Complexity and the nature of metaphoryn
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1.0 Is metaphor feature-filling or feature-delinking?
Spanish dialects in Northwestern Spain have a rule of metaphor or raising, which raises stressed mid vowels to high under the influence of a final high vowel. Metaphony is illustrated in (1) for Pasiego.

(1) Pasiego metaphor (Penny 1969) (centralization/laxing not shown):

<table>
<thead>
<tr>
<th>no metaphor</th>
<th>metaphor</th>
</tr>
</thead>
<tbody>
<tr>
<td>g[ó]dó</td>
<td>g[û]dû</td>
</tr>
<tr>
<td>kon[ê]xos</td>
<td>kun[i]xu</td>
</tr>
</tbody>
</table>

'fat (neuter); fat (masculine)'
'rabbis, rabbit'

In the metaphor environment, shown in the second column, a high vowel occurs when the following suffix contains the high vowel /-û/, but not otherwise (cf. the first column).

The current literature is divided as to whether metaphor is a feature-filling rule (i.e. a spreading rule; cf. Hualde 1989, Kaze 1991, McCarthy 1984, Vago 1988) or a delinking rule (Goad 1992, see also Vago 1988, Wilson 1988 for discussion). In this paper, I argue in favour of a spreading rule, on the basis of the existence of Head-Dependent Asymmetries (henceforth HDAs; Dresher and van der Hulst 1992) in Spanish phonology.

This paper proceeds as follows: In §1, I present assumptions relevant to the discussion. In §2, I argue that HDAs form an essential part of Spanish phonology, as shown by the distribution of vowels in Spanish words. Given this argument, in §3 I re-examine the rule of metaphor in Pasiego, comparing a spreading and a delinking account of metaphor. I show that an analysis of metaphor as a spreading rule is consistent with the presence of HDAs in Spanish phonology, whereas a delinking analysis is counterintuitive, given the presence of HDAs.

1.1 Assumptions
In this section, I outline several assumptions necessary concerning a) vowel geometry, b) complexity, and c) stress.

1.1.1 Vowel geometry
The vowel geometry I assume is shown in (2); the overall structure is based on Clements (1989) and van der Hulst (1989); the details are motivated by my earlier work on Spanish dialects (Dyck 1992).

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(2) Partial vowel geometry:

Root node

Aperture node

V-place node

[low] [high]

This geometry includes an aperture node for vowel height features and a V-place node for vowel place features (cf. Clements 1989). Vertical lines represent heads and non-vertical lines represent dependents throughout this paper. I assume the monovalent height features[^1] [high] and [low], which are dependents of the aperture node. I abstract away from place of articulation (i.e. the V-place node) in this paper. See Rice, Walker (this volume) for discussion of the V-place node.

The representations assumed for Spanish vowels are discussed in §1.2. Notably, the high and low vowels are specified for height, but the mid vowels have no height features.

1.1.2 Complexity

I make several assumptions concerning complexity, which are drawn from Dresher and van der Hulst (this volume; henceforth DH), and Rice and Avery (this volume; henceforth RA).

Complexity at the segmental level is determined by the number and types of contrasts in a given inventory (RA). The overall complexity of segmental representations increases as the number of contrasts in a given inventory increase (RA). Representations are more complex when dependents (features or nodes) and branches are added to already existing nodes (DH, RA). The correlation between complexity and contrast is illustrated in (3).

(3) Complexity and contrasts
a. A 5-vowel system

/ɪ,ʊ/ /ɛ, ə/ /a/

[hiːɡh] [loː]
(3) b. A 3-vowel system

The high vowels in (3.a) require the feature high in order to express the contrast between mid and high vowels. I assume that mid vowels do not have height features; see Dyck (1992) for argument. On the other hand, the high vowels in (3.b) do not require the feature [high], as the contrast between low and high vowels is expressed by the presence of the feature [low] on the low vowel, vs. the absence of a height feature on the high vowels. The high vowels in (3.a) are more complex than the high vowels in (3.b), since the high vowels in (3.a) have one more dependent than the high vowels in (3.b). The increase in complexity is a direct consequence of having to express more height contrasts in (3.a) than in (3.b). Thus complexity is a function of the number and type of contrasts present in an inventory.

The complexity of vowel representations also varies as a function of Head-Dependent Asymmetries. I discuss two types of HDAs in (4) and (5), and relate these HDAs to the complexity of vowel representations.

For the following discussion, I adopt the prosodic hierarchy assumed in DH (this volume), which includes the prosodic word (ω), the foot (f), the rhyme (r), the mora (m), and the skeletal position (x).

(4) Non-local complexity requirement (foot - segmental levels) (DH this volume):

```
foot          f
  \  /   \  /
rhythm        r  r
  |  |
morae         m  m
  |
segment       x
```

The structure in (4) represents an HDA at the rhyme level. The head (strong) rhyme node may be more complex than the weak rhyme branch (and perhaps more importantly, the dependent rhyme may not be more complex in structure than the head rhyme). To illustrate, DH provide examples of vowel reduction in unstressed syllables: typically, in unstressed positions, fewer vocalic contrasts are allowed (i.e. a lesser degree of complexity is allowed), while in stressed syllables, more vocalic contrasts are allowed (i.e. a greater degree of complexity is allowed). This type of example (vowel reduction) is relevant for the Spanish data presented in §2. Specifically, I claim that Spanish dialects have vowel distribution patterns which are reduction-like, and which argue for the existence of HDAs at the rhyme level in Spanish.

