Nat Lang Linguist Theory (2015) 33:1235–1270
DOI 10.1007/s11049-014-9273-5

Maximal prominence and a theory of possible licensors

Aaron Kaplan

Received: 22 July 2013 / Accepted: 23 January 2014 / Published online: 2 December 2014

Abstract Languages often single out prominent positions for special consideration, allowing certain elements to appear only in those positions. Often material in the prominent position surfaces faithfully but neutralizes elsewhere (*preservation* systems), but other systems involve the spreading or migration of features to the prominent position to comply with the positional restriction (*overwrite* systems). The set of positions that behave as prominent for preservation seems to be a superset of the positions that behave as prominent for overwrite. This paper argues that this asymmetry stems from differences between positional faithfulness and positional licensing. Only positional licensing produces overwrite; it is argued here that it may target only the most prominent positions, while positional faithfulness, which produces preservation, may target all kinds of prominent positions.

Keywords Prominence · Positional licensing · Positional faithfulness · Positional markedness

1 Introduction

Phonological systems often restrict certain contrasts to privileged positions: specific consonantal features might appear only in onsets, a vocalic feature might surface only in stressed syllables, etc. In terms of the behavior of the privileged position itself, these phenomena fall into two categories: those in which the underlying presence or absence of the restricted element is faithfully preserved on the surface while the contrast in question is neutralized elsewhere (*preservation* systems), and those in which

A. Kaplan (✉)
Department of Linguistics, Languages and Communication BLDG, 255 S. Central Campus Drive RM 2300, Salt Lake City, UT 84112-0492, USA
e-mail: a.kaplan@utah.edu

elements outside the privileged position gravitate to the privileged position to comply with the positional restriction, potentially overwriting the privileged position's underlying features (*overwrite* systems).

The set of positions that serve as privileged across overwrite systems seems to be a proper subset of the positions that serve as privileged in preservation. Initial syllables, stressed syllables, and roots/stems can behave as privileged in both kinds of phenomena (Beckman 1999; Walker 2011). In contrast, Barnes (2006) and Walker (2011) identify preservation systems that target final syllables but note an apparent absence of overwrite for that position.

In Optimality Theory (OT; Prince and Smolensky 1993/2004), broadly speaking, two kinds of theories exist for these phenomena. Positional faithfulness (Beckman 1999) adopts position-specific faithfulness constraints that preserve elements in privileged positions while allowing markedness constraints to eradicate those elements elsewhere. Positional markedness (Beckman 1999; Goldsmith 1989; Ito 1988; Lombardi 1994; Steriade 1995; Walker 2011; Zoll 1997, 1998a,b, etc.) employs markedness constraints that ban elements appearing (solely) outside in privileged positions, leaving those in privileged positions untouched. This paper argues that the asymmetry between preservation and overwrite in terms of the positions that may serve as privileged in these systems results from an asymmetry in positional faithfulness and positional licensing, a particular kind of positional markedness constraint. The two frameworks overlap to a great extent in their empirical coverage, but only positional licensing can accommodate overwrite (Zoll 1998b). So if positional faithfulness but not positional licensing may target final syllables, we expect only preservation in final syllables, accounting for the asymmetry noted by Barnes and Walker.

The proposal developed here is that positional licensing is more restrictive than positional faithfulness in the kinds of positions it may target, but this greater restrictiveness is not arbitrary. While positional faithfulness has access to prominent positions of all types, positional licensing may only single out maximally prominent positions: positions that are the most prominent along some dimension, such as linear order or metrical prominence. Final syllables show signs of prominence, but they are also weak in important respects (Barnes 2006; Walker 2011) and therefore not as prominent as initial syllables, which lack final syllables' weaknesses. Thus positional faithfulness but not positional licensing may target final syllables. This holds for other positions that behave as privileged in preservation but not overwrite: each is less prominent than some other relevant position. By amending the theories of positional faithfulness and positional licensing developed by Beckman (1999) and Walker (2011), respectively, this difference can be formalized.

This proposal has several desirable consequences. First, it provides an explanation for the fact that not all prominent positions can be singled out in overwrite systems. It also fills a gap in theories of positional faithfulness and positional markedness: while constraints stemming from these theories may designate only prominent positions as privileged, what counts as sufficiently prominent is never, to my knowledge, made explicit. Finally, the analysis defines particular (though still overlapping) empirical domains for positional faithfulness and positional licensing and therefore makes progress toward alleviating the redundancy that comes with adopting both of these approaches at once.

The paper is organized as follows. I begin with a review of the typologies of preservation and overwrite systems (Sect. 2). Section 3 connects these typologies to hierarchies that capture the comparative prominence of positions that participate in preservation and overwrite. Section 4 capitalizes on these hierarchies to refine the positional licensing and faithfulness formalisms to account for the typological generalizations. Section 5 discusses issues raised by those refinements: their consequences for tonal and consonantal systems, explanations for the typological asymmetry, and the relationship between the kinds of patterns examined here and positional augmentation. Section 6 summarizes the results of the paper.

2 The typology of preservation and overwrite

This section examines the range of positions that serve as privileged in preservation and overwrite systems. I focus mainly on vowels and vocalic features for mostly practical reasons. Prominence-based restrictions on vowels seem to have been more exhaustively studied (see Barnes 2006 and Walker 2011) than restrictions on, say, consonants, and as Smith (2005) observes, the range of relevant phenomena involving consonants seems to be impoverished compared to vowels (this point is discussed more fully in Sect. 5.2). Vowels, then, provide more fertile ground for the typological issues pursued here. This section begins by clarifying the difference between preservation and overwrite and then turns to the positions that each kind of system may target.

2.1 Two kinds of positional restrictions

Languages exhibit a variety of strategies for complying with requirements that limit some element to a particular position. Broadly speaking, these strategies fall into two classes, which I will call *preservation* and *overwrite* systems. In preservation systems, if the element subject to the restriction originates in the designated privileged position, it is preserved there. In other positions, the element is banned, if not universally then at least when other conditions are not met. For example, in Tamil the short mid vowels *ɛ*, *ɔ* appear only in initial syllables and are unattested elsewhere (Beckman 1999; Christdas 1988), as shown in (1). (A note on transcription: Christdas (1988:176) states that "[p]honetically, [short] /e/ and /o/ are realized as [ɛ] and [ɔ] respectively"; for consistency in presentation I use the latter symbols throughout in both underlying and surface representations.)

(1) tɛɾɯ 'street'
*tuɾɛ
pɛɾɜ 'room'
*paɾɛ
kɔsɯ 'mosquito'
*kusɔ
pɔɾɪ 'fry'
*piɾɔ

Likewise, in Classical Mongolian (Poppe 1954, 1955; Walker 2001), roundness is permitted on non-initial non-high vowels just when all preceding vowels are also round. The data in (2) illustrate permissible patterns; in contrast, sequences such as **CaCo* and **CeCo* (Walker 2001) are disallowed. (High round vowels are not subject to the restriction: *egyde* 'door,' *bajiqu* 'to be.' The data in (2) also reflect Classical Mongolian's backness harmony system, which is why only a limited number of vowel combinations are shown.)

(2)

nøkør	'friend'
ølø	'gray'
moŋɣol	'Mongol'
qomoɣol	'horse dung'
møren	'river'
kømøske	'eyebrow(s)'
bøgere	'kidney'
qola	'far, distant'
olan	'many'
nomoɣodqa	'to tame'

Walker (2011) interprets this as the effect of a prohibition on [+round] on a non-high vowel if that feature lacks membership in the initial syllable. So *nøkør* is permitted because the [+round] feature in the second syllable is shared by the vowel in the initial syllable, but that is not the case for **CaCo*.

While Classical Mongolian exhibits a static pattern, active assimilation in non-privileged positions is attested in other languages. In Buchan Scots (Paster 2004), unstressed *i* lowers to *e* following a non-high stressed vowel. This is shown in (3) with the suffix /i/.[1] Paster indicates that the first syllable in each word is stressed, and I have added this to the transcriptions. In (3a), the stressed vowel is non-high and the suffix lowers, but in (3b) the suffix remains high because the stressed vowel is also high. Evidence that the suffix is underlyingly *-i* comes from forms containing consonants that block harmony, such as *hez-i* 'hazy.' Walker (2011) argues that the system results from a prohibition on [+high] that lacks membership in the stressed syllable.

(3) a.

ˈgem-e	'gamie'
ˈher-e	'hairy'
ˈmom-e	'mommy'
ˈbatʃ-e	'batchie'
ˈsɔs-e	'saucy'
ˈmɛs-e	'messy'

[1] As an anonymous reviewer points out, the data in (3) are also consistent with the view that it is initial—not stressed—syllables that are important here. Evidence in favor of stressed syllables comes from a word like *motif*, which has final stress according to Paster (2004:389). Were initial syllables the relevant privileged position, we might expect **motef* instead, similar to *ˈmom-e* 'mommy' Consequently, I assume that stressed syllables are the privileged position in Buchan Scots, though nothing crucial hinges on this choice: Sect. 2.2 discusses the positions that participate in preservation systems, and as we will see, there are ample unambiguous systems for both stressed and initial syllables, so the ambiguity of (3) does not affect the larger argument.

b. ˈhus-i ‘housie’
ˈkuθ-i ‘couthy’
ˈsnut-i ‘snooty’
ˈdir-i ‘dearie’
ˈbitʃ-i ‘beachie’
ˈʍil-i ‘wheelie’

Vowels outside the privileged positions in Classical Mongolian and Buchan Scots are permitted to host the restricted features as long as they share those features with the privileged position.[2] What these systems have in common with Tamil-type systems is that some element is banned generally unless it has underlying membership in a designated privileged position. These are all preservation systems because the relevant privileged position remains faithful and hosts a contrast that is neutralized via effacement or harmony elsewhere.

Overwrite phenomena also exclude elements from non-privileged positions, but they differ from the foregoing patterns in that restricted elements originating outside the designated position spread or move to that position. For example, metaphony in the Romance language of Central Veneto involves the raising of stressed *e*, *o* in the presence of a post-tonic high vowel (Walker 2005, 2008, 2010, 2011):

(4)

kalˈs-e̲t-o	‘sock (MASC. SG.)’	kalˈs-i̲t-i	‘sock (MASC. PL.)’
kanˈt-e̲-se	‘sing (1PL.)’	kanˈt-i̲-si-mo	‘sing (1PL. IMPF. SUBJ.)’
ˈmo̲v-o	‘move (1SG.)’	ˈmu̲v-i	‘move (2SG.)’
kanˈto̲r	‘choir singer (MASC. SG.)’	kanˈtu̲r-i	‘choir singer (MASC. PL.)’

As with Buchan Scots, assimilation results in surface forms in which non-privileged positions share the restricted feature with the privileged position. The chief difference between Central Veneto and Buchan Scots is the direction of assimilation. Central Veneto allows the privileged position to be unfaithful to achieve the target configuration, but Buchan Scots does not.

There are also overwrite analogs of Tamil, where the restricted element does not surface outside the privileged position. A pattern like this is found in Esimbi (Hyman 1988; Stallcup 1980a,b). In this language non-high vowel features appear only in initial syllables. In (5), the vowels of the infinitive and singular class 9 prefixes alternate in height according to the following stem. Hyman (1988) argues that the underlying height features of the root surface on the prefix; this is interpreted by Walker (2011) as the product of a prohibition on their appearance outside the initial syllable.

(5)

Underlying Stem Vowels	*Infinitive*		*Sg. class 9*	
/i/	u-ri	‘eat’	i̗-bi̗	‘goat’
	u-bini	‘dance’	i̗-dʒi̗mi̗	‘back’

[2]Buchan Scots is a bit more complicated this: *hez-i* ‘hazy’ shows that when harmony is blocked, the otherwise illicit high vowel survives. This suggests that [–high] cannot be epenthesized to replace the suffix’s [+high]—this feature must be acquired via harmony, and when intervening consonants prevent this, the generalization concerning [+high] in this position is violated.

/u/	u-suhuru	‘crouch’	ì-sù	‘fish’
	u-mu	‘drink’	ì-sùmu	‘thorn’
/e/	o-si	‘laugh’	è-gbì	‘bushfowl’
	o-kibi	‘pour’	è-kìbì	‘antelope’
/o/	o-tu	‘insult’	è-sù	‘hoe’
	o-zumu	‘dry up’	è-nùnù	‘bird’
	o-mu	‘go up’		
/ə/	o-dzɨ	‘steal’	è-bɨ	‘canerat’
	o-tɨnɨ	‘refuse’	è-kpɨ̀sɨ̀	‘rock’
	o-nɨmɨnɨ	‘think’		
/ɛ/	ɔ-rini	‘be poor’	è-nyìmì	‘animal’
	ɔ-njihiri	‘chew’	è-yìsì	‘hole’
/ɔ/	ɔ́-mu	‘sit’	è-zù	‘snake’
	ɔ-zumulu	‘wither’	è-fumù	‘hippo’
/a/	ɔ-bɨ	‘come’	è-tlɨ̀	‘place’
	ɔ-sɨmbɨrɨ	‘scatter’	è-kɨ̀rɨ̀	‘headpad’

Again, the salient difference between Tamil and Esimbi is that the initial syllable is always faithful in Tamil but undergoes assimilation in Esimbi.

