}

This morpheme-initial licensing condition can be formalized using the constraint in (8).\(^6\)
(8) **NonHigh⇒Initial**: Assign a violation mark to any [−high] vowel feature that is not associated with a morpheme initial syllable.

In OT this markedness constraint must dominate the conflicting IdentHeight constraint in order for its effects to be observed – similar to the pattern seen in (2). The tableau in (9) reiterates this point, using the hypothetical input /βɔbɛ/. With the ranking NonHigh⇒Initial ≫ IdentHeight ≫ *NonHigh, the first vowel maps faithfully to [ɔ] while the second vowel maps unfaithfully, losing its distinctive [−high] feature.

(9) **Vowel height features map faithfully just when associated with the initial syllable**

<table>
<thead>
<tr>
<th>/βɔbɛ/</th>
<th>NonHigh⇒Initial</th>
<th>IdentHeight</th>
<th>*NonHigh</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. βɔbɛ</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>b. → βɔbɪ</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>c. bɔbɪ</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

The output is the licit Kɔnni form [bɔbɪ] ‘tie’. Ranking NonHigh⇒Initial above faithfulness is crucial to this result; were the opposite ranking to hold, vowel place features would map faithfully in all positions.

The second licensing environment is nouns. As the data (10) illustrates, a range of vowel qualities are admitted in all positions in nouns; being in the morpheme-initial syllable is not required.7

(10) **All vowel qualities are admitted in nouns** (Cahill 2007: 94-95, 99)

- [ɡbáříəŋ] ‘earthworm’
- [bɪtɪɛŋ] ‘chin’
- [dâjúŋ] ‘rat’
- [ʧâkɔttu] ‘blacksmith’
- [jâltʊ] ‘hunter’
- [bɔɭɭɡɪŋ] ‘bag’
- [ɡəntɔrə] ‘weaver bird’
- [ŋmârɪɭjəpûrɪŋ] ‘speckled dove’

Like morpheme-initial privilege, noun-specific privilege is cross-linguistically well attested. Smith (2001) documents numerous examples from the phonological systems of unrelated languages. Child language provides further evidence; nouns are typically acquired before verbs (see Gentner & Boroditsky 2001 for a review), and, as in adult phonology, have been observed to license a greater range of contrasts (Adam & Bat-El 2008, Jesney & Tessier 2009). Notably, Kɔnni also shows noun-privilege effects in its tonal system. While nouns can contrast based solely on tone, the tonal patterns associated with verbs in Kɔnni are predictable based on inflectional properties of the sentence (Cahill 2007: 386). The constraint in (11) formalizes the noun-category licensing condition for non-high vowels.

(11) **NonHigh⇒Noun**: Assign a violation mark to any [−high] vowel place feature that is not associated with a noun.

In order for the effects of the constraint in (11) to be observed in OT, it must dominate IdentHeight. As the tableaux in (12) and (13) show, however, when both NonHigh⇒Initial and NonHigh⇒Noun dominate IdentHeight, the desired result is not obtained. Rather than [−high] vowels being licensed if they are in the initial syllable (of any lexical category) or in a noun (regardless of position), non-high vowels map faithfully only if they are simultaneously in an initial syllable and a noun. With this ranking, only nouns have distinctive vowel height, and then only in the initial syllable.
Problem: Vowel height features in nouns map faithfully just when they are associated with the initial syllable

<table>
<thead>
<tr>
<th>/gàniàrà Noun/</th>
<th>NONHIGH⇒INITIAL</th>
<th>NONHIGH⇒NOUN</th>
<th>IDENTHEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ← gàniàrà</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. → gàniìri</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. giüri</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Problem: Vowel height features in verbs do not map faithfully in any position

<table>
<thead>
<tr>
<th>/bɔbì Verb/</th>
<th>NONHIGH⇒INITIAL</th>
<th>NONHIGH⇒NOUN</th>
<th>IDENTHEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ← bɔbì</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b. → bɔbì</td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

High-ranking NONHIGH⇒INITIAL assigns violation marks to any non-initial [–high] feature, regardless of whether the feature is found in a noun. This rules out the attested Kònni output in (12). Similarly, high-ranking NONHIGH⇒NOUN assigns violation marks to any instance of [–high] in a verb, ruling out attested outputs with this feature in initial position (13).

This effect is a general one in OT. Whenever two positional markedness constraints that target overlapping sets of features both dominate the set of conflicting faithfulness constraints, the features will appear only in contexts that meet both of the licensing conditions. If further positional markedness constraints are added, the features will appear only in contexts that meet these licensing conditions as well. Positional markedness constraints in OT can only model conjunctive patterns of licensing – i.e., patterns where a feature is licensed just if it is simultaneously in context 1 (initial syllable) and context 2 (a noun), etc. It is not possible to express the type of disjunctive pattern seen in Kònni using these constraints in OT.

As a general rule, markedness constraints act to restrict the set of contexts in which a given structure may appear. To the extent that markedness constraints dominate conflicting faithfulness constraints, the restrictions imposed by the constraints are enforced in the output (assuming that no conflicting markedness constraints outrank them). When multiple markedness constraints targeting overlapping structures are high ranking, the preference is for all of these restrictions to be enforced (if possible). In the case of positional markedness constraints, the result is a general non-licensing of the structure in question unless all of the licensing conditions are simultaneously met.

In Harmonic Grammar, on the other hand, the missing disjunctive pattern can be readily modeled through the cumulative interaction of this set of constraints. The necessary weighting conditions are summarized in (14). For the Kònni pattern, the weight of IDENTHEIGHT must be greater than the independent weights of NONHIGH⇒INITIAL (14a) and NONHIGH⇒NOUN (14b), even as the summed weight of the two positional markedness constraints is greater than the weight of IDENTHEIGHT (14c).
HG weighting conditions for the Kɔnni disjunctive licensing pattern

14. $w(\text{IDENTHEIGHT}) > w(\text{NONHIGH} \Rightarrow \text{INITIAL})$
   a. $w(\text{IDENTHEIGHT}) > w(\text{NONHIGH} \Rightarrow \text{NOUN})$
   b. $w(\text{NONHIGH} \Rightarrow \text{INITIAL}) + w(\text{NONHIGH} \Rightarrow \text{NOUN}) > w(\text{IDENTHEIGHT})$

The tableaux below illustrate the HG analysis, using a set of weights consistent with the weighting conditions in (14). Weights are given immediately below the constraint names; the total Harmony scores of candidates are given on far right. These weights are partially arbitrary; any set of weights consistent with the conditions in (14) would yield the Kɔnni pattern. See Pater [this volume] for more on weighting conditions in HG.

15. Non-high vowels in nouns map faithfully even when they are not associated with the initial syllable

<table>
<thead>
<tr>
<th>Candidate</th>
<th>IDENTHEIGHT</th>
<th>NONHIGH$\Rightarrow$INITIAL</th>
<th>NONHIGH$\Rightarrow$NOUN</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. → gânu'âra</td>
<td>3</td>
<td>-2</td>
<td>-4</td>
</tr>
<tr>
<td>b. gâniiri</td>
<td>-2</td>
<td></td>
<td>-6</td>
</tr>
<tr>
<td>c. gîniiri</td>
<td>-3</td>
<td></td>
<td>-9</td>
</tr>
</tbody>
</table>

16. Non-high vowels in the initial syllable map faithfully even when they are associated with a verb

<table>
<thead>
<tr>
<th>Candidate</th>
<th>IDENTHEIGHT</th>
<th>NONHIGH$\Rightarrow$INITIAL</th>
<th>NONHIGH$\Rightarrow$NOUN</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. → bôbî</td>
<td>3</td>
<td></td>
<td>-2</td>
</tr>
<tr>
<td>b. bîbî</td>
<td>-1</td>
<td></td>
<td>-3</td>
</tr>
</tbody>
</table>

In (15) the weight of IDENTHEIGHT is greater than the weight of NONHIGH$\Rightarrow$INITIAL and so vowels in non-initial position, like the target /a/ and /a/ in /gânu'âra/, map faithfully. The input here is a noun, and so all of the vowels satisfy the constraint NONHIGH$\Rightarrow$NOUN. This is the result attested in Kɔnni. In (16) the input is a verb, and so faithful mapping of the non-high vowel in the initial syllable leads to violation of NONHIGH$\Rightarrow$NOUN. Because the weight of IDENTHEIGHT is greater than the weight of NONHIGH$\Rightarrow$NOUN, however, the faithful form is selected. The key case here is (17), where the input is the hypothetical form /ɲîgâsi/ – a verb that includes an illicit non-high vowel in the second syllable. The faithful candidate (17a) incurs violations of both of the positional markedness constraints, giving it a lower Harmony value than the unfaithful candidate (17b). The winning form – [ɲîgâsi] – is an attested verb in Kɔnni, meaning 'flash' (Cahill 2007: 90).
Non-high vowels map unfaithfully when they are not associated with the initial syllable or a noun.

<table>
<thead>
<tr>
<th>/nɪɡəsi_{verb}/</th>
<th>IDENTHEIGHT</th>
<th>NONHIGH⇒INITIAL</th>
<th>NONHIGH⇒NOUN</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. nɪɡasi</td>
<td>3</td>
<td>−1</td>
<td>−1</td>
</tr>
<tr>
<td>b. → nɪɡiśi</td>
<td>−1</td>
<td></td>
<td>−3</td>
</tr>
</tbody>
</table>

Given the importance of disjunctive licensing in Kɔnni and the fact that this is precisely the type of pattern that poses difficulties for positional markedness constraints in OT, one might wonder whether a positional faithfulness solution would be better suited to the data. Indeed, as previewed in section 2.1, positional faithfulness constraints can model precisely this type of scenario. For Kɔnni, the required positional faithfulness constraints are the two in (18), along with the conflicting general markedness constraint *NONHIGH.