Another type of non-local complexity relevant for the analysis to follow is that of HDAs at the foot level.
(5) HDAs at the foot level:

word  \[w\]
foot  \[f f]\nrhyme  \[r r r r\]
mora  \[m m\]

DH cite as a typical example languages in which main stress appears to be sensitive to quantity, but secondary stress does not. In (5), the head (rightmost) foot can be sensitive to quantity but the dependent foot cannot. I argue in §2 that Spanish has the type of HDA shown in (5),\(^2\) in that the head foot in Spanish is quantity sensitive and can contain heavy nuclei, while dependent feet are not quantity sensitive and cannot contain heavy nuclei.

In summary, I will argue for two types of HDA in Spanish, an HDA at the foot level and an HDA at the rhyme level. I will argue that these HDAs are supported by asymmetries in vowel representations, or asymmetries in complexity, evident in given metrical positions in the Spanish word.

Finally, in order to choose between a spreading and a delinking account of metaphor, I make the following assumptions concerning the relationship between HDAs/complexity and rule types. First, I assume that feature-filling or spreading rules increase the complexity of representations, since they add features and structure to representations. On the other hand, I assume that feature-delimink rules reduce the complexity of representations, since they eliminate features and structure. I then argue in §3 that spreading (i.e. enhancing the complexity of heads) is the process that is relevant for Spanish dialects.

1.1.3 Summary of assumptions

The above assumptions form a model of phonology for Spanish dialects. The highlights of this model are 1) that mid vowels are unspecified for height in Spanish dialects (3.a); and 2) that complexity plays a role in Spanish dialects; specifically, that Spanish dialects have HDAs at the rhyme level and at the foot level.

2.0 Spanish stress and vowel distribution

In this section, I introduce facts about Spanish stress which argue for the presence of HDAs in Spanish. First, I describe and present Harris' (1983) analysis of main word stress and secondary stress. Second, I then show that Harris' analysis of stress provides a basis for identifying which metrical positions represent heads and dependents in Spanish. Third, I then present vowel distribution facts which provide evidence for the heads and dependents posited on the basis of the stress facts. The ultimate purpose of this section is to establish that HDAs are an integral part of Spanish phonology, and to argue that phonological rules such as metaphor must be interpreted in light of strong support for HDAs.

2.1 Main stress

Main stress in Spanish is determined by trochaic foot construction from the right edge of the word (Harris 1983). Other factors, such as extrametricality and quantity sensitivity (Harris' Branching Condition) also influence stress assignment (Harris 1983: 121). The means for deriving main stress assignment are illustrated in (6).

\(^2\) In this respect, I differ from DH, who analyse Spanish as a variant, but not a canonical example, of the type of HDA shown in (5).
(6) Main word stress assignment in Spanish:

a. \[ \text{f} \]
   \[ \text{sa} \] \[ \text{bá} \] \[ \text{na} \]

b. \[ \text{f} \]
   \[ \text{sában} \] \[ \text{-a} \]

c. \[ \text{f} \]
   \[ \text{con} \] \[ \text{vóy(strong)} \]

(6.a) shows the prototypical case of penultimate stress assignment, which applies to monomorphemic words such as [sabána]. To derive (6.a), Harris assumes that trochaic foot construction applies straightforwardly the right edge of the word. Example (6.b) illustrates the type of word that normally receives antepenultimate stress, viz. a word containing a derivational stem [sában] with an inflectional suffix [-a]. To derive the pattern in (6.b), Harris assumes that the penult is extrametrical and that trochaic foot construction ignores the extrametrical syllable.³ Example (6.c) illustrates the stress pattern for monomorphemic words that end with a heavy syllable. Harris argues that for such words, the final syllable must be labelled strong (cf. Harris 1983: 118). Because the final syllable is strong, only a non-branching trochee can be constructed in (6.c). This final example illustrates that Spanish main word stress is quantity-sensitive. I present further evidence for quantity sensitivity in §2.4.

2.2 Secondary stress

Secondary stress is distinguished from main stress by means of a right-strong word tree, which marks the rightmost trochee in a word as strong, and feet preceding the main word stress as weak, as shown in (7). Secondary stress is derived by trochaic footing, which proceeds from right to left, to the right of the main word stress (Harris 1983: 85-87). Unlike main stress, secondary stress is not quantity sensitive (Harris 1983: 122).

(7) Secondary stress (Harris 1983: 122)

a. lócu'a 'craziness'
   \[ \text{ω} \]
   \[ \text{ω} \]
   \[ / \]
   \[ / \]
   \[ / \]
   \[ / \]
   \[ lo \] \[ cu \] \[ ra \]

b. Sàlamánca
   \[ \text{ω} \]
   \[ \text{ω} \]
   \[ / \]
   \[ / \]
   \[ / \]
   \[ / \]
   \[ / \]
   \[ / \]
   \[ la \] \[ sa \] \[ man \] \[ ca \]

³ It is possible to reformulate Harris' analysis by having stress assigned cyclically to derivational stems instead of to words. However, a reformulation is not necessary for this paper; Harris' analysis captures the intuition that stress is basically penultimate and morphological structure affects stress assignment.
(7.a) illustrates a unary branching secondary stress trochee, while (§7.b) illustrates a binary branching secondary stress trochee. Harris assumes that non-branching secondary stress feet are weak; he indicates this by attaching unary secondary stress feet directly to the word, with no intervening foot level.

