Weak position constraints: the role of prosodic templates in contrast distribution*

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0 Introduction

Surveys of lenition processes (recent examples include Kirchner 1998, Lavoie 1996) have shown that medial positions are a predominant weakening environment in the languages of the world. Intervocalic position, a subset of medial positions, is widely assumed to be the most common site of phonetic and phonological "reductions" or lenition, such as voicing, spirantization, and sonorization of obstruents, as exemplified in (1a, b). Further processes generally classified as lenition include degemination (e.g. tt → t), deaspiration (e.g. th → t), debuccalization (e.g. t → ʔ), and even total deletion. Such changes are often assumed to follow a trajectory from the strongest or least sonorous consonants to the weakest or most sonorous, moving along a sonority or consonantal strength scale (cf. Hock 1991:83).

(1) Lenition processes (Hock 1991:81)

a. k, t → g, d → ɣ, ð
  Latin pacatum
    intervocalic stop voicing > *pagado
      spirantization > Spanish [paɣaðo]

b. t → d → y
  Sanskrit mata-
    intervocalic stop voicing > Middle Indo-Aryan (dialectal) mada-
      sonorization > dialectal maya

Though the phonetic motivations for shifts such as voicing and spirantization in intervocalic environment seem clear (cf. Kirchner 1998), when phonetic explanations are used to drive phonological accounts of lenition, they run afoul of contradictory data, namely, that this same putative lenition environment is also the canonical environment for the realization of geminate consonants, the "strongest" possible type of consonant, according to Hock's (1991) strength hierarchy. Harris (1998) has also noted this phonological contradiction in the occurrence of both lenited and geminate segments in medial positions, sometimes in the same language, and sees it as evidence against ambisyllabicity.

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Phonetic pressures affecting consonants in an intervocalic environment may certainly give rise independently to both strengthening and weakening of consonants, but the question of how these phonetic pressures might be phonologized remains open to debate. In a phonological study of strengthening and weakening processes, it seems rational to view "strengthening" and "weakening" not in terms of scalar values or phonetic universals, but rather as relative terms pertaining to the distribution of phonemic contrast in various environments, with corresponding elaboration or restriction of the phonetic expression of contrast. Strength hierarchies remain useful descriptors of changes relating to the phonetic expression of contrast, but the phonologist must be concerned with the systematic implementation of phonetic realizations within a given system. The goal, then, is to explain the motivations for the presence or absence of contrast as well as systematic alternations in the phonetic realizations of contrast.

While analyses of strengthening and weakening phenomena at the level of syllabic juncture (Vennemann 1988, for example) view medial position in terms of a syllabic nucleus/ coda and a following onset, syllabic approaches neglect the fact that syllable boundaries often fall entirely within higher levels of metrical structure such as the foot or prosodic word. Accordingly, the focus of this study is cases where realizations of certain consonants are conditioned by their position in a foot or prosodic word, with cases presented below in section 1.

I argue in this study that consonantal strength shifts can be explained through positional bans on features, expressed over positions marked as weak at a given level of prosodic structure, usually the metrical foot. This approach might be characterized as "templatic" in the sense it seeks to explain positional restrictions and distributional patterns relative to independently motivated, fixed prosodic elements. In this sense, it follows Dresher & Lahiri's (1991) idea of *metrical coherence* in phonological systems, namely, "[T]hat grammars adhere to syllabic templates and metrical patterns of limited types, and that these patterns persist across derivations and are available to a number of different processes..." (251).

The primary formal mechanism of this templatic view is phonological licensing, itself developed by Itô (1986) as a type of template matching that regulates syllable structure and phonotactics. The analysis presented here simply extends the notion of licensing beyond the syllable level, following, for example, Harris (1997, 1998) or Piggott (1999). Though the proposals presented here share much in common with Harris' work on similar topics, they disagree in a number of substantive points, particularly in the interpretation of privative features and in the syllabification of word-final consonants, but also in the characterization of the laryngeal distinctions of Danish and German. These points are discussed in sections 2 and 4.

A templatic approach, which accords a central role in segmental licensing to the metrical foot, further recognizes the existence of positions that are not explicitly marked as either strong or weak, suggesting that unfooted syllables (or "degenerate" feet) within a prosodic word, for example, will not be subject to the same sorts of positional restrictions that hold for "true" foot-medial onsets. Section 3 of this study examines the distribution of /h/ and aspiration in English as well as the process of *d*-weakening in Emsland German, finding that in some cases, non-prominent initial syllables, as well as syllables following trochaic feet within the same prosodic word, can show realizations of features that are not found foot-medially. Assuming that feet are maximally binary, such disjunctions can be explained quite simply if distributional constraints are assumed to hold only in syllables marked as weak within a metrical foot. Such distributions serve as a strong argument for the necessity of weak position constraints in explaining positional alternations.

The study is structured as follows: section 1 presents a typology of distributional asymmetries based on data from unrelated languages, demonstrating that the stress foot of each of these languages determines the contexts of neutralization and weakening of stops. Section 2 elaborates the notion of a template, exploring some of its formal properties, while section 3 presents templatic analyses of data from English and German. Section 4 explores the properties of weak positions, especially weak onsets, in more detail, including discussion of templates in phonological acquisition. Section 5 summarizes and concludes the study.

1 Strengthening and weakening in medial position

The following section, which exemplifies shifts in consonantal strength conditioned by position in the metrical foot, takes data from languages with a binary opposition in the laryngeal specification of their stop series. Lenition conditioned by trocahic feet is found in Danish (data following Harris 1997, 1998), and Husby German (hereafter Hus.G.), a Low German dialect spoken in Schleswig, near Germany's border with Denmark. Some of the primary phonological differences that Hus.G. shows relative to Standard German (Std.G.) are a lack of "final devoicing" and the reduction of certain medial stops. The consonantism of Hus.G. is quite similar to that of Danish, which allows for an easy comparison of distributional alternations. This study also investigates two languages with prosodically-conditioned lenition and iambic stress patterns, namely, Walpole Island Ottawa/Eastern Ojibwe[1] (Algonquian, spoken in southeastern Ontario), and Bannack[2] (Numic/Uto-Aztecan, spoken in Nevada).

[1] Walpole Island Ottawa (Odawa), as described by Bloomfield (1957), Holmer (1953), and Rhodes (1985), and Eastern Ojibwe belong to different dialect groupings. The two are nonetheless phonologically similar in many ways and for current purposes can be discussed together as one language.

[2] It is debatable whether Bannack indeed has iambic stress, since Liljeblad (1950) claims that it has no stress at all (as a tonal language). The distribution of "degrees of stress" he describes, however, is such that the initial syllable receives a lesser degree of stress than the syllable following it in a majority of cited forms, regardless of tonal qualities.

For the moment, the analysis is only concerned with the appearance of lenition in the canonical binary foot. Issues related to polysyllabic forms with degenerate feet, monosyllabic forms, and forms with atypical stress patterns will be addressed later. At this point, we turn to brief sketches of the plosive systems of each of the languages under consideration and specifically the distribution and phonetic realizations of plosive allophones.