(18) Positional faithfulness constraints to account for the Kɔnni pattern

a. IDENTHEIGHT/INITIAL: Assign a violation mark to any instance of an output segment in the morpheme-initial syllable that differs in vowel height features relative to its input correspondent.

b. IDENTHEIGHT/NOUN: Assign a violation mark to any instance of an output segment associated with a noun that differs in vowel height features relative to its input correspondent.

Ranking these constraints sufficiently high in OT allows the disjunctive licensing pattern to be captured.

Simply using positional faithfulness constraints is not an adequate solution, however, because positional faithfulness constraints cannot capture conjunctive licensing conditions that interact with disjunctive conditions like those described above. Within Kɔnni, this issue is highlighted by the role that root membership plays in licensing vowel features. While roots abide by the generalizations already described, the inventory of vowels in Kɔnni suffixes is restricted, so that only [i, u, e, o] appear with [+ATR] stems, and only [i, u, a] appear with [−ATR] stems (Cahill 2007: 88). Long vowels and the [−ATR] mid vowels [ɛ] and [ɔ] are not admitted in suffixes. This is true regardless of the lexical category of the word as a whole and regardless of the fact that the vowel may be in the initial syllable of the morpheme spelled out by the suffix. In effect, the full range of vowel features is admitted only when the relevant vowel is in a morpheme initial syllable and in a root or when it is in a noun and in a root.

The conjunctive aspect pattern of this pattern – i.e., the fact that being in a root plus some other strong environment is required – eludes positional faithfulness constraints in OT. If a root-specific positional faithfulness constraint dominates *NONHIGH, the set of contexts where vowel place features are freely admitted will extend to all positions in all roots – including non-initial syllables of verbs. High-ranking positional faithfulness constraints admit contrasts for the relevant features in every case where those features are associated with any context identified by one of these constraints – a too liberal result in the Kɔnni case.

This additional component of the pattern poses no difficulty for positional markedness constraints in HG; the key constraint is MID⇒ROOT, defined in (19).
(19) **Mid⇒Root**: Assign a violation mark to any instance of a [–high, –low] vowel that is not associated with a root.

The vowel qualities targeted by this markedness constraint are a proper subset of those targeted by the other positional markedness constraints. Mid vowels are [–high], and therefore, depending upon their position within the form, may also violate **NonHigh⇒Initial** and/or **NonHigh⇒Noun**. The necessary weighting conditions for the Kɔnni pattern are summarized in (20).

(20) **HG weighting conditions for the Kɔnni disjunctive + conjunctive licensing pattern**
   a. Vowel height features, including [–high, –low], are freely admitted when in a root and a noun (even non-initially) – cf. (14a)
      \[ w(\text{IDENT HEIGHT}) > w(\text{NonHigh⇒Initial}) \]
   b. Vowel height features, including [–high, –low], are freely admitted when in a root and an initial syllable (even of a verb) – cf. (14b)
      \[ w(\text{IDENT HEIGHT}) > w(\text{NonHigh⇒Noun}) \]
   c. All [–high] vowels are disallowed if they are not in a noun or a morpheme-initial syllable (even if they are in a root) – cf. (14c)
      \[ w(\text{NonHigh⇒Noun}) + w(\text{NonHigh⇒Initial}) > w(\text{IDENT HEIGHT}) \]
   d. [–high, –low] vowels are disallowed in suffixes (even if the form as a whole is a noun, and the vowel is morpheme initial)
      \[ w(\text{Mid⇒Root}) > w(\text{IDENT HEIGHT}) \]

The Kɔnni pattern of vowel place licensing has both disjunctive and conjunctive aspects. Non-high vowels – and particularly mid vowels – are admitted if they are in a morpheme-initial syllable and in a root, or if they are in a noun and a root. In OT, positional markedness constraints can capture only the conjunctive aspects of this pattern, and positional faithfulness constraints can capture only the disjunctive aspects of this pattern. Neither set of constraints can capture both. If constraints are weighted as in HG, on the other hand, cumulative constraint interaction allows positional markedness constraints to capture the conjunctive and disjunctive aspects of the pattern. The Kɔnni distribution can be effectively modeled in HG using only a limited set of simple constraints.

2.3. English [h] licensing

The distribution of English [h] provides a second natural-language illustration of combined disjunctive and conjunctive licensing. While the licensing environments involved in the Kɔnni case are arguably due to psycholinguistic prominence, contextual privilege driven by phonetic cues can be equally implicated in disjunctive and conjunctive licensing patterns. It is the constraint formalism and the consequent violation profiles that produce the HG vs. OT differences discussed in the previous sections. The substantive source of the licensing is immaterial to the range of patterns that can be modeled with these constraints.

As has been discussed extensively in the literature, the distribution of English [h] is restricted, with the segment appearing only when certain conditions are met (see, among others, Borowsky 1984, 1986, Davis & Cho 2003, Hammond 1999). The most commonly-recognized environments for English [h] are onset of a word-initial syllable (21) and onset of a stressed syllable (22).
[h] is licensed in the onset of word-initial syllables

[həˈbɪ.tʃʊ.ɪ] ‘habitual’
[haˈlou] ‘hello’
[ˈhe.ə] ‘heather’

[h] is licensed in the onset of stressed syllables

[viˈhɪ.kju.ɫ] ‘vehicular’
[pɪə.ˈhi.bət] ‘prohibit’
[ˈæl.kə.ha] ‘alcohol’

If one of these conjoined conditions is not met, [h] cannot appear. There are no words with [h] in the coda of a word-initial syllable, even when that syllable is stressed.

[h] is not licensed in the coda of word-initial syllables

[ˈbɹɑ.mɪn] ~ *[ˈbɹah.min] ‘brahmin’
[tʰə.ˈjæn] ~ *[tʰə.ˈjæn] ‘Tehran’

[h] is not licensed in the coda of stressed syllables

[ˈæt.həs] ‘atlas’,
[ˈɹæ.pəd] ‘rapid’. cf. ‘vehicular’

[ˈæ.bɹə.ɹə.ˈdæ.bɹə] ‘abracadabra’,

These environments closely mirror those where aspiration is found. Voiceless stops are aspirated in word-initial position, and in the initial position of stressed syllables (Davis & Cho 2003, Jensen 2000, Kreidler 1989, Selkirk 1982). Aspiration is absent from the coda of word-initial syllables, even when that syllable is stressed, and from most unstressed non-initial syllables – e.g., *[ˈætʰ.æs] ‘atlas’, *[ˈæ.ɹə.ɹə.ɹə.ɹə] ‘vehicle’ cf. ‘vehicular’

[ˌæ.bɹə.ɹə.ɹə.ɹə] ‘prohibition’ cf. ‘prohibit’

This final context is arguably a less robust licensor of [h] than of aspiration. Davis & Cho (2003: 609) note that words with [h] in this environment are “exceedingly rare” and identify only one example: [tʰə.ˈhə.ˈmərə] ‘Tarahumara’. Further distinguishing the distribution of [h] from the distribution of aspiration is the predictability and necessity of aspiration on voiceless stops in the contexts where it is licensed. The presence of [h] is unpredictable; it is not, for example, epenthesized in cases where a syllable would otherwise be onsetless. Nonetheless, it seems clear that the two distributions are connected. Articulatory evidence supports this; the extent of the glottal gesture in the various licensing contexts is similar for [h] and for aspiration (Goldstein 1992). Given these (incomplete) parallels, it seems reasonable to suppose that the phonetic enhancement observed with aspiration has found a categorical instantiation with English [h]. For simplicity we will focus in the theoretical discussion on the distribution of [h] as represented in (21) through (24).

As with the Konni pattern, the distribution of English [h] can be understood as resulting from a requirement that multiple licensing conditions be satisfied in order for the segment to appear. The relevant constraints are given in (25).
Positional markedness constraints for English [h] licensing

a. \( H \Rightarrow \text{ONSET} \): Assign a violation mark to any segment [h] that is not associated with a syllable onset.

b. \( H \Rightarrow \text{INITIAL} \): Assign a violation mark to any segment [h] that is not associated with a word-initial syllable.

c. \( H \Rightarrow \text{STRESS} \): Assign a violation mark to any segment [h] that is not associated with a stressed syllable.

The claim here is that these are distinct licensing conditions that interact, and that the full pattern cannot be reduced to an onset-licensing requirement. This stands in contrast with stress-based resyllabification accounts, like that of Selkirk (1982), which attribute the absence of [h] in words like *vehicle* to a preference in English for intervocalic consonants to be syllabified as codas when the immediately preceding vowel is stressed (for related experimental findings involving other consonants, see, among others, Ishikawa 2002, Redford & Randall 2005, Turk 1994). The initial syllabification for the form *vehicle* under a resyllabification approach would be ['vih.ə.kl], with subsequent deletion of coda [h]. There are two reasons to question the adequacy of this account. First, alternative pronunciations of loanwords like *Tehran* and *Bahrain*, epenthesize a vowel immediately following target /h/; this allows the segment to syllabified as an onset and preserved even though the preceding syllable retains its stress – i.e., [tʰə.hə.ˈæn] *Tehran*, [bə.hə.ˈæn] *Bahrain*. While preservation of the [h] in these cases is unexpected, given that the epenthetic vowel is unstressed, it is clear that stress does not force coda syllabification. This effectively undermines the claim that target /h/ is deleted in words like *vehicle* due to stress-based resyllabification; minimally, resyllabification is not mandatory for [h], and therefore cannot be the sole factor governing the segment’s distribution.10 Second, articulatory evidence from work by Goldstein (1992) indicates that production of [h] varies across the onset contexts in which it appears. More extreme gestures occur when the associated syllable is stressed than when it is unstressed, and, in the case of unstressed syllables, when the syllable is initial than when it is non-initial. In effect, onset syllabification is crucial in licensing [h], but stress and word-initial position are also key factors in determining the precise realization of the segment. To the extent that these factors are represented within the grammar, reducing the account to one relying on syllabification seems unwarranted.

