Against the underlying specification of an 'exceptional'
English stress pattern

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This paper is on English nouns, such as Mississippi, that defy the general rule that a penultimate syllable receives stress only if it is heavy. Hayes (1980), and Halle and Vergnaud (1987) give these words a special underlying specification so that they can be subjected to the normal stress rules, including the rule of syllable extrametricality. The opposite tack is taken in Selkirk (1984), where extrametricality is lexically marked on the more common antepenultimately stressed words like America, and the Mississippi pattern is generated by a grammar that contains no rule of extrametricality. In what follows, I argue that neither of these 'rule + underlying specification' approaches can explain the fact that both patterns are quite productive. I then apply Itô and Mester's (1993a) model of lexical constraint domains to construct a grammar that generates the two competing patterns, but still captures the core and peripheral status of antepenultimate and penultimate stress respectively. Because the proposal here is that the difference between the core and the periphery lies in whether an extrametricality-like constraint is active or not, I conclude with a reply to some criticisms of Selkirk's (1984) 'zero extrametricality' account of Mississippi-type words that apply equally to the present analysis. The main thrust of the criticisms is that the consonant following the penultimate syllable of these words behaves as a coda, which is predicted if this consonant is underlyingly a geminate, as claimed by Chomsky and Halle (1968). The reply consists of a demonstration that independently needed constraints in the English grammar force the post-penultimate consonant into coda position, thus obviating the need for underlying specification that appears to have no contrastive function.

1. Light penult stress as underlyingly specified

1.1 Underspecification and stress

The usual approach to the underlying specification of segmental features is stated by Kenstowicz (1994: 60) as follows:

An underlying or phonological representation will contain all and only the unpredictable (distinctive) information for each lexical item.

It is also generally assumed, though rarely asserted, that syllable structure is absent from underlying representations because it fails to distinguish words, and is predictable. The sole exceptions are long vowels or geminate consonants, which are granted an extra underlying mora, root node, or skeletal position if and only if vowel or consonant length is contrastive (cf. Hayes

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1989 and Tranel 1991 on underlying weight and length).

However, this correlation between contrast and the underlying specification of structure, as well as between contrast and predictability, seems to disappear further up the prosodic hierarchy. White underlying stress is sometimes posited to contrast otherwise identical words (as in Sanskrit—cf. Halle and Mohanan 1985), it is predictability alone that usually determines specification in this domain. The general stress pattern in the language is taken to be predictable and is generated by rule rather than being specified in the lexical entry, while words that diverge from the norm are assumed to bear some sort of underlying specification, regardless of whether stress shows any evidence of being distinctive in the language (see for example, Hammond 1989a and Franks 1991 on Polish, along with most of the literature on English cited below). Since syllable weight and extrametricality can play a role in determining stress placement, there are a number of ways in which the underlying representations of exceptional items can be altered to allow the rules to generate the correct surface stress pattern. The various possibilities are fully illustrated in the extant analyses of stress on light penultimate syllables of English nouns, to which we now turn.

1.2 A short history of light penult stress

The generalization that only heavy penultimate syllables of nouns are stressed has guided treatments of English stress since Chomsky and Halle (1968)1. When the penult is light, stress usually falls on the antepenult. This is exemplified by the words in (1), most of which are taken from SPE:

(1) a. 'XLX: Cánada América cinema arsenal análisis jévelín vénison
    b. X'HX: agénda uténsil appendíx placénta sãoópsis amálgam
    c. X'HX: aróma balarláika hiátus horizórn aréna Minnesótá angína

The strings of letters before each group of words refer to the weights of the final three syllables, H being heavy, and L light. The heavies in (1b) are of the form CVC, while those in (1c) are CVV.

Analyses that follow Chomsky and Halle's practice of deriving the main stress of words like those in (1a) by rule commit themselves to postulating a special underlying specification for words such as in (2), also from SPE:

(2) X'XLX: ·vanilla Mississippi Kentúcky conféttí abscísséa Philippa

These words with 'light penult stress' (LPS) violate the generalization that the stressed penults of nouns are heavy, since the penultimate vowel is short and has no apparent closing consonant.

The SPE solution for this problem is to postulate underlying 'double consonants' between the last two vowels of the words in (2), so that the stress rule treats them like the words in (1b). Following the assignment of stress, a degemination rule applies to create the surface single consonant. In current parlance, their approach is to grant honorary weight to the penultimate

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1 The terminology used in this paragraph postdates SPE, of course. Vowel length is there encoded as tenseness, and syllable closure as intervocalic consonant clusters.
syllable of the words in (2), so that exceptional light penult stress becomes regular heavy penult stress.

This notion of honorary weight is taken quite literally by Hayes (1980), who introduces a [+H] feature that makes the penultimate syllable of LPS words heavy for the purposes of the stress rules. Since this is in effect a restatement of the SPE analysis, it shares with its predecessor the goal of maximizing the generality of the stress rules, even at the cost of introducing non distinctive (SPE) and otherwise unmotivated (Hayes 1980) underlying material. In Hayes' case, it is the generality of noun extrametricality, which he claims is 'virtually exceptionless' (Hayes 1980: 282), that is preserved by using the [+H] diacritic. Hayes' rule of English extrametricality renders the final syllable of nouns (and certain suffixed adjectives) invisible to the rest of the stress rules, so that the creation of a left-headed binary foot will stress the antepenultimate syllable when the penult is light. Since the penults of LPS words are made heavy by the [+H] diacritic, they can be accounted for along with 'true' heavy penults by quantity sensitivity, which disallows a heavy syllable in the weak (unstressed) position of the foot.

Halle and Vergnaud (1987) and Hammond (1989a) similarly assume that extrametricality applies to LPS words, though the underlying diacritics they use are slightly different from Hayes (1980). Halle and Vergnaud propose that LPS is the product of an underlying line 1 asterisk, which is their representational equivalent to underlying stress (and perhaps underlying weight), while Hammond argues on theoretical and cross-linguistic grounds that a [+accented] diacritic is preferable to an underlying line 1 mark. The diacritic feature accented is also used by Halle and Mohanan (1985: 76), but they posit a rule that supplies this feature to the penultimate syllable of certain words, so that they can:

...capture the fact that stress in English (unlike stress in Sanskrit) is not present in lexical representations...

Rather than creating a special rule, a more straightforward way of capturing this fact is to have the regular stress rules, except for extrametricality, apply to LPS words. Given the usual assumptions that word final tense vowels are underlyingly short, and that final consonants are also extrametrical (cf. Hayes 1982), this will get the right results for the words in (2), and almost all of the other LPS words given in the Appendix.

The reason that Hayes (1980) does not treat LPS words in this way is that a few of them have final consonant clusters (lieutenant, adoléscence), or a tense/long vowel followed by a consonant (Ulysses, Achilless). Hayes points out that even with final consonant extrametricality, the 'superheavy' final syllables of these words are still heavy, and should be stressed if they are not extrametrical. However, words of the adoléscence type parallel those like calendar, Kissinger, carpenter, passenger, infantry, and burgundy in which the unexpected initial stress can be explained by having the penultimate nasal in nuclear position underlyingly, thus forming a monomoraic (non-branching) syllable. Also, even if some diacritic is used to account for penultimate stress, the words like Ulysses must still be marked as exceptions to Hayes' rule of long vowel stressing, since the final vowels are stressless. This suggests that these vowels are

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2 There is no mention of LPS in either the version of Hayes' dissertation distributed by the IULC (Hayes 1981), or in Hayes (1982).