1.1 Danish and Husby German

Following Iverson & Salmons' (1995) proposals on laryngeal features in Germanic, I will assume that laryngeal distinctions in Hus.G. and Danish are privative, characterized phonologically by the feature [spread glottis] rather than [voice] (i.e., /p/ is marked as [s.g.], thus actually /p^h/, while the other series, transcribed here as /b/, has no laryngeal specification). This is seen in the contrast of aspirated versus plain stops in word-initial syllables, for example, as opposed to unaspirated realizations in clusters, medially and finally. The lenis stops /b d g/, with no laryngeal specifications of their own, display laryngeal qualities ranging from fully voiceless to passively voiced throughout, depending on the surrounding environment. Initial and final environments tend to condition voicelessness, while medial and especially intervocalic environments promote voicing.

The lenis stops of both Danish and Hus.G. are subject to lenition in some positions. Harris (1998:9) argues that non-foot-initial position conditions reduction of Danish stops, shifting /b d g/ respectively to [w, ð/ɾ, j/w]. Danish non-initial /p, k/ are subject to ambient voicing between sonorants, with /t/ further subject to flapping. In Hus.G., /p t k/ are unaspirated except initially and can be voiced in non-foot-initial position. Contrast between the two plosive series of Hus.G. is neutralized in any syllable coda, though the realization there is lenis, rather than fortis as in Std.G. Furthermore, contrast between /p, k/ and /b, g/ is neutralized in medial onsets (again to the lenis realization), while /d/ has the allophone [ɾ] in this position. Thus, medial /t, d/ still contrast, though as [d, ɾ].[3] Examples of the variable realizations of stops in these two languages are presented in (2):

(2) LARYNGEAL DISTINCTIONS AND CONSONANT WEAKENINGS IN DANISH AND HUSBY GERMAN

	(foot-)initial syllable onset	**(foot-)medial syllable onset**	**coda**
Husby German (Germanic, trochaic) source: Bock (1933)	[t^{h}ain] "ten" <tain> [d̥e:b] "deep" <deeb>	[lo:dən] "to allow" <laten> [bro:ra] "brother" <brodar>	[dad] "that" <dat> [bre:d] "broad" <breed>
Danish (Germanic, trochaic) source: Harris (1997, 1998)	[p^h]il "arrow" <pil> [p]il "car" <bil>	næ[b]e "hardly" <næppe> e[b]e "low tide" <ebbe> pe[w]er "pepper" <peber>	la[p] "patch" la[p] "paw"

[3] Historically, some instances of /d/ were entirely lost, as in [bo:am] "floor, bottom," from Old Saxon *bodem*.

In both languages, medial onsets support contrast, albeit only in a limited number of cases, and then with a phonetically weakened implementation of the contrast relative to that found in initial position. Medial realizations of [spread glottis] are lacking in both languages, with neutralizations of /p, k/ and /b, g/ possible in Danish (and obligatory in Hus.G.). The same pattern of reduction and neutralization found in medial onsets holds for Danish codas, while Hus.G. allows no laryngeal distinctions there.

1.2 Eastern Ojibwe/Ottawa

Eastern Ojibwe dialects have iambic, rather than trochaic stress, but phonetic realizations of the fortis and lenis stop series in this linguistic grouping is quite similar to that of Hus.G. and Danish. The sources consulted (Bloomfield 1957, Holmer 1953 and Rhodes 1985[4]) do not entirely agree in their phonetic descriptions of the stops and their likely laryngeal characterization. Rhodes (1985) describes the /p, t, k/ of stressed medial onsets as aspirated and fortis. He disagrees with Bloomfield's description of word-initial stops, however, stating that word-initial /p t k/ are also aspirated and fortis, while Bloomfield states that only lenis stops appear initially. Thus, for Bloomfield, contrast between the two series is possible only intervocalically. Bloomfield also describes the medial fortes as pre-aspirated rather than post-aspirated.

Sources differ strongly in their characterizations of the lenis stop series, which I will transcribe here as /b d g/ for expository convenience. In Eastern Ojibwe, surface realizations of these stops range from voiceless in initial position to partially or fully voiced in intervocalic position and after nasals (Bloomfield 1957:8). Rhodes (1985:xxx-xxxi, xlii-xlvi) also states that lenis stops are realized as voiceless before heterorganic fortis stops (i.e., /bt/ is realized as [pt]) and deleted before homorganic fortis stops, except for /g/, which can be realized as a voiceless spirant before /k/ (e.g., [xk:]). The dialects also diverge as to the presence of final devoicing: Rhodes (1985:xxiv) notes that final devoicing is characteristic of Ottawa dialects but not of Eastern Ojibwe as a whole. Furthermore, Holmer (1953) notes that some postvocalic stops can spirantize, although it is not clear under precisely what conditions: lenes become fricatives between vowels, but only if the following vowel is not schwa, but some coda lenes are apparently also subject to spirantization. As the spirantization data are unclear, I will omit them from discussion but note their their potential to contradict the analysis presented here.

Positional distributions in Ojibwe are summarized in (3):

[4] Piggott (1980) was consulted after much of this article had been drafted; full consideration of his analysis of Odawa fortis obstruents as underlying geminates deserves discussion as well, but for reasons of length, such discussion is omitted from this version of my article.

(3) LARYNGEAL DISTINCTIONS AND CONSONANT WEAKENINGS IN OJIBWE

	(foot-)initial syllable onset	(foot-)medial syllable onset	coda
Ojibwe/Ottawa (Algonquian, iambic) source: H=Holmer 1953, B=Bloomfield 1957, R=Rhodes 1985	R:[p:^{h}]abid "to sit on s.t." vs. [b̥/p]aabiid "to wait" R: lenis C can be lost entirely in this position in some speech registers. B: no contrast initially: lenis only.	B: pe[k/g]a:na:kk "walnut tree," pe[^{h}kk]a:nat "it is different"	R: Ottawa devoices phrase-final stops. B: pe:šekwa:pi:[k] "one string or row", pe:šekwa:pi[kk] "one dollar"

Ojibwe thus contrasts a series of stops marked as [spread glottis] with an underspecified series. As seen in the table above, the realization of the laryngeally unspecified series varies strongly by position, with Ottawa even allowing a spirantized realization postvocalically, even in stressed onsets. The underlying [spread glottis] specification, however, is always realized on the surface, albeit non-contrastively in codas, and to varying degrees in onset positions.

1.3 Bannack

The laryngeal distinctions of Bannack, the remaining language in this sample, are rather different from those of the languages discussed above. In initial position, Bannack stops are realized variably: they can appear either as stops (voiceless lenis or voiced), or as voiced spirants. Liljeblad (1950) states, however, that in initial position, these are "most often ... heard as a voiceless lenis stop" (130). There is a length and laryngeal distinction between two series in medial position, though. Medially, long and voiceless or glottalized stops contrasts with a series of stops that is always voiced, though sometimes either long or spirantized. Illustrated graphically, the range of realizations is as below, using labials as representative examples:

initial	*medial*
[p, b, β]	[b, β, b:]
	[p$^?$, p:$^?$]

In Liljeblad's analysis, the free variation in glottalized versus voiceless realizations of the "strong" series in medial position only means that the laryngeal opposition between the two series is best characterized as ʔC versus C, which is neutralized in initial position to C. To be consistent with the privative feature analyses assumed for Danish, German and Ojibwe, the laryngeal distinctions of Bannack will be presumed here to derive from a privative [constricted glottis] specification. Sample data from Bannack are given in (4), where vowel diacritics indicate relative stress rather than tone.