Besides preservation and overwrite, there is a third kind of positional restriction that is worth mentioning: positional augmentation (Smith 2005). (The following discussion draws largely on Smith’s comparison of positional augmentation and neutralization. She argues, as I do here, that augmentation and preservation/overwrite—though she does not use the latter terms—are fundamentally different and require distinct formalisms.) Augmentation imposes particular requirements on elements in prominent positions: vowels in stressed syllables must be long, stressed syllables must have onsets or be heavy, onsets or nuclei must meet certain sonority or prominence thresholds, etc. For example, in Zabiče Slovene, high vowels are banned from stressed syllables (Crosswhite 2001). Smith treats this as the reflection of a requirement that stressed-syllable nuclei have high sonority. This is superficially similar to Esimbi and Tamil in that all three languages exhibit a vowel-height restriction wherein some kind of syllable does not pattern with other syllables. But there are important differences that reveal a fundamental distinction between augmentation and overwrite/preservation. First, the orientation of the restrictions differs. In augmentation, the restriction is imposed on the designated position itself: every instance of that position must exhibit a certain property. But in overwrite/preservation, the restriction holds for the property: every instance of the property must appear in a particular position. This means that in augmentation, if the relevant property is absent underlyingly, it must be added to the surface form: a high vowel in the stressed syllable lowers in Zabiče Slovene, whether or not the [–high] feature can be acquired from other vowels in the word. But in overwrite/preservation, if the relevant property is absent, the positional restriction is satisfied and no change is necessary: initial vowels lower in Esimbi only if [–high] is underlyingly present elsewhere in the word, and in Tamil

the initial syllable is not required to contain ɛ or ɔ. In other words, in augmentation, the prominent position *must* have a certain property, while in overwrite/preservation, it (is the only one that) *may* have it.

A related difference concerns the role of contrast in the two kinds of systems. Overwrite and preservation serve to place contrasting features in prominent positions, while augmentation has no such direct relationship with contrast: Smith (2005) documents many languages in which a contrast that exists in weak positions is neutralized via augmentation in a strong position (as in Zabiče Slovene, where the high/non-high vowel contrast is neutralized in stressed syllables), and others in which augmentation adds a feature—say, vowel length—that is not otherwise present in the language.

The content of the positionally restricted elements also differs between these systems. Augmentation invariably involves strengthening (Smith 2005): the position that undergoes augmentation acquires some property that enhances its salience, such as onsets (often specifically low-sonority onsets), high-sonority nuclei, or high tones. But overwrite/preservation may involve weakening of the target position (Walker 2011): stressed syllables in Central Veneto acquire high (i.e. low-sonority) vowels, for example.

These are subtle but crucial distinctions that reveal a contrast in motivation for these phenomena. For augmentation, the goal is to enhance the prominence of the target position by providing it with perceptually prominent material (Smith 2005), while in overwrite/preservation the goal is to enhance the perceptual prominence of the restricted property by realizing it in a prominent position (Walker 2011). Thus overwrite/preservation can sometimes work against augmentation desiderata. The two categories of phenomena are simply qualitatively different, and they require different kinds of formalisms: as Smith points out, her M/str augmentation constraints (M/str constraints are markedness constraints that hold only for a particular strong position) cannot account for preservation/overwrite, and the positional faithfulness and positional licensing constraints that are the subject of the formalism proposed below produce preservation and overwrite but not augmentation. Consequently, I exclude augmentation effects from the current investigation, although the proposal developed here has implications for augmentation, and I return to the topic briefly in Sect. 5.4.

To summarize, positional restrictions of the relevant sort can be distinguished by the behavior of the privileged position: in some systems, the privileged position is always faithful, and in others it can acquire the restricted feature by assimilating to another position. Both have the effect of ensuring that the restricted feature at least partially coincides with the privileged position. The rest of this section examines the range of positions that can participate in preservation and overwrite.

2.2 Preservation

This section examines positions that behave as privileged in preservation systems. Beckman (1999) and Walker (2011) identify three positions that can be privileged in vowel-based patterns: initial syllables, primary stressed syllables, and roots/stems.[3]

[3] Walker additionally identifies the head mora of the stressed syllable as the privileged position in a process from the Ligurian dialects of Italy. I take this to be a special case of stressed-syllable privilege for present purposes.

Both Beckman and Walker connect these positions' status as privileged with well-known acoustic, articulatory, perceptual, and cognitive properties that render them prominent. To put it differently, these positions are prominent and therefore potentially privileged.

Though these three positions have received most of the attention in the literature, a handful of other positions also show evidence of prominence and participate in preservation. These include final syllables, secondary stress, and certain categories of unstressed syllables. This section presents examples of preservation involving each of these six positions and summarizes evidence that these positions are prominent.

2.2.1 Initial syllables

We've already seen preservation systems involving initial syllables: Tamil and Classical Mongolian. Here is a brief sample of relevant work pointing to the prominence of initial syllables (see also Barnes 2006; Beckman 1999; Walker 2011 for more details): certain mispronunciations in initial syllables are detected more often than those in other syllables but with slower reaction times, suggesting that subjects use the initial syllable's content for word identification more than subsequent syllables (e.g. Cole 1973; Cole and Jakimik 1980). And in tip-of-the-tongue states, subjects most often recall initial material (Brown and McNeill 1966).

2.2.2 Primary stressed syllables

We will see evidence below that it is worth distinguishing primary from secondary stress, so I begin that practice here. Preservation involving primary stress is common in vowel-reduction systems. In English, for example, non-final unstressed vowels reduce to ə, but vowel features are retained in stressed syllables, both primary and secondary (Crosswhite 2001). The Buchan Scots pattern presented above also reflects preservation that targets primary stress. Stressed syllables—both primary and secondary—are prominent: they tend to have greater duration and intensity than unstressed syllables, and they host greater pitch contours (e.g. Lehiste 1970).

2.2.3 Roots/stems

Beckman (1999) discusses a variety of preservation systems involving roots and stems, wherein some segment type appears exclusively in the root or stem. For example, Zulu and Xhosa allow clicks only in roots: *úku-/^{h}óla* 'to pick up'; **ú/u-/^{h}óla* (example from Xhosa). Cuzco Quechua restricts glottalization and aspiration to roots (Parker and Weber 1996), and in Arabic pharyngeals appear only in roots (McCarthy and Prince 1995). In German, the segmental inventory of suffixes is narrowed to *s*, *t*, *n*, *r*, ə (Bach 1968). ATR harmony in Lango (Noonan 1992; Woock and Noonan 1979) shows a more intricate preservation system involving roots, but as this also involves overwrite for roots I set it aside until Sect. 2.3.1.

Independent evidence for the prominence of roots and stems (I am unaware of any studies that systematically distinguish roots from stems) comes from a range of research suggesting that roots are central to lexical storage and access. (In addition

to the studies cited here, see Beckman 1999; Smith 2005, and Walker 2011 for discussion.) Root frequency affects ease of recall and recognition of inflected words (Rosenberg et al. 1966). Inflected forms can prime the bare roots they contain as effectively as the bare root can prime itself (Fowler et al. 1985; Kempley and Morton 1982; Stanners et al. 1970), and same/different decisions are faster when subjects compare words' stems than when they compare their affixes (Jarvella and Meijers 1983).

2.2.4 Final syllables

Barnes (2006) argues that final syllables show evidence of prominence, chiefly because of their duration: final syllables tend to be longer than non-final syllables (Horne et al. 1995; Lehiste 1972; Lehiste et al. 1976; Lunden 2006; Oller 1973; Wightman et al. 1992). Kehoe and Stoel-Gammon (1997) provide evidence pointing to a cognitive advantage for final syllables in that they tend to be retained in children's truncations (perhaps as a recency effect), and Brown and McNeill (1966) found that final material was recalled in a tip-of-the-tongue state more often than medial material.

This prominence is reflected in phonological systems. For example, final syllables may resist harmony or host a larger vowel inventory than other positions (Barnes 2006; Steriade 1999). The former situation is exemplified by Maltese (Puech 1978), where vowels in final open syllables do not harmonize. The latter pattern is found in Hausa, where the full range of short vowels appears only in final syllables (Schuh and Yalwa 1999). Non-finally, short /e/ and /o/ neutralize with /a/, which itself surfaces with "a range of pronunciation in the low to mid area" (Schuh and Yalwa 1999:90), transcribed as ə. (It is not clear what domain a short vowel must be final in to escape neutralization, but Schuh and Yalwa indicate that it is larger than the word.) Morphological processes may shorten medial long vowels, so there are active alternations that show the neutralization; Schuh and Yalwa provide the following examples. In (6a), the underlined long vowels in the singular forms become shortened in the plural forms and consequently neutralize. But the underlined short vowels in (6b) escape neutralization because they are final.

(6) a. *Short medial /e, o/ are neutralized*

zo̲ːbèː	'ring'	zə̲̂bbaː	'rings'
re̲ːʃèː	'branch'	rə̲̂ssaː	'branches'

b. *Short final /e, o/ are not neutralized*

tàːɾe̲	'together'
gʷoːrò̲	'kola nut'

Similarly, in Javanese, the tense/lax contrast on high vowels is preserved in closed syllables only in final position (Bye and de Lacy 2000; Dudas 1976).

Much discussion of final-syllable privilege is not explicit about whether it is phrase-final or word-final syllables that are relevant, but Barnes lists some cases in which the prominent position is clearly word-final, among them Eastern Mari, English, and Yakan, all of which show word-final resistance to vowel reduction. Likewise, Canalis (2009, to appear) describes a vowel-reduction system in the Veroli dialect of Italian that targets all post-tonic syllables except final ones.

2.2.5 *Secondary stress*

Like primary stress, secondary stress resists vowel reduction in English, for example. In Guaraní (Beckman 1999; Gregores and Suárez 1967; Rivas 1975), nasal harmony domains are delimited by stressed syllables, both primary and secondary (and by prenasalized stops). Nasalization in Guaraní is contrastive only on stressed vowels. Unstressed vowels are oral except when they are targeted by nasal harmony. Thus *tuˈpa* 'bed' and *tũˈpã* 'god' are attested, but **tũˈpa* and **tuˈpã* are impossible (Rivas 1975). Harmony is regressive, stopping when it encounters a stressed oral vowel, so /re+ˈxo+ta+raˌmõ/ 'if you go' surfaces as *reˈxo̰tã̰ã̰ˌmõ* (Gregores and Suárez 1967:83). And whereas prenasalized stops generally trigger regressive harmony (/a+ǰe+re^{n}ˈdu/ → *ãñẽr̃ẽ^{n}ˈdu* 'I hear myself' Rivas 1975:136), harmony fails in *^{m}baˌʔe^{m}bɨaˈsɨ* 'sadness' (Gregores and Suárez 1967:69) because of the secondary stress on the vowel immediately preceding the medial prenasalized stop. These examples show that secondary stress can begin and end a harmony domain. As in other cases of preservation, then, the nasalization contrast is preserved under primary and secondary stress but neutralized elsewhere.

McCarthy (2008b) examines another example of preservation involving secondary stress. Non-initial odd-numbered and final vowels in Awajún (also known as Aguarana) are deleted. McCarthy interprets this as evidence for an iambic system (except that the final foot is a trochee) in which the unstressed vowels are deleted. For example, the underlined vowels in *(iˈʧi)(na̲ˈka)(ŋu̲ˈmi)(ˈnaki̲)* are targeted for deletion, yielding *iʧinkaŋminak* 'only your pot (acc.).' Stress is not explicitly reported for the language but must be inferred from other facts that McCarthy discusses. If this analysis is correct, and assuming a principle of culminativity by which only a single primary stress is permitted (Hayes 1995), some of the stresses in this example must be secondary, and the vowels in those syllables are targeted for preservation.

2.2.6 *Certain unstressed vowels*

Languages often treat certain unstressed vowels as more prominent than others. Maiden (1995) and Walker (2011:269) observe that pretonic syllables in many Romance languages are more prominent than post-tonic vowels, as evidenced, for example, by greater vowel reduction in the post-tonic domain. Crosswhite (2001) and Bethin (2006) discuss a variety of languages in which certain unstressed vowels undergo greater reduction than other unstressed vowels, and they connect this to facts about syllable duration. For example, pretonic syllables in Brazilian Portuguese and immediately pretonic syllables in many Slavic languages undergo less extreme reduction than other unstressed syllables (in some languages they show no reduction at all), and these syllables are measurably longer than other unstressed syllables. Duration contributes to the prominence of stressed and final syllables (Barnes 2006; Beckman 1999), so it is reasonable to suppose these syllables are prominent by virtue of their duration and therefore protected from extreme reduction. Certain unstressed syllables, then, may show preservation.