3 Some ostensible motivations for underlying gemination in English are discussed in section 4.

4 These were not included in the Appendix because it is not clear that they are monomorphemic.
final in the word, with the final /z/ analyzed as analogous to a separate plural morpheme. Finally, none of the other LPS words, fairly exhaustively listed in the appendix, have a superheavy syllable word finally, with the exception of Appomátox and Carruthers, which could also be analyzed as 'false plurals'. This rather striking absence of final clusters could actually be taken as supporting the 'zero extrametricality' account of LPS.

Hayes' objection is rightfully ignored by Selkirk (1984), Kager (1989), and Jensen (1993), all of whom argue that LPS is best explained by a lack of final syllable extrametricality, rather than by an underlying diacritic. Selkirk's (1984) treatment of extrametricality differs from that of Hayes (1980/81/82) and Halle and Vergnaud (1987) in that she does not view extrametricality as being assigned by rule. It is the extrametricality designation on a word like América which is present in the lexicon, rather than a marking of [-Extrametricality Rule] on Kentucky. Because of this, her proposal is at odds with the general practice of metrical theory, and phonology in general, to capture generalizations by rule, and to reserve lexical markings for exceptions. She provides no account for the fact that antepenultimate stress is more general than penultimate stress in English nouns with light penultimate syllables, which is demonstrated and explained in section 3. While Selkirk's approach is for this reason somewhat problematic, in the next section I will show that it does express a valid insight: that LPS is not simply an idiosyncratic exception to be marked in the lexicon, but is productively generated by the grammar.

2. Light penult stress is productive

As discussed above, Hayes (1980/81/82), and Halle and Vergnaud (1987) posit the operation of a 'virtually exceptionless' rule of noun extrametricality, with special lexical markings for instances of LPS (the somewhat different geminate analysis is further discussed in section 3). Under this account the following predictions should hold:

i. Words with LPS should be relatively rare
ii. The lexicon should be expanded in accordance with the rule, not the exception
iii. Regularization should be toward antepenultimate, and never penultimate stress
iv. In tests of productivity, antepenultimate stress should be strongly preferred

In this section I will demonstrate that all of these predictions are false, prompting the conclusion that LPS is a productive pattern of English stress.

2.1 LPS is widespread

Discussions of LPS provide but a few examples, with the implication that 'these are quite marginal cases' (Halle and Vergnaud 1987: 231). To test my intuition that these words are less marginal than is usually recognized, I compiled a list of all the instances of LPS I could find in Kenyon and Knott (1953), supplemented by a few other common words missing from that source. The result of this search is displayed in the Appendix. Words such as those in (5) have been omitted from the list.

(5) alárum appárel Sahára siérra sombréro Trocadéro

As vowel quality is usually neutralized before /t/, the underlying weight of the penultimate
syllables is somewhat indeterminate, though the words in (5) are transcribed by Kenyon and Knott with lax vowels. Even with the omission of words like these, the Appendix is of considerable size. A rough estimate is that it constitutes about 20% of the relevant cases in Kenyon and Knott (1953). This is ample evidence that LPS is in fact not particularly rare.

2.2 LPS is used in new words

Especially prevalent amongst LPS words are North American place names. In fact, if a survey of the stress facts of English were confined to an atlas, LPS might be considered the rule, rather than the exception. In disputing the productivity of trisyllabic laxing, Kahn (1980: 11) points out that 'the language expands its lexicon as though the rule didn't exist (Idaho, Omaha, etc.)'. This comment applies equally to the rule of extrametricality, given the number of North American place names that must have entered the language relatively recently.

One might object that the pronunciation of American place names simply reflects the stress patterns of the languages from which they were borrowed, rather than being productively coined. While somewhat cogent, there are two flaws in this argument. One is that these words have been regularized in all respects except this one. Why should extrametricality be special under a rule-based account? The second is that words are sometimes adapted into English with LPS in conflict with the evidence in the source language. Willamette is one particularly jarring example of this, since words ending in -ette are usually pronounced with French-like final stress. Another instance is the penultimately stressed variant of Monáco, which must be an English innovation, since as Nessly (1974: 520) points out, it is stressed initially in Italian, Spanish and Portuguese, and finally in French. In addition, a fairly large class of these words comes from the usual American pronunciations of Japanese names such as those in (6):

(6) Osáka Kawasáki Takáko

Takako Kawasaki (p.c.) points out that these are the default assumptions for most English speakers\(^5\), even though all of these words have antepenult high pitch in Japanese. That the Japanese high pitch is interpreted by an English speaker as stress is substantiated by Kenyon and Knott's (1953) citation of Osaka with antepenultimate stress in Japanese. Further evidence of this propensity for penultimate stressings of Japanese names comes from Nessly (1974), who asked four native speakers of English to provide as many Japanese names as they could remember. Very few of the words received anything but penultimate stress.

This phenomenon is mirrored in Spanish, as discussed by Saciuk (1969: 109). Under his analysis, the native pattern is penultimate stress, with antepenultimate stress being reserved for [-Native] words. In support of the productivity of the [-Native] rule, he points to a group of words that are antepenultimately stressed, even though the languages from which they are borrowed stress the words on other syllables.

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\(^5\) This observation is supported by the transcriptions in Kenyon and Knott (1953) and Webster's (1981), which give Osáka and Kawasáki as the English pronunciations.
2.3 Regularization is bidirectional

It is indubitably historically significant that the words in the Appendix seem to have all entered English in the last few centuries. While this may or may not justify treating them as synchronically special in some way, we are at least assured that by assuming that LPS is productive, we are not 'groveling in the muck left behind by historical change' (Hayes 1982: 238). It is also significant, however, that once in the language, they do display a considerable resistance to 'regularization' to antepenultimate stress. Besides Monaco, only learned or obscure words, which might not be heard before being spoken, currently alternate between penultimate and antepenultimate stress.6

(7) abatis Aquila Attila Balthazar Barabbas debacle Haliver Kanaka Popacatepetl

The two most common of these words appear to be undergoing 'regularization' in opposite directions. Kenyon and Knott (1953) list only Attila and débacle. Débacle is given as an alternate pronunciation in Webster's (1981), while Attila is attested in Webster's (1989). While Jensen (1993) claims that the British pronunciation Átila is the regularized form of the American Attila, this is contradicted by the fact that Attila is the more recent pronunciation. A more likely account is that débacle is being treated as a 'native' word, and Attila as a 'foreign' one, with antepenultimate stress the norm for 'native' words and penultimate stress for those that are 'foreign'. This is made more explicit in section 2.5.

2.5 LPS is used frequently in tests of productivity

In his repudiation of Selkirk's (1980) view that stress is stored lexically and that the regularities in the language can be captured by a template describing the maximal foot, Hayes cites evidence from historical change, the role of the cycle, and experiment in favour of the productivity of his rules of stress.7 The last of these is based on the work of Trammell (1978):

Trammell (1978) has shown that when subjects are asked to read unfamiliar words of English, for the most part they prefer pronunciations having feet that are maximal according to the rules that follow. (Hayes 1982: 239)

To some extent, Hayes is justified in making this claim, since Trammell's subjects do display a

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6 The variant umbrëlla, with initial primary stress and an unreduced penultimate vowel, does exist in some areas of the United States. However, this form is problematic for any theory, since neither a combination of consonant and syllable extrametricality (Selkirk 1984), nor extrametricality and the rhythm rule (Halle and Vergnaud 1987) can account for it. One possible approach is suggested by Prince and Smolensky's (1993: 43) definition of Nonfinality: 'The head foot of the Prosodic Word must not be final.' This constraint is violated by umbrëlla, but not umbrëlla, provided that the foot is final in the prosodic word, which is only the case if LPS words are treated as exceptions to extrametricality. The problem, of course, is that without further elaboration this predicts that all LPS words should have non-final stress if there are two feet in the word. A constraint domains analysis as put forth in section 3 could resolve this dilemma, but the analysis there is limited to the positioning of the rightmost stress, whether primary or secondary.