(4) LARYNGEAL DISTINCTIONS AND CONSONANT WEAKENINGS IN BANNACK

	(foot-)initial syllable onset	(foot-)medial syllable onset	coda
Bannack (Numic/Uto-Aztecan, iambic) source: Liljeblad 1950	[pía], [bía], [βía] "woman"	[màk·á] -[màk '·á] "to feed", [pàɣá] - [pàgá] - [pàg·á] "arrow"	n/a

As in the other languages described above, the laryngeally unspecified stops of Bannack are subject to allophonic reductions, while the marked feature [constricted glottis] is restricted in its appearance. The contrast between the two series of stops is realized in a maximal phonetic elaboration between long and glottalized [constricted glottis] stops versus voiced and potentially spirantized unmarked stops.

1.4 Summary of positional distributions across the metrical foot

In each of the languages discussed above, the ability of a given syllable to support contrast appears to be determined by the language's metrical foot: in Hus.G. and Danish, the distributional template for feature realization is a syllabic trochee, where the initial syllable is stressed and underlying laryngeal specifications fully realized. Thus, [spread glottis] stops are aspirated initially but lack aspiration medially. The medial onset position is subject to allophonic reduction, though contrasts between phonemic series may still be present: Hus.G. retains a contrast between coronal stops only, while Danish implements its contrast in medial position in terms of continuancy only. Across the iambic feet of Bannack, we see that initial onsets are subject to neutralization and allophonic reductions, while medial onsets preserve contrast between two series. In fact, seen in terms of strength scales, the contrasts found in Ojibwe and Bannack even appear exaggerated in medial position: phonemically marked series are long and have fully realized laryngeal gestures (i.e., strengthened), while the unmarked series can be subject to spirantization (i.e., weakened).

There is, in contrast, considerable variation in the realization of word-or phrase final stops: Hus.G. treats such stops as it does all codas and neutralizes distinctions, while Danish variably weakens or neutralizes stops in final position (laryngeal neutralization is found in phrase-final position, lenition in word or syllable-final position). In Ojibwe and Bannack, we observe the opposite distribution. When the initial syllable of the foot is weak, its onset can be subject to neutralization or deletion. While Bannack tolerates only [h] and [ʔ] as coda consonants and sheds no light on the licensing potential of codas in iambic languages, the two varieties of Ojibwe discussed demonstrate quite contrary possibilities. Eastern Ojibwe preserves a contrast between fortis and lenis elements in non-final codas, while Ottawa requires a fortis realization: in either case, the marked laryngeal feature [spread glottis] appears in this position, whether contrastively or not.

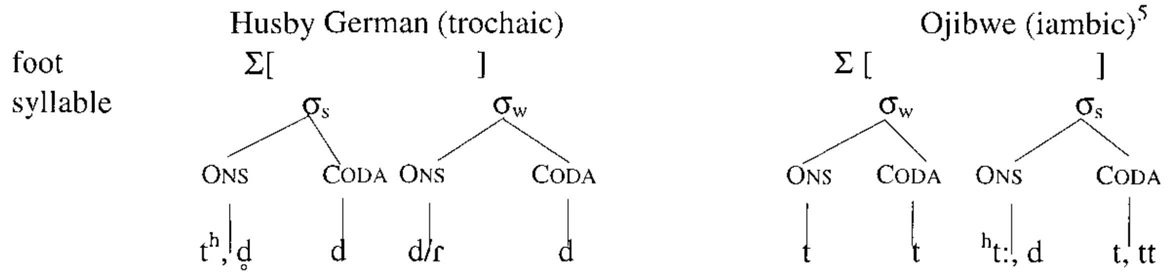
The templatic distributions of laryngeal features in stops for the four languages discussed here are summarized in (5). Darkly shaded cells indicate sites of neutralization, while lightly shaded cells indicate sites where either phonetic reduction or neutralization can occur.

(5) SUMMARY OF POSITIONAL ALTERNATIONS

Language	(foot-initial) syllable onset	(foot-medial) syllable onset	coda
Husby German: trochaic	supports full contrast, full phonetic expression of features	supports contrast [with reduced realizations]	lenis only
Danish: trochaic	supports full contrast, full phonetic expression of features	neutralization or reduction	neutralization or reduction
Walpole Island Ottawa/Eastern Ojibwe: iambic	either neutralization (Bloomfield) or contrast with reduced realizations (Rhodes)	maximal contrast: lenis voiced and/or spirantized, fortis long and aspirated or preaspirated	supports contrast [with reduced realizations]; or neutralization (phrase finally)
Bannack: iambic	lenis only, sometimes with reduced realizations	maximal contrast: fortis long/glottalized, lenis often spirantized	N/A

In the templatic approach outlined above, the potential of syllabic elements to license both phonological contrast and phonetic enhancement can be directly determined by the relative strength of the syllable within the foot. The foot, then, determines the distribution of stop allophones. The templates of Hus.G. and Ojibwe can be graphically represented as in (6):

(6) THE FOOT AS DISTRIBUTIONAL TEMPLATE



The most notable regularity across the distributional templates of both trochaic and iambic feet is the asymmetry in licensing potential between strong and weak onsets. Weak onsets are poor licensers even when word-initial in an iambic language: due to their association to the weak syllable, such onsets are subject to neutralization or reduction of distinctive features, or even to outright loss of the entire segment. On the surface, however, the laryngeally un-

[5] This is the distribution following Bloomfield's description; following Rhodes (1985), the distribution would appear somewhat different, though with foot-initial syllables still constrained in a way that stressed syllables are not.

marked series tend to behave as articulatory phonetics would predict they should: the typical realization of the unmarked series in Ojibwe and Bannack is voiceless lenis word-initially but voiced and potentially spirantized medially. Strong onsets, however, show maximal phonetic elaboration of underlying phonemic contrast: in both Ojibwe and Bannack, we note lengthening and/or strengthening of the laryngeally marked series often contrasting with weakened realization of the laryngeally unmarked stops.

The templatic view allows the distributional effects noted in (5) to be unified as a single type of distributional template, with the site of maximal contrast determined entirely by the foot parameters of each language:

POSITION	SUPPORTED CONTRASTS
strong syllable onset	full range of contrast (with phonetic enhancement)
coda	contextual markedness/neutralization
weak onset	contextual markedness/neutralization

Distributional restrictions appear not only sensitive to prosodic structure, but follow the headedness parameters required by the metrical foot of the language: it is not root- or word-initial or final position that conditions alternations in consonantal strength so much as the location of the head element of a prosodic domain. As noted earlier, this is due to metrical coherence in the grammar: the prosodic structures of the language are central to the organization of the phonology, conditioning distributions and alternations not only at the metrical level but also at the segmental level.