2.2.7 Summary

To summarize, we've seen six positions that participate in preservation systems. The discussion turns now to overwrite, for which only initial syllables, primary stress, and roots/stems are possible privileged positions.

2.3 Overwrite

2.3.1 Initial syllables, primary stress, and roots/stems

Esimbi (5) and Central Veneto (4) illustrate overwrite involving initial syllables and primary stress, respectively. Recall that in Esimbi non-high height features migrate to the initial syllable, and in Central Veneto post-tonic high vowels trigger the raising of the (primary) stressed vowel.

Lango (Noonan 1992; Woock and Noonan 1979) shows both preservation and overwrite for roots. In certain root/suffix combinations in this language, ATR features spread from the root to the suffix, and in other combinations spreading in the opposite direction occurs. Progressive assimilation is illustrated in (7), with spreading of [+ATR] (7a) and [–ATR] (7b). Only [+ATR] spreads regressively, and this is shown in (8). (The [+ATR] counterpart of *a* is ə.) See Smolensky (2006) for an analysis of the factors that determine the direction of spreading. These factors are quite complex and include vowel quality (e.g. creating high lax vowels is avoided), syllable structure (e.g. [+ATR] cannot spread from a non-high vowel in a closed syllable), and the feature to be spread (e.g. [–ATR] cannot spread regressively). These issues are interesting in their own right, but for our purposes the crucial point is that spreading can either target or emanate from the root.

(7) a.

Root	*Gloss*	*1sg poss.*	*3sg poss.*
ŋùt	'neck'	ŋùt-ɔ́	ŋùt-é
wót	'son'	wód-ɔ́	wód-é
ém	'thigh'	ém-ɔ́	ém-é
ŋèt	'side'	ŋèt-ɔ́	ŋèt-é
ɲíḿ	'forehead'	ɲíḿ-ɔ́	ɲíḿ-é
cíŋ	'hand'	cíŋ-ɔ́	cíŋ-é

b.

bwɔ́m	'wing'	bwɔ́m-á	bwɔ́m-ɛ́
wàŋ	'eye'	wàŋ-á	wàŋ-ɛ́
lɛ́b	'tongue'	lɛ́b-á	lɛ́b-ɛ́
tyɛ́n	'leg'	tyɛ́n-á	tyɛ́n-ɛ́
yíb	'tail'	yíb-á	yíb-ɛ́

(8)

kɔ́m	'chair'	kòm-mí	'your (sg) chair'
kɔ́m	'chair'	kòm-wú	'your (pl) chair'
bɔ́	'net'	bó-wú	'your (pl) net'
còŋ	'chaff'	cùŋ-wú	'your (pl) chaff'
jɔ̀	'people'	jò-wú	'your (pl) people'

dɛ̀k	‘stew’	dɛ̀k-kɪ́	‘your (sg) stew’
lɛ̀	‘net’	lɛ̀-wú	‘your (pl) net’
pí	‘for’	pɪ̀-wú	‘for you’
bɔ̀ŋɔ́	‘dress’	bɔ̀ŋɔ́-nɪ́	‘your (sg) dress’
cɔ̀ŋɔ̀	‘beer’	cɔ̀ŋɔ̀-nɪ́	‘your (sg) beer’
àmʊ́k	‘shoe’	àmúk-kɪ́	‘your (sg) shoe’
àtîn	‘child’	àtɪ́n-nî	‘your (sg) child’
ìmáɲ	‘liver’	ìmáɲ-ɪ́	‘your (sg) liver’
pàlà	‘knife’	pàlə-wú	‘your (pl) knife’
ɔ̀kwɛ́ˈcɛ́	‘bitch’	ɔ̀kwɛ́ˈcé-nɪ́	‘your (sg) bitch’
ɔ̀kwɛ́ˈcɛ́	‘bitch’	ɔ̀kwɛ́ˈcé-wú	‘your (pl) bitch’
lɛ̀mʊ́n	‘orange’	lɛ̀mún-wú	‘your (pl) orange’
mɔ̀tɔ̀kà	‘car’	mɔ̀tɔ̀kə̀-ê	‘cars’
dàktàl	‘doctor’	dàktə̀l-ê	‘doctors’
ìdíkɛ̀	‘leech’	ìdɪ́k-ê	‘leeches’

Kaplan (2008a,b) argues that spreading in either direction is motivated by a requirement that ATR features coincide with the root. That this is the goal of harmony is revealed by the longer roots in (8): only the final root vowel harmonizes in regressive harmony. In contrast, progressive harmony involving the middle-voice suffix /-ɛ́rɛ̂/ targets both suffix vowels: *wùc-érɛ̂* ‘throw.’ The property that unites all harmonized forms is that their suffixes match the final root vowel for [ATR]. Progressive assimilation is Buchan Scots-style preservation, and regressive harmony is overwrite.

As another example involving roots/stems, Kaplan (2011) argues that Chamorro umlaut (Chung 1983; Topping 1968), in which [–back] spreads from certain prefixes and clitics to root-initial stressed syllables (9), is best understood as being driven by a prohibition on immediately pretonic [–back] that is not realized on the root. This, then, is an example of overwrite involving the root.

(9)

a.	ˈnana	‘mother’	i ˈnæna	‘the mother’
b.	ˈguma?	‘house’	i ˈgima?	‘the house’
c.	ˈcupa	‘cigarettes’	i ˈcipa	‘the cigarettes’
d.	ˈsoŋsuŋ	‘village’	i ˈseŋsuŋ	‘the village’

2.3.2 Other prominent positions

While initial syllables, primary stress, and roots/stems participate in both overwrite and preservation, there appear to be no overwrite counterparts to the preservation systems involving final syllables, secondary stress, and unstressed syllables.

Barnes argues that final-syllable strength is typically manifested as resistance to some process: preservation rather than overwrite.[4] Walker (2011) also notes that there appear to be no examples of overwrite involving final syllables, and Smith (2005:14,

[4]Again, this is a generalization about vowels and their features. Tones, of course, are another matter: Zhang (2001) argues that final syllables’ phonetic properties make them very good hosts for contour tones, and Zoll (1997) develops an analysis of contour tones’ attraction to final syllables. In Sect. 5.1 I argue, following Zhang, that this attraction is due to final syllables’ greater duration, not their prominence.

fn. 7) points out the lack of augmentation in that position. This might be attributable to the fact that final syllables also exhibit weakness, such as decreased amplitude, devoicing, glottalization, and deletion (Barnes 2006; Hock 1999). Alongside the systems in which final syllables resist neutralization, Barnes discusses a number of patterns in which final syllables are singled out for processes of contrast reduction. It is notable that such mixed strength and weakness—and the concomitant mixed behavior in both resistance and susceptibility to neutralization—is not reported for other prominent positions such as stressed or initial syllables.

In fact, Barnes argues that certain patterns that seem to be driven by final-syllable strength are products of that position's weaknesses. For example, in Pasiego Spanish (Penny 1969), only the final syllable hosts a tense/lax contrast. According to Barnes (2006:244), "the only underlyingly lax vowel in the language is in the lax /-U/ suffix of masculine singular count nouns." When this suffix appears, all preceding vowels harmonize for laxness (e.g. *abiˈʎanus* 'hazels'; *AvIˈʎAnU* 'hazel'; capitalization indicates laxness). But Barnes argues that the final syllable is a poor host for a tense/lax contrast, and harmony is a means of compensating for the perceptual inadequacy of that position. The fact that the contrast exists only in this position for morphological rather than phonological reasons supports his conclusion. So final syllables are prominent enough to protect contrasts in languages like Hausa, but they're also weak enough to trigger harmony that enhances the perceptual properties of their contents.

A similar example comes from Jaqaru, which I take up in more detail in Sect. 4. In this language, the stressed vowel harmonizes for all features with the final vowel of certain suffixes (Cerrón-Palomino 2000; transcriptions and glosses follow Walker 2011):

(10)				
	tʃima	'belly'	tʃiˈmi-ni	'with belly'
	wasa-ma	'be careful'	was-ˈmi-ʎi	'hey, be careful'
	naru-	'to laugh'	naˈra-ja	'to make someone laugh'
	tʃ'ipi-	'to shine'	tʃ'iˈpa-ja	'to cause to shine'
	aja-	'to give the hand'	aˈju-ru	'to introduce the hand'
	palu-ʃi-	'to eat (med. pass.)'	pal-ˈʃu-ʃu-	'eating'

Again, final syllables seem prominent enough to control harmony, but weak enough that features they host seek membership in a more prominent position like a stressed syllable.

Final syllables, then, show signs of prominence, but not to the extent that stressed syllables, initial syllables, and roots/stems do, and this is reflected in the kinds of processes they participate in. Final syllables are not alone in this regard. For example, secondary stress—uncontroversially a prominent position—seems never to be targeted by overwrite. Central Venetan metaphony involves spreading to the (primary) stressed syllable, but there seems to be no analogous pattern in which spreading either preferentially targets secondary stress over primary stress or targets both kinds of stress. In fact, while Walker (2011) examines many cases of overwrite involving primary stress, secondary stress plays no role in any of those systems, not even as an alternative target in case the primary-stressed syllable is unavailable for some reason.

I am aware of two ostensible counterexamples. The first is Chamorro umlaut, but closer inspection tells a different story. As illustrated in (9) and repeated in (11), front vowels in prefixes and clitics trigger fronting of root-initial stressed vowels.

(11)	a.	ˈnana	‘mother’	i ˈnæna	‘the mother’
	b.	ˈguma?	‘house’	i ˈgima?	‘the house’
	c.	ˈcupa	‘cigarettes’	i ˈcipa	‘the cigarettes’
	d.	ˈsoŋsuŋ	‘village’	i ˈseŋsuŋ	‘the village’

Secondary stress is optionally targeted for umlaut under conditions discussed below:

(12)	ˈmiˌpigas, ˈmiˌpugas	‘abounding in uncooked rice’	ˈpugas	‘uncooked rice’
	iˌgimaʔˈniha, iˌgumaʔˈniha	‘their house’	ˈguma?	‘house’
	iˌkebblinˈmami, iˌkobblinˈmami	‘our (excl.) cash’	ˈkobbli	‘cash, money’

But Kaplan (2011) argues that umlaut is triggered by an immediately pretonic syllable (even one that itself bears stress, as in *ˈmiˌpigas*) and targets the root, so the fact that the targeted syllable bears stress is coincidental; this is overwrite of the root, not the stressed syllable, so Chamorro does not show that secondary stress can be targeted by overwrite.

Furthermore, secondary stress can be the target of umlaut only if it is the remnant of primary stress from a previous derivational cycle: the bare roots to the right in (12) show that the syllables that undergo umlaut in the complex forms bore primary stress before affixation. “Rhythmic” secondary stress, which, roughly speaking, falls on alternating syllables to the left of primary stress, does not permit umlaut: *i ˌputamuˈneda*, **i ˌpitamuˈneda* ‘the wallet.’ So it appears that, independently of the root-targeting nature of the process, umlaut is sensitive only to primary stress. As for why umlaut is optional with secondary stress, an Output-Output Correspondence approach (Benua 1997; Crosswhite 1996) can optionally require vowels to maintain faithfulness to a primary stressed correspondent in a related output form; alternatively, a derivational account of the facts (Kiparsky 1986) can optionally apply umlaut before primary stress is demoted to secondary stress (and obligatorily apply umlaut after that point so that primary stress that is not demoted is always subject to umlaut).

The second potential counterexample is umlaut in Old English (Campbell 1959; Hogg 1992). Stressed vowels are fronted when the following syllable contains an unstressed *i* or *j*. Fronting may occur non-locally if the intervening vowel is *u*: *ˈgædeling* ‘companion’ (cf. Old Saxon *gaduling*; I add diacritics here and subsequently for ease in identifying stress, whose position I infer from the discussion of the Old English stress system by Campbell and Hogg and the targets of umlaut in their examples).

Evidence that umlaut can target secondary stress comes from disyllabic suffixes wherein the second syllable triggers umlaut on the first syllable, which bears secondary stress. For example, the suffix /-ohti/ surfaces as *-ehti* in words like *ˈstāˌnehte* ‘stony.’ (The umlaut-triggering vowel often—perhaps typically—does not surface faithfully; hence the lowering of the underlying final *i* in this example.) Similarly, /-ōdi/ surfaces as *-ede*: *ˈhōˌcede* ‘hooked.’ The word-initial back vowels show that umlaut does not target primary stress in these examples.