2.3 **Summary of stress**

In summary, Spanish main stress is derived by building a quantity-sensitive foot at the right edge of the word; if the final syllable is heavy, then a unary foot is constructed; otherwise, a binary trochee is constructed. In addition, extrametrical syllables may cause main stress to be antepenultimate, rather than basically penultimate. Finally, Spanish secondary stress is derived by building quantity-insensitive trochees proceeding from right to left, to the left of the main foot.

2.4 **Implications for segmental complexity**

The above analysis of Spanish stress provides a basis for the claims that I present below concerning HDAs in Spanish. As shown in (8), the metrical analysis in §2.2 assumes two types of head in Spanish metrical phonology.

(8) HDAs in the Spanish word (d=dependent, h-head):

<table>
<thead>
<tr>
<th>word</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ω</td>
</tr>
<tr>
<td></td>
<td>/</td>
</tr>
<tr>
<td>foot</td>
<td>d   h</td>
</tr>
<tr>
<td></td>
<td>/ \   / \</td>
</tr>
<tr>
<td>rhyme</td>
<td>h   d   h (d) d</td>
</tr>
</tbody>
</table>

First, at the level of the word there is a right-strong head. Given this fact, one might expect that an HDA exists at the foot level in Spanish, and that it is instantiated by the distinction between quantity-sensitive main stress and quantity insensitive secondary stress. I present detailed evidence for such an HDA in §2.5.

Second, as shown in (8), a left-strong head exists at the level of the foot. One might therefore expect to find HDAs at the rhyme level in Spanish as well. I demonstrate in the §2.6 that this is the case, with vowels in dependents being less complex than vowels in heads.

In the following sections, I review the evidence which supports the types of HDAs that I have posited on the basis of the metrical structure.

2.5 **Evidence for HDAs at the foot level**

An HDA distinguishing the main stress foot from secondary stress feet is based on the quantity sensitivity of the main foot. Evidence for quantity sensitivity in the main stress foot comes from several facts about stress and vowel distribution, discussed below (cf. Harris 1983: 87-90; 111; 118). The data concerning stress consists of the following (hypothetical and real) words drawn from the discussion in Harris (1983).

(9) Preference for heavy syllables in Spanish (Harris 1983: 87-90):

<table>
<thead>
<tr>
<th>Impossible:</th>
<th>Possible:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. *at[á]pamba</td>
<td>b. atap[ám]ba</td>
</tr>
<tr>
<td>c. *at[á]payba</td>
<td>d. atap[á]ba</td>
</tr>
<tr>
<td>e. *at[á]piaba</td>
<td>f. atap[í]ba</td>
</tr>
<tr>
<td>g. *nawtr[á]go</td>
<td>h. náwtr[í]go</td>
</tr>
<tr>
<td>i. *farmaceut[í]co</td>
<td>j. farmac[é]tico</td>
</tr>
</tbody>
</table>

nonsense word  
nonsense word  
nonsense word  
shipwreck (h)  
pharmaceutical (j)
The impossible patterns in (9) incorrectly stress a light syllable instead of a heavy syllable to the right of the light syllable; the possible patterns in (9) correctly stress the rightmost, heavy syllable. These patterns show that main word stress in Spanish is quantity-sensitive.

Further evidence for quantity sensitivity in the main stress syllable is a series of regular alternations between diphthongs and monophthongs that occurs in Spanish:

(10) Spanish alternating diphthongs:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>h[e]lár</td>
<td>'to freeze'</td>
</tr>
<tr>
<td>b.</td>
<td>h[jé]lo</td>
<td>'I freeze s.t.'</td>
</tr>
<tr>
<td>c.</td>
<td>o[lér]</td>
<td>'to smell'</td>
</tr>
<tr>
<td>d.</td>
<td>h[wé]lo</td>
<td>'I smell s.t.'</td>
</tr>
<tr>
<td>e.</td>
<td>p[e]gár</td>
<td>'to fasten s.t.'</td>
</tr>
<tr>
<td>f.</td>
<td>p[é]go</td>
<td>'I fasten s.t.'</td>
</tr>
<tr>
<td>g.</td>
<td>p[o]nér</td>
<td>'to put'</td>
</tr>
<tr>
<td>h.</td>
<td>p[ó]ngo</td>
<td>'I put'</td>
</tr>
</tbody>
</table>

As shown in (10), monophthongs in non-main-word-stress position (10.a,c) alternate with diphthongs in main-word-stress position (10.b,d). (The forms in (10.e-h) illustrate non-alternating phonemes for comparison.) Under the assumption that diphthongs are universally heavy (Hayes 1990), the diphthong/monophthong alternations in (10) provide evidence that the head foot in Spanish is quantity-sensitive, for it is only in this position that the heavy (diphthong) alternants may appear. This, in turn, is evidence for an HDA at the foot level, since heaviness is only possible in head position.

2.6 Evidence for HDAs at the rhyme level

Evidence for HDAs at the rhyme level in Spanish comes from the reduction-like patterns reviewed in (11).