As one would expect, OT achieves limited success with the constraints in (25). When the three positional markedness constraints dominate faithfulness, [h] is licensed just at the intersection of the privileged contexts – i.e., in the onset of stressed word-initial syllables. In contrast, Harmonic Grammar is able to capture both the conjunctive and disjunctive aspects of the pattern with little difficulty. To ensure that [h] is admitted in the onset of initial syllables and the onset of stressed syllables, the weighting conditions in (26a) and (26b) are required. Supplemeting these with the conditions in (26c) and (26d) ensures that [h] is banned outside of the attested contexts.
HG weighting conditions for the English [h] disjunctive + conjunctive licensing pattern

a. [h] appears in word-initial onsets (even when the syllable is unstressed)
   \( w(\text{MAX-C}) > w(\text{H} \Rightarrow \text{STRESS}) \)

b. [h] appears in the onset of stressed syllables (even when they are non-initial)
   \( w(\text{MAX-C}) > w(\text{H} \Rightarrow \text{INITIAL}) \)

c. [h] is barred from coda (even of initial syllables and stressed syllables)
   \( w(\text{H} \Rightarrow \text{ONSET}) > w(\text{MAX-C}) \)

d. [h] is barred from the onset of unstressed non-initial syllables
   \( w(\text{H} \Rightarrow \text{INITIAL}) + w(\text{H} \Rightarrow \text{STRESS}) > w(\text{MAX-C}) \)

The weights shown in the tableaux below meet these conditions, ensuring that [h] is restricted to the attested environments.

(27) [h] is admitted in the onset of an unstressed initial syllable

<table>
<thead>
<tr>
<th>/həˈlou/</th>
<th>(\text{H} \Rightarrow \text{ONSET} )</th>
<th>(\text{MAX-C} )</th>
<th>(\text{H} \Rightarrow \text{INITIAL} )</th>
<th>(\text{H} \Rightarrow \text{STRESS} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. → həˈlou</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>b. əˈlou</td>
<td>3</td>
<td>-1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

(28) [h] is admitted in the onset of a stressed non-initial syllable

<table>
<thead>
<tr>
<th>/vi.ˈhi.kju.ə/</th>
<th>(\text{H} \Rightarrow \text{ONSET} )</th>
<th>(\text{MAX-C} )</th>
<th>(\text{H} \Rightarrow \text{INITIAL} )</th>
<th>(\text{H} \Rightarrow \text{STRESS} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. → vi.ˈhi.kju.ə</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>b. vi.ˈi.kju.ə</td>
<td>3</td>
<td>-1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

(29) [h] is barred from coda

<table>
<thead>
<tr>
<th>/tʰɛh.ən/</th>
<th>(\text{H} \Rightarrow \text{ONSET} )</th>
<th>(\text{MAX-C} )</th>
<th>(\text{H} \Rightarrow \text{INITIAL} )</th>
<th>(\text{H} \Rightarrow \text{STRESS} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. tʰɛh.ən</td>
<td>-1</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>b. → tʰɛ.ən</td>
<td>-1</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

(30) [h] is barred from the onset of an unstressed non-initial syllable

<table>
<thead>
<tr>
<th>/vi.hə.əkl/</th>
<th>(\text{H} \Rightarrow \text{ONSET} )</th>
<th>(\text{MAX-C} )</th>
<th>(\text{H} \Rightarrow \text{INITIAL} )</th>
<th>(\text{H} \Rightarrow \text{STRESS} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ˈvi.hə.əkl</td>
<td>-1</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>b. → ˈvi.ə.əkl</td>
<td>-1</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

The problems for positional faithfulness in OT seen with the Kɔnni system in section 2.2 extend to the current case. Positional faithfulness can capture the disjunctive aspects of the pattern – i.e., the fact that either stress or initial-syllable positioning is required for licensing – but not the fact that [h] must also be associated with an onset in each case. In OT positional faithfulness and positional licensing constraints make opposing predictions. As a result, neither set of constraints alone can capture complex patterns like Kɔnni vowel feature licensing or
English [h] licensing. In HG, on the other hand, a single set of constraints can capture both conjunctive and disjunctive licensing effects. The simplicity of the resulting analyses is a distinct advantage of the HG approach.

3 Typology size

3.1. Typology size and static distributions

Alone, both positional markedness constraints and positional faithfulness constraints undergenerate in OT. Given that each of these sets of constraints can capture some types of positional asymmetries, however, it is reasonable to consider the consequences of a Con that includes both. To examine this, we will continue with the constraints defined while discussing the distribution of English [h].

The OT and HG typologies produced with only positional markedness constraints, only positional faithfulness constraints, and both positional markedness and positional faithfulness constraints are compared in (31). A total of six models are represented; the OT models are given on the left and the HG models are given on the right. All models include the general constraints $\text{MAX-C}$ and $\text{\:*H}$. Additionally, models with positional markedness constraints included $H \Rightarrow \text{ONSET}$, $H \Rightarrow \text{INITIAL}$ and $H \Rightarrow \text{STRESS}$, and models with positional faithfulness constraints include $\text{MAX-C/ONSET}$, $\text{MAX-C/INITIAL}$ and $\text{MAX-C/STRESS.}$

Models with both positional markedness and positional faithfulness constraints include all six positional constraints. Typology computations were conducted using OT-Help (Staubs et al. 2010).

A total of eight inputs are considered. Two outputs – faithful and unfaithful mapping of target /h/ – are possible for each form, giving 256 potential combinations of optima. In fact, however, maximally 20 languages are produced with the constraints used here. All twenty are generated by HG with only positional markedness, HG with only positional faithfulness, and HG with both positional markedness and positional faithfulness. In other words, the full range of conjunctive and disjunctive patterns can be modeled in HG with any of the three constraint sets.

The picture in OT is rather more complex, but unsurprising given the discussion thus far. Positional markedness constraints in OT do not allow any type of disjunctive licensing pattern to be modeled, and so languages (31i) through (31s) are ruled out. Positional faithfulness constraints in OT do not allow any type of conjunctive licensing pattern to be modeled, and so languages (31e) through (31h) and languages (31m) through (31s) are ruled out. The English pattern is represented by (31r), and cannot be generated in OT with only positional markedness or positional faithfulness constraints. With both sets of positional constraints in OT, 19 of the languages – i.e., all except (31s) – are admitted.
Possible patterns of licensing in OT and HG with different sets of positional constraints

<table>
<thead>
<tr>
<th>Pattern</th>
<th>OT pos. lic. only</th>
<th>OT pos. faith only</th>
<th>OT pos. lic. &amp; pos. faith</th>
<th>HG pos. lic. only</th>
<th>HG pos. faith only</th>
<th>HG pos. lic. &amp; pos. faith</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. h] in all contexts</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>b. [h] only if onset</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>c. [h] only if stressed</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>d. [h] only if initial</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>e. [h] only if stressed &amp; onset</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>f. [h] only if stressed &amp; initial</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>g. [h] only if onset &amp; initial</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>h. [h] only if stressed &amp; onset &amp; initial</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>i. [h] if stressed or if onset</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>j. [h] if stressed or if initial</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>k. [h] if onset or if initial</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>l. [h] if onset or if initial or if stressed</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>m. [h] if stressed or if onset &amp; initial</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>n. [h] if initial or if stressed &amp; onset</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>o. [h] if onset or if stressed &amp; initial</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>p. [h] if stressed &amp; initial or if stressed &amp; onset</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>q. [h] if initial &amp; stressed or if initial &amp; onset</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>r. [h] if onset &amp; stressed or if onset &amp; initial</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>s. [h] if onset &amp; stressed or if onset &amp; initial or if stressed &amp; initial</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>t. [h] in no contexts</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Two primary observations emerge from this comparison. First, all three of the HG models generate precisely the same set of languages. Unlike in OT, there is no typological benefit to be gained in HG from the inclusion of both positional faithfulness and positional markedness constraints. Second, the HG typologies only include one language that is not generated by OT with the two sets of constraints. Typological expansion due to cumulative constraint interaction is quite limited. An HG model with a single set of positional constraints is thus a viable solution, allowing conjunctive and disjunctive licensing patterns to be effectively modeled while reducing redundancy in CON.

3.2. Restricting the constraint set, restricting the typology

The possibility in HG of restricting the constraint set to just one type of contextual constraint – specifically positional markedness constraints – offers typological benefits that become evident when a wider range of phenomena are considered. We will focus in this section on the licensing of derived marked structures, which, as Zoll (1998) argues, show a
preference for association with strong positions. This type of patterning requires analysis using positional markedness constraints; positional faithfulness constraints make precisely the wrong predictions (Zoll 1998; see also Itô & Mester 2003).

As an initial example, we will consider the Sanskrit morpheme denoting authorship, which, in addition to suffixation with [-a] (or [-i-ya] in certain cases), induces lengthening and, when non-vacuous, introduction of the [a] vowel quality in the initial syllable of the base (Kiparsky 1972). This type of pattern is particularly interesting because the two exponents of the morpheme are not aligned with one another; instead, the vowel length and quality change are attracted to the strong initial (licensing) position.  For illustrative purposes, we will focus upon the lengthening effect, which can be attributed to docking of a floating mora introduced by the morpheme.

(32) Sanskrit authorship morpheme triggers lengthening and lowering of the initial syllable (Kiparsky 1972: 202)

<table>
<thead>
<tr>
<th>a. Base form</th>
<th>b. Derived form</th>
</tr>
</thead>
<tbody>
<tr>
<td>jīnendra</td>
<td>jainendra</td>
</tr>
<tr>
<td>bija</td>
<td>baida</td>
</tr>
<tr>
<td>apiśāli</td>
<td>apiśāla</td>
</tr>
</tbody>
</table>

Tableaux illustrating the necessity of positional markedness constraints in modeling such patterns are given in (33) and (34).  (The results in (33) and (34) are shown using HG tableaux, but the patterns rely on simple harmonic bounding and therefore extend straightforwardly to OT.)  The first tableau, (33), shows a successful analysis using the positional markedness constraint $V:\Rightarrow\text{INITIAL}$, which penalizes long vowels that appear outside the strong word-initial syllable.  The optimal candidate here has lengthening of the initial vowel, as in the attested forms.  The other candidates, all of which introduce the marked structure into a weak environment, are harmonically bounded.  With the ordering of the constraints in (33), long vowels are admitted as faithful mappings in any position, but derived long vowels are limited to the position where they are best licensed.  