The fact that umlaut on secondary stress involves these disyllabic suffixes is suspicious, especially in comparison with the behavior of compounds. The primary stress of the second member of a compound is demoted to secondary stress, and umlaut may target it. For example, *ˈāˌnīġe* 'one-eyed' and *ˈānˌlīpe* 'single' show fronting of the first vowel of the second member of the compound (i.e. the vowel with secondary stress). The simplest account of these compounds is that they have the structure $[[\ldots]_{\text{PWd}}[\ldots]_{\text{PWd}}]_{\text{PWd}}$, and the secondary stress is actually the primary stress of the second prosodic word.[5] Perhaps the disyllabic suffixes behave similarly, introducing a new prosodic domain in which their secondary stress is the main stress. Then, like the compounds, we need not interpret their behavior as evidence for overwrite involving secondary stress.

Campbell and Hogg describe the stress pattern as deeply connected to the language's morphology. Hogg (1992:137) even goes so far as to say that umlaut "is frequently subject to morphological conditioning in the synchronic grammars of OE dialects. It is therefore difficult to suppose that phonological accounts of OE which assume a general synchronic rule of *i*-umlaut... can be fully justified." If Hogg is correct, Old English umlaut is not a productive synchronic process in the first place and therefore does not provide strong evidence for overwrite involving secondary stress. In support of this position, the underlying forms given above for the problematic suffixes, /-ohti/ and /-ōdi/, are identified by Campbell as, respectively, the Old High German and Old Saxon cognates for these suffixes. Perhaps by the relevant point in the history of English these suffixes had changed in ways that give the appearance of undergoing umlaut in comparison with their historical cognates. Alternatively, it is possible that umlaut here, as in Chamorro, involves a non-prosodic target—say, the initial syllable in some morphological domain—while the language's prosodic and morphological systems conspire to give the appearance of a stressed-syllable target. Stress in Old English is initial, so disentangling morphological and prosodic targets is not trivial. For these reasons I tentatively set Old English aside. All is not lost, though, if Old English umlaut does in fact productively target secondary stress, but further discussion is best deferred until Sect. 4.2.

Turning to unstressed syllables, although languages may protect certain kinds of unstressed syllables from undergoing reduction, I know of no comparable examples of overwrite: no Romance metaphony system, for example, involves spreading specifically to the pretonic domain.

To summarize, there are three positions that participate in both preservation and overwrite: primary stressed syllables, roots/stems, and initial syllables. A few additional positions, including final syllables, secondary stressed syllables, and various kinds of unstressed syllables, show evidence of prominence but participate only in preservation. The next section incorporates this asymmetry into formal accounts of these phenomena.

[5] Campbell (1959:83, fn. 3) notes that some compounds also allow umlaut of the first member. So alongside *ˈāˌnīġe* and *ˈānˌlīpe* he provides *ˈæˌnīġe* and *ˈænˌlīpe*. Perhaps this shows that for at least some speakers these words lost their compound status and umlaut began targeting the primary stress for the entire word, spreading through the intervening syllable.

3 The asymmetry and prominence hierarchies

In the previous section I argued that while some positions are treated as privileged in both preservation and overwrite systems, others participate only in preservation. How can we make sense of this? Why does overwrite not make use of the full range of prominent positions, especially in light of the fact that preservation does seem to make use of this full range (or at least targets a wider range of positions)? The crucial observation, I claim, is that each position that does not participate in overwrite is less prominent than one of the positions that does. To take a simple example, secondary stress is less prominent than primary stress, perhaps by definition. Recall that stressed syllables show greater duration, intensity, and pitch contours than unstressed syllables. Different degrees of stress seem to be distinguished—at least in some languages and in some contexts—by these factors as well, with primary stress showing more extreme values of (at least some of) these properties than secondary stress (Fougeron 1997; Plag et al. 2011; van Heuven 1987). In addition, Magen (1997) reports that vowels under secondary stress may be more susceptible to influence from coarticulation than those under primary stress.

Prince and Smolensky (1993/2004) encode relationships of this sort in the form of prominence hierarchies. In their treatment of syllabification in Imdlawn Tashlhiyt Berber (Dell and Elmedlaoui 1985, 1988, 2002), they account for the language's preferential selection of more sonorous segments as nuclei with the prominence hierarchies in (13). ('>' means "is more prominent than.")

(13) a. **Syllable Position Prominence:** Peak > Margin
b. **Segmental Sonority Prominence:** $a > i > \cdots > t$

Prince and Smolensky use these hierarchies to project markedness constraints whose effect is to favor more sonorous segments in syllable peaks and less sonorous segments in syllable margins.

In a similar vein, the evidence concerning stressed syllables gives rise to the following prominence hierarchy.

(14) **Metrical Prominence:** Primary Stress > Secondary Stress > Unstressed Syllables

One can imagine refining this scale to include tertiary stress if necessary. Also, since languages can distinguish certain kinds of unstressed syllables, such as pretonic ones, as more prominent than others, the hierarchy in (14) may need further elaboration, perhaps on a language-particular basis.[6] In any case, even though syllables bearing secondary stress are prominent, at least compared to unstressed syllables, they are not maximally prominent along the relevant dimension of prominence.

This pattern holds for the other positions examined above: those that participate in overwrite occupy the maximal position on a prominence hierarchy, and positions that do not participate in overwrite are not maximal on any prominence scale.

[6]For example, Canalis (2007) proposes the following metrical hierarchy for certain varieties of Italian: Stressed Vowel > Unstressed Pretonic Vowel > Word-Final Unstressed Vowel > Penultimate Vowel of Proparoxytone (see also Canalis 2009, to appear).

Consider the case of initial versus final syllables. Evidence that these positions are prominent was presented above, as were factors that detract from the prominence of final syllables. Hock (1999) also argues that final positions are common loci of various phonological processes that are associated with weakening, such as accent retraction off of final syllables. (See also Sect. 5.1 below.) So while final syllables are prominent, they possess a number of properties associated with non-prominence that initial syllables do not. Furthermore, Horowitz et al. (1968) argue, based on word-recognition and lexical-retrieval studies, that initial syllables are more important for word recognition than final syllables. Thus we can project the following prominence hierarchy.

(15) **Sequential Prominence:** Initial Syllable > Final Syllable > Medial Syllable

As with the metrical hierarchy, we may ultimately need to recognize more distinctions here, but, crucially, I am unaware of evidence from any language suggesting that any non-initial syllable is more prominent than an initial syllable simply by virtue of being non-initial (or second, third, penultimate, etc.). A non-initial stressed syllable may be more prominent than an unstressed initial syllable, but that is because of the stress pattern (and the situation is therefore captured by (14)), not properties of the linear order of syllables. As with the comparison between primary and secondary stress, the position that is maximally prominent in (15) is the one that participates in overwrite systems.

Finally, (16) gives a morphological prominence hierarchy.

(16) **Morphological prominence:** root/stem > affix

Support for this hierarchy comes from the studies cited in Sect. 2.2.3 that show that roots and stems play a more central role in language processing than do affixes. There is also evidence supporting a distinction between different kinds of affixes: Hyman (2002, 2008) notes that suffixes are more common crosslinguistically than prefixes, and while there are many root- and suffix-controlled harmony systems, there do not seem to be any prefix-controlled patterns. There also seem to be psycholinguistic differences between derivational and inflectional morphology. For example, while inflectional morphology seems not to affect subjects' performance in word-recall tasks (Rosenberg et al. 1966), derivational morphology can slow down lexical-decision response times (Taft et al. 1986). Similarly, Jarvella and Meijers (1983) found that Dutch subjects could identify two words as containing the same stem more quickly than they could identify two words as belonging to the same inflectional category (suggesting that inflectional morphology is ignored in the early stages of word recognition), but the presence of derivational morphology slowed subjects' response times (suggesting that derivational morphology is not ignored to the extent that inflectional morphology is). See Smith (2005) for a more comprehensive summary of studies examining the role of morphology in psycholinguistic tasks. It is not clear to me how the prefix/suffix and inflectional/derivational contrasts are best represented simultaneously in the morphological prominence hierarchy, so I adopt (16) with just two positions. Once again, the position that is available to overwrite is maximal on the

relevant scale (and would remain maximal were we to distinguish between different kinds of affixes).

To reiterate, the details of these hierarchies may vary crosslinguistically and diachronically. Precedent for this comes from Steriade (1999), who projects fixed constraint rankings from hierarchies that encode the suitability of different contexts for hosting cues for laryngeal features. She argues that as the phonetic properties of these contexts change, the hierarchies and ultimately the fixed constraint rankings should also change. The same may be true for the hierarchies given above, but it is probable that the crucial parts of the hierarchies—the maximally prominent positions—will remain constant. Relationships among unstressed syllables may vary from language to language, but the likelihood that any of them (or secondary stress) will overtake primary stress in terms of metrical prominence seems remote; if they did, they'd bear primary stress themselves. Likewise, roots and initial syllables have inherent advantages because of their centrality to language processing, so other positions are unlikely to become more psycholinguistically prominent without changes in human cognition.

To summarize, we've seen that some positions are eligible for both overwrite and preservation (stressed syllables, initial syllables, and roots/stems), but others seem to participate only in preservation (secondary stress and final syllables, e.g.). This distribution is not haphazard: the positions that participate in overwrite are maximally prominent along some dimension as encoded in a prominence hierarchy.[7] Preservation, in contrast, seems to be available to both maximally and non-maximally prominent positions.

This is only the first step in accounting for the asymmetry between overwrite and preservation. The next section examines OT analyses of these kinds of phenomena and amends the relevant constraint types to reflect the results of this section.

4 Positional licensing and positional faithfulness

4.1 Accounts of preservation and overwrite

Theories of positional markedness (Goldsmith 1989; Ito 1988; Lombardi 1994; Steriade 1995; Zoll 1997, 1998a,b) and positional faithfulness (Beckman 1999) account for patterns like the ones we've seen here in which some element is restricted to a particular position. Positional markedness accomplishes this by prohibiting the restricted elements from appearing in other positions, and positional faithfulness does so by preserving those elements just when they appear in the permissible positions. While positional faithfulness can only preserve elements that appear in privileged positions underlyingly, positional markedness can also motivate spreading or movement of an element to the privileged position. That is, positional faithfulness gener-

[7] Recall that Ligurian dialects of Italy seem to adopt the head mora of the stressed syllable as a privileged position (fn. 3). This might motivate yet another prominence hierarchy that encodes relationships among moras in various positions.

ates preservation but not overwrite, and positional markedness can produce both (Zoll 1998b). To illustrate, consider the Tamil data from (1): mid vowels only appear in initial syllables. Beckman's (1999) analysis of these facts is centered on the positional-faithfulness constraints IDENT-σ_1(high) and IDENT-σ_1(low), each of which encourage faithfulness for the relevant feature in initial syllables. These constraints outrank *MID and thus preserve mid vowels in initial syllables. But since *MID outranks the context-free IDENT(high) and IDENT(low), mid vowels do not appear in other positions. As (17a) shows, mid vowels in initial syllables are preserved. But in (17b), the mid vowel in the second syllable is either raised or lowered to satisfy *MID (in the absence of alternations the choice is arbitrary). Both tableaux are modified from Beckman (1999); the second form is hypothetical.

(17) a.

/tɛruʊ/	IDENT-σ_1(high)	IDENT-σ_1(low)	*MID	IDENT(high)	IDENT(low)
☞ a. tɛrɯ			*		
b. tirɯ	*!			*	
c. tarɯ		*!			*

b.

/purɛ/	IDENT-σ_1(high)	IDENT-σ_1(low)	*MID	IDENT(high)	IDENT(low)
a. purɛ			*!		
☞ b. purɪ				*	
☞ c. purɜ					*

Tamil also submits to a positional markedness account. Perhaps the most common instantiation of this theory invokes licensing, in which constraints penalize a marked element that lacks membership in a particular position. I give in (18) Walker's (2011:45) initial definition of a prominence-based positional licensing constraint. The formalism draws heavily on OT-based precursors, especially Crosswhite (2001), Walker (2004, 2005), and Zoll (1997, 1998a).

(18) *Generalized prominence-based licensing constraint schema*:
LICENSE(λ, π)
$\lambda/\neg$LICENSE(λ, π) $\equiv_{def}$
Let any occurrence of λ, a given type of constituent, in a chain $C_j(\lambda)$ be λ_j and p be an occurrence of π, a given type of prominent position.
Then assign a violation to each λ_j if the following holds
$\exists\lambda_j[P(\lambda_j)] \wedge \forall\lambda_j[\neg\text{Coincide}(\lambda_j, p)]$

Some explanatory remarks: a chain is an element—a feature, say—and all of its correspondents. (Walker assumes that output elements may stand in correspondence with each other, accounting for things like discontiguous feature domains. Her definition of a chain requires corresponding elements in a chain to be in a single representation so as to exclude the input/output and output/output correspondence relations.) So $C_j(\lambda)$ is a chain containing λ. $P(\lambda_j)$ provides a means for imposing certain restrictions on λ: for example, that it be a particular value of the feature λ (e.g. [+high] rather than simply [high]) or that it be in a particular weak position (e.g. in Central Veneto only post-tonic high vowels trigger metaphony). Coincide(x, y) is true if x =

y, x dominates y, or y dominates x (Zoll 1998a). LICENSE(λ, π), then, assigns a violation mark to each λ that meets certain criteria—P(λ_j)—and is in a chain that does not coincide with a position of type π.