2 Prosodic domains as distributional templates

Though "strong" and "weak" may be intuitively obvious in their descriptive meanings, it is important to clarify exactly what is meant by each, as well as the subset of positions to which these labels can apply. Zoll (1998:8) uses the following criteria to distinguish the phonological properties of strong and weak positions:

	strong	*weak*
contrast	supports more contrast	supports less contrast
reduction	resists reduction	yields to reduction
stress	attracts stress	does not attract stress
tone	attracts H tone	does not attract H tone
harmony	commonly triggers harmony	may yield to harmony
	may resist assimilation	

For current purposes, Zoll's criteria serve as an adequate diagnostic and capture the distributional asymmetries in supported contrast versus reduction as discussed above. Diagnosing elements of the prosodic hierarchy as strong or weak, however, will require an elaboration of the prosodic hierarchy and dominance relations within prosodic domains. I will assume the following set of structures, which are somewhat simplified and reduced from the full range of possible prosodic constituents. These structures and organizing principles follow the model of syllable structure and the prosodic hierarchy proposed by Blevins (1995) unless otherwise noted:

> *prosodic word* (ω): consists of one or more *feet*. Some recent analyses (Zoll 1998) have argued that if the PrWd contains more than one foot, one of the feet will be designated the head prosodic word, and that this constituent can restrict the application of certain phonological processes.
>
> *foot* (Σ): following Hayes' (1995) foot typology, feet are binary at the level of syllables (σ) or moras (μ). Syllabic trochees are headed by their leftmost syllable. Iambs, if they contain more than one syllable, are headed by their rightmost syllable. Iambs may not contain a heavy syllable (>1 mora) in their left branch.
>
> *syllable* (σ): consists of a *rhyme* and an *onset*. The rhyme consists of a vocalic *nucleus* (the head of the rhyme) and an optional *coda* which may contain consonantal material. The onset is an adjunct of the rhyme but its content is not constrained by the melodic content of the rhyme. (Thus, rhymes are headed, but syllables as a unit are not.)

These definitions, including the definitions of the heads of each domain, provide the basis for the definitions of strong and weak positions. *Strong* refers to the head position of a prosodic domain as well as to those constituents that are immediately dominated by it. Such elements are subject only to the general well-formedness constraints applicable to their level of structure (i.e., onsets in a strong position must be well-formed onsets, but will not be subject to any other systematic restrictions). *Weak* positions are those which are both adjacent to a strong position and, though contained within the same domain as the strong/head position, are not themselves heads. Examination of the lenition patterns in (6) above reveals that strong positions need not necessarily be domain-initial and vice versa: languages such as Bannack and Copala Trique (Macken & Salmons 1998) show neutralization and even reduction of stops foot-initially, contrary to the expected phonetic tendency for stops to strengthen in such positions (cf. Fougeron & Keating 1997). This shows that strong positions vary with the position of the head of a prosodic domain, rather than simply following from descriptive criteria.

2.1 Constraint types in the prosodic template

Formally, as noted above, strong positions can be equated with a lack of constraints over supported contrasts and feature realizations. Weak positions, by contrast, will show either neutralization or a restricted range of contrast with phonetically reduced implementation of distinctive feature values. The question of which features are disallowed will be discussed presently, but as preliminary examples, we might state the following sets of constraints for Hus.G.:

(7) WEAK POSITION CONSTRAINTS FOR HUSBY GERMAN (*first formulation*)

*[spread glottis]/CODA	"[spread glottis] is disallowed in codas."
*[spread glottis]/ $\Sigma\{\sigma_s\ \underset{\text{ONS}}{\underset{\mid}{\sigma_w}}\}$	"[spread glottis] is disallowed in the onset of the weak syllable of a foot."

These weak position constraints are an accurate, though disjunctive, statement of the distribution of features in various templatic positions. Our goal must obviously be to provide an explanation of weak position effects that avoids such a disjunction.

Harris' (1997) theory of Licensing Inheritance allows the disjunction in (7) to be circumvented, although not without presenting further problems in terms of representation. Licensing Inheritance starts from the position that all phonological units in a domain except the head of the domain must be licensed (the Phonological Licensing Principle, Harris 1997:336). Licensing of syllabic constituents follows from the licensing potential of the syllable nucleus: onsets are licensed by nuclei, codas by following onsets. Similarly, non-head nuclei are licensed by head nuclei within the same domain. Licensing Inheritance, then, states that the potential of various positions to license melodic material is in an inverse relationship to the number of elements which license a particular constituent. That is, a head nucleus should be unrestricted, a non-head nucleus more restricted, the onset of a non-head syllable still more restricted.

Licensing Inheritance assumes the privative specification of features or melodic elements, and further assumes that these melodic elements are directly phonetically interpretable. Neutralization is the result of the suppression of melodic elements in given positions. In Harris' example, a labial stop consists of three elements: *U*, or labiality (place features); *?*, or stop qualities; and *h*, or noise/release burst. The suppression of one or more of these elements can result in the following types of lenition (343):

suppression of *?* (stop qualities) = spirantization, i.e., [f]
suppression of *U* (place) and *h* (release) = stop debuccalization, i.e., [?]
suppression of *U* and *?* = spirant debuccalization, i.e., [h]
suppression of *?* and *h* = vocalization, i.e., [w]

Such representations and constraint mechanisms give us a clear picture of how and why neutralization occurs in various positions: non-prominent positions are constrained in their capacity to license melodic contrast, and the types of neutralization found in these positions is due directly to the suppression of privative melodic elements. Nonetheless, Licensing Inheritance does not provide a clear explanation for the strong degree of variability in the surface realization of laryngeally unspecified plosives found in the languages described in section 1. Why, if features are directly phonetically interpretable, should a stop with identical feature specifications–such as the lenis series in Ojibwe–show realizations ranging from fully voiceless to voiced spirant, depending its position in the foot? To resolve this question, we would be forced into an overspecification of phonetic detail in phonological analysis, obviating the advantages of a privative feature system, namely, economy in representation.

2.2 Formulation and application of weak position constraints

Weak position constraints, as proposed here, retain the advantages of privative feature specifications as in the theory of Licensing Inheritance, referring only to the marked feature value that defines an opposition. The relevant question in considering neutralization and reduction, however, is that of the nature of the contrast itself, namely, what distinctive information is preserved or lost in various positions? Surface variation in the phonologically unspecified (or underspecified) member of a series is left here to surface phonetic detail rather than phonology. In the absence of a distinctive feature specification, segments show surface variation in their realization according to phonetic context: post-pausal stops are prone to be more voiceless than their intervocalic counterparts (cf. for example Iverson 1983 on the noncontrastive voicing of Korean plain stops intervocalically). Intervocalic stops are more likely to become spirants than initial stops, and so on. Such shifts have no phonological consequences, however, in the sense that they neither create nor eliminate contrast. They are thus not considered at the phonological level. This understanding of contrast and neutralization is similar to that of Natural Phonology, where contrast is viewed relative to a principle of contrast sharpening or "figure and ground" (Dressler 1996:42): in prosodically strong positions, elements tend to be foregrounded or enhanced relative to prosodically weak positions. Similarly, perceptually salient or systemically relevant information will also tend to be enhanced or strengthened at the expense of weaker elements; as with a figure displayed against a background, the relevant information is highlighted or foregrounded relative to its background.