(33) Positional markedness leads to docking in the strong position

<table>
<thead>
<tr>
<th>/apiśāli + a + μ/</th>
<th>IDENTVLENGTH</th>
<th>V:\Rightarrow\text{INITIAL}</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. → apiśāla</td>
<td>–1</td>
<td>–2</td>
</tr>
<tr>
<td>b. apiśāla</td>
<td>–1</td>
<td>–1 –4</td>
</tr>
<tr>
<td>c. apiśāla:</td>
<td>–1</td>
<td>–1 –4</td>
</tr>
</tbody>
</table>

The tableau in (34) shows that positional faithfulness constraints fail to achieve the same success with the Sanskrit data.  The positional faithfulness constraint IDENTVLENGTH/INITIAL penalizes initial vowels that differ in length relative to their input correspondents.  As a result, the floating mora actively avoids associating with the initial syllable; the candidate that violates IDENTVLENGTH/INITIAL is harmonically bounded.  Including a general IDENTVLENGTH constraint does not alter these results.  With positional faithfulness constraints, any candidate where the floating mora docks in the strong position is harmonically bounded by a candidate where the floating mora docks elsewhere.
Positional faithfulness leads to avoidance of the strong position

<table>
<thead>
<tr>
<th>/apiśali + a + μ/</th>
<th>IDENTVLENGTH/INITIAL</th>
<th>*V;</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ← apiśala</td>
<td>−1</td>
<td>−1</td>
</tr>
<tr>
<td>b. → apiśala</td>
<td>−1</td>
<td>−2</td>
</tr>
<tr>
<td>c. → apiśala:</td>
<td>−1</td>
<td>−2</td>
</tr>
</tbody>
</table>

The preferences reflected in these tableaux persist as long as there are no additional constraints that favour association of the derived marked structure with some other position. For example, it would be possible to model a suffix’s preference for lengthening an immediately preceding vowel – even if that vowel is in a relatively weak position – by including a constraint that is violated just in the case that the derived long vowel is not aligned with the suffix. Such a constraint would break the harmonic bounding pattern in (33), allowing a different candidate to prove optimal. Similarly, constraints disfavouring long vowels of a particular quality could block lengthening of the initial vowel in (33). What is crucial here is that positional markedness constraints allow marked structures to preferentially associate with strong positions, as is observed with the Sanskrit pattern. Positional faithfulness constraints cannot express this preference; indeed, all else being equal, positional faithfulness constraints block association of derived marked structures with strong licensing positions.¹⁴

Zoll (1998), building on Kager’s (1996) analysis of Guugu Yimidhirr, provides a more complex case that illustrates how static licensing-based inventory restrictions can interact with morpheme-specific alignment considerations. As the data in (35) illustrate, Guugu Yimidhirr limits long vowels to the first two syllables of the stem.

(35) Guugu Yimidhirr: long vowels are admitted in the first two syllables of the stem (Kager 1996: 66)

[wa.ḍa] ‘crow’
[da.ra:ľan] ‘kangaroo’
[gam.bu:gu] ‘head’

When vowel length is derived, this restriction still holds. The suffix [-ŋu], for instance, has the effect of lengthening the immediately preceding vowel (36a,b). Lengthening only occurs, however, if the preceding vowel is one of the first two vowels of the stem; no lengthening occurs if the targeted vowel falls outside of the licensing domain (36c).

(36) Guugu Yimidhirr: Lengthening induced by the suffix [-ŋu] is restricted to the first two syllables of the stem (Kager 1996: 93-94)

a. /mayi/ [ma.yi:ŋu] ‘food-PURP’
b. /ŋaŋgal/ [ŋaŋ.gal:ŋu] ‘smoke-PURP’

* [ba.ɖi:bi.ŋa.yu]

This type of pattern is readily modeled with positional markedness constraints. The key constraint here is V;⇒HEADPWd, which limits long vowels to the two-syllable stem-initial licensing domain that Kager (1996) identifies as the head PWd. Weighting this constraint above IDENTVLENGTH ensures that long vowels map faithfully just if they appear within this two-syllable domain. V;⇒HEADPWd conflicts with ALIGN-ŋu, a morpheme-specific constraint that requires the suffix [-ŋu] to immediately follow a heavy syllable. In cases where the stem is
only two syllables long, the weighting of **ALIGN-ŋu** above **IDENTVLENGTH** allows the stem-final vowel to lengthen. In cases where the stem is longer than two syllables, however, the added weight of violating **V:**⇒**HEADPWD** blocks lengthening. This same effect is achieved in **OT** with the ranking **V:**⇒**HEADPWD** ≫ **ALIGN-ŋu** ≫ **IDENTVLENGTH**. (See Kager 1996 and Zoll 1998 for further discussion of the constraints involved.)

With positional markedness constraints, derived marked structures are, by default, attracted to positions that are the best licensors. Derived marked structures can appear in other positions, such as immediately preceding an associated suffix, but additional morpheme-specific constraints are necessary for this to occur. The Guugu Yimidhirr case illustrates both of these properties. Derived long vowels are restricted to a position where they are independently licensed, as captured with the **V:**⇒**HEADPWD** constraint. The selection of the second syllable as the locus for vowel lengthening, rather than the first, however, is a function of the morpheme-specific constraint **ALIGN-ŋu**.

In order to capture both disjunctive and conjunctive licensing patterns, **OT** requires both positional markedness and positional faithfulness, while **HG** requires only positional markedness. Integrating this distinction with the type of alternations discussed in this section, reveals rather dramatic typological differences. To illustrate, we will consider the marked feature [+voice], and two environments for its licensing – onset, and the word-initial syllable. The constraint set for the **HG** system is limited to **VOICEDOBS⇒ONSET** and **VOICEDOBS⇒INITIAL**, along with general **VF** constraints. The **OT** system adds the positional faithfulness constraints **IDENT[±voice]ONSET** and **IDENT[±voice]INITIAL**. Two inputs are considered: the simple input /bad.na.bad/, and the input /kat.na.kat [ +voice]/, which includes a morphologically-introduced [+voice] feature. The resulting typologies are summarized in (37).

(37) Predicted sets of possible outputs in **HG** with only positional markedness constraints vs. **OT** with positional markedness and positional faithfulness constraints

<table>
<thead>
<tr>
<th>/kat.na.kat [+ voi]/→</th>
<th>gat.na.kat</th>
<th>kad.na.kat</th>
<th>kat.na.gat</th>
<th>kat.na.kad</th>
</tr>
</thead>
<tbody>
<tr>
<td>/bad.na.bad/</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. <strong>bad.na.bad</strong></td>
<td>HG &amp; OT</td>
<td>OT</td>
<td>OT</td>
<td>OT</td>
</tr>
<tr>
<td>b. <strong>pat.na.pat</strong></td>
<td>HG &amp; OT</td>
<td>OT</td>
<td>OT</td>
<td>OT</td>
</tr>
<tr>
<td>c. <strong>bad.na.pat</strong></td>
<td>HG &amp; OT</td>
<td>OT</td>
<td>OT</td>
<td>OT</td>
</tr>
<tr>
<td>d. <strong>bat.na.bat</strong></td>
<td>HG &amp; OT</td>
<td>OT</td>
<td>OT</td>
<td>OT</td>
</tr>
<tr>
<td>e. <strong>bad.na.bat</strong></td>
<td>HG</td>
<td>OT</td>
<td>OT</td>
<td>OT</td>
</tr>
<tr>
<td>f. <strong>bat.na.pat</strong></td>
<td>HG &amp; OT</td>
<td>OT</td>
<td>OT</td>
<td>–</td>
</tr>
</tbody>
</table>

Six languages are generated by the **HG** system, each corresponding to one of the six configurations sketched in (5). As a faithful mapping, [+voice] may be realized in all contexts (37a), in no context (37b), if it is in the initial syllable (37c), if it is in onset (37d), if it is in onset or the initial syllable (37e), and if it is in onset and the initial syllable (37f). As a derived instance of the marked structure, the floating [+voice] feature consistently docks on the best licensor – i.e., the onset of the initial syllable – giving [gat.na.kat]. This is to be expected given the preferences of positional markedness constraints; derived marked structures preferentially target the context that allows all positional markedness constraints to be satisfied – i.e., the
conjoined context. All other options are harmonically bounded. More generally, the HG system predicts that derived instances of a marked structure are limited to positions where underived instances of that structure are also licensed. The only exception comes from cases where the marked structure is not normally admitted in any position – e.g., cases where input /bad.na.bad/ maps to [pat.na.pat]. Licensing of derived marked structures is governed by the same basic conditions as licensing of non-derived marked structures.

The OT typology is considerably larger, comprising 22 languages. When both positional faithfulness and positional markedness constraints are at play, the set of available sites for docking of the floating [+voice] feature expands substantially. Depending upon the ranking of the constraints, the feature can associate with an initial onset, an initial coda, a non-initial onset, or a non-initial coda. These possibilities cross-classify almost exhaustively with the six patterns of faithful mapping. A number of the resulting languages are distinctly odd, imposing entirely different conditions on the licensing of floating and non-floating [+voice] features even in the absence of morpheme-specific alignment constraints. The OT-generated language with output forms [bad.na.pat] and [kat.na.qat], for example, generally licenses faithful realization of [+voice] just in the initial syllable, but prefers that derived [+voice] features target the onset of a non-initial syllable. Similarly, the language with outputs [bad.na.bat] and [kat.na.kad] normally admits voiced segments if they are in onset position or in the initial syllable, but explicitly avoids docking [+voice] features in these positions. With both sets of positional constraints, there is no necessary relation in the OT system between the licensing of derived and non-derived marked structures.