Walker subsequently expands (18) to accommodate further nuances, but the core of the formalism remains intact. For Tamil, LICENSE([–high, –low], σ_1) penalizes each instance of [–high, –low] that does not coincide with an initial syllable. In the case of /tɛruʊ/, LICENSE([–high, –low], σ_1) is not violated because the mid vowel is in the first syllable:

(19)

/tɛruʊ/	LICENSE([–high, –low], σ_1)	IDENT(high)	IDENT(low)
☞ a. tɛrɯ			
b. tirɯ		*!	
c. tarɯ			*!

For /purɛ/, the faithful *$purɛ$ violates the licensing constraint. There are several ways to repair the violation. The offending features might be removed, so that we get raising or lowering much like in (17b). The offending features might instead relocate or spread to the initial syllable, giving *porɪ* or *porɛ*, respectively. Both forms satisfy LICENSE([–high, –low], σ_1) because [–high, –low] coincides with the initial syllable, assuming the features are shared across the two syllables in *porɛ*. Of these possibilities, only *$porɛ$ is inconsistent with the facts of Tamil. It can be ruled out by a constraint penalizing features that span multiple syllables. Walker (2011) uses CRISPEDGE constraints for this purpose (see also Ito and Mester 1999; Kawahara 2008; Walker 2001). The tableau in (20) shows how positional licensing and CRISPEDGE narrow the options to candidates that lack non-initial mid vowels.

(20)

/purɛ/	LICENSE([–high, –low], σ_1)	CRISPEDGE	IDENT(high)	IDENT(low)
a. purɛ	*!			
b. porɛ		*!	*	
☞ c. purɪ			*	
☞ d. purɜ				*
e. porɪ			**!	

As Tamil shows, both positional faithfulness and positional markedness can produce preservation. Only the latter is compatible with overwrite because positional faithfulness specifically protects privileged positions from the changes that characterize overwrite. This is easily illustrated with the Esimbi data from (5); Zoll (1998b) presents comparable arguments. Only the initial syllable in Esimbi can host a non-high vowel. Walker accounts for this pattern with LICENSE([Height]/[–hi], σ_1). In her system, [Height] subsumes the features [high], [low], and [ATR]. LICENSE([Height]/[–hi], σ_1) uses the P(λ_j) notation to require licensing of height features in a segment that is [–high]. Together with CRISPEDGE, this constraint motivates migration of non-high height features to the initial syllable:

(21)

/u-mɔ/	LICENSE([Height]/[–hi], σ_1)	CRISPEDGE	MAX(–high)	IDENT(Height)
a. umɔ	*!			
b. ɔmɔ		*!		*
☞ c. ɔmu				**
d. umu			*!	*

This tableau follows Walker (2011:225) in the essentials, but I make a number of simplifications that do not affect the point at hand. In particular, Walker represents the prefix as lacking height features underlyingly and the root vowel's height features as floating underlyingly.

Positional faithfulness, on the other hand, would capture the generalization that the height contrast exists only in initial syllables with the ranking IDENT-σ_1(Height) ≫ *[–high] ≫ IDENT(Height). The subhierarchy IDENT-σ_1(Height) ≫ *[–high] allows non-high vowels in the initial syllable, and *[–high] ≫ IDENT(Height) militates against them elsewhere. However, as (22) shows, the analysis fails because the contrast appears in initial syllables not because that position is faithful, but because features from other positions move there. The correct form, candidate (c), is harmonically bounded by candidates (a) and (d).

(22)

/u-mɔ/	IDENT-σ_1(Height)	*[–high]	IDENT(Height)
a. umɔ		*!	
b. ɔmɔ	*!	**	*
(☞) c. ɔmu	*!	*	**
💣 d. umu			*

These brief examinations of Tamil and Esimbi suggest that positional markedness obviates positional faithfulness because only it can produce both preservation and overwrite. The situation turns out to be less straightforward than this, however: even though positional faithfulness cannot motivate overwrite, it is often necessary in a full account of certain overwrite systems. For example, recall that in Jaqaru, stressed vowels harmonize for all features with the final vowel of certain suffixes:

(23)

tʃima	'belly'	tʃiˈmi-ni	'with belly'
wasa-ma	'be careful'	was-ˈmi-ʎi	'hey, be careful'
naru-	'to laugh'	naˈra-ja	'to make someone laugh'
tʃ'ipi-	'to shine'	tʃ'iˈpa-ja	'to cause to shine'
aja-	'to give the hand'	aˈju-ru	'to introduce the hand'
palu-ʃi-	'to eat (med. pass.)'	pal-ˈʃu-ʃu-	'eating'

Walker's (2011) analysis drives assimilation with a licensing constraint requiring the vowel features of certain morphemes to be realized in the stressed syllable. As with Esimbi, positional faithfulness fails: preserving vowel features in stressed syllables rules out assimilation in that position.

The licensing constraint is satisfied by forms in which the vowels of the relevant morphemes share features with the stressed syllable, but this configuration can

be achieved either by spreading from these morphemes to the stressed syllable, as in (23), or by spreading in the opposite direction (e.g. **tʃiˈma-na*). To enforce the correct spreading, Walker adopts IDENT-σ_{Final}(V-Features), a positional-faithfulness constraint for all vowel features in final syllables. The relevant aspects of the analysis are shown in (24). The subscript L, following Walker, indicates that this licensing constraint holds only for a certain class of morphemes.

(24)

/tʃima-ni$_{\text{L}}$/	LICENSE$_{\text{L}}$([V-Feats], ˈσ)	IDENT-σ_{final}(V-Feats)	IDENT-ˈσ(V-Feats)
a. tʃiˈma-ni	*!		
☞ b. tʃiˈmi-ni			*
c. tʃiˈma-na		*!	

Jaqaru shows that even positional restrictions that demand an analysis grounded in positional markedness can present evidence for positional faithfulness. Beckman (1999) gives similar arguments: while positional markedness can require non-prominent positions to share features with a prominent position, it cannot control which position is targeted for assimilation, and it falls to positional faithfulness to make this choice.

OT, then, requires both positional faithfulness and positional markedness, and this conclusion opens the door to an explanation for the asymmetry discussed in the previous section concerning positions that are available for preservation and overwrite. Since only positional licensing produces overwrite, and since such systems target only maximally prominent positions, positional licensing constraints must have access to only these maximally prominent positions. On the other hand, preservation targets a wider range of prominent positions, and this indicates that positional faithfulness must be able to target non-maximally prominent positions. In what follows I formalize these proposals.

4.2 Amended positional licensing and faithfulness

The formalization of Generalized Licensing in (18) requires π to be a prominent position, but what counts as prominent remains unspecified. It is up to the analyst to determine what counts as sufficiently prominent to be a licensor, but there is nothing internal to the formalism that prevents selection of even the weakest positions. This lack of specificity provides an opportunity to capture the preservation/overwrite asymmetry by restricting positional licensing to maximally prominent positions. First, (25) establishes the set of maximally prominent positions:

(25) a. Let H be a prominence hierarchy with the members $p_1, p_2 \ldots p_n$. Then $Max(H) = p_i$ such that $\neg\exists p_j (p_j > p_i)$.
b. Let $\Pi = \{p : \exists H[Max(H) = p]\}$
c. Let π be a variable over elements of Π.

The members of Π, then, are primary stressed syllables, roots, and initial syllables. The revision to the Generalized Licensing schema is straightforward: having already restricted π to the members of Π in (25c), we simply remove the statement from (18) that π must be a prominent position:

(26) *Generalized prominence-based licensing constraint schema* (revised):
LICENSE(λ, π)
$\lambda/\neg$LICENSE(λ, π) $\equiv_{def}$
Let any occurrence of λ, a given type of constituent, in a chain $C_j(\lambda)$ be λ_j. Then assign a violation to each λ_j if the following holds
$\exists\lambda_j[P(\lambda_j)] \wedge \forall\lambda_j[\neg\text{Coincide}(\lambda_j, \pi)]$

This revised Generalized Licensing schema is compatible with all the overwrite systems discussed above because each requires a licensing constraint that identifies a member of Π—a maximally prominent position—as the licensor.

Smith (2005) provides precedent for the kind of restriction imposed on licensing constraints by (25) and (26). She implements a similar restriction in her treatment of augmentation phenomena, whereby prominent positions are required to host some prominence-enhancing feature. Augmentation can be neutralizing if the mandated feature is contrastive in the language, and this poses a problem if that neutralization occurs in a position that is important for word recognition. In response, and in the face of typological evidence pointing toward the avoidance of augmentation in such situations, Smith argues that these psycholinguistically salient positions are off-limits to positional-augmentation constraints. She adopts the Segmental Contrast Condition to rule out certain augmentation constraints that target psycholinguistically prominent positions even though they are otherwise consistent with her formalism and the goal of positional augmentation. Likewise, (26) excludes licensing constraints with non-maximally prominent licensors even though restricting a feature to secondary stress, e.g., is consistent with the goal of limiting that feature to prominent positions.

Revised Generalized Licensing accommodates overwrite and those preservation systems in which the privileged position is maximally prominent, as in Tamil and Xhosa, for example. But other preservation phenomena are incompatible with this formalism. In English, both primary and secondary stress resist vowel reduction. While LICENSE([V-Features], $'\sigma$) can account for the failure of reduction in primary stress, LICENSE([V-Features], $,\sigma$) is now illicit, and positional licensing cannot account for secondary stress's exemption from vowel reduction. Similarly, the Hausa pattern, in which the full set of short vowels appears only in final syllables, is beyond the reach of revised Generalized Licensing.

Such systems must therefore be driven by positional faithfulness. The formalization of positional IDENT constraints provided by Beckman (1999:11) is given in (27).

(27) IDENT*Position*(F)
Let β be an output segment in a privileged position P and α the input correspondent of β. If β is [γF], then α must be [γF].

As with the original formulation of Generalized Licensing, this definition does not specify what it means to be a privileged position. Since preservation may target non-maximally prominent positions, positional faithfulness must have access to those positions. But how far down on a prominence hierarchy can positional faithfulness reach? Admitting positional faithfulness constraints for the least prominent positions (unstressed syllables, medial syllables, and affixes, according to the prominence hierarchies developed above) would undermine a chief consequence of positional

faithfulness: prominent and non-prominent positions behave asymmetrically because there are positional faithfulness constraints to protect the former but not the latter. Positional faithfulness, then, must have access to positions lower on prominence hierarchies than the maximal positions, but it must not have access to the entire length of these hierarchies.

Hierarchies that are more elaborate than the ones adopted above would shed more light on the issue, but in their absence I suggest that positional faithfulness can target all but the least prominent elements on a hierarchy. I take this position for two reasons. First, we've seen preservation for all the positions given in these hierarchies except the least prominent ones. Second, recall that some of these hierarchies may require further elaboration. For example, in some languages pretonic vowels reduce less drastically than post-tonic vowels, so the metrical prominence hierarchy in (14) may need to be fleshed out as in (28). In this case, positional faithfulness protects the third most prominent element on the hierarchy. It seems more probable that positional faithfulness can target all non-minimally prominent positions than, say, just the three most prominent positions on a hierarchy, both because the latter would be an inexplicably arbitrary cut-off and because counting in grammars is undesirable (e.g. McCarthy 2003; McCarthy and Prince 1986).

(28) **Metrical prominence:** primary stress > secondary stress > pretonic syllables > post-tonic syllables

Revising (27) accordingly requires something similar to the changes made to Generalized Licensing. This time, instead of defining the set of maximally prominent positions, we begin with the set of non-minimally prominent positions:

(29) a. Let H be a prominence hierarchy with the members $p_1, p_2 \ldots p_n$, and Ω be the set of non-minimally prominent positions. Then $p_i \in \Omega$ iff $\exists H$ such that $\exists p_j (p_i > p_j)$.
b. Let ω be a variable over elements of Ω.

So Ω is the set of non-minimally prominent positions, and positional faithfulness can target any of them. The revision to (27) is given in (30).

(30) IDENT*position*(F)
Let β be an output segment in some ω and α the input correspondent of β. If β is [γF], then α must be [γF].

(This definition is specific to IDENT constraints, but it is extendable to other families of faithfulness constraints in obvious ways.) Under this definition, positional faithfulness may single out both maximally prominent positions and those positions that are neither maximally nor minimally prominent. Alongside IDENT-ˈσ(F), which targets only primary stress, we might also have IDENT-ˌσ(F), which targets secondary stress (but not primary stress). The typologies of preservation and overwrite are accounted for. Overwrite is limited to maximally prominent positions because that is all positional licensing may target, but preservation may involve other prominent positions due to the greater reach of positional faithfulness.