Weak position is, of course, dependent upon a strong position: the labels *weak* and *strong* have no relevance outside of a grouping of phonological units in a metrical domain. This grouping in itself creates an intrinsic ordering of structural demands, essentially an instantiation of the Elsewhere Condition: strong positions are those that are unregulated, the most general case where underlying contrasts are free to occur on the surface. In other positions (i.e., weak positions), a more specific delimitation of allowable features or sets of features will override the more general, unrestricted case found in other positions. There is thus no need to define a constraint set that holds over strong position only: it can be assumed that any constraint holding in strong position must also hold in weak position.[6]

Defining weak position constraints, then, requires reference only to the levels of structure at which marked features are neutralized or banned. I will adopt the following formula for such constraints:

(8) WEAK POSITION CONSTRAINT SCHEMA

> WEAK([feature]/DOMAIN(S)): "a feature is constrained in the non-head sector of a headed prosodic domain." Headed domains include: RHYME, FOOT, PROSODIC WORD.

Constraints over features in syllable codas (the Coda Condition, Itô 1986) are expressible as WEAK([feature]/RHYME), "a feature is disallowed in the non-head sector of the rhyme (i.e., the coda)." The advantage of this formulation, rather than traditional coda licensing, is the ability to describe feature bans at any or all headed levels of prosodic structure. The same logic that makes the coda the weak element of the syllable and subjects it to neutralization then applies to the weak sector of the foot or weak elements of the prosodic word.

The distribution of [spread glottis] in Hus.G. can be expressed as a prohibition of that feature in the weak position of the syllabic rhyme (namely, the coda), as well as in the weak position of the foot. Since the weak position of the foot comprises a syllable, all elements of that syllable will be constrained (the rhyme/coda vacuously, since this element is already constrained). Note that weak position constraints must apply to *headed* prosodic constituents, since it is prosodic heads that provide the definition of weak positions. This means, for example, that onsets will not be constrained unless the entire syllable containing them is constrained (i.e., at the level of the foot or prosodic word).

The constraints of (7) above can thus be recast simply as: WEAK([spread glottis]/RHYME, FOOT), "the feature [spread glottis] is constrained in the non-head sectors of the rhyme and the foot." Thus, the disjunction of codas and foot-medial onsets is described as a set of weak positions at various layers of prosodic structure.

3 Strong, weak and unreferenced positions in templatic analysis

It is important to note that in a prosodic domain, the strong element, which is defined in section 2.1 as unconstrained, is not exempt from structure-changing processes. While the strong element is not subject to neutralization, which eliminates or restricts feature

[6] An exception might be constraints aligning features to root or word-initial position, but these typically reference the initial *edge* of a domain rather than the strong position itself (cf. McCarthy & Prince 1993 for the definition of alignment).

specifications, this does not eliminate the possibility of the allophonic addition of features to strong positions (cf. Holsinger 2000:51–55). In fact, it would be a mistake to view segments or features in strong positions as fundamentally exempt from any change in their phonetic realization. Precisely because strong positions are unconstrained, they tend naturally to become sites of non-structure-preserving processes, allowing phonetic and eventually phonological variation rather than neutralization (again according to the Natural Phonology principle of "figure and ground.") Numerous historical changes in the Germanic languages, for example, have resulted in the shifting of distinctions previously carried by a vowel in a weak syllable to other sites. In addition to the well-known set of sound changes categorized as umlaut, Old Norse u-mutation provides another example from Germanic, cited below in (9a). A templatic consonantal change from Chalcotongo Mixtec, as outlined by Macken & Salmons (1997), where medial consonants were weakened or lost while initial consonants were sometimes strengthened, is summarized in (9b).

(9) TEMPLATIC SHIFTS IN OLD NORSE AND CHALCOTONGO MIXTEC

a. *Old Norse u-mutation* (Noreen 1923): V→ [+rnd]/__ C_0u ("weakly stressed")

Roundness shifts from an unstressed or "weakly stressed" syllable to a preceding stressed or root-initial syllable.

Proto-Germanic	*Old Norse*	*gloss*
(Gothic) *magus*	*mǿgr*	'boy'
*triggur	*tryggr*	'true'
*fehu	*fǿ*	'money, fee'

All forms listed have initial stress.

b. *Chalcotongo Mixtec consonantal shifts* (Macken & Salmons 1997, following Longacre 1957)

The fricative [x] is lost from a foot-medial onset while in some cases, the initial segment of the foot is strengthened.

Proto-Mixtec	*Chalcotongo Mixtec*	*gloss*
*wexi	bèi	'come'
*xexiʔ	zée	'eat'
*kixi	kii	'will come'

Vowel diacritics indicate tone rather than stress, but the cited sources agree that syllabic trochees or "couplets" play a morphological role in Mixtec.

The cases above, both from languages with trochaic feet, show the transfer of the burden of contrast away from medial positions towards the strong syllable of the foot. Both consonantal and vocalic material are shown to drift in this manner, often resulting in innovations to the phonological system (the creation of front rounded vowels in Germanic languages, for example). These examples show, however, that the strong syllable of the template is amenable to the addition of structure, while the weak syllable is constrained in its ability to support contrast and tends to shed marked features or structures.

The examples given in (9) show not only that weak positions are limited in their capacity to support certain contrasts, but also that features tend to drift towards the stressed syllable of the foot to be realized there rather than simply being lost. This, again, must be related to metrical parameters in these languages, and allows us to add a further criterion to Zoll's typology of strong and weak positions: strong position tends to attract marked feature values in sound change. In the templatic view, each weak element is naturally bound to another element marked strong. Features lost from the weak syllable, the constrained element, may still be licensed by the strong element of the prosodic domain over which positional bans hold. This should naturally follow the established metrical parameters of the language: features lost from unstressed syllables should drift leftward within a trochaic template, rightward within an iambic template. The natural pairing of strong and weak elements in a template should mean that marked feature values will seek out a site where they can be licensed in the absence of constraints mitigating against such drift.

It is worth noting that changes such as those described in (9) contradict the predictions made by Positional Faithfulness constraints in Optimality Theory, namely, that strong positions should by nature be resistant to change. The "weak positions" schema outlined above views such change as a natural consequence of the loss of distinctive information from constrained positions. Furthermore, the types of initial consonant weakening described in the data from Ojibwe and Bannack (in 3 and 4, above), represent a fundamental problem for the Positional Faithfulness approach: consonants in root-initial position, especially in unpreceded root-initial position, would not be expected to weaken or fail to support contrasts found elsewhere. Again, the "weak positions" schema can relativize the strength of such positions according to the headedness of prosodic structures in a given language.

3.1 Alignment, augmentation, and positional bans

In Optimality Theory, the family of alignment constraints provide a means of capturing patterns of feature drift such as those in (9). Alignment constraints reference edges of words, roots, or metrical feet in determining the distribution and direction of spread of features; any available edge might potentially serve as a reference point for such constraints. Davis (1999), for example, discusses the distribution of /h/ and aspiration in (American) English and in the Arawakan language, Baré, viewing both as resulting from ALIGN constraints holding over [spread glottis] at different levels. His examples are presented in (10):

(10) THE DISTRIBUTION OF [spread glottis] IN BARÉ AND AMERICAN ENGLISH (following Davis 1999)

a. Baré possessives

haba 'fingernail'	*hnu-aba* 'my fingernail'	*p^h^i-aba* 'your fingernail'
nene 'tongue'	*nu-nene* 'my tongue'	*hi-nene* 'your tongue'[7]

but cf. Aikhenvald (1995): *nu-kat^h^esá-waka* (1sg-know-NEG) "I don't know" (no drift of [spread glottis] from noninitial aspirated stop), *titehe* "knife" ([h] outside of word-initial position)

b. English aspiration and /h/ resulting from alignment of [spread glottis] to stressed syllable onsets and the left edge of the word, viz. constraints ALIGNL(σ́, [spread glottis]) and ALIGNL(WORD, [spread glottis]).