Spanish also has words such as m[je]dósó 'fearful', in which an alternating diphthong in a heavy antepenult remains unstressed, while a light penult is stressed. Harris' (1983) analysis such examples is that cyclicity is involved. The word 'miedoso' is composed of a derivational stem /mied/, a derivational suffix /os/ and an inflectional suffix /o/. Main stress initially appears on the derivational stem, but moves to the derivational suffix when the latter is added, as shown below:

```
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ω</td>
<td></td>
<td>ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f</td>
<td></td>
<td>f</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>\</td>
</tr>
<tr>
<td>mied</td>
<td></td>
<td>mied os o</td>
</tr>
</tbody>
</table>
```

Examples such as 'miedoso' thus provide evidence for cyclicity, and are not problematic for the assumption of quantity sensitivity. See Harris (1983) for details.
(11) HDAs and vowel distribution in the Spanish word (d=dependent, h=head):

\[
\begin{array}{c|c|c|c}
\text{word} & \omega & / & \\
\hline
\text{foot} & d & h & \\
\hline
\text{rhyme} & h & d & h & (d) & d & \text{je} & a & a & a & a & o & o & o & u & u
\end{array}
\]

As a consequence of the lack of quantity sensitivity in secondary stress feet, a more reduced number of vowels occurs in initial position than in main stress position—the vowels /i, e, a, o, u/ occur in initial position, but not the alternating diphthongs /je/ and /we/, which only occur in main stress position (Penny 1991: 47). In final unstressed syllables, the number of vowels which can occur is reduced even further—only the vowels /e, a, o/ occur in Standard Spanish (Penny 1991: 49), and only the vowels /e, a, o, u/ occur in Pasiego (Penny 1969). Finally, in syllables dominated exclusively by dependent structure, an extremely reduced set occurs—mainly the vowel /a/ in Standard Spanish and Pasiego, and also the vowel /e/ in Pasiego—(Penny 1991: 50-1; 1969). Example (11) graphically illustrates that the number—and hence the complexity—of vowels that can appear in a given metrical position varies with the strength of that position. This vowel distribution provides evidence for HDAs at the rhyme level in Spanish.

2.7 Conclusion: HDAs in Spanish and implications for rule types

The above facts show that in dependent positions, decreased complexity is the rule (i.e. a reduction in the number of contrasts is normal in Spanish). On the other hand, in head positions, increased complexity is the rule in Spanish, as illustrated by the ability to retain contrasts in head positions and the ability to have heavy rhymes in main word stress position. These facts together provide evidence that HDAs are important for the phonology of Spanish.

Having demonstrated that HDAs as realized by asymmetries in vocalic complexity are the rule in Spanish, I draw the following conclusions concerning the types of rules that I predict to occur in Spanish. Given the assumption that there is a correlation between complexity and rule types (cf. §1.1.2.1), I expect dependent positions in Spanish to favour delinking processes, which create less complexity. On the other hand, strong positions should favour spreading processes which create greater complexity, and at the very least, strong positions should disfavour delinking, since there is no evidence in Spanish for reduced complexity in strong positions. In the following section, I evaluate two alternative analyses of Pasiego metaphony in light of the above expectations concerning rule types.

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5 Exceptions to this latter generalization occur in learned words in Standard Spanish and Pasiego.

In Pasiego, syllables dominated exclusively by dependent structure are often copies of the following vowel, particularly in proparoxytonic words; eg. [fespado] 'sod'. It is often the case that such vowels are extremely reduced (i.e. to schwa) in Pasiego.
3.0 Two phonological analyses of metaphor

In this section, I describe in more detail the process of metaphor in Pasiego, first presented in §1. I then present two alternative analyses of metaphor, a spreading account and a delinking account. I evaluate each alternative and decide in favour of the spreading account.

3.1 Pasiego metaphor

In Pasiego, metaphor is triggered by final /u/, and by tonic /ú/ and /í/. Metaphony triggered by final /u/ affects main-word-stress vowels, as illustrated in (12).

(12) Pasiego metaphor (Penny 1969):

<table>
<thead>
<tr>
<th>Non-raised</th>
<th>Raised and non-raised (only the mid vowels raise)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. a[fl][e]ros</td>
<td>a[fl][f]nu</td>
</tr>
<tr>
<td>b. g[R]do</td>
<td>g[R][u]no</td>
</tr>
<tr>
<td>c. a[fl][e]ros</td>
<td>a[fl][i]tu</td>
</tr>
<tr>
<td>d. k[w][e]ros</td>
<td>k[w][e]pu</td>
</tr>
<tr>
<td>e. i [u][n]los</td>
<td>i [u][n]yu</td>
</tr>
<tr>
<td>f. b[j][u]õa</td>
<td>b[j][u]õu</td>
</tr>
<tr>
<td>g. b[r][a]õos</td>
<td>b[r][a]õu</td>
</tr>
</tbody>
</table>

The results of raising can be seen by comparing (12.a,b,c,d), where the mid vowels raise to high. The underlying vowel quality surfaces in the non-raised forms—eg. g[ó]do—which ends with the mid vowel -/o/. On the other hand, the underlying mid vowel [ó] raises to [u] in the form g[u]do, which ends with the high vowel [u]. As shown in (12.e,f.g), tonic [á], [í] and [ú] are unaffected by metaphor. I assume, following Vago (1988) and Goan (1992), that the /a/ is neutral to metaphor. /í/ and /u/ are unaffected because they are already high.