As an alternative to (30), we might adopt Smith's (2005) position that all constraints are simply barred from referencing weak positions. Under this view a con-

straint like IDENT-$\check{\sigma}$(F) is illicit regardless of the formalization of positional faithfulness, and no restrictions in the definition of positional faithfulness would be necessary. This strategy would allow simplification of (30), but it is overly restrictive in other domains. It seems necessary, sometimes, to limit a licensing constraint's force to just those elements that are in weak positions. For example, Walker's (2011) analysis of Central Veneto is driven by LICENSE([+high]/$\sigma_{\text{post-tonic}}$, $'\sigma$): [+high] spreads from just post-tonic syllables, not all unstressed syllables, and if the licensing constraint were unable to make this distinction, the analysis would, at the very least, become much more convoluted because other machinery would be necessary to prevent spreading from pretonic syllables.

One consequence of the revisions to positional licensing and positional faithfulness is that they move us closer toward the resolution of a redundancy. As we saw above in the two analyses of Tamil, positional licensing and positional faithfulness overlap in their empirical coverage to the extent that it is often impossible to tell which theory provides the best approach to a particular phenomenon. We're left with an inelegant system that provides two very different ways of formalizing the same facts. (This redundancy is pointed out explicitly by Jesney 2011, though it can be detected in the literature predating Jesney's work. For example, Beckman 1999 acknowledges the possibility of positional markedness and positional faithfulness analyses for some preservation systems.) But the changes to positional licensing and positional faithfulness presented here ameliorate some of this inefficiency. In particular, preservation systems involving non-maximally prominent positions, like English vowel reduction and Hausa's final vowels, must result from positional faithfulness. Preservation in maximally prominent positions, as in Tamil, remains compatible with either theory, but the degree of overlap between the theories is reduced. (Even the remaining overlap could be eliminated were we to restrict positional faithfulness to only non-minimally prominent positions that are also non-maximal. This would introduce its own problems, however. For example, in English, resistance to vowel reduction under primary stress would be the product of LICENSE([V-Features], $'\sigma$), but resistance under secondary stress would be a result of IDENT(V-Features)-$_{,}\sigma$. The two kinds of stressed positions would be controlled by very different constraints, and the similarity in their behavior would be obscured.)

It is in this context that returning to Old English umlaut is fruitful. Recall that this process may target both primary and secondary stress for overwrite. If this is an accurate description of umlaut, it presents a challenge to the framework developed here. But there is a way to reconcile Old English with the limitations placed on positional licensing, and it dovetails nicely with issues related to those of the previous paragraph.

Both primary and secondary stress resist reduction in Modern English. If grammars treat primary and secondary stress as formally distinct positions, as the hierarchy in (14) entails, a treatment of English vowel reduction requires two different (sets of) positional faithfulness constraints, FAITH-$'\sigma$ and FAITH-$_{,}\sigma$. This is clearly unappealing because it misses the obvious fact that what these two positions have in common is stress: any position that bears stress in English is exempt from reduction, and this is most perspicuously captured with a single constraint, FAITH-Stress. Perhaps, then, one way in which the metrical hierarchy in (14) can vary crosslinguistically is in

whether different levels of stress are represented separately. If languages are allowed to combine all levels of stress as in the revised hierarchy in (31), FAITH-Stress becomes possible.

(31) **Metrical prominence:** stressed syllables > unstressed syllables

But this also means that licensing constraints can refer to the highest position in (31), leading to overwrite that targets both primary and secondary stress. This might be instantiated by Old English. If this is the correct line of reasoning, the proper generalization concerning the unavailability of secondary stress for overwrite is the following: overwrite cannot target secondary stress to the exclusion of primary stress, and systems that target both levels should treat them equally (i.e. there should be no system in which both are targeted but one is given preference over the other) because (31) does not distinguish them. Old English, if its umlaut does indeed target secondary stress, appears to bear out these predictions.

To summarize this section, I argued that the typological asymmetry between preservation and overwrite is a symptom of a difference between the theories of positional faithfulness and positional licensing. Positional licensing may target only maximally prominent positions while positional faithfulness may target all non-minimally prominent positions. This section formalized that proposal by incorporating references to the prominence hierarchies from Sect. 3 into the constraint schemas for positional faithfulness and positional licensing.

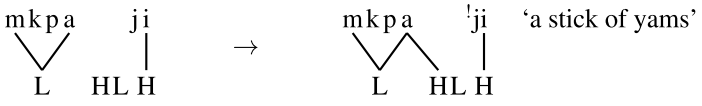
The next section addresses some residual issues and implications of the revisions to positional licensing and positional faithfulness.

5 Discussion

5.1 Tone and final syllables

There is one large class of potential counterexamples to the claim that final syllables are never targeted for overwrite: contour tones are often restricted to final syllables. For example, in the variety of Igbo examined by Clark (1983), the high tone of the associative particle (the unassociated H to the left of the arrow in (32)) surfaces, in certain cases, on the final syllable of a word, creating a contour:

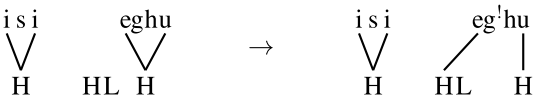
(32)



'a stick of yams'

In other circumstances this tone appears on the first syllable of a word. Here, though, the contour is simplified, with the tone that was previously linked to the target syllable retracted off of it:

(33)



'the head of a goat'

Positional faithfulness provides no account of this process: the contour in (32) is not present underlyingly, so a constraint preserving final syllables' tones will block the docking of the associative particle's tone. Positional licensing would work, however: LICENSE(Contour, σ_{Final}) will permit a contour in (32) but not in (33). Do these facts mean that positional licensing must have access to final syllables? I suggest not. Zhang (2001), in his crosslinguistic survey of contour tones, argues that contours tend to prefer positions of higher sonority or greater duration. (Clark 1983 also makes the connection between contour tones and duration.) Zhang provides phonetic measurements of syllable duration in languages that restrict contour tones to final syllables, confirming that final syllables in these languages are indeed longer than other syllables, and he argues that this duration is what makes them better contour tone hosts. In fact, he argues that this extra duration attracts contour tones in spite of the fact that "prosodic-final position is far from being a general-purpose prominent position" (p. 75). That is, contour tones' attraction to final syllables is driven by a need for greater duration, not enhanced prominence. Because contour tones require the execution of a series of pitch targets (or pitch trajectories), a longer host provides more time for their successful production. This is not a prominence-driven pattern, but a duration-driven one.

As evidence for this position, Hock (1999) identifies a number of tonal and accentual processes that involve avoidance of final syllables by prominent pitch, mostly involving retraction of tone or accent from both utterance- and word-final syllables to penults. He explicitly associates this with notions of prominence: "[Utterance] Finality tends to favor low tone or non-prominence in prepausal context, leading either to the loss of underlying accent, i.e. **prominence,** or to the displacement of prominence to the left" (p. 20; emphasis original).[8]

This is in stark contrast to the vocalic systems examined above: there are no systems in which, say, long vowels actively avoid stressed syllables. So it appears that tones' attraction to final syllables is not for their prominence, but for their duration. Duration certainly contributes to prominence, but the two properties are not inextricable. Prominence may exist absent duration: roots and initial syllables, for example, are prominent for psycholinguistic reasons, not acoustic ones. Likewise, increased duration may not lead to increased prominence: Bethin (2006) describes a number of Slavic languages in which the immediately pretonic syllable is longer than the stressed syllable, but in none of these languages does the pretonic syllable host a greater range of vowel contrasts than the stressed syllable. In fact, in some languages the longer pretonic syllable exhibits vowel reduction that the shorter stressed syllable does not, suggesting that these languages treat the immediately pretonic syllable as less prominent than the stressed syllable, duration notwithstanding. Duration and prominence are therefore separable, and the mechanism that limits tones to final syllables is concerned with the former: it only encourages contour tones to seek longer

[8]Hock specifically references utterance-final elements here, not word-final contexts more generally. He argues that this position exhibits phonetic pressures for weakening that are absent in word-final, utterance-medial contexts. But he also points out a tendency of utterance-final effects to be generalized to word-final contexts, so while final-syllable avoidance may begin as an utterance-level phenomenon, it can be extended to the domain of the word as well.

hosts, even if that means settling on an otherwise non-prominent position. Final-syllable avoidance may be prominence-driven, but final-syllable attraction is not.

This should not be a surprising state of affairs. Certain elements, like contour tones, depend on duration for their reliable articulation or perception, while other elements—low-sonority vowels, say—gain benefits from prominent hosts (that may not be long). So a single position can exhibit a range of effects, each of which capitalizes on a different property of that position. Final syllables have the duration necessary to be targets for contour tones, but not the prominence necessary to participate in overwrite.[9]

As further evidence that final-syllable attraction is not prominence-driven, we do not find the same range of licensing patterns with tones and final syllables that are attested for vowel features. For example, there is no tonal analog of Central Veneto. Recall that in that language, a high post-tonic vowel triggers raising of the stressed vowel. I know of no system in which the presence of a contour tone on a non-final syllable triggers the appearance of one on a final syllable. Nor are there Classical Mongolian-like patterns: the existence of a final-syllable contour tone does not license the appearance of contours in other positions. Since these are patterns that positional licensing is capable of generating (Walker 2011), their absence suggests that whatever drives contour tones' attraction to final syllables is quite different from positional licensing.

What formalism produces final-syllable attraction? There are a number of possibilities ranging from a straightforward constraint against contour tones on non-final syllables to a more phonetically informed framework like the one Zhang develops. Exploring the options is beyond the scope of this paper; the crucial point is that alternatives to a prominence-based positional-licensing approach exist, so positional licensing need not (and in fact should not) be able to designate final syllables as privileged.

5.2 Consonantal systems

The framework proposed here makes obvious predictions about preservation and overwrite involving consonants. Unfortunately, these predictions can only be partially investigated because the typology of prominence-based consonantal patterns is severely impoverished compared to systems involving vowels. In particular, while there are many preservation systems involving consonants, there appear to be no corresponding prominence-based overwrite systems.

Starting with overwrite, there seem to be no languages in which feature spreading or movement specifically targets a consonant in a prominent position. Hansson (2001:176–177) makes this point explicitly with regard to prosody: "consonant harmony systems never interact with prosodic structure in any way; for example, they are never affected by stress, syllable weight or segmental length, and are never limited to prosodically-defined domains such as the foot." The same seems to go for

[9] An anonymous reviewer asks whether all seemingly prominence-driven final-syllable effects can be reduced to duration-driven ones. This seems unlikely because, as discussed in Sect. 5.4, final syllables often undergo augmentation, which Smith (2005) argues to be a prominence-driven effect.

morphological and sequential prominence. Hansson argues that consonant harmony systems show only either stem-controlled harmony or right-to-left harmony. Either may coincidentally target consonants in initial syllables, and right-to-left harmony may coincidentally target roots/stems, but crucially, these positions never seem to be the explicit target of harmony. Not only are systems that target maximally prominent positions unattested, but so are those that target non-maximally prominent positions: Hansson reports no languages in which final syllables, for example, are singled out for harmony.

In contrast, preservation involving consonantal features is well attested. Hansson's stem-controlled harmony instantiates this pattern. He also discusses a handful of languages that seem to show left-to-right harmony and argues that they reflect preferential faithfulness to consonants in initial syllables. Both kinds of harmony are analogous to Classical Mongolian-type systems: a feature is preserved in a prominent position and permitted elsewhere via harmony. There are also Tamil-like consonantal systems wherein the restricted feature simply cannot appear outside the designated prominent position. Beckman (1999) discusses many patterns of this sort involving stress, initial syllables, roots/stems, and syllable onsets.

Likewise, McCarthy (2008a) notes that assimilation between a coda and a following onset is always regressive: the onset never acquires features of the coda. Onsets being more prominent than codas (see Beckman 1999 for a summary of research supporting this position), we again see consonantal preservation but not overwrite.

All of the attested prominence-based consonantal patterns are consistent with the proposal developed above once we adopt the prominence hierarchy in (34). Since the attested patterns involve preservation, positional faithfulness easily accounts for the facts.

(34) **Margin prominence:** onset > coda

What do we make of the absence of overwrite systems for consonants? This state of affairs is not inconsistent with the view of positional licensing developed above in the sense that there are no overwrite systems involving non-maximally prominent positions. Furthermore, it would of course be possible to restrict the λ argument of licensing constraints to vocalic features and thereby exclude any consonant-based overwrite. But Hansson suggests instead that this empirical gap may have a diachronic source: the interaction of independently necessary synchronic constraints can yield unattested consonant harmony patterns, and therefore we cannot devise a set of constraints that excludes the unattested patterns without also excluding some attested ones. For example, positional faithfulness constraints for stressed syllables account for languages in which that position hosts more contrasts than other positions, but they also predict stress-controlled consonant harmony, which is unattested.