onsets of monosyllables	[k^{h}æt]	*cat*;
word-initial syllables	[k^{h}æ̀təstráfɪk]	*catastrophic*;
primarily stressed syllables	[k^{h}æ̀tət$^{\text{h}}$ánɪk]	*catatonic*;
certain word-medial syllables	[æ̀brək$^{\text{h}}$ədǽbrə]	*abracadabra.*

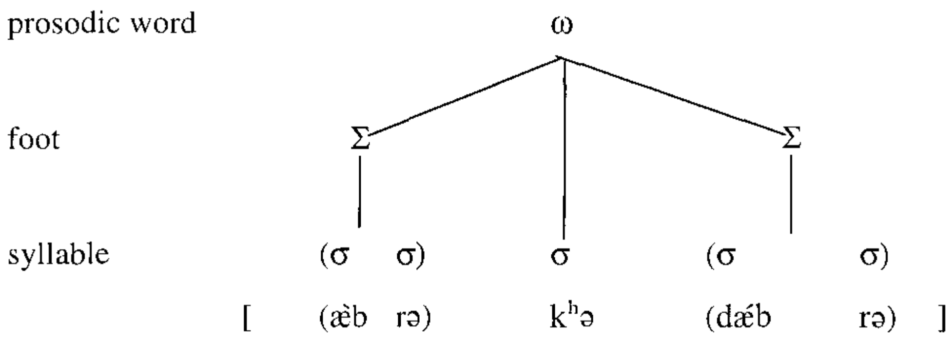
In the data in (10a), Baré shows some cases of [spread glottis] drifting toward initial syllables, but this does not appear to be a categorical behavior of the feature: a number of lexical items in Baré show [h] or aspiration outside of initial position. The behavior of [h] relative to the possessive prefixes seems to indicate a classic autosegmental behavior: in a certain class of lexical items, [h] (or [spread glottis]) is preferentially associated to the initial element of a stem. This is not, however, a property of strong positions, as seen by the appearance of [spread glottis] outside of initial position in other lexical items. Rather, it is a property of certain morphemes that [spread glottis] be aligned to the initial word edge. This, in itself, appears to be a good argument in support of alignment. Though banning this feature from non-head syllables, as a weak position constraint would, captures the distribution of [h] in possessive forms, it does not explain the appearance of aspiration and [h] in the other forms cited. In the absence of morpheme-specific alignment constraints, an Optimality approach should presume that faithfulness will select any underlying specification for /h/ or [spread glottis]. Thus, a weak position constraint alone cannot capture this distribution.

This is not in itself a reason to abandon the notion of weak position constraints, however. The leftward drift of /h/ in Baré possessives appears to be morpheme-specific: Kager (1999:119) argues that relativization of constraints to specific morphemes is limited to the class of alignment constraints. Thus, this behavior can be relativized to a single morpheme, weakening neither alignment theory nor the logic of weak position constraints as determiners of contrast distribution.

[7] Davis presumes a highly ranked constraint *[sg, +voice], since voiced segments never appear aspirated in Baré (preventing, for example, *b^{h}i-aba 'your fingernail').

We see a theoretical advantage for weak position constraints as opposed to alignment in the distribution of [spread glottis] in English, however. Numerous previous analyses have addressed the question of limitations on aspiration and /h/ (starting in generative phonology with Kahn 1976). Typically, such approaches have attempted to explain where the feature [spread glottis] is found. It seems more appropriate in a constraint-based approach to ask where this feature is *not* found, and this indeed leads to a clearer picture of its distribution. While [spread glottis] seems to align itself at one of two prosodic domains, as expressed by Davis through the constraints ALIGNL(σ́, [spread glottis]), and ALIGNL(WORD, [spread glottis]), [spread glottis] is in effect found everywhere *except* in codas and in syllables following a stressed syllable, i.e., a foot-medial weak onset. As Davis notes, between two stressless syllables, both aspiration and [h] are possible, as in the names *Nèbu*[k^h]*adnézzar*, *Wìnne*[p^h]*esáukee*, or *Tàra*[h]*umára*. Furthermore, in some American English pronunciations of these words, [spread glottis] appears in an onset of a schwa-headed syllable, a combination not attested elsewhere.

I will assume that in these admittedly unusual cases, prosodic structure is constructed such that feet are aligned to word edges. Holding to the assumption that feet are maximally binary, this means that intervening material must be metrically weak and licensed not by adjunction to a foot (creating a ternary structure) but by direct incorporation into the prosodic word. This entails a rejection of the Strict Layer Hypothesis (Selkirk 1982), but constrains the possible foot structures of a language such that ternary feet are not acceptable. By my analysis, the metrical structure of a word such as *abracadabra* is as follows:



Unfooted syllables that are not licensed directly by the Prosodic Word, e.g. the medial syllables in *Nebu*(kad)*nezzar*, *Winne*(pe)*saukee*, and *Tara*(hu)*mara*, escape constraints holding at the foot level. They do not belong to a headed prosodic domain to which a weak position constraint applies, and accordingly cannot be classified as either strong or weak. This leads to a quite simple explanation of the distribution of aspiration and /h/: weak position constraints hold over [spread glottis] apply at the level of the rhyme and the foot, but not at the prosodic word.

Furthermore, if we follow Iverson & Salmons (1995) in assuming that [spread glottis] in clusters is realized throughout the cluster, resulting in an incompletely aspirated second element (e.g., [spɪn]), there is no need to propose an additional constraint over aspiration in clusters.[8] The necessary constraint on [spread glottis] in (American) English bans its appearance in weak syllable onsets, since the only instance where there is no [spread glottis] release, apart from clusters and codas, is in unstressed, footed onsets (e.g., rá[p]id). Thus, the positional ban, WEAK([spread glottis]/RHYME, FOOT), adequately captures the distribution in a way that neither alignment nor positional faithfulness constraints can, eliminating a disjunction of environments in favor of a set of paradigmatic alternations.

Kahn (1976) presents a very similar argument that has long been accepted in discussions of English aspiration. He analyzes American English stops as aspirated in syllable onsets except when the stop in question is ambisyllabic. The weak position approach has one major advantage over Kahn's analysis in its simultaneous capture of the absence of /h/ and aspiration in both codas and post-stress onsets. Again, these environments are joined simply as weak positions at two different structural levels, expressing a relation between a feature and its presence in non-head positions in both rhyme and foot. The dubious theoretical device of ambisyllabicity can then be avoided entirely.

3.2 Unreferenced positions within the template: neither strong nor weak

The data discussed above suggest that a third possibility exists for constraints holding over positions in prosodic domains. Specifically, we see that features banned from weak positions might surface not only in strong positions, but also in positions for which no distributional constraints hold. A given prosodic domain should typically have one position marked strong and one position marked weak, but may contain other positions with no particular status, such as degenerate feet or unfooted syllables within a prosodic word. Such positions are neither strong nor weak, and will not participate in structure-changing processes that affect the other positions. If we assume that [spread glottis] in English is banned from foot-medial positions, for example, the same feature could still potentially surface in unfooted positions within a prosodic word. In other words, a given weak position constraint might hold at the level of rhyme or foot, but not at any higher levels.