To summarize: The greater power of positional markedness constraints in HG allows fewer constraints to be used, leading to a more restricted typology that excludes various dubious patterns (see also Potts et al. 2010). Far from expanding the typology of possible patterns in an unbounded fashion, HG’s weighted mode of constraint interaction sometimes allows attested patterns to be modeled using fewer, more basic constraints, thereby constraining typological expansion in novel and important ways.

4 Other positional effects

Section 2 argued that positional markedness constraints in HG are able to capture a range of patterns that would require the addition of positional faithfulness constraints in OT. Section 3 extended the argument, demonstrating that restricting the set of contextual constraints to positional markedness has the benefit of tying the realization of derived marked structures to more general conditions on licensing, consistent with patterns observed in natural language. The possibility of limiting the set of contextual constraints to positional markedness does raise other issues, however, given that positional faithfulness constraints have uses beyond simply allowing disjunctive patterns of licensing to be captured in OT. This section turns to these issues.

Beckman (1998) identifies the three criteria in (38) as diagnostic of positional privilege, and argues that all three can be captured using positional faithfulness constraints.
Diagnostics of positional privilege (Beckman 1998: 2)

a. Positional maintenance of contrasts that are neutralized elsewhere
b. Positional triggering of phonological processes
c. Positional resistance to processes that apply elsewhere

The first of these, (38a), was argued in section 2 to be effectively modeled by positional markedness constraints in HG. The diagnostics in (38b) and (38c) are both often connected with directionality in assimilation processes, which presents notable challenges for positional markedness constraints in parallel theories, regardless of the mode of constraint interaction (e.g., Beckman 1998, Walker 2001b, 2011, Zoll 1998; cf. McCarthy 2008a on direction of assimilation in Harmonic Serialism). The diagnostic in (38c) also has instantiations in the domain of alternations and blocking, however; these are of particular interest because the use of weighted constraints alters the landscape of potential analyses. This section thus first considers HG-OT differences in resistance to phonological processes, and then turns to the persistent challenge of directionality, arguing that positional faithfulness is not a fully general solution to this problem.

4.1. Alternations and blocking

In scenarios like those described in section 3.2, a marked structure is present in the input but not associated with a segment in a licensing position. The task of the grammar, then, is to determine the optimal association of the marked structure. As we have seen, positional markedness constraints generally predict that derived marked structures will, all else being equal, preferentially target strong licensing positions, giving rise to alternations just in strong contexts. The alternations in section 3.2 were morphologically driven, but purely phonological alternations can show similar behaviour. In metaphony processes, for example, marked vowel features in weak positions trigger changes to the specifications of vowels in strong positions (Walker 2005, 2006, 2011). Metathesis processes in child language show similar effects, with marked segments shifting to strong positions where they are better licensed (Gerlach 2009, Marshall & van der Lely 2009, Velleman 1996). These types of alternations targeting strong positions are precisely what is predicted by positional markedness constraints, and stand in contrast with the type of blocking in strong positions that is predicted by positional faithfulness constraints.

This said, there are also established cases where strong positions resist alternations – indeed, this is the third diagnostic in (38) (see Becker, Nevins & Levine 2012 for additional evidence). In Optimality Theory, such patterns simply cannot be modeled using positional markedness constraints. In Harmonic Grammar, however, these same constraints can block alternations in strong positions in cases where the alternation would lead to markedness reduction – i.e., removal of a marked structure targeted by the positional markedness constraint. As an initial illustration, we will consider the constraint AGREEVOICE, which is violated when a sequence of two obstruents differ in \( \pm \text{voice} \) specification. This constraint interacts with the general faithfulness constraint IDENT[\( \pm \text{voice} \)] and the positional markedness constraint VOICEOBS⇒INITIAL, leading to a restricted pattern of voicing assimilation that is blocked just in the strong initial syllable.

In the first tableau (39), the base form is monosyllabic, placing the final segment – voiced /d/ – in the privileged initial syllable. Adding the suffix /-pa/ leads to a violation of AGREEVOICE if both segments retain their input voicing specifications. As we would expect, if the weight of IDENT[\( \pm \text{voice} \)] is greater than the weight of AGREEVOICE, this voicing...
disagreement is tolerated, alternation is blocked, and the voicing specification of /d/ is preserved in the output. This contrasts with the second tableau (40), where the input /d/ is found in a non-initial syllable and its faithful mapping therefore incurs a violation of $\text{VoicedObs} \Rightarrow \text{INITIAL}$. Cumulative interaction is crucial here. Voiced segments are generally allowed in non-initial syllables based on the $w(\text{IDENT}[\pm \text{voice}]) > w(\text{VoicedObs} \Rightarrow \text{INITIAL})$ weighting condition, but when the summed weight of $\text{VoicedObs} \Rightarrow \text{INITIAL}$ and $\text{AGREEVoice}$ is greater than the weight of the $\text{IDENT}[\pm \text{voice}]$, assimilation is triggered in the weak context. The voicing alternation here is restricted to weak non-initial environments; segments in the strong initial syllable resist the markedness-reducing change.

(39) Voicing alternations are blocked in the initial syllable

<table>
<thead>
<tr>
<th>/tad + pa/</th>
<th>IDENT[± voice]</th>
<th>AGREEVoice</th>
<th>VoicedObs⇒INIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. → tad.pa</td>
<td>4</td>
<td>−1</td>
<td>−3</td>
</tr>
<tr>
<td>b. tat.pa</td>
<td>−1</td>
<td></td>
<td>−4</td>
</tr>
</tbody>
</table>

(40) Voicing alternation are triggered through the addition of an affix in non-initial syllables

<table>
<thead>
<tr>
<th>/tanad + pa/</th>
<th>IDENT[± voice]</th>
<th>AGREEVoice</th>
<th>VoicedObs⇒INIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ta.nad.pa</td>
<td>4</td>
<td>−1</td>
<td>−5</td>
</tr>
<tr>
<td>b. → ta.nat.pa</td>
<td>−1</td>
<td>−1</td>
<td>−4</td>
</tr>
</tbody>
</table>

Given these constraints, this type of pattern, where (39a) and (40b) are co-optima, cannot be modeled in OT. With ranked constraints, a voicing alternation triggered by $\text{AGREEVoice}$ will either apply in all contexts or in no context, depending upon the relative ranking of $\text{IDENT}[\pm \text{voice}]$ and $\text{AGREEVoice}$. The ranking of the positional markedness constraint can determine whether voicing is ever allowed in a given context, but it cannot serve to selectively block alternations. It is only in HG that positional markedness constraints are able to block (markedness-reducing) alternations in strong positions.15

The ability of positional markedness constraints to model this type of blocking in HG but not in OT should come as no surprise. As we have seen throughout this paper, in OT positional markedness constraints cannot capture patterns of disjunctive licensing. The constraint $\text{AGREEVoice}$ is a contextual markedness constraint, and, as such, acts much like the positional markedness constraints we have already seen. In effect, $\text{AGREEVoice}$ licenses $[+\text{voice}]$ obstruents in any context where they are not immediately preceded or followed by a $[−\text{voice}]$ obstruent. The pattern sketched in above is thus precisely the type of disjunctive pattern that poses a challenge for positional markedness constraints in OT. A $[+\text{voice}]$ obstruent is licensed if it is in the initial syllable or if it is not immediately adjacent to a $[−\text{voice}]$ obstruent.

A natural-language example of this type of patterning comes from the licensing of independent place features on sonorant segments in the dialect of Tamil described by Christdas (1988; see also Beckman 1998). As the data in (41) show, sonorants appear in onset position with freely-specified place of articulation. In addition, coronal sonorants that disagree in Place
with the following segment also freely appear in the coda of the initial syllable; the overall pattern here is one of disjunctive licensing.\textsuperscript{16}

(41) Independent place specifications are permitted on coda sonorants in the initial syllable (Christdas 1988: 230-234)

```
/maarkajiy/ [maar.x3.ⱥ]  a month
/teyvam/ [tэy.vⱥ]  ‘god’
/munʃiy/ [mun.ʃɪ]  ‘teacher’
/nanpan/ [nαn.bα]  ‘friend’
/aarauam/ [aar.vα]  ‘eagerness’
/keelįiy/ [keel.iɪ]  ‘question’
```

Outside of the initial syllable, the pattern is more complex. In word-final coda position, glides and nasals delete (with nasalization of the preceding vowel in the case of nasals), while liquids freely appear.

(42) Independent place specifications are permitted on coda liquids in the word-final syllables (Christdas 1988: 159-161)

```
/kappal/ [kapp3l]  ‘ship’
/porul/ [porul]  ‘thing’
/tayir/ [tayir]  ‘yoghurt’
/pukal/ [pox3l]  ‘praise’
```

Despite the admissibility of independent place on liquids in forms like those in (42), a repair is consistently triggered when affixation places a non-homorganic consonant next to a sonorant in a non-initial syllable. For laterals, assimilation is the preferred repair when the following segment is coronal (43), and epenthesis is the preferred repair when the following segment is non-coronal (44).