Metaphony triggered by the tonic vowels /í/ and /ú/ affects initial vowels, as illustrated in (13). The affected initial vowels head their own feet (the three-syllable words have the structure shown in (6.a); the two syllable words have the same structure, minus the final vowel).

(13) Pasiego metaphor triggered by tonic vowels (Penny 1969: 52-53; 121):

<table>
<thead>
<tr>
<th>Non-raised forms</th>
<th>Raised forms:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. r[è]yér.os</td>
<td>r[i]yér.u</td>
</tr>
<tr>
<td>b. k[o]t.ér</td>
<td>k[u]t.ín.a</td>
</tr>
<tr>
<td>c. k[o]t.ér</td>
<td>k[u]t.ín.u</td>
</tr>
<tr>
<td>d. g[o]los.os</td>
<td>g[u]lós.u</td>
</tr>
</tbody>
</table>

The tonic vowel in (13.b), k[u]t.ín.a, triggers raising of the pretonic vowel, whose underlying value (i.o) can be seen in the related word k[o]t.ér. The forms [kuðína] and [kuðínu] in particular show that it is the presence of the derivational vowel [í]—rather than an inflectional (word-final) vowel [u]—that causes the first vowel of the stem.

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6 I abstract away from centralization (cf. McCarthy 1984 and Hualde 1989), discussing only the process of raising that results from metaphor
[kuθ-]—underlying /koθ-/—to surface as high. Morphologically, these forms contain a root /koθ-/ a derivational affix /-in/, and an inflectional affix, either /-a/ or /-u/ (Penny 1969: 106). According to Hualde (1989) and Penny (1969), all the vowels in a derivational stem must agree in height, so that a form like *koθina* is not possible.

### 3.2 Summary of characteristics of metaphony

Metaphony in Pasiego has the following characteristics. First, it is triggered by high vowels. The targets are mid vowels to the left of the triggers. Metaphony raises the target mid vowels to high. In the following sections, I present and evaluate a delinking and a spreading analysis of metaphony.

### 3.3 A delinking analysis

Goad (1992) analyses metaphony in Pasiego (and high harmony in general) as a delinking process. In Goad's feature geometry (cf. also Clements 1989), high vowels are characterized by a bare Vo node; mid vowels additionally have the node [open], and low vowels additionally have the node [low] (14.a). Extending the claims concerning complexity in §1.1.2 to Goad's geometry, the high vowels in (14) are the least complex, the mid vowels are more complex, and the low vowels are the most complex.

(14) A delinking analysis of metaphony (based on Goad 1992: 103)

<table>
<thead>
<tr>
<th>a. Underlying vowels:</th>
<th>b. Metaphonized mid vowels:</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>a</td>
</tr>
<tr>
<td>e</td>
<td>e —&gt; i</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Vo</td>
<td>Vo</td>
</tr>
<tr>
<td>[open]</td>
<td>[open]</td>
</tr>
</tbody>
</table>

Metaphony delinks [open] from the mid vowels, resulting in derived high vowels (i.e. vowels with a bare Vo node; cf. (14.b)); low vowels are outside the class of targets for this rule (Goad 1992: 106).

In (15) I illustrate how the delinking analysis of metaphony would appear in the context of complexity.

(15) A delinking analysis of metaphony:

```
  ω
  f
  \ 
  x x
  | | |
  .*.*
  | | | Vo Vo
  ↓ [open]
```
The hypothetical analysis in (15) delinks [open] from an underlying mid vowel just in case the trigger (the inflectional ending /u/ (cf. (12)) is high. In terms of complexity, the rule in (15) makes a head (the main word stress vowel) less complex just in case a non-head (the ultimate vowel) is non-complex.

The rule outlined in (15) is counterintuitive in the context of complexity theory. First, it decreases the complexity of heads in Spanish, which runs against the (exceptionless) tendency to maintain complexity in heads in Spanish. Second, the rule in (15) levels a Head-Dependent Asymmetry, creating a symmetrical representation where an asymmetrical one previously existed. The structure existing before the rule applies is better-formed than the structure created as a result of the rule of metaphor. I argue for rejecting the delinking analysis of metaphor shown in (15) on the grounds that it is not consistent with the facts of complexity, as illustrated through vowel distribution, reduction, etc. in Spanish.

3.4 A spreading analysis

On the other hand, the spreading analysis of metaphor presented below is functionally consistent with complexity in Spanish. In my spreading analysis, metaphor spreads the feature [high] to underspecified mid vowel targets (cf. (3.a)). The vowel representations that result are illustrated in (16), in which the mid vowels /e, o/ neutralize to [i, u].