Historical lenition processes affecting [d] in Emsland German gives us further evidence of this type of distribution. In this Low German dialect, the unstressed syllable of a syllabic trochee is the site of various processes of reduction and deletion, as listed below. Following a long vowel or diphthong, as in (11a), /d/ appears as a glide homorganic to the preceding vocalic element (also analyzable as deletion of /d/). Following a short vowel, as in (11b), /d/ appears as a coronal flap. Originally geminate segments, shown in (11c), appear as singletons. The orthography of the Middle Low German cognates is ambiguous for Emsland German: a

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[8] Some unrelated constraint must still account for the fact that /h/ does not appear in English clusters.

double consonant can indicate either a historical geminate or a preceding short vowel. In most Low German dialects, closed-syllable shortening and degemination have leveled this distinction such that the spelling always indicates a sequence of short vowel plus singleton consonant. Emsland German preserves the historical length distinction in the case of this particular consonant as an alternation between flaps and singleton consonants, though always preceded by a short vowel.

(11) D-WEAKENING IN EMSLAND GERMAN (transcriptions adapted to IPA from Schönhoff 1908: §171, 164)

	IPA	*gloss*	*Middle Low German gloss*
a.	[tɔ́ɒfbòʊ̯ə] [9]	'peat cellar'	*torfbode*
	[moʊ̯ə]	'mother'	*moder*
	[høʏ̯ən]	'to protect'	*hüden*
b.	[bɛɾə]	'bed'	*bedde*
	[mɪɾə]	'middle'	*midde*
	[lʏɾək]	'small'	*lüddek*
	[sχʏɾən]	'to shake'	*schüdden*
c.	[bɪdən]	'to request'	*bidden*
	[fɛdɐ]	'cousin'	*vedder*
	[hœdə]	'(he) protected (pret. ind.)'	*hödde*

The examples given in (11) can all be uncontroversially parsed into single trochaic feet with the exception of *torfbode* (11a), which is a compound composed of two feet. In all of these forms, /d/ is subject to weakening processes under two conditions: (1) it must occur foot medially, and (2) the following vowel must be one of the canonical reduced vowels (i.e., [ə, ɐ]) or a syllabic sonorant.

The templatic nature of these weakening processes can be illustrated on the basis of the exceptions to d-weakening cited in (12). After an overlong, falling diphthong (12a), [d] is retained. Here, the trimoraic diphthong (a sequence of long vowel plus schwa) presumably constitutes a foot on its own; the following syllable lies beyond this foot and thus outside the conditions for d-weakening. The quality of the following vowel also affects the process: (12b) shows that weakening fails in the presence of an unreduced vowel. Some scholars of German (Hall 1998, Jessen 1999) have argued that suffixes such as *-los* "-less, lacking" and *-haft* "-ful, containing" (though not *-ig*) inherently possess secondary stress. If Emsland German *-ig* bears secondary stress, we can presume that this suffix, or potentially even the presence of any non-schwa vowel, blocks reduction.

[9] This word is a compound, with the initial syllable (the root *torf*, "peat") receiving primary stress.

(12) EXCEPTIONS TO THE WEAKENING PROCESSES IN EMSLAND GERMAN

	IPA	*gloss*	*Middle Low German cognate*
a.	[ba:ədə]	'both'	*beide*
	[ha:ədə]	'heath'	*heide*

metrical structure:

ω — prosodic word

Σ — foot

[(ba:.ə) də]

b.	[nø:dɪχ]	'necessary'	*nodig*
	[ni:dɪχ]	'spiteful'	*nidig*
	[kry:dɪχ]	'lively'	*krüdig*

These two cases provide strong evidence of the necessity of contextual markedness constraints that ban features from a set of prosodically-determined weak positions. Both alignment constraints and positional faithfulness fail to explain the occurrence of features otherwise limited to strong or edge positions outside of their prescribed domains. Why, for example, would [spread glottis] be found in certain metrically non-prominent positions as opposed to others? While alignment constraints could certainly be invented to capture this distribution, the alignment argument weakens in view of a single markedness constraint that results in the same pattern. Positional faithfulness fails here for the same reason: why would nonprominent, unfooted syllables allow exceptional feature identity constraints of a type justified on the basis of the phonetic and psycholinguistic strength of stressed and initial positions?

Weak position constraints neatly capture both the static distribution of [spread glottis] in English and the historical weakenings of [d] in Emsland German as natural consequences of the limitations placed on feature distribution within the foot. The fact that these constraints apply at the foot level does not, however, mean that constraints could not apply within the prosodic word. A constraint WEAK([spread glottis]/RHYME, FOOT, PRWD), for example, would eliminate the feature [spread glottis] from any coda, as well as from any unstressed onset within the entire prosodic word, rather than simply from foot-medial onsets, as in English. Whether or not a constraint of this type is attested will remain an open question at this point.

4 Weak positions

We turn now to an examination of another type of weak position constraint. As argued above, phonologically weak does not necessarily equate to phonetically weak. Rather, the primary characteristic of a weak position is that it is constrained. Phenomena like German final fortition show that weak position constraints can also result in the neutralization of contrast through the obligatory insertion of a feature. Though this type of neutralization (i.e., to the marked element of a distinctive alternation) is not widely accepted in phonological analyses, there are cases that appear to require it, as will be discussed below.

4.1 "Neutralization to the marked"

The process commonly called "final devoicing" in German was referred to by pre-SPE Germanists (e.g., Schirmunski 1962) as "final fortition" (a perspective which Iverson & Salmons 1995, 1999 have grounded in current feature theory). This reflects the general view that the German "voiced" or lenis obstruents were phonetically strengthened in the syllable coda. As Iverson & Salmons (1999) argue:

> Since "voiced" or lenis obstruents are not laryngeally marked in this system, there is no laryngeal feature available to spread leftward into a fortis (or fortified) segment. Obviously, the feature which is available in the system, [spread glottis], cannot spread leftward into an already fortis obstruent. By Final Fortition, therefore, both /s+b/, /z+b/ → [sb] (*Eisbär* 'polar bear', *eßbar* 'edible'), while /z+p/, /s+p/ → [sp] (*Hausputz* 'big housecleaning', *Fußpilz* 'athlete's foot'). In German, then, all members of a heterosyllabic cluster come to share the laryngeal specification of the last member if there is such a specification (namely, [spread glottis]), but this is an effect of Final Fortition, not a consequence of feature spread or assimilation. Further, if there is no laryngeal specification in the last member of the cluster, the preceding member will still be fortis because of Final Fortition, resulting in laryngeally heterogeneous clusters like [sb] (= [sb̥]).

In other words, in a system where obstruents are distinguished by the presence or absence of [spread glottis], this feature is obligatory any time an obstruent is associated to a right syllable edge. The marked feature can spread into following unspecified obstruents as well.

Up to this point, neutralization has been described as a situation where contrastive specifications for feature X are disallowed in the weak sector of domain Y. Neutralization could conceivably also occur via a requirement that a specific feature value always be present in weak domains (i.e., all weak sectors of domain Y must contain feature X). Both types of requirement eliminate contrast, but the mechanism by which contrast is eliminated is presumably a matter of language-specific implementation. Weak position constraints specify only the phonological consequences of neutralization, leaving the phonetic dimension of feature implementation open.