7 The evidence from historical change involve shifts in the main stress placement on donate type verbs, which is irrelevant to the case at hand, as is the cycle, since we are dealing with monomorphemic words.
high degree of regularity in their pronunciation of learned Greek, Latin, and Germanic words. However, most of the variation can be attributed to the presence or absence of extrametricality markings. Words that have a majority of antepenult stress vary greatly in whether or not they have secondary stress on the final syllable, which would be accounted for by Selkirk (1984) as being due to a lack of final consonant extrametricality, and by Halle and Vergnaud (1987) as exceptionality to extrametricality combined with the Rhythm Rule (Hayes treats final stress as underlingly specified, which seems to be contradicted by this result). Especially significant for present concerns is the fact that one of the two words that the Trammell claims disobeyes the rules of SPE is petasos, which usually received penultimate stress. This pattern can actually be accommodated by the rules of SPE, since the single consonant could be interpreted as an underlying geminate. It cannot, however, be generated by the rules of Hayes (1980/81/82) or Halle and Vergnaud (1987). A lack of strong preference for antepenultimate stress in light penult words is also seen in the experiments of Nessly (1974), Baptista (1984), and Pater (1993), all of which study the pronunciation of nonsense words. Since each of these studies contains but a small number of relevant tokens, and there is variation from item to item, it is impossible to make any strong claims based on these data. However, the evidence that there is suggests that native speakers display considerable uncertainty about the placement of stress when confronted with an unknown word with a light penultimate syllable. This is in fact recognized by the authors of SPE (p. 151):

[A] person who is given the "segmental" phonetic representation for the name of the Massachusetts town Assinippi would not be able to determine whether the stress contour should be Assinippi or Assinippi, although he would know that these are the only possibilities.

In conclusion, none of the predictions that a diacritic-based account of LPS makes are substantiated. The only argument for treating LPS as exceptional is that it is somewhat less frequent than antepenultimate stress. In connection with this, it should be noted that Pinker and Prince (1991) have conclusively demonstrated that frequency is not necessarily a correlate for rule-based productivity in the domain of morphology. There is no reason to believe that the situation is any different in phonology. In contrast, any genuine test that can be applied indicates that LPS is in fact productive.

3. Doing light penult stress in the grammar

3.1 A model of lexical constraint domains

Having established that LPS is productive in English, the question that must be addressed is how to construct a grammar that allows either penultimate or antepenultimate stress for a word with a light penult. As alluded to at the end of the last section, Chomsky and Halle (1968) achieve this by positing underlying gemination for English, so that no diacritics are needed to generate LPS. Some putative motivations for, and problems with this account are discussed in the next section. However, at this point we can note that with no further elaboration, underlying gemination predicts that 'apparent' LPS should be spread throughout the language, since there is no restriction on the occurrence of gemination. Besides demonstrating the frequency of LPS, the Appendix serves another purpose. It allows us to determine whether LPS is evenly distributed in
the lexicon or whether it is restricted to a special class of words. It is quite evident that the latter is more accurate. While LPS words cannot be captured as a class by a simple etymologically based diacritic like [+Latinate], they do seem to fall into four main categories:

i. Borrowings from romance languages: e.g. antenna, armadillo, banana, spaghetti
ii. North American and other place names: e.g. Alabama, Cincinnati, Manila, Nantucket
iii. Biblical names and terms: e.g. Armageddon, Belshazzar, Gehenna, Nebuchadnezzar
iv. Proper names: e.g. Joanna, Henrietta, Botticelli, Buchanan, Vanessa

These four groups can in turn perhaps be distilled into the two classes of borrowings and names. Thus, there is a sense in which these words can be seen as peripheral to the more common penultimately stressed words. There are no Anglo-Saxon or other Germanic words, usually considered the native stratum of English, that display LPS. One might speculate that extrametricality in fact arose as a means of preserving initial stress on trisyllabic Germanic words when the system shifted to right-to-left iterative trochaicity. In any case, an appropriately vague way of characterizing the difference is to say that LPS is a productive property of the periphery of the grammar, and antepenult stress the core. That LPS is productive for words in the periphery explains why it is used relatively often in the pronunciation of unfamiliar words in experimental settings, and why it is the default assumption for obviously foreign words, which might include North American place names based on words from Native American languages, along with Japanese names (but not French words, which usually receive final stress - cf. Nessly 1971).

The observation that LPS belongs to the periphery of the language leads to an alternative to the SPE method of accounting for the productivity of LPS. The basic claim of Itô and Mester's (1993a) model of lexical stratification is that the core set of lexical items may be subject to constraints that do not hold of entries in the periphery. Inasmuch as extrametricality can be understood as a constraint on representations, this account of the relationship of core and peripheral elements in the lexicon applies perfectly to the case at hand. As a word becomes nativized, it moves into the core of the grammar, becoming subject to its constraints. The differences in the pronunciations of débâcle and Attila can in this view be attributed to their position in the lexicon, as illustrated by the following Venn diagram:

Constraints within a given cell, or constraint domain hold of all lexical items within that cell. The final syllable of débâcle or Attila is extrametrical if the word in the core of the lexicon, but not if it is in the periphery. As extrametricality is here conceived as applying to output rather than underlying representations, there is no need to stipulate any sort of diacritic in the underlying forms of these words. Thus, there is no sense in which the peripheral pattern is not generated by the grammar.

This is of course an unconventional characterization of extrametricality, but it is exactly
the one argued for in the Optimality Theory of Prince and Smolensky (1993), and McCarthy and Prince (1993a&b). In the remainder of this section, I provide an explicit Optimality-based account of noun 'extrametricality' and 'non-extrametricality' in English, and show how this account extends to the stress behaviour of adjectives.

3.2 An Optimality account of extrametricality in English

In this brief paper a proper exposition of the precepts of Optimality Theory is impossible, so the reader completely unfamiliar with it is referred to the above works, especially chapter 4 of Prince and Smolensky (1993), as well as McCarthy and Prince (1993b). The following, however, are the basic principles, as stated in McCarthy and Prince (1993b: 4):

(9) Principles of Optimality Theory
   a. Violability
      Constraints are violable, but violation is minimal.
   b. Ranking
      Constraints are ranked on a language-particular basis; the notion of minimal violation is defined in terms of this ranking.
   c. Inclusiveness
      The constraint hierarchy evaluates a set of candidate analyses that are admitted by very general considerations of structural well-formedness.

In addition, it is assumed that the constraints evaluate a fully prosodified structure - there is no sense in which the representation is constructed from the bottom-up, or even the top-down. Prosodic structure is supplied all at once to the unprosodified input string of features. The constraints have access only to the output, and not to any intermediate stage of prosodic construction, or even the input (the last being the position of McCarthy and Prince 1993b).