(16) Representations for vowels after metaphor occurs:

\[
\begin{align*}
\text{i, u} & \quad \text{[i, u]} \\
\text{Pl} & \quad \text{Ap} \\
\text{[high]} & \\
\hline
\text{e, o} & \quad \text{[i, u]} \\
\text{Pl} & \quad \text{Ap} \\
\text{[high]} & \\
\hline
\text{a} & \quad \text{[a]} \\
\text{Pl} & \quad \text{Ap} \\
\text{[low]} & 
\end{align*}
\]

The spreading rule in the context of complexity is illustrated in (17).
The rule shown in (17) increases the complexity of heads by spreading the feature [high] to them. This happens just in case the dependent (the final high vowel) is more complex than preceding heads. The rule in (17) is consistent with the complexity facts in Spanish for several reasons. First, it increases the complexity of heads, and is superior to the delinking account for this reason (recall that a delinking account decreases the complexity of heads). Second, it does so just in case an ill-formed HDA exists in the first place, i.e. just in case the final dependent vowel is more complex than the preceding head vowels. The spreading rule in (17) makes the heads at least as complex as the dependents, resulting in a well-formed HDA structure. In contrast, the delinking account creates an ill-formed HDA structure. Given the merits of the spreading analysis over the delinking analysis, I conclude that a spreading analysis of metaphor in Pasiego is superior to a delinking account, given the nature of HDAs in Spanish. This conclusion answers the question first posed in §1 as to whether metaphor is a spreading or a delinking rule.

While I have addressed the question as to whether metaphor is a spreading or delinking rule, the spreading analysis presented in §3.4 raises several interesting questions. I discuss and resolve these questions in Appendix A, rather than detract from the main point of this paper.

4.0 Conclusions

In this paper, I have shown that complexity theory is a useful tool for choosing between alternative phonological analyses—in this case, between a spreading and a delinking account of metaphor. In the case of Pasiego, only a spreading analysis of metaphor is compatible with the demonstrated presence of HDAs in Spanish.

The functional complexity approach that I have employed in this paper shows promise for evaluating similar cases, where diametrically opposed phonological analyses of the same data seem possible. It seems particularly relevant for those vowel harmony cases which may logically be analysed as either spreading or delinking processes.

References


Appendix A: Atomic vowel quality in Pasiego

In this appendix, I provide Penny's (1969) description of the phonetic value of vowels in Pasiego. This description has several purposes; first, to make clear the transcription used in the body of the paper; second, to provide a basis for discussing several interesting questions raised in Appendix B.

The following are the conventions I use in the body of the paper:

<table>
<thead>
<tr>
<th>Transcription</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a], [e], [i], [o], [u], [ə]</td>
<td>Close to IPA values</td>
</tr>
<tr>
<td>[A]</td>
<td>slightly raised and fronted [a], resulting from metaphony triggered by final /-u/</td>
</tr>
<tr>
<td>[ɔ̃]</td>
<td>see description below</td>
</tr>
<tr>
<td>[œ̃]</td>
<td>see description below</td>
</tr>
<tr>
<td>[l]</td>
<td>lowered and centralized [l], resulting from metaphony triggered by final /-u/</td>
</tr>
<tr>
<td>[o]</td>
<td>see description below</td>
</tr>
<tr>
<td>[ʊ]</td>
<td>see description below</td>
</tr>
<tr>
<td>[U]</td>
<td>lowered and centralized [u]; occurs word-finally and also results from metaphony triggered by final /-u/</td>
</tr>
<tr>
<td>[ɨ]</td>
<td>secondary head</td>
</tr>
<tr>
<td>[ɨ̃]</td>
<td>primary head</td>
</tr>
</tbody>
</table>

An important observation about Pasiego atomic vowels is that they are more lax than vowels in other positions. I describe final vowels and then other atomic vowels below in order to exemplify this point; the significance of the following material becomes apparent in the discussion in Appendix B.

1. Laxness in final vowels:

Penny consistently transcribes the final vowels with lax/centralized counterparts, described below and exemplified in (18).

All [of the final vowels] are articulated [in a manner that is] much more lax than the Castillian corresponding final vowels. [ɔ̃] is lax and palatal;... [œ̃] is lax and very close, but without ever attaining [the quality of] open [i]; ... [ʊ] fluctuates in its place of articulation between an open [u] and a close [o]. The commonest pronunciation is [u]... [Penny 1969: 51]. [U] is somewhat advanced in its point of articulation, and the lips are considerably rounded; it also has a guttural [engolado] timbre. [Penny 1969: 50].
(19) Final vowels in Pasiego:

<table>
<thead>
<tr>
<th></th>
<th>Vowel Pattern</th>
<th>Pronunciation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>/kar+ (a)/</td>
<td>kár[ə]</td>
<td>'expensive (f.)'</td>
</tr>
<tr>
<td>b.</td>
<td>/grand+ (e)/</td>
<td>gránd[ə]</td>
<td>'big'</td>
</tr>
<tr>
<td>c.</td>
<td>/gwen+(o)/</td>
<td>gwén[ʊ], gwén[ø]</td>
<td>'good (n.)'</td>
</tr>
<tr>
<td>d.</td>
<td>/gwen+ (u)/</td>
<td>gwín[U]</td>
<td>'good (m.)'</td>
</tr>
</tbody>
</table>

The final vowel [U] triggers metaphor, and also a process of centralization (cf. Hualde 1989, McCarthy 1984), which affects preceding mid and high vowels. The centralized variants that result from centralization/metaphony are [A,I,U].

2. Laxness in non-initial atonic vowels:

Penny states that in general, atonic mid vowels are more close and more lax than tonic mid vowels [Penny 1969: 68].² For example, in some instances, Penny uses the final (lax) vowel variants to transcribe atonic vowels in the middle of the word, as shown in (20).