One advantage to this view of neutralization is that it allows us to circumvent other formal devices, such Harris' (1997) analysis of the behavior of final consonants under Licensing Inheritance. Specifically, he argues (1997:354-356) that final consonants are syllabified as onsets with a following empty nucleus (a generally accepted position in Government Phonology). The presence or absence of a vowel in the nucleus of a following syllable determines whether (L), the phonological element that determines voicing, can appear. Standard German final devoicing in *Han*[t] "hand (sg.)" vs *Hän*[d]*e* "hand (pl)." is explained in this manner.

This analysis crucially relies on the characterization of some German stops as voiced. Though Harris classifies the Danish voicing alternation as aspirated vs. plain and characterized phonologically by the element (H), or plosive aspiration, German, whose phonetics and phonology match the criteria used to determine the Danish distribution (cf. Jessen 1998), is not characterized in the same way. If we accept the good arguments that exist for assigning the same phonological feature to both the German and Danish stops, this leaves a Licensing Inheritance analysis in a bind. Since plosive aspiration does not appear in weak onsets, we would assume that (as in Danish), (H) is not licensed there. But with the assumption that final consonants are onsets, and more specifically that they are onsets with no (H) license, there is no way to motivate neutralization of final consonants to the marked series except to recognize that this is a property categorically associated to coda consonants.

All other things being equal, the consistency of analysis for the laryngeal features of the two languages is certainly preferable, as is the assumption that final consonants are codas when they behave like all other codas. Where Danish and German are distinct, then, is in the types of constraints that hold over codas: Danish has moved in the direction of feature elimination, while German requires neutralization to a marked feature value.

4.2 The onset position in distributional templates

The systematic distinction between the behaviors of weak onsets and codas discussed above leads us now to a discussion of the asymmetries that exist between strong and weak onsets. Work on phonological acquisition (Fikkert 1995, Gerken 1996, Macken 1996; cf. also Kehoe & Stoel-Gammon 1997) shows that children, in the development of their phonological systems, frequently restrict certain features to prosodically strong positions, such as the initial syllable of a trochaic foot, and that during acquisition, children acquire first syllabic templates, then feet, and finally, fully-formed prosodic and intonational structures. The stage at which the foot becomes functional for children is characterized by clippings of polysyllabic words to fit the template, or more rarely, by epenthesis such that monosyllabic forms become disyllabic. The presence of such an acquisitional stage suggests that a close relationship between features or segments and units of prosody might be a fundamental aspect of phonological systems; whether the prosodic template continues to play a role in adult phonology or is simply lost after more fully-elaborated prosodic structures are acquired remains a point of discussion.

Macken (1996) notes strong restrictions in some children's speech as to the ordering of consonants with certain places and manners of articulations, as well as directional effects of consonantal harmony processes by which medial onset consonants assimilate place of articulation to a preceding onset, but not a preceding coda consonant. As she states: "A crucial factor is not linear order of the segments *per se* but rather prosodic structure, specifically the prosodic template and the onset positions in that template, and that, within the prosodic structure, there is a directionality effect" (1996:169). Distributional templates obey principles of headedness in the same direction as the stress templates of a given language: in a language with iambic feet, the initial onset is weaker and subject to neutralization, despite its position at the beginning of the word, a position which is commonly argued to be more perceptually salient.

Furthermore, the asymmetric behavior of onsets comes as a natural consequence of prosodic headedness in the templatic approach. Within the syllable, onsets are undominated. While they are not the head of the syllable, neither are they constrained by the melodic content of the nucleus, and thus are unconstrained. A constraint over an entire syllable, though, would constrain a syllabic onset. Given the weak position constraint schema proposed in section 2.2, the demarcation of one syllable in a foot as weak applies to all dependent element of that syllable, including the onset. In fact, it is *only* at the level of the foot that constraints over syllables (and thus onsets) become possible, since feet have syllables as heads (and thus also as non-head elements). When a weak element can be constrained only in reference to a strong element within a headed domain, there is no way of constraining onsets except via the syllable (thus at the level of the foot). Any independent definition of an onset grants undue power to the theory, and would predict constraints on onsets relative to nuclei that are not found in human language.

Many prosodically-triggered sound changes, such as those mentioned above, involve reduction of contrast in certain positions and the concomitant shift of distinctive features to the head position of a prosodic domain. Let us examine the Old Norse sound changes already noted in (8) above as an example, listed here again for expository convenience:

Proto-Germanic		*Old Norse*		*gloss*
(Gothic) *magus*	[maː.gʊs]	*møgr*	[møgr̩]	'boy'
*triggur	[trɪg.gʊr]	*tryggr*	[tryg.gr̩]	'true'
*fehu	[fɛ.hu]	*fǿ?*	[føː]	'money, fee'

Transcriptions are reconstructions of likely pronunciations.

A weak position constraint, WEAK([round]/FOOT), expresses the loss of distinctive [round] from the weak sector of the foot. The constraint is presumably not WEAK([round]/RHYME) since it does not eliminate rounded vowels entirely. Rounded offglides of diphthongs are still attested, as in *auka* "to increase". Whether the constraint is better formulated as WEAK ([round]/PRWD) is not apparent from available data. Though the feature [round] is no longer preserved in the same position where it was specified in the input, it is nonetheless preserved by the nearest available unconstrained licenser within the same domain. In the absence of a higher-ranked well-formedness constraint against front rounded vowels, the feature [round] can be added to the vocalic specifications of the initial syllable, producing front rounded vowels and creating a new contrast. (The eventual deletion of the unstressed vowel and resulting monosyllabic forms are not considered here.)

While strong positions may be subject to universal feature co-occurrence or well-formedness constraints, such constraints are necessarily apositional and reflect the broader demands of the phonological system: they will apply to any disallowed combination of features, regardless of the prosodic constituency of their potential licensers and do not reflect on any theory of distributional asymmetries. The role of weak position constraints appears crucial to the motivation of diachronic shifts such as the Old Norse example above. Since weak position constraints are expressed over features and structural levels, if phonological systems tend to preserve distinctive information (the nature of faithfulness in Optimality Theory), the restriction of a distinctive feature in a weak position need not eliminate contrast entirely if the strong element can "pick up" the feature in question.

5 Summary and conclusion

In sum, I hope to have shown a number of advantages of a templatic approach to contrast distribution. My analysis has expressed the utility of a type of constraint that determines the ability of headed prosodic constituents to support contrast. The advantages of these constraints are threefold. First, the weak position constraint schema is dependent on pre-existing parametric variation in prosodic structures, which gives a clear phonological explanation to the initial consonant weakenings found in some iambic languages. A "phonetics-only" approach would not predict the loss or spirantization of word-initial stops, for example, simply because the phonetic context is not appropriate for such processes. Second, the weak position approach captures static distributions clearly, without need for exceptional syllabifications or other formal devices. Rather, it attempts to derive the phonological contexts of neutralization from the natural asymmetries inherent in metrical groupings at all levels of metrical structure, further deriving the asymmetries of strong and weak onsets within the foot from well-established principles of syllabic structure. Finally, the templatic approach provides a clear explanation for prosodically-motivated sound change, arguing that contrast preservation naturally occurs within the same domain in which features become constrained, migrating from weak to strong positions.

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