For our purposes, there are two relevant constraints at work. The first demands that there be a foot lined up with the right edge of the word. Called 'Edgemost' in Prince and Smolensky (1993), this can be stated in the terminology of McCarthy and Prince (1993b) as an Align constraint:

(10) Align-Right
   'Align the right edge of a prosodic word with the right edge of a foot'

Also active would be a constraint demanding that the edges of the morphological word be aligned with the prosodic word (where morphological word includes the root, prefixes, and suffixes). As this is not violated, its precise formulation is not important here.

The second constraint is the one which compels non-alignment of the prosodic word with a foot, which as Nonfinality is Prince and Smolensky's (1993) replacement for extrametricality. This constraint can be stated as the converse of (10):

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8 The precise formulation of this Align constraint is somewhat different from that in McCarthy and Prince (1993b), since the concern here is only with the placement of foot boundaries, rather than of main stress. See also Pater (1994) for further discussion of Align constraints and stress placement in English.
(11) *Align-Right

'Don't align the right edge of the prosodic word with the right edge of a foot'

These constraints are obviously in conflict, since there is no way that both can be satisfied, leaving aside the possibility of having no feet in the word. In Optimality Theory, conflict is resolved not by having one constraint ON and the other OFF, but by having them ranked. All else being equal, the output will satisfy the higher ranked constraint, and violate the lower one. Thus we can say that the higher ranked constraint is 'active' (see Prince and Smolensky 1993: 107 for a formal definition of this term).

The constraint domain analysis of LPS becomes one of differential ranking of constraints in the lexical domains. The core 'extrametrical' domain has *Align Right >> Align Right (where >> indicates the relationship of dominance), while the peripheral 'non-extrametrical' domain has Align Right >> *Align Right. Besides these two constraints, the hierarchy in the two domains is identical. To illustrate how these constraint rankings select the correct output, the tableaux in (12) are provided:

(12) a. Core

Input: debacle

<table>
<thead>
<tr>
<th></th>
<th>*Align Right</th>
<th>Align Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>(x x) x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>debacle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>* !</td>
<td></td>
</tr>
<tr>
<td>x(x x)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>debacle</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. Periphery

Input: debacle

<table>
<thead>
<tr>
<th></th>
<th>Align Right</th>
<th>*Align Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>* !</td>
<td></td>
</tr>
<tr>
<td>(x x) x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>debacle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>x(x x)</td>
<td>debacle</td>
<td></td>
</tr>
</tbody>
</table>

Asterisks indicate violations of constraints, and an exclamation mark a fatal violation. If debacle is in the core of a speaker's lexicon, then the tableau will be as in (12a), with a foot unaligned
with the right edge, which results in antepenult stress on the optimal form (pointed to by the hand icon). If it is in the periphery, the tableau looks like (12b), with right-aligned penultimate stress chosen.

3.2.1 *Align and stress on adjectives

It is observed in SPE that for the most part, words constructed with adjectival suffixes behave like nouns with regards to stress. (15) gives examples parallel to those in (1):

(13)  
a. 'XLX: original medicinal precipitous calamitous
b. X'IX: parental incidental tremendous amorphous
c. X'HX: anecdotal medieval desirous

Exceptions to this are words ending in the suffix -ic, which consistently have LPS:

(14)  
X'lx: metallic alcoholic narcotic aldermanic platonic Socratic

Hayes (1980/81/82) and Halle and Vergnaud (1987) deal with adjectives ending in -ic, and -id, by marking them as exceptions to extrametricality, which applies to suffixed adjectives along with nouns. This disjunctive treatment of these two instances of 'exceptional' stress raises a serious learnability problem. Why should the learner posit underlying stress, or an underlying [+Accented] diacritic, for LPS in nouns, but a [-Rule] diacritic for LPS in adjectives? A more reasonable scenario is that LPS nouns and adjectives are both simply assigned to the same peripheral domain of the lexicon.

Unsuffixed adjectives provide further evidence of variable behaviour with regard to extrametricality, or *Align Right. Though most authors treat monomorphic adjectives together with verbs as not being subject to syllable extrametricality (cf. Hayes 1982, Selkirk 1984, Halle and Vergnaud 1987, as well as SPE), Halle and Keyser (1971) point out that the majority of adjectives are correctly stressed by the noun rule (the similarity of noun and adjective stress is also noted by Jespersen 1909/54, and Burzio 1992). Of particular interest are those that end in a consonant cluster:

(15)  
a. earnest honest modest haggard ribald covert fecund awkward jocund subject expert perfect forward second

b. absurd corrupt immense robust overt august succinct occult abstract direct

The stress pattern of the adjectives in (15a) can only be derived with syllable extrametricality, since consonant extrametricality alone would still leave a heavy syllable in final position (recall Hayes' criticism of zero extrametricality, discussed in Section 1). Finally stressed adjectives like those in (15b) are provided by Chomsky and Halle (1968) in support of their contention that adjectives form a class with verbs. However, a significant difference between (15a) and (15b) is that the latter is comprised entirely of words borrowed from Middle French or Latin, whereas (15a) contains some Germanic words, as well as some borrowed from Old French. Further, some of those in (15b) have developed variants with initial stress and reduced vowels (robust, overt—these alternate pronunciations, as well as the etymologies, are from Webster's 1981). This lends
credence to the view that the core pattern for both suffixed and unsuffixed adjectives is to obey *Align Right >> Align Right*, as in (13) and (15a), and that the pattern produced by Align Right >> *Align Right*, seen in (14) and (15b), is peripheral.

Thus, by treating noun LPS as the product of reranking of the 'extrametricality' constraint *Align Right, we obtain a unified account of the peripheral patterns in nouns and adjectives. Of course, Hayes (1980) and Halle and Vergnau (1987) could have extended their 'zero extrametricality' analysis of -ic adjectives to nouns to achieve the same level of generality. Hayes' (1980) reasons for not doing so were discussed in section 1. Next I will examine Halle and Vergnau's (1987) justification for underlying line 1 asterisks, as well as some related arguments for the underlying geminates of SPE, all of which focus on potential deficiencies of Selkirk's (1984) analysis of LPS, and by extension, of the one put forth here.

4. Independent evidence for underlying stress or gemination?

The argument presented by Halle and Vergnau (1987) for the rejection of Selkirk's (1984) analysis of LPS is based on a misrepresentation of her position. They point out that if stems like Kentucky, and Mississippi were marked as exceptions to extrametricality, then one might expect words derived from them, like Mississipian and Kentuckian, also to have penultimate stress. Since Selkirk (1984) takes a representational approach to extrametricality, and does not assume that LPS words carry any diacritics, her theory does not predict penultimate stress in the derived forms. Similarly, in the present account the rankings represented by the lexical constraint domains only apply at the root level of the phonology (cf. McCarthy and Prince 1993a on levels in Optimality Theory). When entering the suffix level, LPS words carry no special flags that mark them as 'non-extrametrical'.