---

1 The following conventions are used: 'ε' indicates a derivational morpheme boundary. '(' indicates an inflectional ending; '¨' indicates that the vowel in question is potentially a primary head; the rightmost '¨' is the one that receives main word stress. '¨¨' indicates a secondary head. The prefixes /a-/ and /re-/ are not marked as heads/dependents because they do not affect cyclic stress assignment.

2 However, atonic vowels tend to be more open when next to an /l/ or /k/ 1969: 68].
(20) Atonic vowels which have final vowel variants:

a. [ə] or [i] where [e] or [i] is expected:

/sègle+ménte/  segl[ə]ménte  'surely'
/sér+úx(u)/  s[ə]rúxU  'branch that has dried on the tree'
/sòbre+gwés(u)/  sòbfr[ə]gwísU  'goiter'
/sòbre+párt(u)/  sòbfr[ə]pártU  'after-pains'
/θésped(e)/  thesp[ə]dθ  'turf, sod'
/trébed(e)/  trèb[ə]θ  'tripod'
/bèrgwénθ+ós(u)/  b[ə]rgw[ə]nθúsU  'shameful (m.)'
cf. /bèrgwénθ(a)/  v[ə]rgwénθa  'shame'
/bèrak(u)/  b[ə]rAkU  'hogg'
/mjéđ+ós(u)/  mj[ə]dúsU  'fearful (m.)'
/pùnetθ(u)/  puñ[ə]tθúsU, puñ[ə]tθU  'punch (blow)'
/rec+bólθt+ós(u)/  r[ə]búltúsU, r[T]búltúsU  'rebellious (m.)'

b. [u] where [A] or [a] is expected:

/agwa+téx(u)/  agw[ə]túxU, agw[ə]túxU  'small drainage hole'
/téxa+bán(a)/  te[n]bána  'lean-to with a shed cover'

c. [o] where [o] is expected:

/rec+bólθt+ós(os)/  r[ə]búltósos  'rebellious (m.pl.)'

3. Laxness in initial vowels

Penny also indicates that the initial vowel in Pasiego is unstable when followed by /s/ or a nasal consonant, or when in contact with /h/ or /r/, and either [a], [e] or [i] occur freely in this position [Penny 1969: 53]:

(21) Pasiego initial vowels [Penny 1969: 53, 66]:

a. /eskwel(a)/  [a]skwelà, [e]skwelà, [i]skwelà  'school'

b. /enён(a)/  en[ə]nθna, en[ə]nθna, en[ə]nθna  'evergreen oak, live oak'

c. /rekik(u)/  r[ə]kikU, r[T]kikU  'ricketts'

Example (21) also illustrates the greater phonetic variability of atonic vowels, in comparison with tonic vowels.

---

3 Many words containing the prefix /re-/ have the variant with [rə].
4 Cf. Standard Spanish "a teja vana" 'with a shed cover'.
4. **Lack of metaphony in atonic vowels:**

The words provided in (22) illustrate that metaphony—i.e. raising and centralization—is optional in atonic position. The significance of this finding is that Penny's (1696) description implies that metaphony is exceptionless, and should apply in atonic syllables.

(22) Non-metaphonized variants in atonic position:

a. [a] rather than metaphonized [A]:

i. /agwaθʌl/  Agw[a]θʌl  'constable, bailiff'
ii. /ənθjáːn(u)/  [a]nθjAnU  'old (person) (m.)'
iii. /ənθwél(u)/  [a]nθwIlU  'styal'
iv. /a+re+bolt+ós(u)/  [a]řbUltUsU  'rebellious (m.)'

b. [i] rather than metaphonized [I]:

i. /miadɛr(u)/  m[i]AdIrU  'shady spot where cattle like to sleep'

b. [o] or [ɔ] rather than metaphonized [I] (repeated from (21)):

i. /sɛɾ+úx(u)/  s[ɔ]rÚxU  'branch that has dried on the tree'
ii. /бережвенθ+ós(u)/  b[ɔ]rgw[ɔ]nθUsU  'shameful (m.)'
iii. / mjɛd+ós(u)/  mj[ɔ]dUsU  'fearful (m.)'
iv. /re+bolt+ós(u)/  r[ɔ]bUltUsU, r[I]bUltUsU  'rebellious (m.)'
v. /rekitik(u)/  ř[ɔ]kItkU, ř[I]kItkU  'ricketts'

For example, in (22.a.i), the non-centralized, non-metaphonized vowel [a] appears where in other instances, the centralized, metaphonized vowel [A] would occur. I discuss the significance of these examples in Appendix B.
Appendix B: Metaphonized dependent vowels in Pasiego

In (17), I assumed that spreading targets vowels in head positions only. However, Penny (1969) indicates that metaphony applies to all vowels preceding the trigger. Penny's description is problematic because it implies that metaphony spreads [high] from the trigger to all preceding vowels, not just to head vowels. I deal with this apparent counterexample below, arguing that a) dependent vowels do not always become high in a metaphony environment, and b) dependent vowels that do become high do so by means of an optional phonetic spreading process, rather than by means of metaphony.