In summary, prominence-based consonantal patterns are much less abundant than their vocalic counterparts. While this deserves a better explanation than I can give here, it does not contradict the framework that I argued for above. In particular, as that framework predicts, there are no overwrite systems involving non-maximally prominent positions.

5.3 Why the difference?

Why should Positional Licensing target only a subset of the positions available to Positional Faithfulness? In this section I offer some speculation on the matter.

Consider first the situation entailed by overwrite. Some element is relocated to a prominent position, one that is central to psycholinguistic processes like word recognition. Improving the perceptual salience of the relocated element therefore comes at the cost of unfaithfulness in and often prominence reduction of an important position. Perhaps overwrite is confined to the most salient positions to ensure that these sacrifices are in service of the greatest prominence boost available.

This trade-off doesn't exist for preservation, which simply involves faithfulness in these important positions. Greater faithfulness is advantageous for all positions that play central cognitive roles, so there is no impetus for restricting Positional Faithfulness to a subset of them. In short, then, there are greater costs associated with overwrite, so the constraint type that produces it is subject to greater restrictions.

5.4 Augmentation

Where does positional augmentation fit into the typology examined here? Smith (2005) describes augmentation involving both consonants and vowels for the positions claimed above to be maximally prominent: primary stress, initial syllables, roots/stems, and syllable onsets. As for non-maximally prominent positions, Smith does not systematically distinguish primary stress from secondary stress, so it is difficult to assess the prevalence of augmentation in secondary stress. But there are a few strong candidates. (In keeping with the distinction between augmentation and overwrite/preservation argued for in Sect. 2, it is important to distinguish patterns in which secondary stress *must* have a particular property—augmentation—from those in which it simply *may* have the property, as in nasalization preservation in Guaraní.) For example, English imposes a minimum-sonority requirement on all stressed nuclei, including secondary stress: in these positions, "syllabic nasals are banned, and some dialects ban [l̩] as well, allowing only [ɹ̩]" (Smith 2005:114).

As for final syllables, an anonymous reviewer observes that many languages exclude low-sonority vowels in this position. Such patterns are catalogued by Barnes (2006), including the following: word-final /i, u/ optionally lower to *e*, *o* in Ongota; in Dasenech, word-final /i, u/ lower to *e*, *o*, while word-final /e, o/ lower to *ɛ*, *ɔ*; and certain Castillian dialects disallow high vowels in final syllables. As Barnes argues, these sonority-increasing alternations are most likely strengthening effects (i.e. augmentation), not weakening ones.

Again, these patterns are distinct from overwrite systems: all word-final vowels of the right type in these languages are subject to lowering, regardless of the vowel qualities present elsewhere in the word, and the process improves the perceptual salience of final syllables, not that of a weak feature that originates elsewhere in the word.

It seems, then, that augmentation has the same range of targets as positional faithfulness. Smith (2005) accounts for augmentation with M/str constraints, positional markedness constraints that hold for a specific strong position. It is noteworthy, then, that this constraint type patterns with positional faithfulness and not positional licensing. This implies that the restriction to maximally prominent positions that positional

licensing exhibits is not a general property of positional markedness. Positional licensing and M/str constraints are formally quite different—the former requires coincidence between a prominent position and some weak element while the latter imposes a prominence-enhancing markedness requirement on a strong position—so it should not be surprising that the two constraint types are subject to different restrictions.

The typology of augmentation is consistent with the explanation for the asymmetry in available target positions presented in the previous section. Like overwrite, augmentation entails unfaithfulness in a prominent position, but the nature of this unfaithfulness is quite different. The change that the prominent position undergoes improves its salience, whereas overwrite involves a decrease in prominence. Furthermore, no element is relocated in an augmentation pattern; the prominent position acquires some property, but it doesn't come from elsewhere in the word. So the unfaithfulness required for augmentation is less severe than that seen in overwrite, and the trade-off that overwrite entails is muted in augmentation.

6 Conclusion

Positional faithfulness and positional licensing are tools for distinguishing prominent and non-prominent positions. But identifying (non-)prominence is not always a trivial task. Final syllables, for example, seem both prominent and non-prominent, and secondary stress is prominent in comparison with unstressed syllables but less prominent than primary stress. The argument developed here is that positional licensing and positional faithfulness use different criteria for determining whether a position is sufficiently prominent to be singled out for special treatment. For positional licensing, only the most prominent positions are suitable licensors, but for positional faithfulness, all but the least prominent positions will do.

The evidence for this proposal comes from an asymmetry in the typology of prominence-based patterns. Maximally prominent positions behave as privileged in both overwrite and preservation systems, but non-maximally prominent positions participate only in preservation. Since only positional licensing can produce overwrite, limiting this constraint type to maximally prominent positions accounts for the typological asymmetry.

The revisions to positional licensing and positional faithfulness adopted here achieve several goals. They provide an explanation for the typologies of overwrite and preservation and further specify what it means to be prominent for the purposes of these theories. They also help clarify the roles of positional markedness and positional faithfulness, two frameworks that compete for the job of producing prominence-based patterns.

The approach pursued here could be applied to other pieces of the Generalized Licensing schema. For example, $P(\lambda_j)$ specifies the conditions under which λ is subject to licensing. Walker (2011) states that P must identify a marked positional or featural environment. It may be possible to capitalize on research that probes featural and contextual markedness (Archangeli and Pulleyblank 1994; Rice 2003, 2007) to more rigorously formalize the threshold of markedness that a context must meet to be a candidate for P.

This paper has focused almost exclusively on vowels so it remains to be seen whether the proposal extends robustly to tones and consonants. One immediate challenge presented by tones was dealt with, but this barely scratches the surface as far as relevant tonal patterns are concerned. Likewise, as more work on consonantal systems emerges, we may be able to better evaluate the proposal's predictions in this domain.

The hierarchy-based approach to positional markedness and positional faithfulness touches on some long-standing questions regarding prominence hierarchies: where do they come from (are they learned, or part of UG?), and where do they reside in the theory? Prominence hierarchies have played important roles in OT since the theory's conception, but they do not have a comfortable home in GEN, EVAL, or CON. In the view developed here, they exist in some form as things constraint formalisms can refer to. Following Steriade (1999), I suggested in Sect. 3 that the hierarchies may not be constant across languages and across time; this implies that they are not inherited from UG, at least not in their entirety. Under the conception of the constraint set developed by Hayes (1999), in which learners' articulatory and perceptual experience guides the projection of grounded constraints, we might take prominence hierarchies to encode part of that experience. This is merely speculative; while the proposal developed here answers some questions, it raises—or reminds us of—many others. Formalized external criteria for the well-formedness of constraints is a rather common feature of OT-based frameworks (Hayes 1999; Smith 2005; Steriade 1999, to name just some of the relevant research that has been mentioned elsewhere in this paper), and their status in the theory merits more attention.

A related question concerns domains. It appears that, for example, whether a stressed syllable is a permissible target for overwrite depends on whether there are any syllables with greater stress in the word; greater stress beyond the word is irrelevant. I am aware of no metaphony-like phenomena that seek out primary phrase-level stress (as opposed to word-level stress) wherever it may be. Likewise, overwrite systems involving initial syllables always target word-initial and not phrase- or utterance-initial syllables. There seem to be many processes that take the word as their domain, and the kinds of phenomena examined here appear to fall into that category. Further work on overwrite and preservation phenomena may yield a satisfactory explanation as to why this may be.

Finally, in making use of the notions of (non-)maximality and (non-)minimality, the current proposal echoes other recent work. Ito and Mester (2009, 2010, 2013) develop a theory of recursive prosodic structure that allows constraints to target (non-)maximal and (non-)minimal nodes in a series of recursive categories. The recurrence of these constructs suggests that they play a central role in the organization of phonological grammars, and prominence-based positional phenomena are just one of their manifestations.

Acknowledgements I am grateful to the following people for their generous feedback on various versions of this work: Ricardo Bermúdez-Otero, Rachel Hayes-Harb, Robert Henderson, Abby Kaplan, Rachel Walker, the audience at the 21st Manchester Phonology Meeting, and three anonymous reviewers. Their comments and questions have been enormously helpful.

References

Archangeli, Diana, and Douglas Pulleyblank. 1994. *Grounded phonology*. Cambridge: MIT Press.

Bach, Emmon. 1968. Two proposals regarding the simplicity metric in phonology. *Glossa* 2(2): 128–149.

Barnes, Jonathan. 2006. *Strength and weakness at the interface: positional neutralization in phonetics and phonology*. Berlin: de Gruyter.

Beckman, Jill N. 1999. *Positional faithfulness*. New York: Garland.

Benua, Laura. 1997. Transderivational identity: phonological relations between words. PhD diss., University of Massachusetts, Amherst.

Bethin, Christina Y. 2006. Stress and tone in East Slavic dialects. *Phonology* 23(2): 125–156.

Brown, Roger, and David McNeill. 1966. The "tip of the tongue" phenomenon. *Journal of Verbal Learning and Verbal Behavior* 5(4): 325–337.

Bye, Patrick, and Paul de Lacy. 2000. Edge asymmetries in phonology and morphology. In *North East Linguistics Society (NELS) 30*, eds. Ji-Yung Kim and Masako Hirotani, 121–135. Amherst: GLSA.

Campbell, Alistair. 1959. *Old English grammar*. Oxford: Oxford University Press.

Canalis, Stefano. 2007. Total Vowel Harmony in Two Romance Dialects. Handout from talk presented at Phonetics and Phonology in Iberia, Universidade do Minho, Braga, June 25–26.

Canalis, Stefano. 2009. Post-tonic vowel harmony in some dialects of Central Italy: the role of prosodic structure, contrast, and consonants. In *Phonetics and phonology: interactions and interrelations*, eds. Marina Vigario, Sonia Frota, and M. Joan Freitas, 48–67. Amsterdam: Benjamins.

Canalis, Stefano. to appear. Post-tonic vowel harmony in some dialects of Central Italy. In *Phonetics and phonology in Iberia (PaPI) 3*, 247–266.

Cerrón-Palomino, Rodolfo. 2000. *Lingüistica aimara*. Cuzco: Bartolomé de Las Casas.

Christdas, Prathima. 1988. The phonology and morphology of Tamil. PhD diss., Cornell University.

Chung, Sandra. 1983. Transderivational relationships in Chamorro phonology. *Language* 59: 35–66.

Clark, Mary M. 1983. On the distribution of contour tones. In *West Coast Conference on Formal Linguistics (WCCFL)*, 44–55.

Cole, Ronald A. 1973. Listening for mispronunciations: a measure of what we hear during speech. *Perception and Psychophysics* 1: 153–156.

Cole, Ronald A., and Jola Jakimik. 1980. How are syllables used to recognize words? *Journal of the Acoustical Society of America* 67(3): 965–970.

Crosswhite, Katherine M. 1996. Base-derivative correspondences in Chamorro. In *UCLA Working Papers in Phonology*, ed. Chai-Shune Hsu, Vol. 93, 57–85. UCLA Graduate Linguistics Circle.

Crosswhite, Katherine M. 2001. *Vowel reduction in Optimality Theory*. New York: Routledge.

Dell, François, and Mohamed Elmedlaoui. 1985. Syllabic consonants and syllabification in Imdlawn Tashlhiyt Berber. *Journal of African Languages and Linguistics* 7: 105–130.

Dell, François, and Mohamed Elmedlaoui. 1988. Syllabic consonants in Berber: some new evidence. *Journal of African Languages and Linguistics* 10(1): 1–17.

Dell, François, and Mohamed Elmedlaoui. 2002. *Syllables in Tashlhiyt Berber and in Moroccan Arabic*. Dordrecht: Kluwer Academic.

Dudas, Karen Marie. 1976. The phonology and morphology of Modern Javanese. PhD diss., University of Illinois at Urbana-Champaign, Urbana, Illinois.

Fougeron, Cécile. 1997. Prosodically conditioned articulatory variation: a review. In *UCLA working papers in phonetics*, Vol. 97, 1–73.

Fowler, Carol A., Shirley E. Napps, and Laurie Feldman. 1985. Relations among regular and irregular morphologically related words in the lexicon as revealed by repetition priming. *Memory and Cognition* 13(3): 241–255.

Goldsmith, John. 1989. Licensing, inalterability, and harmonic rule application. In *Chicago Linguistic Society: Part one: The general session (CLS) 25*, eds. Caroline Wiltshire, Randolph Graczyk, and Bradley Music, 145–156.

Gregores, Emma, and Jorge A. Suárez. 1967. *A description of colloquial Guaraní*. The Hague: Mouton.

Hansson, Gunnar Ólafur. 2001. Theoretical and typological issues in consonant harmony. PhD diss., University of California, Berkeley, Berkeley, CA.

Hayes, Bruce. 1995. *Metrical stress theory: principles and case studies*. Chicago: The University of Chicago Press.