Though Halle and Vergnau's criticism carries little force, there are two ways in which LPS nouns behave differently from antepenultimately stressed nouns that cannot be captured by the minimally elaborated constraint hierarchy supposed thus far:

(16)

a. LPS words, like bacillus, cerebellum, and patella retain their penultimate stress when -ar is added - bacillar, cerebellar, and patellar. Like the related suffix -al (see ex. 14), -ar is extrametrical (cópula/cópular), not stress-neutral (molecule/molécular, columna/columnar). In a metrical theory that assumes Bracket Erasure between levels (McCarthy and Prince 1993a) or Stress Erasure between cycles (Halle and Vergnau 1987) the penultimate stress in these words is unpredicted unless the penults of these LPS words are heavy (cf. Burzio 1992: 32).

b. LPS words never undergo 'CiV lengthening' with -ian suffixation, as opposed to antepenultimately stressed words e.g. Nevada/Nevadayian vs. Canada/Canadayian. In this

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9This abstracts from apparent differences in the stress shift patterns in nouns and adjectives (cf. Halle and Keyser 1971). For discussion of some complications induced by final secondary stress, see Pater (1994).
way they behave analogously to words with closed penults, like *Alex[ə]ndrian*\(^\text{10}\).

These facts show that the penults of *LPS* words are closed by the following consonants. This is predicted if these consonants are underlying geminates, which seems to provide some motivation for the treatment of noun *LPS* as a phenomenon separate from the adjectival stress patterns discussed above. In what follows, I will show that this behaviour is caused by independently motivated constraints in the phonology, thus rendering the underlying gemination account of these facts superfluous, and allowing us to retain the unified analysis of 'exceptional' stress patterns. As the *CiV* case is more complex, and has apparently yet to be mentioned in the literature, it will be the focus of the discussion.

4.1 The problem

In (17), some examples of *CiV lengthening* are provided.

(17) a. /æ/- > /ey/ /ɛ/- > /iy/ /ʌ/- > /uw/ /ɑ/- > /ow/

<table>
<thead>
<tr>
<th>Alsatian</th>
<th>collegian</th>
<th>Lilliputian</th>
<th>Chekovian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arabian</td>
<td>comedian</td>
<td>Venusian</td>
<td>Bostonian</td>
</tr>
<tr>
<td>Canadian</td>
<td>Handelian</td>
<td>Malthusian</td>
<td>Babylonian</td>
</tr>
<tr>
<td>Iranian</td>
<td>Mendelian</td>
<td></td>
<td>Kingstonian</td>
</tr>
</tbody>
</table>

b. /ɪ/- > /i/ /aɪ/- > /i/ /ɪ/- > /i/

| Floridian   | crocodilian  |             |           |
| Justian     | Christian    |             |           |
| Davidian    | Palestinian  |             |           |
| civilian    | Carolinian   |             |           |

As pointed out by Myers (1985), *CiV lengthening* only affects non-high vowels (17a), while high vowels surface as short (17b). */aɪ/- > /i/ in (17b) is therefore an example of the more general process of English vowel shortening, which is given a non-derivational analysis in Section 4.4.

There are a number of idiosyncratic exceptions to *CiV lengthening*, such as *Maxwellian* and *Italian*, both of which have short stressed vowels. However, there are two groups of systematic exceptions:

(18) a. Alexandrian Columbian Dickensian Liverpudlian Zoroastrian

b. Indianian Kentuckian Louisianian Machiavellian Nevadian Parnassian\(^\text{11}\)

---

\(^{10}\) (16b) was brought to my attention by Bill Idsardi, who attributes the observation to Merris Halle. Other arguments from SPE for underlying gemination succumb to a treatment parallel to the one to be proposed, as will be discussed below.

\(^{11}\) These are all from Kenyon and Knott (1953), and Webster's (1981), who are obviously deaf to the protestation of Hoosiers that there is 'no such thing as an Indianian'.
The words in (18a) have two consonants between the target and the trigger of the rule, while those in (18b) are all derived from roots with LPS. The difference between Nev[ə]dian and Can[ey]dian shows that there is more than just a spelling based rule at play here (cf. Jaeger 1986).

SPE's postulation of underlying gemination for the roots of the words in (18b) predicts that (18a) and (18b) should behave as a class with regards to their vowel tensing rule, whose environment is /_CiV/. Chomsky and Halle (1968) do in fact point to the similar alternation between gymnasiu[m] and potassiu[m], as well to the voicing difference in the post-penultimate consonants of the words, in support of geminates in English.

Just as CC vs. C has been in eliminated from the SPE account of English stress in favour of a heavy vs. light syllable distinction, an analysis of CiV lengthening should similarly abandon the linear rule formulation (see Sherer 1993 for relevant discussion). One way of doing so is to appeal to Borowsky's (1989) constraint that rimes are maximally bipositional, or bimoraic. If this 'Bimoraic Maximum' constraint is ranked above the constraint forcing lengthening of non-high vowels, which we can simply call 'Lengthen [-high]/CiV' in absence of a better understanding of the process, then CiV lengthening will not apply if the syllable is heavy (closed).

Once the SPE 'double consonant' representation is translated into prosodic theory as a moraic consonant (Hammond 1993, 1994), the transformation of the linear analysis into current formalism is complete. Since the underlying mora is retained in the surface form, the use of the non-linear representation avoids the surface neutralization of the underlying consonantal length contrasts in the SPE analysis (Hammond 1994). Because of this, underlying moraicity is a relatively unobjectionable means of accounting for LPS, and the fact that it leads to a straightforward analysis of the exceptionality of LPS words to CiV lengthening makes it quite appealing. However, there are independent reasons, some already discussed in the literature, for why the post-penultimate consonants of LPS words should be moraic, or in more theory neutral terms, part of the penultimate syllable.

4.2 Stress-to-Weight in English

Anderson and Ewen (1987) and Giegerich (1993) propose that a consonant in English is ambisyllabic under the conditions in (19):

(19) A consonant is ambisyllabic if it is (part of) a permissible onset (cluster) and if it immediately follows a stressed lax [short] vowel (Giegerich 1993: 57).

In justification of this claim, Anderson and Ewen (1987: 67) cite Jespersen's (1950) observation that 'in words like better, upper, jester, and biscuit it is impossible to fix the point of syllable division and determine where the first may be said to end and the second to begin.' This is claimed to contrast with a word like beater, where the syllable break more clearly follows the long vowel.\(^{12}\) Anderson and Ewen also mention the experimental evidence of Fallows (1981),

\(^{12}\) This use of the term ambisyllabic is different from that of Kahn (1980), who recognizes no distinction between the syllabification in these two cases. Also, the present version of ambisyllablecity does not attempt to account for phenomena such as flapping and aspiration (see Kiparsky 1979 and Jensen 1993 for foot based accounts of these consonant alternations).
who shows that preliterate children are sensitive to this distinction in the syllabification of consonants following long and short vowels. Other studies showing results from a variety of tasks that are consistent with Fallows' findings are Treiman and Danis (1988), and Treiman and Zukowski (1990). In addition, the work of Cutler et al. (1986) points to a robust difference in the way French and English native speakers syllabify a word like balance, even if they hear the word pronounced in the other language.

While these intuitive and experimental justifications are suggestive, this variety of ambisyllabicitvce receives little formal motivation in either Anderson and Ewen (1987) or Giegerich (1993), and what there is might seem unsound. As Giegerich (1993) states:

\[(20)\] Stressed syllables must be heavy while unstressed syllables may be light: any stressed syllable, whether it is a monosyllable or part of a polysyllabic word, must have a complex rhyme (that is, a rhyme containing at least two X-positions). It is a consequence of this condition on stressed syllables that there can be no lexical words of the form */bI/ in English...