(43) Assimilation is triggered when the suffix begins with a non-homorganic coronal (Christdas 1988: 319)

```
/vayal + ɬaan/ [vay3ɬaα]  ‘field.EMPH’
/kappal + ɬaan/ [kapp3ɬaα]  ‘ship.EMPH’
```

(44) Epenthesis is triggered when the suffix begins with a non-coronal (Christdas 1988: 324, 328)

```
/kaatuəkal + ɬk/ [kaadux3uʃkʊ]  ‘ear.PL.DAT’
/vayal + kal/ [vay3lʊx3]  ‘field.PL’
```

Within HG, these data can be analyzed using the markedness constraints PLACE⇒INITIAL, which licenses independent place specifications on sonorants in the initial syllable, AGREEPLACE, which requires that adjacent segments have the same place of articulation, and LATERAL⇒CORONAL, which penalizes lateral segments that are not also specified as coronal. These constraints conflict with IDENTPLACE and DEP-V. If the weight of each of the faithfulness constraints exceeds the weight of AGREEPLACE, sonorants (including coronal laterals) freely appear with independent place features in the coda of the initial syllable, even when they are not homorganic with the following consonant (45). If the weight of faithfulness also exceeds the weight of PLACE⇒INITIAL, coronal laterals freely appear in word-final position bearing their own (coronal) place features (46).
Independent place features freely appear on laterals in the initial syllable – even if the following segment is not homorganic:

<table>
<thead>
<tr>
<th>/kappal/</th>
<th>LAT⇒COR</th>
<th>DEP-V</th>
<th>IDENTPLACE</th>
<th>AGREE</th>
<th>PLACE⇒INIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. → käp.pəl</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>b. käp.pəl uu</td>
<td>-1</td>
<td></td>
<td></td>
<td></td>
<td>-5</td>
</tr>
</tbody>
</table>

Independent place features freely appear on laterals when no consonant follows – even in a non-initial syllable:

<table>
<thead>
<tr>
<th>/kappal/</th>
<th>LAT⇒COR</th>
<th>DEP-V</th>
<th>IDENTPLACE</th>
<th>AGREE</th>
<th>PLACE⇒INIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. → käp.pəl</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>b. käp.pəl uu</td>
<td>-1</td>
<td></td>
<td></td>
<td></td>
<td>-5</td>
</tr>
</tbody>
</table>

In non-final codas where the following segment is not homorganic, both PLACE⇒INITIAL and AGREEVOICE are violated; this triggers a repair. Assimilation applies if the affix segment is coronal (47), and epenthesis applies if the affix segment is non-coronal (48).

Laterals in non-initial syllables undergo assimilation when followed by a non-homorganic coronal consonant:

<table>
<thead>
<tr>
<th>/vayal + tan/</th>
<th>LAT⇒COR</th>
<th>DEP-V</th>
<th>IDENTPLACE</th>
<th>AGREE</th>
<th>PLACE⇒INIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. va.yəl.ʔaʔ</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>b. → vay.əl.ʔaʔ</td>
<td>-1</td>
<td></td>
<td></td>
<td></td>
<td>-4</td>
</tr>
<tr>
<td>c. va.yəl.łu.ʔaʔ</td>
<td>-1</td>
<td></td>
<td></td>
<td></td>
<td>-5</td>
</tr>
</tbody>
</table>

Laterals in non-initial syllables trigger epenthesis when followed by a non-coronal consonant:

<table>
<thead>
<tr>
<th>/kaatuka + kk/</th>
<th>LAT⇒COR</th>
<th>DEP-V</th>
<th>IDENTPLACE</th>
<th>AGREE</th>
<th>PLACE⇒INIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. kaa.du.xəl.k.ku</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>b. kaa.du.xəl.k.ku</td>
<td>-1</td>
<td>-1</td>
<td></td>
<td></td>
<td>-10</td>
</tr>
<tr>
<td>c. → kaa.du.xəl.tək.kku</td>
<td>-1</td>
<td></td>
<td></td>
<td></td>
<td>-5</td>
</tr>
</tbody>
</table>

The alternations triggered by AGREEPLACE rely on cumulative interaction of this constraint with PLACE⇒INITIAL. Alternations are blocked when they do not allow violations of both...
constraints to be avoided. An OT ranking with the same ordering as seen above cannot achieve this type of selective blocking.

The particular usefulness of Harmonic Grammar here stems from the fact that multiple conditions interact in the licensing of Place. Lateral segments can bear independent place specifications when they are coronal and in an onset or when they are coronal and in the initial syllable or when they are coronal and not followed by a place-disagreeing segment. This final condition can be even further refined based on mappings like /vayal + kal/ → [sayasluuxs], which show that being in a root is key to the admissibility of coda laterals with independent place in non-initial syllables. The full set of contexts is summarized in (49).

(49) Conditions for the licensing of independent place on lateral segments
   a. Coronal & Onset or
   b. Coronal & Initial syllable or
   c. Coronal & Not followed by a place-disagreeing segment & Root

Alternations are blocked in contexts that are sufficiently strong – i.e., in cases where one of the sets of conjunctions in (49) is satisfied.

This ability of positional markedness constraints in HG to block alternations extends to all situations where the alternation is markedness reducing. A constraint like PLACE⇒INITIAL is satisfied by segments that do not bear independent place features, effectively preferring segments that are either placeless or share their place specification. Similarly, a positional markedness constraint like VOICEDOBSS⇒ONSET is satisfied by obstruents that are not specified as [+voice], effectively identifying [–voice] specification as unmarked. In each of these cases the markedness distinction is only relevant outside of the strong licensing context, as it is only there that violations of the positional markedness constraint can be accrued. This encoding of (un)markedness is key to the blocking effects seen here. Alternations that decrease markedness in weak positions can lead to removal of violations of the markedness constraints. If a markedness-reducing alternation is to be blocked in some context, then, it will be blocked in the strong position where no violation of the positional markedness constraint can be removed, and therefore no additional benefit can be derived.

While the cases seen above involved introduction of a marked structure in the immediate environment of an affix, there is no inherent locality-based restriction on this type of selective blocking. For example, if an unmarked [–voice] feature is introduced in the course of morphological derivation, positional markedness predicts that this feature will preferentially target weak positions where a violation of the contextual constraint will be removed. Strong positions will be targeted only if overt realization of the unmarked feature is required by the grammar, and segments in weak positions cannot host the feature. This basic preference for the docking of unmarked features holds of both OT and HG. In HG, however, it is also possible to model patterns where actual blocking occurs, so that if the only host for the unmarked feature is a marked segment in the strong position, association will be blocked and the unmarked feature will receive no overt reflex. In OT it is expected that unmarked features will target weak positions, but there can be no positional blocking. Cumulative constraint interaction is key to the ability of positional markedness to generate this type of pattern in HG; no OT ranking of these constraints will lead to selection of the same set of optima. Tableaux illustrating the HG blocking pattern are given below.
[50] [ + voice] obstruents are generally allowed in all positions

<table>
<thead>
<tr>
<th></th>
<th>IDENT[ ± voice]</th>
<th>MORPHREAL</th>
<th>VOICEDOBΣ⇒ONSET</th>
</tr>
</thead>
<tbody>
<tr>
<td>/bad/</td>
<td>4</td>
<td>3</td>
<td>−2</td>
</tr>
<tr>
<td>a. → bad</td>
<td></td>
<td></td>
<td>−1</td>
</tr>
<tr>
<td>b. bat</td>
<td>−1</td>
<td></td>
<td>−4</td>
</tr>
</tbody>
</table>

(51) Floating [−voice] features target obstruents in coda where possible

<table>
<thead>
<tr>
<th></th>
<th>IDENT[ ± voice]</th>
<th>MORPHREAL</th>
<th>VOICEDOBΣ⇒ONSET</th>
</tr>
</thead>
<tbody>
<tr>
<td>/gad, [−voice]/</td>
<td>4</td>
<td>3</td>
<td>−5</td>
</tr>
<tr>
<td>a. gad</td>
<td>−1</td>
<td></td>
<td>−1</td>
</tr>
<tr>
<td>b. → gat</td>
<td></td>
<td>−1</td>
<td>−4</td>
</tr>
</tbody>
</table>

(52) Docking of unmarked features onto the strong onset position is blocked

<table>
<thead>
<tr>
<th></th>
<th>IDENT[ ± voice]</th>
<th>MORPHREAL</th>
<th>VOICEDOBΣ⇒ONSET</th>
</tr>
</thead>
<tbody>
<tr>
<td>/ban [−voice]/</td>
<td>4</td>
<td>3</td>
<td>−3</td>
</tr>
<tr>
<td>a. → ban</td>
<td>−1</td>
<td></td>
<td>−3</td>
</tr>
<tr>
<td>b. pan</td>
<td>−1</td>
<td></td>
<td>−4</td>
</tr>
</tbody>
</table>

The predictions made by Harmonic Grammar with positional markedness constraints appear to be correct in at least some cases, as markedness-reducing alternations are blocked in strong positions. The Tamil case discussed above is one example. Another case comes from Turkish, where coda devoicing is blocked with greater probability in monosyllables than in longer words – i.e., voicing persists when the final consonant is found in the strong initial syllable (Becker, Ketrez & Nevins 2011). The Brazilian Portuguese coalescence of stem-final [w] with the initial segment of the plural marker [−is] to yield surface [j] is blocked with greater frequency in monosyllables than in longer words, and is also conceivably of this type (Becker, Clemens & Nevins 2011).