Hayes, Bruce. 1999. Phonetically driven phonology: the role of Optimality Theory and inductive grounding. In *Functionalism and formalism in linguistics, Volume I: General papers*, eds. Michael Darnell,

Edith Moravscik, Michael Noonan, Frederick Newmeyer, and Kathleen Wheatly, 243–285. Amsterdam: Benjamins.
Hock, Hans Henrich. 1999. Finality, prosody, and change. In *Linguistics and phonetics (LP '98): item and order in language and speech*, eds. Osamu Fujimura, Brian D. Joseph, and Bohumil Palek, 15–30. Prague: Prague Karolinum Press.
Hogg, Richard M. 1992. *A grammar of Old English: Volume 1: Phonology*. Cambridge: Blackwell.
Horne, Merle, Eva Strangert, and Mattias Heldner. 1995. Prosodic boundary strength in Swedish: final lengthening and silent interval duration. In *International Congress of Phonetic Sciences XIII*, eds. Kjell Elenius and Peter Branderud, 170–173. Stockholm, Sweden.
Horowitz, Leonard M., Margaret A. White, and Douglas W. Atwood. 1968. Word fragments as aids to recall: the organization of a word. *Journal of Experimental Psychology* 76(2): 219–226.
Hyman, Larry M. 1988. Underspecification and vowel height transfer in Esimbi. *Phonology* 5(2): 255–273.
Hyman, Larry M. 2002. Is there a right-to-left bias in vowel harmony? Ms., UC Berkeley.
Hyman, Larry M. 2008. Directional asymmetries in the morphology and phonology of words, with special reference to Bantu. *Linguistics* 46(2): 309–350.
Ito, Junko. 1988. Syllable theory in prosodic phonology. PhD diss., University of Massachusetts, Amherst, New York.
Ito, Junko, and Armin Mester. 1999. Realignment. In *The prosody-morphology interface*, eds. René Kager, Harry van der Hulst, and Wim Zonneveld, 188–217. Cambridge: Cambridge University Press.
Ito, Junko, and Armin Mester. 2009. The extended prosodic word. In *Phonological domains: universals and derivations*, eds. Baris Kabak and Jaent Grijzenhout, 135–194. The Hague: de Gruyter.
Ito, Junko, and Armin Mester. 2010. Recursive prosodic phrasing in Japanese. In *Japanese/Korean Conference (JK18) 18*, 147–164. Stanford: CSLI.
Ito, Junko, and Armin Mester. 2013. Prosodic subcategories in Japanese. *Lingua* 124: 20–40.
Jarvella, Robert J., and Guust Meijers. 1983. Recognizing morphemes in spoken words: some evidence for a stem-organized mental lexicon. In *The process of language understanding*, eds. Giovanni B. Flores d'Arcais and Robert J. Jarvella, 81–112. New York: Wiley.
Jesney, Karen. 2011. Licensing in multiple contexts: an argument for Harmonic Grammar. In *Chicago linguistic society (cls) 45*, eds. M. Ryan Bochnak, Peter Klecha, Alice Lemieux, Nassira Nicola, Jasmin Urban, and Christina Weaver, Vol. 1, 287–301. Chicago: University of Chicago.
Kaplan, Aaron F. 2008a. Licensing and noniterative harmony in Lango. In *North East Linguistics Society (NELS) 37*, eds. Emily Elfner and Martin Walkow, Vol. 1, 311–322.
Kaplan, Aaron F. 2008b. Noniterativity is an emergent property of grammar. PhD diss., University of California, Santa Cruz, Santa Cruz, CA.
Kaplan, Aaron. 2011. Gradualness and harmonic improvement without candidate chains in Chamorro. *Linguistic Inquiry* 42(4): 631–650.
Kawahara, Shigeto. 2008. On the proper treatment of non-crisp edges. In *Japanese/Korean linguistics*, eds. Mutsuko Endo Hudson, Peter Sells, and Sun-Ah Jun, Vol. 13, 55–67. Stanford: CSLI Publications.
Kehoe, Margaret, and Carol Stoel-Gammon. 1997. The acquisition of prosodic structure: an investigation of current accounts of children's prosodic development. *Language* 73(1): 113–144.
Kempley, S. T., and John Morton. 1982. The effects of priming with regularly and irregularly related words in auditory word recognition. *British Journal of Psychology* 73: 441–454.
Kiparsky, Paul. 1986. Systematic optionality in the lexical phonology of Chamorro. Ms., Stanford University.
Lehiste, Ilse. 1970. *Suprasegmentals*. Cambridge: MIT Press.
Lehiste, Ilse. 1972. The timing of utterances and linguistic boundaries. *Journal of the Acoustical Society of America (JASA)* 51(6): 2018–2024.
Lehiste, Ilse, Joseph P. Olive, and Lynn A. Streeter. 1976. Role of duration in disambiguating syntactically ambiguous sentences. *Journal of the Acoustical Society of America (JASA)* 60(5): 1199–1202.
Lombardi, Linda. 1994. *Laryngeal features and laryngeal neutralization*. New York: Garland.
Lunden, S. L. Anya. 2006. Weight, final lengthening and stress: a phonetic and phonological case study of Norwegian. PhD diss., University of California, Santa Cruz.
Magen, Harriet S. 1997. The extent of vowel-to-vowel coarticulation in English. *Journal of Phonetics* 25: 187–205.
Maiden, Martin. 1995. Evidence from the Italian dialects for the internal structure of prosodic domains. In *Linguistic theory in the Romance languages*, eds. John Charles Smith and Martin Maiden, 115–131. Amsterdam: Benjamins.

McCarthy, John J. 2003. OT constraints are categorical. *Phonology* 20(1): 75–138.
McCarthy, John J. 2008a. The gradual path to cluster simplification. *Phonology* 25: 271–319.
McCarthy, John J. 2008b. The serial interaction of stress and syncope. *Natural Language and Linguistic Theory (NLLT)* 26: 499–546.
McCarthy, John J., and Alan Prince. 1986. Prosodic morphology. Ms., University of Massachusetts, Amherst, and Brandeis University.
McCarthy, John J., and Alan Prince. 1995. Faithfulness and reduplicative identity. In *University of Massachusetts occasional papers in linguistics 18: papers in Optimality Theory*, eds. Jill Beckman, Laura Walsh Dickey, and Suzanne Urbanczyk, 149–348. Amherst: GLSA.
Noonan, Michael. 1992. *A grammar of Lango*. Berlin/New York: de Gruyter.
Oller, D. Kimbrough. 1973. The effect of position in utterance on speech segment duration in English. *Journal of the Acoustical Society of America (JASA)* 54(5): 1235–1247.
Parker, Steve, and David Weber. 1996. Glottalized and aspriated stops in Cuzco Quechua. *International Journal of American Linguistics* 62(1): 70–85.
Paster, Mary. 2004. Vowel height harmony and blocking in Buchan Scots. *Phonology* 21(3): 359–407.
Penny, Ralph J. 1969. Vowel harmony in the speech of the Montes de Pas (Santander). *Orbis* 18(1): 148–166.
Plag, Ingo, Gero Kunter, and Mareile Schramm. 2011. Acoustic correlates of primary and secondary stress in North American English. *Journal of Phonetics* 39: 362–374.
Poppe, Nicholas. 1954. *Grammar of written Mongolian*. Wiesbaden: Otto Harrassowitz.
Poppe, Nicholas. 1955. *Introduction to Mongolian comparative studies*. *Mémoirs de la société finno-ougrienne no. 110*. Helsinki.
Prince, Alan, and Paul Smolensky. 1993/2004. Optimality Theory: Constraint interaction in generative grammar. Ms., Rutgers University, New Brunswick and University of Colorado, Boulder. Published 2004. Malden: Blackwell.
Puech, Gilbert. 1978. A cross-dialectal study of vowel harmony in Maltese. In *Chicago Linguistics Society (cls) 14*, eds. Donka Farkas, Wesley M. Jacobsen, and Karol W. Todrys, 377–389. Chicago: CLS.
Rice, Keren. 2003. Featural markedness in phonology: variation. In *The second glot international state-of-the-article book*, eds. Lisa Cheng and Rint Sybesma, 389–429. Berlin: de Gruyter.
Rice, Keren. 2007. Markedness in phonology. In *The Cambridge handbook of phonology*, ed. Paul de Lacy, 79–97. New York: Cambridge University Press.
Rivas, Alberto M. 1975. Nasalization in Guaraní. In *North Eastern Linguistic Society (NELS) 5*, eds. Ellen Kaisse and Jorge Hankamer, 134–143. Cambridge: Harvard University Linguistics Department.
Rosenberg, Sheldon, Paul J. Coyle, and Walter L. Porter. 1966. Recall of adverbs as a function of the frequency of their adjective roots. *Journal of Verbal Learning and Verbal Behavior* 5: 75–76.
Schuh, Russel G., and Lawan D. Yalwa. 1999. Hausa. In *Handbook of the international phonetic association*, 90–95. Cambridge: Cambridge University Press.
Smith, Jennifer L. 2005. *Phonological augmentation in prominent positions*. New York: Routledge.
Smolensky, Paul. 2006. Optimality in phonology II: harmonic completeness, local constraint conjunction, and feature domain markedness. In *The harmonic mind: from neural computation to Optimality-Theoretic grammar*, eds. Paul Smolensky and Géraldine Legendre, Vol. 2, 27–160. Cambridge/London: MIT Press. Chap. 14.
Stallcup, Kenneth. 1980a. A brief account of nominal prefixes and vowel harmony in Esimbi. In *L'expansion bantoue*, ed. Luc Bouquiaux, Vol. II, 435–441. Paris: Société d'Etudes Linguistiques et Anthropologiques de France.
Stallcup, Kenneth L. 1980b. Noun classes in Esimbi. In *Noun classes in the Grassfields Bantu borderland*, ed. Larry M. Hyman. Vol. 8 of *Southern California occasional papers in linguistics*, 139–153. Los Angeles: Department of Linguistics, University of Southern California.
Stanners, Robert F., James J. Neiser, William P. Hernon, and Roger Hall. 1970. Memory representation for morphologically related words. *Journal of Verbal Learning and Verbal Behavior* 18(4): 399–412.
Steriade, Donca. 1995. Underspecification and markedness. In *Handbook of phonological theory*, ed. John Goldsmith, 114–174. Oxford: Blackwell.
Steriade, Donca. 1999. Phonetics in phonology: the case of laryngeal neutralization. In *UCLA working papers in linguistics*, ed. Matthew K. Gordon, Vol. 2, 25–146.
Taft, Marcus, Gail Hambly, and Sachiko Kinoshita. 1986. Visual and auditory recognition of prefixed words. *Quarterly Journal of Experimental Psychology* 38A: 351–366.
Topping, Donald M. 1968. Chamorro vowel harmony. *Oceanic Linguistics* 7(1): 67–79.

van Heuven, Vincent J. 1987. Stress patterns in Dutch (compound) adjectives: acoustic measurements and perception data. *Phonetica* 44: 1–12.
Walker, Rachel. 2001. Round licensing, harmony, and bisyllabic triggers in Altaic. *Natural Language and Linguistic Theory (NLLT)* 19: 827–878.
Walker, Rachel. 2004. Vowel feature licensing at a distance: evidence from northern Spanish language varieties. In *West Coast Conference on Formal Linguistics (WCCFL) 23*, eds. Benjamin Schmeiser, Vineeta Chand, Ann Kelleher, and Angelo J. Rodriguez, 787–800. Somerville: Cascadilla.
Walker, Rachel. 2005. Weak triggers in vowel harmony. *Natural Language and Linguistic Theory (NLLT)* 23: 917–989.
Walker, Rachel. 2008. Gradualness and fell-swoop derivations. Handout from talk presented at the UCSC Alumni Conference, Sept. 13.
Walker, Rachel. 2010. Nonmyopic harmony and the nature of derivations. *Linguistic Inquiry* 41(1): 169–179.
Walker, Rachel. 2011. *Vowel patterns in language*. New York: Cambridge University Press.
Wightman, Colin W., Stefanie Shattuck-Hufnagel, Mari Ostendorf, and Patti J. Price. 1992. Segmental durations in the vicinity of prosodic phrase boundaries. *Journal of the Acoustical Society of America (JASA)* 91(3): 1707–1717.
Woock, Edith Bavin, and Michael Noonan. 1979. Vowel harmony in Lango. In *Chicago Linguistic Society (CLS) 15*, eds. Paul R. Clyne, William F. Hanks, and Carol L. Hofbauer.
Zhang, Jie. 2001. The effects of duration and sonority on contour tone distribution-typological survey and formal analysis. PhD diss., University of California, Los Angeles.
Zoll, Cheryl. 1997. Conflicting directionality. *Phonology* 14: 263–286.
Zoll, Cheryl. 1998a. *Parsing below the segment in a constraint-based framework*. Stanford: CLSI Publications.
Zoll, Cheryl. 1998b. Positional asymmetries and licensing. Ms., MIT ROA-282, Rutgers Optimality Archive. http://roa.rutgers.edu.