There are two apparent flaws in this. First of all, that a monosyllable containing a lax vowel requires a coda to satisfy a minimal word requirement is derivable from a requirement that feet must be binary on some level of analysis (bisyllabic or bimoraic) (McCarthy and Prince 1986, Prince and Smolensky 1993). Therefore, this phenomenon does not force the position that all stressed syllables must be heavy. Secondly, this proposed constraint flies in the face of the reanalyses of Myers' (1987) account of vowel shortening presented in Halle and Vergnaud (1987), and especially Prince (1991). While Halle and Vergnaud specify only that vowels in the head position of binary constituents (feet in other frameworks) are shortened, and make no claim about vowel shortening being linked to weight reduction, Prince explicitly states that vowel shortening is a readjustment process changing a HL foot into a LL one. In fact, since Prince (1991) denies the existence of a Stress-to-Weight principle, and since he rules out LL \(\rightarrow\) HL on universal markedness grounds, Giegerich's proposal is unstateable in his theory.

However, there is some additional evidence that Giegerich's constraint is in fact active in English, and that Prince's theory is overly restrictive (see Kenstowicz 1994: 592 for similar criticism of Prince 1991). Burzio (1992: 115), commenting on Halle and Mohanan's (1985) lexically marked rule of lengthening, points to the following regularity:

\[(21)\] Burzio's generalization

...[I]n a sequence V_{i}V_{i+1}, if V_{i} is stressed, it is always long. Thus, in contrast to hundreds of sequences /Cay\_Ε/ (namely: consonant, long i, reduced vowel)...the English lexicon contains no instances of /CIE/, with 'i' stressed but short. Vowels other than 'i' seem to behave quite analogously...

Some examples are given in (22):

\[(22)\]

a. Unstressed, short: various, maniac, simultaneous, algebra, formula, mora...
b. Stressed, long: variety, maniacal, simultaneity, algebraic, formulaic, moraic...
A requirement that stressed syllables in English must be bimoraic allows a straightforward explanation for Burzio's generalization (see Burzio's own analysis for a less direct one, and Dresher and Lahiri 1991 for historical precedent for the bimoraic minimum). When there is an intervocalic consonant, the incorporation of the consonant into the coda of the stressed syllable fulfills this requirement, as claimed by Anderson and Ewen, and Giegerich. In the absence of a consonant, bimoracity is achieved by vowel lengthening\(^\text{13}\).

An Optimality Theoretic expression of this explanation requires a constraint that drives the bimoraic minimum for stressed syllables. Though the pre-Optimality Prince (1991) rejects a Stress-to-Weight principle, he suggests in a footnote that 'a more even-tempred position would hold that Stress-to-Weight is a principle, but one with a different position than Weight-to-Stress in the ranking of rhythmic priorities'. In the context of Optimality Theory, in which ranking is language specific, the 'even-tempered' position implies that some languages could rank Stress-to-Weight more highly than others. This leads to the stance taken here: in English, Stress-to-Weight is an active constraint, ranked higher than the 'trochaic harmony' constraints that force HL to become LL. In languages that do display HL -> LL, Stress-to-Weight takes its perhaps unmarked position beneath the trochaic harmony constraints.\(^\text{14}\)

With an account of the bimoraic minimum in hand, the next issue to resolve is why vowel lengthening only occurs if there is no intervocalic consonant. That is, in the terminology of moraic theory, why should adding a mora to a consonant be more optimal than adding an extra mora to the vowel? An answer to this is provided by the premise that unstressed syllables are 'weak licensers' (cf. Ito and Mester 1993b, Steriade to appear), so that if possible, an onset of an unstressed syllable will also be linked to, and licensed by, a stressed syllable. The addition of a mora to the intervocalic consonant both satisfies Stress-to-Weight and licenses the consonant, while adding the mora to the vowel provides no succor to the unlicensed consonant\(^\text{15}\).

One might well ask why the non-licensing of a consonant between two unstressed syllables, or following a long vowel, does not lead to its deletion. This is because in contrast to the theory of licensing proposed in Ito 1989, non-licensing in Optimality Theory does not necessarily force deletion. So long as there is constraint requiring the realization of underlying material (Parse Consonant) that is ranked higher than the constraint demanding licensing,

\(^{13}\) In an encouraging convergence of opinion, the conclusion that English has a bimoraic minimum for stressed syllables has been reached independently by Hammond (1994) in an unpublished manuscript that came to my attention shortly after writing the first draft of this paper. The evidence that he puts forth in favour of the bimoraic minimum for stressed syllables is much the same as that discussed here, though he also provides additional evidence from expletive infixation. The details of the analyses, however, are quite different.

\(^{14}\) See Piggott (to appear) for an alternative approach to trochaic lengthening that does not assume the operation of the Stress-to-Weight principle. He instead uses a slight revision to the Trochaic Rhythmic Harmony Scale, along with the premises that a stressless syllable is made weightless, and that its mora is transferred to the head of the foot, to get tonic lengthening. The approach taken in the present paper to deal with exceptions to 'Galilean principles', which Prince (1991) does recognize English to be, is in fact similar to the one urged in Prince and Smolensky (1993: 188), though that of course does not constitute a justification for it.

\(^{15}\) I have remained silent on how an ambisyllabic consonant is distinguished from a geminate. There are at least two possibilities: either a geminate could be represented with two root nodes or skeletal positions and an ambisyllabic consonant with one (see Tranel 1991 on this type of geminate representation), or the difference could be one of phonetic implementation, as suggested by Borowsky, Ito, and Mester (1984). The choice is irrelevant for the present discussion.
deletion of unlicensed material will not occur (see Ito and Mester 1993b, Ito, Mester, and Padgett 1993 as well as Pater in prep for further comments). As unlicensed consonants are parsed in English, Parse Consonant must be ranked over the constraint that is satisfied by the linking of the consonant to the stressed syllable, which will here simply be called License Consonant.

We need not consider candidates that violate Parse Consonant, since it can be assumed for present purposes to rest undominated and unviolated at the top of the hierarchy. What is important to see is the work done Stress-to-Weight and License Consonant. The tableaux in (23) show these two constraints in action.

(23)

a. Input: Nevada

<table>
<thead>
<tr>
<th></th>
<th>Stress-to-Weight</th>
<th>License Consonant</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Nevada tableaux" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

16 Properly speaking, in Optimality Theory unparsed material is not deleted - it remains present in the representation but is not phonetically realized. As this distinction is not important to the case at hand, the term 'deletion' is retained for expository purposes. An interesting extension of this licensing account is that if vowel reduction is viewed as the non-parsing of the melodic material of the vowel or of the mora (Figgott to appear, Hammond 1994), it could be explained by the ranking of the relevant Parse Vowel Feature/V-Mora constraints below the Vowel Feature/V-Mora Licensing constraints.
b. Input: *moraic

<table>
<thead>
<tr>
<th></th>
<th>Stress-to-Weight</th>
<th>License Consonant</th>
</tr>
</thead>
<tbody>
<tr>
<td>ñ</td>
<td>µ</td>
<td>*</td>
</tr>
</tbody>
</table>
| /
| mor[ey]ic     |                  |                  |
| µ              | *                |                  |
| mor[æ]ic      |                  |                  |

In (23a), there are two candidates that satisfy Stress-to-Weight, but License Consonant chooses the one with the consonant linked to the penultimate syllable via a mora. In (23b), License Consonant does not play a role in determining the structure of the penultimate syllable, but Stress-to-Weight discriminates against the monomoraic candidate. Note that as well as accounting for the fact that stressed vowels are only lengthened in the absence of a following consonant, the application of these two constraints produces the consonantal mora needed to block lengthening when -ian is added to Nevada.