Other cases are more difficult to interpret. Giavazzi (2010), for example, reports that the Italian process of palatalization is blocked for segments immediately following a stressed vowel – e.g., /anˈtik-i/→[anˈtik.i] – but is required in other contexts – e.g., /komik-i/→[ˈko.mi.ʧi], *[ˈko.mi.ʧi]. This pattern can be analyzed using constraints that license dorsal place feature in post-tonic position, but it is unclear that this type of constraint is motivated by more general markedness considerations. Similarly, the blocking of [+nasal] spreading onto stressed vowels in Guarani (Beckman 1998, Gregores & Suárez 1967) can be analyzed using positional markedness constraints that prefer preservation of oral place features in stressed contexts, but this is at odds with other markedness criteria that deem nasal vowels to be more marked than oral vowels. Positional faithfulness does not standardly encode the type of markedness polarity that positional markedness constraints do, and therefore avoids this type of conflict between language-specific patterns and general markedness principles. Ultimately, investigation of a broader array of patterns should shed light on these issues and reveal to what extent the markedness-increasing vs. markedness-reducing nature of alternations plays a role in strong positions’ resistance to change.
4.2. Directionality and additional challenges

Beyond the types of blocking effects discussed in the previous section, positional faithfulness constraints have been widely used to model directionality in assimilation processes where elements in strong positions determine the feature value that is propagated onto elements in weak positions (e.g., Baković 2000, Beckman 1997, 1998, Lombardi 1999). The basic approach in these cases is simple. Given a sufficiently high ranking / weighting, a constraint like \text{IDENT}[\pm \text{voice}]/\text{ONSET} ensures that the input [\pm \text{voice}] specifications of segments in onset position are preserved; if adjacent segments are required to agree in this feature, then, it is necessarily the segments in the weak (coda) position that alter their input specifications. Positional markedness constraints do not have this same effect. As (53) shows, a constraint like \text{VOICEDOBS} \Rightarrow \text{ONSET} is equally satisfied by a [+voice] feature that originates in onset position and spreads to coda, and a [+voice] feature that originates in coda and spreads to onset. \text{IDENT}[\pm \text{voice}]/\text{ONSET} can distinguish between directions of spreading, but \text{VOICEDOBS} \Rightarrow \text{ONSET} cannot.

(53) Positional faithfulness distinguishes between directions of spreading; positional markedness does not

<table>
<thead>
<tr>
<th></th>
<th>\text{VOICEDOBS} \Rightarrow \text{ONSET}</th>
<th>\text{IDENT}[\pm \text{voice}]/\text{ONSET}</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. at.ba \rightarrow ad.ba</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[-voi][+voi] \rightarrow [+voi]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. ad.pa \rightarrow ad.ba</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[+voi][-voi] \rightarrow [+voi]</td>
<td></td>
<td>–1</td>
</tr>
</tbody>
</table>

The licensing of marked features in weak positions through association with strong licensers, as in (1b), is precisely what occurs in cases of metaphony (Walker 2005, 2006, 2011), and so is arguably a positive prediction of positional markedness constraints. The problem lies in the fact these constraints cannot capture cases where features systematically spread from strong to weak positions regardless of markedness, as is more typically the case in many assimilatory processes.

More generally, it seems that in order for constraints to capture some form of directionality, the preferred source of the spreading features must be distinguished in the constraint definition. Positional faithfulness constraints are not alone in having this property. For instance, \text{SPANHEAD} constraints (McCarthy 2004), \text{INITIAL}(F) and \text{FINAL}(F) constraints (McCarthy 2009), and targeted constraints (Wilson 2000, 2003) all assign violations differently depending upon the source of the propagating features. It is not clear that positional faithfulness constraints enjoy a particular advantage over these other approaches in capturing directional phenomena. McCarthy (2004) identifies nasal harmony phenomena as particularly problematic for positional faithfulness, based on the potentially unbounded nature of the processes and their ignorance of the prosodic positions of either the trigger or target segments. Nasal spreading in Johore Malay (Onn 1976), for example, is initiated by underlying [nasal] segments regardless of their position in the word. This type of position-insensitive pattern is quite pervasive; indeed, Walker (1998) identifies the sonority of target segments as the key factor in blocking nasal spreading processes. Neither positional faithfulness constraints nor simple positional
markedness constraints predict this type of directional spreading that ignores the prosodic position of the trigger and the targets.

Additional difficulties for positional faithfulness constraints come from a series of pathologies generated through interaction of positional faithfulness with constraints governing prosodic structure. While a full discussion of these issues is beyond the scope of this paper, the basic issue is straightforward: If the constraints that determine the default prosodic structure of a language are sufficiently low-ranking / low-weighted, input featural contrasts can be opaquely displaced onto the output prosodic structure. For example, with a sufficiently low ranking / weighting of the constraint ONSET, positional faithfulness constraints predict a system where input [–voice] intervocalic obstruents are syllabified in unmarked onset position, giving the mapping /pata/ → [pa.ta], even as input [+voice] intervocalic obstruents are syllabified in marked coda position where they can devoice without incurring a violation of the positional faithfulness constraint, giving the mapping /pada/ → [pat.a] (Beckman 1998: fn.37; see also Jesney 2011, Wilson 2000). As Wilson (2000, 2003) points out, similar opaque subversions of the expected prosodification can be generated through the interaction positional faithfulness constraints with certain constraints enforcing assimilation. Incorporating directionality into the spreading constraint themselves, rather than relying upon positional faithfulness, allows these types of unusual patterns to be avoided.

4.3. Summary

While the diagnostics of positional privilege identified by Beckman (1998) appear to be correct for a range of cases, it is not clear that positional faithfulness is the most effective, or only, means of accounting for the relevant phenomena. Contrary to the positional faithfulness prediction that strong (but not weak) positions block alternations that apply elsewhere (38c), there are well-documented cases where strong positions actually attract derived marked structures (see §3.2 and §4.1). Similarly, despite the positional faithfulness association of strong positions with trigger behaviour (38c) and weak positions with target behaviour (38b), directional patterns in assimilation do not universally reflect this type of dichotomy (see §4.2). Such facts suggest that positional faithfulness is, at best, an inadequate account of positional privilege. Taken together with the fact that cumulative constraint interaction allows a greater range of the attested patterns to be modeled using only positional markedness constraints, it would seem that positional faithfulness constraints are truly unnecessary in Harmonic Grammar.

5 Simple vs. complex constraints

Certain aspects of the cumulative interaction seen in HG can be imitated in Optimality Theory through the use of complex, or highly-specified, constraints. One possible way of extending the range of analyses while retaining ranked constraints, then, is to allow for either positional constraints with highly-specified contexts or local conjunction of constraints (Smolensky 1993 et seq.). This section considers these possibilities in turn, and compares the basic results with those obtained through cumulative constraint interaction in HG.

To illustrate, we will use the simple system laid out in (5) where the marked feature is [±voice] and the two strong licensing environments are onset and the initial syllable. In the analyses sketched so far, the contextual constraints have each referred to only one of these licensing contexts. The contexts have been simple, and patterns where multiple contexts are relevant have been the result of interaction between these simple constraints. One alternative
means of extending the OT typology is to specify the contexts of the constraints in greater
detail. Thus, instead of only IDENT[±voice]/ONSET and IDENT[±voice]/INITIAL, CON might
include a constraint IDENT[±voice]/INITIALONSET, which is violated just when a segment in the
onset of an initial syllable differs in specification for [±voice] relative to its input
correspondent. This effectively conjoins contexts within the very definition of the constraint,
allowing positional faithfulness constraints in OT to model patterns where marked features are
admitted only when they are simultaneously in the first context and the second context. In
(54), for example, [+voice] maps faithfully just when it is in the onset and the initial syllable.
This type of conjunctive licensing pattern eludes positional faithfulness constraints in OT when
only constraints with simple contexts are included.

(54) Complex contexts allow positional faithfulness constraints to model patterns of
conjunctive licensing in OT (locus of potential faithfulness violation is underlined)

<table>
<thead>
<tr>
<th>/bad.na.bad/</th>
<th>IDENT[±voice]/INITIALONSET</th>
<th>*VOICEDOBS</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. bad.na.bad</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>b. pat.na.pat</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>c. bad.na.pat</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>d. bat.na.bat</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>e. bad.na.bat</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>f. → bat.na.pat</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

The same approach cannot be used to extend the typology produced with positional
markedness constraints in OT. A constraint like VOICEDOBS⇒INITIALONSET assigns violation
marks to any instance of a voiced obstruent that is not in the onset of the initial syllable –
precisely the same result as is obtained by simply ranking both VOICEDOBS⇒INITIAL and
VOICEDOBS⇒ONSET above IDENT[±voice]. This type of highly-specified context does not
allow the missing disjunctive pattern to be modeled with positional markedness constraints in
OT.

Local constraint conjunction (Smolensky 1993, et seq.) is the second possibility for
extending the OT typology. Under this approach, two (or more) constraints are conjoined to
form a new constraint that is violated just when both of its conjuncts are violated within a
specified domain. This conjoined constraint can then be ranked differently than either of its
conjuncts, allowing apparently cumulative patterns to be modeled. As defined in (55), the
conjunction of IDENT[±voice]/INITIAL and IDENT[±voice]/ONSET has precisely the same effect
as the highly specified constraint IDENT[±voice]/INITIALONSET in (54). In other words, the
conjunction of positional faithfulness constraints admits patterns whereby features are limited
to positions of double privilege.
(55) \[\text{IDENT}[^{±}\text{voice}]/\text{INITIAL} & \text{IDENT}[^{±}\text{voice}]/\text{ONSET}]_{\text{Segment}}: \] Assign a violation mark to any output segment that is both in onset and in the initial syllable, and that differs in specification for \[^{±}\text{voice}\] relative to its input correspondent.

Furthermore, because local constraint conjunction is logical disjunction when viewed from the perspective of constraint satisfaction – i.e., the constraint is satisfied when either conjunct 1 or conjunct 2 is satisfied – this approach also allows the missing disjunctive pattern to be modeled with positional markedness constraints. Ranking the constraint in (56) above \(\text{IDENT}[^{±}\text{voice}]\) predicts a pattern whereby voiced obstruents are admitted except when they are neither in the initial syllable nor in a syllable onset.

(56) \[\text{VOICEDOBS}⇒\text{INITIAL} & \text{VOICEDOBS}⇒\text{ONSET}]_{\text{Segment}}: \] Assign a violation mark to any output voiced obstruent segment that is not associated with the initial syllable and that is not in onset position.