4.3 CiV (non)-lengthening

Crucial here is a theory of the relationship of the structure of the root Nevada to that of the derived word (hereafter stem) Nevadian. In traditional phonological theory, this relationship is expressed derivationally, with the root being used to construct the stem (e.g. Nevada + ian = Nevadian). An anomaly of the fundamentally non-derivational, non-constructionist Optimality Theory is that this derivational conception of morphological relatedness continues to hold sway (see Burzio 1992 for a monostratal approach to metrical consistency, and Bochner 1993 for an essentially declarative theory of morphology).

McCarthy and Prince (1993a) borrow the notion of phonological levels from the theory of Lexical Phonology. In Optimality Theory, what this means is that are are several 'mini-phonologies' in a language, each with its own constraint hierarchy applying one after the other to a single word, so that the output of one level serves as the input to the next. What is important here is not the reranking of constraints between levels, but only that the prosodic structure of a root (i.e. the output of the Root level) is contained within the root + suffix combination (the input to the Stem level). McCarthy and Prince do propose a process of Bracket Erasure that removes prosodic structure from the output of one level before it becomes the input to the next. However, syllable structure is not affected at all in their 'narrow' formulation of Bracket Erasure, and even in the 'radical' formulation, moraic structure remains. Thus, the critical penultimate mora of LPS words is preserved into suffixation.

Besides the Bimoraic Maximum, Parse C-mora is needed to ensure that a mora in the input is faithfully parsed\(^1\). The following Stem-level tableaux show the blocking of CiV Lengthening (24a) and its application (24b):

---

\(^1\) For present purposes, unfaithful parsing is understood to include the reassociation of the consonantal mora to the vowel. Some refinement would of course be necessary to account for cases of compensatory lengthening.
(24)

a. Input: 

<table>
<thead>
<tr>
<th>Bimoraic Maximum</th>
<th>Parse C-Mora</th>
<th>Lengthen/CiV</th>
<th>License Consonant</th>
</tr>
</thead>
<tbody>
<tr>
<td>μ μ μ</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Nev[æ]dian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>μ μ μ</td>
<td>* !</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nev[ey] dian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>μ μ&lt;μ&gt;</td>
<td>* !</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nev[ey] dian</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. Input: Canadian

<table>
<thead>
<tr>
<th>Bimoraic Maximum</th>
<th>Parse C-Mora</th>
<th>Lengthen/CiV</th>
<th>License Consonant</th>
</tr>
</thead>
<tbody>
<tr>
<td>μ μ</td>
<td></td>
<td>* !</td>
<td></td>
</tr>
<tr>
<td>Can[æ]dian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>μ μ μ</td>
<td>* !</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can[ey] dian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>μ μ</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can[ey]dian</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference between the results of (24a) and (24b) lies in the presence of the unparsed mora (indicated as <μ> in the bimoraic version of Nev[ey]dian). To avoid the output Can[æ]dian, License Consonant is ranked below Lengthen/CiV, and therefore plays no role in distinguishing (24a) and (24b).

This completes the analysis of the LPS blocking of CiV lengthening. It should be noted that a reinterpretation of prevocalic lengthening without Stress-to-Weight would not necessarily undermine the derived ambisyllabic account, since License Consonant alone would ensure ambisyllabic following short vowels, if ranked sufficiently highly. Some additional motivation for this ranking comes the ability of post-short vowel ambisyllabic to account for the data in (25) (cf. Kiparsky 1979, Hayes 1982, Hammond 1989b, Halle and Kenstowicz 1991, and Burzio 1992):
(25) a. Tätamagóuchi
   b. Monòngahéla
   c. origináity

   Winnepesáukée
   Atáscadéro
   medicináity

   Pèmigewássett
   Saskatchewàn
   divisibility

   Kālamazóo
   Valenciennes
   religiósity

(25a) demonstrates the generalization that secondary stress tends to fall on the initial syllable of the word, even though this disrupts the rhythmic alternating pattern of stress. Halle and Kenstowicz (1991) propose that secondary stress is assigned post-cyclically from left-to-right, while Burzio (1992) and McCarthy and Prince (1993b) hypothesize that a constraint of left edge alignment is at work. Consistent with the constraint-based account above, I will adopt the Align-Left analysis (see Burzio 1992, and Pater to appear, for further arguments against Halle and Kenstowicz's approach). In (25b), it is shown that if the second syllable is heavy, Align-Left is overridden. This indicates that Weight-to-Stress >> Align-Left. Since the account here claims that the stressed syllables of original, medicinal, divisible, and religious¹⁸ are all closed, and that this closure, or moraicity is carried into the Stem level, the words in (25c) are predicted to behave like those in (25b), not (25a). This squelches the need, in this case at least, for a powerful rule of Stress Copy (Halle and Kenstowicz 1991), or for stress preservation (Burzio 1992), which are anathema to a theory that assumes Bracket Erasure between levels, or the analogous Stress Erasure (Halle and Vergnaud 1987) between cycles.

4.4 Excursus on vowel shortening

While the constraint forcing CiV Lengthening must be ranked above License Consonant for it to have any effect, vowel shortening can be explained by License Consonant >> Parse V-Mora, where Parse V-Mora is satisfied by the parsing of an underlying vowel as long. This analysis of vowel shortening is in fact the one suggested by Stampe (1979: 49) in discussing Old English shortening:

As in Modern English, a weak vowel is incapable of supporting a consonant in its syllable.¹⁹

Unlike the foot-based accounts of Halle and Vergnaud (1987) and Prince (1991), this analysis of shortening is unthreatened by the occurrence of vowel lengthening under stress when there is no intervocalic consonant. There are, however, three well-known exceptions to vowel shortening which remain to be discussed.

First of all, when a syllable, or a consonant, is 'extrametrical', and does not form a foot

¹⁸ The ranking Align Head >> Align Left accounts for the non-initial stress of these words (cf. McCarthy and Prince 1993b). See below for an explanation of the fact that the initial stress and weight of medicine and origin is not reflected in the derived words.

¹⁹ The constraint favouring syllables with onsets (Onset) would favour ambisyllabic over Stampe's (1979) and Myers' (1987) syllabification of the intervocalic consonant entirely in the coda. McCarthy and Prince (1993b) suggest in an aside that an Alignment version of the Onset constraint might be Align (Syl, L, C, L). This would be violated by an ambisyllabic candidate since the left edge of the syllable to the right of the consonant could not be aligned with the left edge of the ambisyllabic consonant. However, the fact that in one of their own analyses an ambisyllabic candidate must satisfy Onset suggests that this particular Align formulation should be rejected (thanks to John McCarthy for discussion of this point). One alternative is *Align (Syl, L, V, L).
with a preceding syllable containing a long vowel, there is no shortening (see Myers 1987 for discussion and examples). This observation is what led to the Halle and Vergnaud and Prince's purely foot-based treatments of shortening. Here this blocking can be explained by a prohibition against ambisyllabicity across a foot boundary. As suggested by McCarthy and Prince (1993b), this constraint can be formulated in Alignment terms as Align (Foot, Syl), which states that the edge of a foot must be aligned with the edge of a syllable. With Align (Foot, Syl) ranked higher than License Consonant, the extrametrical consonant will remain unlicensed, rather than violate Align (Foot, Syl) by being linked to the preceding stressed syllable across the foot boundary. Without the possibility of licensing the consonant, there is no longer any compulsion to shorten the vowel. That Align (Foot, Syl) is highly ranked in English also explains why the weight of the stressed syllables in words like origin and médecine, as well as Viênne, is not preserved in the suffixed forms original, medicinal and Viennese. Since the final feet of the derived forms must have an onset (due to the constraint Onset), and since Align (Foot, Syl) forbids the sharing of that onset with a syllable outside of the foot, the root's consonantal mora is lost.

Secondly, vowel shortening is confined to a sub-vocabulary of the language, roughly 'Latinate', though not exactly, as obese -> ob/ /fy/sity demonstrates. So far as vowel shortening is a productive part of English phonology, which is certainly the assumption of most work on the subject, this constraint domains approach is eminently suited to it. The non-shortening domain can be characterized by the ranking Parse V-mora above License Consonant.

Finally, words that undergo CiV lengthening are of course not subject to shortening. Myers (1985) and Halle and Vergnaud (1987) attribute this to disjunctive rule ordering, a solution which is not available in Optimality Theory. However, this has already been captured here by the necessary ranking of Lengthen [-high]/CiV above License Consonant (see 24). Since Lengthen [-high]/CiV does not apply to /syl/, which is an underlyingly high vowel (cf. Chomsky and Halle 1968 and Halle and Mohanan 1985), it is shortened like other long vowels in this configuration.

4.5 Against underlying gemination

The derived ambisyllabicity account can be extended to other facts adduced in favour of underlying gemination. That it can explain the penultimate stress in bacillar (see 17a) should be obvious, but there is a more subtle phenomenon that it can cope with as well. The failure of intervocalic voicing to apply following a lax vowel, as illustrated by Chomsky and Halle's pair gymnasmnium vs. potassium, can be attributed to a cross-linguistically widespread constraint against voicing in a coda, usually inactive in English, but ranked above the constraint(s) causing intervocalic voicing (cf. Itô and Mester 1993b for relevant discussion).

As a result, there remain no independent arguments for underlying gemination, while there

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20 Implicit in this formulation is the view that the term 'syllable' includes all of the segmental features dominated by the syllable node, so that all the features of the left-most and right-most segments must be edge-aligned with the edge of the foot. However, this rules out an Align (X, Syl) constraint that is satisfied by a place-linked coda, which appears to be required for Prince and Smolensky's (1993) analysis of Lardil. One way of overcoming this problem is to have the Align constraints target the nodes (and features) themselves, so that they are not sensitive to the alignment of the features that the nodes dominate. In this view of Alignment, Align (Foot, Syl) would be stated as Align (Foot, Root Node), the Lardil Alignment constraint as Align (Stem, R, Syl, R), and the Aztínina Campa Alignment constraint, which forbids place linkage (McCarthy and Prince 1993a: 39), as Align (Stem, R, Place Node, R).
are several reasons to prefer the analysis of LPS developed here. The criticism levied at Hayes' (1980) and Halle and Vergnaud's (1987) treatment of LPS in adjectives and nouns as separate phenomena necessarily applies to the gemination analysis. As Halle and Vergnaud (1987) point out, one must assume that -ic is non-extrametrical, and forms a foot with the preceding syllable, to account for the fact that the vowel in that syllable shortens. Thus, it is not only implausible, but impossible for LPS adjectives to be stored underlyingly with a geminate preceding the suffix, and subject to extrametricality, so as to treat LPS homogeneously.

It is also impossible to integrate the constraint domains model with the underlying gemination account. The coda-like behaviour of consonants following stressed short vowels applies across the board. Since gemination cannot be limited to the periphery, the prediction of the underlying gemination account would have to be that LPS is a property of the lexicon as a whole. As discussed in section 3, an examination of the types of words found in the Appendix shows this to be false.

At the outset of this paper, a distinction was drawn between the justifications for underlying specification that are used in the segmental and syllabic domains, versus those that are used when analyzing stress placement. The former are most often based on contrast, while the latter usually rely solely on predictability. Underlying gemination for LPS would perhaps be the sole instance of non-distinctive underlying moraicity. A positive result of the present analysis is that it avoids the postulation of non-contrastive underlying material just to get the stress rules to work properly. Since Chomsky and Halle (1968) it has generally been assumed that stress is not a distinctive feature of English (cf. Halle and Vergnaud 1987: 232). In this regard, it is noteworthy that not a single minimal contrast exists between the words in the Appendix, and words with antepenultimate stress, with the possible exception of Kanada vs. Cánada, for a speaker whose intervocalic /l/ are flapped and are represented underlyingly as such.

Conclusion

This constraint domains account of 'exceptional' stress in English resolves a problem that might not be at the core of an analysis of English stress, but which has still been the subject of considerable discussion and controversy. One likely reason that there has been so much disagreement about how to treat words with LPS is the intuition that penultimate stress in a word like Mississippi or banana is not particularly exceptional. As shown in section 2 of this paper, this intuition is corroborated by several phenomena that point to the productivity of LPS. On the other hand, that the occurrence of LPS is somewhat lexically restricted has undoubtedly led others to believe that it is the product of an underlying diacritic. With the constraint domains model, the apparent contradiction in the productivity and the peripherality of LPS can be reconciled in a way that would seem impossible in any rule + underlying specification theory.

One could, however, propose a 'rule domains' analysis in which the application of an extrametricality rule is restricted to a certain portion of the lexicon, or alternatively, is ordered variably for different groups of words (cf. Anderson 1969, 1974, Halle and Keyser 1971: 73, Halle and Vergnaud 1987: 244). The constraint based approach of Optimality Theory was chosen for the present study for two main reasons. Firstly, it offers a new and interesting perspective on the vowel shortening and lengthening alternations that interact with LPS. Secondly, by viewing LPS as the reranking of constraints, this paper can serve as a contribution to the emerging discussion on the extent to which these lexical domains can vary.

Itô and Mester (1993a) claim that constraints can only be turned off, and not introduced,
in the periphery. Combining Optimality Theory with Itô and Mester's model forces the abandonment of the idea that the periphery must be subject to fewer constraints than the core, since in Optimality Theory, constraints are never turned off, and the demotion and deactivation of one constraint often entails the promotion and activation of another. This may not be a bad result, though, since if the core penultimate and peripheral antepenultimate stress of Polish and Spanish is expressed in terms of the same constraints responsible for core antepenultimate and peripheral penultimate stress in English, then Itô and Mester's (1993a) hypothesis about the relationship between the core and periphery would appear to be falsified (see, however, Hammond 1989a, Inkelas 1989, Franks 1991, and Idsardi 1992, 1994, on Polish, and Saciuk 1969, Harris 1983, Roca 1988, Inkelas 1989, on Spanish for discussion of the complexities of peripheral stress in these two instances). In any case, the question of how much rearrangement of the constraints is possible between domains remains to be addressed (see Inkelas, Orgun, and Zoll 1994 for critical comments). Obviously, this reranking must be fairly minimal, since languages do not have different lexical classes which behave entirely differently with regards to their phonology. Unfortunately, it would seem that we must await a better understanding of the cross-linguistic limits on constraint ranking (Prince and Smolensky 1993: chapter 9 contains some relevant proposals), as well as the accumulation of further data on language internal reranking, before any well-informed restrictions on the periphery can be established.

References


Pater, J. (in prep.) Coda licensing and the specification of voicing in nasals. McGill University comprehensive evaluation paper.


## Appendix

*N.B. Some words with /æ/ penults have variants with /ɑ/, and vice versa*

<table>
<thead>
<tr>
<th>/æ/ penults:</th>
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