(57) Local constraint conjunction allows positional markedness constraints to model patterns of disjunctive licensing in OT (locus of potential markedness violation is underlined)

<table>
<thead>
<tr>
<th>/bad.na.bad/</th>
<th>[\text{VOICEDOBS}⇒\text{INITIAL} &amp; \text{VOICEDOBS}⇒\text{ONSET}]_{\text{Segment}}</th>
<th>\text{IDENT}[^{±}\text{voice}]</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. bad.na.b_d</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b. pat.na.p_t</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>c. bad.na.p_t</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>d. bat.na.b_t</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>e. (\rightarrow) bad.na.b_t</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>f. bat.na.p_t</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

As Pater (2009, [this volume]) discusses, while local constraint conjunction in OT and cumulative constraint interaction in HG can capture many of the same effects, local constraint conjunction is more powerful in many cases. The primary reason for this lies in the need to specify a domain for conjoined constraints. In (55) and (56) the specified domain is as small as possible – i.e., the segment – and it overlaps precisely with the locus of the conflicting constraint. In situations like this, the conjoined constraint simply replicates the effect of cumulative interaction in HG. Indeed, when these conjoined constraints are added to \text{CON} in HG, there is no additional effect on the typology.

This said, there is no inherent restriction on the size of the domain that can be specified for locally-conjoined constraints. Indeed, the only true restriction is that it be possible to simultaneously violate both conjuncts within \text{some} domain (Moreton & Smolensky 2002). As a result it would be possible to define a constraint like \[\text{IDENT}[^{±}\text{voice}]/\text{INITIAL} & \text{IDENT}[^{±}\text{voice}]/\text{ONSET}]_{\text{PWd}},\] that is equally violated by mappings like /bad.na.bad/\(\rightarrow\) [pad.na.bad], where the two violations are localized on the same initial segment, and by mappings like /bad.na.bad/\(\rightarrow\)[bat.na.pad], where the two violations simply occur in the same PWd. In effect, local constraint conjunction does not carry the same inherent locality restriction as HG cumulative constraint interaction (\textit{cf.} Łubowicz 2005). When larger domains
are defined for conjoined constraints, the typology is necessarily extended beyond what is
generated in HG with cumulative constraint interaction alone.

The key point here is simply this: cumulative constraint interaction in Harmonic Grammar
makes local constraint conjunction unnecessary for cases like those discussed in this paper.
Patterns of both conjunctive and disjunctive licensing can be modeled using simple positional
markedness constraints. For a range of cases, positional faithfulness constraints are not
necessary, nor are locally-conjoined constraints or constraints with highly-specified contexts.
Cumulative constraint interaction opens the door to alternative analyses that are not possible in
a theory that relies upon ranked constraints.

6 Conclusion

This paper has argued that the availability of cumulative constraint interaction in Harmonic
Grammar provides for alternative analyses requiring fewer and more basic constraints. While
the set of patterns that can be generated in HG with a given set of constraints is typically a
(possibly non-proper) superset of those that can be generated in OT with the same set of
constraints, cumulativity can allow for analyses that require fewer constraints. This, in turn, can
act to restrict the HG typology.

There remain, of course, many issues to be considered in determining the best set of
constraints to employ in either theory. The examples in this paper have demonstrated that
exclusively markedness-based accounts of both conjunctive and disjunctive licensing patterns
are possible in HG. Other differences between the types of patterns that can be modeled using
positional faithfulness and positional markedness constraints will benefit from further research.
The patterns of alternation blocking discussed in section 4 are of particular interest, as they
suggest an enhanced role for markedness polarity in determining whether a strong position will
attract or resist alternations. These are predictions particular to HG, and provide a further
illustration of how altering the mode of constraint interaction can change the set of patterns that
a given set of constraints can be used to model. The subset-superset relationship between the
typologies generated in the two theories holds only insofar as the constraint set is held constant.
When cumulativity allows a given set of constraints to model a greater range of patterns, fewer
constraints may be required in HG, and the typology limited in consequence.

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2 The type of positional markedness constraints used in this paper are commonly known as “positional licensing” constraints. Simple contextual markedness constraints – e.g., *VOICEDOBSTRUENTCODA – are also widely used in modeling positional asymmetries. For all of the cases discussed in section 2 of this paper, both types of markedness constraint have precisely the same properties. In OT they can be used to model conjunctive licensing patterns, but not disjunctive licensing patterns, whereas in HG they are able to model disjunctive licensing patterns as well. I use the more general term “positional markedness” here in order
to highlight the key role played by the markedness vs. faithfulness distinction in generating the different patterns.

3 The selection of “initial syllable” as the second licensing environment here is purely for ease of comparison with the natural language examples presented in section 2.2 and 2.3; it is not intended as an empirical claim regarding the relative markedness of obstruent voicing in this position.

4 Transcriptions directly reflect those provided by Cahill (2007), except for the following IPA-based substitutions based on Cahill’s (2007: 97) description of the consonant inventory: r→[ɾ], ch→[ʧ], j→[ʤ], y→[j].

5 The second vowel of trisyllabic verbs can also be one of the high rounded vowels [u] or [ʊ] just in the case that the first vowel is also [u] or [ʊ] and the intervening consonant is [ɡ] (Cahill 2007: 90).

6 The addition of constraints identifying backness and vowel length as marked structures would allow these restrictions to be captured as well. Importantly, these restrictions do appear to be distinct, as the limitations on the vowel inventory in suffixes affect height and length, but not backness. These root vs. suffix effects are discussed briefly later in this section.

7 While Cahill (2007) does not directly address the distribution of vowel place features in adjectives, from the data provided it appears that they pattern with nouns – e.g., [kūó-bí!ké] ‘the small farm’, cf. [kūáŋ] (Cahill 2007: 187).

8 Simply adding a general inventory constraint like *MID would be ineffective in saving the OT positional faithfulness analysis. In order to preserve mid vowels in nouns and in the initial syllable of verbs, IDENTHEIGHT/NOUN and IDENTHEIGHT/INITIAL would both need to dominate *MID. Given these rankings, however, mid vowels would incorrectly surface faithfully in affixes if these vowels were also in the initial syllable of the morpheme or in a noun. A more effective positional faithfulness approach would require inclusion of constraints that specify more detailed contexts, such as root-initial position vs. morpheme-initial position vs. in a noun root. These constraints effectively encode a conjunction of contexts within the definition of the constraints themselves and can therefore be used in OT to capture patterns like that found in Kɔnni. This approach requires a significant expansion of the constraint set; see section 5 for related discussion.

9 I assume that the admissibility of the vowels [e] and [o] in suffixes is due to the fact that there are no low [+ATR] vowels in the inventory – i.e., [a] is unpaired. In order to harmonize and preserve a [−high] specification, vowels in suffixes added to [+ATR] words are therefore necessarily mid. This can be accommodated if the weight of the constraint enforcing agreement is greater than the weight of the constraint MID⇒ROOT.

10 Thanks to John Kingston for pointing out the relevance of these data.

11 In parallel theories like the versions of OT and HG presented here, privileged contexts for positional faithfulness constraints are typically defined with respect to the output. Because violations of MAX are incurred precisely when there is no output correspondent for the element in question, however, a definition that ties the privileged position to the output is untenable in these cases (McCarthy 2005). Avoidance of this problem is a further reason to prefer an HG analysis that requires only positional licensing. For an alternative that avoids this problem

12 Long vowels are indicated here using the symbol [ː]. In all other respects the transcription follows Kiparsky (1972).

13 I assume throughout this section that the derived structures must be realized in the output. This is equivalent in HG to saying that the weight of a constraint forcing docking of morphologically-introduced floating features – e.g., MorphREAL (Kurisu 2001) – is greater than the summed weight of the conflicting constraints.

14 Michael Becker suggests that effects of this type might be captured through positional faithfulness constraints of the form MAXFLOAT/INIT – “Assign a violation mark to any floating element that does not have correspondent in the initial syllable of the output” – on analogy with the non-positional MAXFLOAT constraints of Wolf (2005). While this approach achieves the desired effect, it does so precisely because, unlike the positional IDENT constraints discussed in this paper, it does not demand faithfulness between an input segment and its output correspondent. In effect, this constraint prefers unfaithfulness in the initial syllable by attracting the floating element to that position; it is, essentially, a morpheme alignment constraint. To the extent that MAXFLOAT/INIT achieves the same result as the positional markedness constraints discussed in this section, it does so through morpheme-specific properties rather than general licensing preferences.

15 The properties of AGREEVOICE, and specifically its ability to trigger alternations that are markedness reducing per the positional markedness constraint VOICEDOBS⇒INIT, are important to this example. Markedness constraints favouring alternations that increase markedness show the opposite effect; they can be selectively blocked just in weak positions by positional markedness constraints. The application of intervocalic voicing, for example, can be limited to stems if the weight of VOICEDOBS⇒STEM is sufficiently high. This is the effect seen in §3, where derived marked structures are limited to strong positions. In the case of markedness-increasing alternations, the predictions of positional markedness constraints are the same in OT and HG.

16 Coronal place includes dental, alveolar, retroflex, and palatal articulations in Tamil. Among these, retroflex place is generally barred from word-initial position, suggesting that post-vocalic position is an additional source of licensing required in this case (see Steriade 2001 for related discussion). I abstract away from this here; the pattern can be accommodated through the addition of constraints referring specifically to this subplace. For consistency, examples in this paper adopt the transcription used in Beckman (1998).

17 Christdas (1988: 326-330) identifies the nominalizing suffix /-al/ as an exception to this generalization – e.g., /moot + al/ → [mood3l] ‘shove + N’. Lateral-final suffixes that are subject to deletion include /-kal/ ‘plural’, /-aamal/ ‘negative gerundive’, /-aai/ ‘conditional’, /-aal/ ‘3rd person feminine’, and /-aaŋkal/ ‘3rd person plural’.

18 One possibility in both of these cases would be to define the spreading constraints so that they are violated by a failure to spread coronality / nasality onto weak targets – i.e., segments in unstressed contexts – but not by a failure to spread onto strong targets. This would avoid the need for positional faithfulness, while maintaining the pattern of encoding contexts on markedness rather than faithfulness constraints. See section 4.2 for related discussion.