My argument is based on observations by Penny which show that dependent vowels are more phonetically variable than head vowels in Pasiego. Following Rice (this volume), I assume that the degree of phonetic variability of a vowel correlates with the complexity of the vowel's representation, and with the overall complexity of the vocalic inventory. To illustrate, within the five-vowel system shown in (3.a), the mid vowels are less complex than either the high or the low vowels. (The mid vowels have no features.) The mid vowels in (3.a)—and in Pasiego—can be more phonetically variable than the more specified high and low vowels. I assume that this is because, for the less specified mid vowels, it is possible for context-dependent rules to apply and fill in features missing in the unspecified mid vowel representations. As another example, the non-low vowels of three-vowel inventories are more variable in height than the high vowels of five-vowel inventories (cf. RA). For example, in languages and dialects of the Iberian peninsula, it is generally the case that three final vowels are possible. However, there is great variability in the instantiation of these three final vowels, with [i,a,u], [e,a,o], [e,o,u] etc. being attested (cf. Dyck 1992). I assume that this is a consequence of the fact that the non-high vowels in three-vowel systems are less specified for height than the high vowels in five-vowel systems. I apply this reasoning to the facts in Pasiego presented below.

In Pasiego, Penny reports that vowels in dependent position can be more variable that vowels in head position (see Appendix A for details). For example, /e/ in non-final positions may be realized as schwa (an extremely lax allophone of /e/ that often occurs word-finally), as shown in (23). Significantly, the schwa allophone may occur instead of the metaphonized (high) variants of the mid vowels that are expected given Penny's description of metaphony. This is shown in the example in (23), which has a reduced schwa rather than the metaphonized, high variant [i].

(23) Lack of metaphony in intertonic (dependent) vowels:

<table>
<thead>
<tr>
<th>Underlying form</th>
<th>Actual form</th>
<th>Form expected given the description in Penny (1969)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. /sobregwesu/</td>
<td>sub[r3]gwfsu</td>
<td>sub[r1]gwfsu 'goiter'</td>
</tr>
</tbody>
</table>
(24) Reduction in initial vowels in Pasiego:

a. /mjéd+ós(u)/ [mjéðúsU] ‘fearful’

b.b. /mjéd+ós(u)/ (stress assignment):

\[
\begin{array}{cccc}
\omega & \omega & \omega & \omega \\
/ & / & / & / \\
f & f & f & f \\
| & | & | & | \\
x & x & x & x \\
| & | & | & | \\
* & * & * & * \\
\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ Pl Ap Pl Ap Pl Ap \\
\end{array}
\]

(high)

c. [mjéðúsU] (destressing and reduction apply)

\[
\begin{array}{cccc}
\omega & \omega & \omega & \omega \\
/ & / & / & / \\
f & f & f & f \\
| & | & | & | \\
x & x & x & x \\
| & | & | & | \\
* & * & * & * \\
\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ Pl Ap Pl Ap Pl Ap \\
\end{array}
\]

(high)

The word in (24.a) contains a derivational stem /mjed/, a derivational suffix /ós/, and an inflectional suffix /ul/. Harris (1983) assumes cyclic stress assignment in such cases, so that at some point, both the initial and the main stress vowel receive strong stress, as shown in (24.b). In order to avoid two adjacent strong stresses in (24.b), the leftmost strong stress at the foot level is destressed and defooted, as shown in (24.c). The result is that the feature [high] does not spread to the initial vowel in (24.c) because the initial vowel is no longer a head. The vowel that results instead is a reduced mid vowel that is realized as schwa.

For words of the shape vvvv, where the second vowel is more lax than the first vowel, a somewhat different situation holds: reduction does not occur; instead mid vowels in second position in vvvv words already have little structure, for the following reasons. After rules such as metaphor have applied to a Pasiego word, dependent mid vowels still have the representations shown in (3.a), repeated below, because they are not subject to metaphor (spreading of [high]).
(3.a) Representations for vowels in dependent position:

/ɪ,ʊ/       /e, o/       /ɑ/

\[ \text{Pl} \quad \text{Ap} \]  \[ \text{Pl} \quad \text{Ap} \]  \[ \text{Pl} \quad \text{Ap} \]

[high]       [low]

On the other hand, head mid vowels that have been subject to metaphony have the representations shown in (25):

(25) Representation of vowels in head positions after metaphony:

Root node

Aperture node

V-place node

[\text{a}]       [\text{i} \quad \text{from } /ɪ, \text{o}/]

[low]       [high]

The dependent mid vowels in (3.a) have less structure than the vowels in (25), and are therefore more influenced by surrounding segments: Specifically, dependent mid vowels may be subject to variable rules of postlexical spreading—i.e. rules that spread features from surrounding segments—which may fill in some of the structure missing in the dependent mid vowel representations (cf. Cohn 1993 for a more detailed discussion of postlexical spreading rules). The workings of postlexical spreading are illustrated in (26).
(26) Postlexical spreading:

a. Metaphony; phonetic spreading does not apply: [subrọgwíṣu]

b. Phonetic spreading does apply  [subrígwíṣu]

(26.a) shows the result of metaphony, i.e. [high] spreading to heads only, and the result if no postlexical spreading applies. In the latter case, the penultimate vowel, with little structure, may be realized as a reduced vowel (in this case, a form of schwa). Example (26.b), on the other hand, shows the result of phonetic spreading, which causes the penultimate vowel to be realized as [high]. The arrow in (26.b) indicates that spreading applies within the foot, spreading [high] from the head of the foot to the dependent of the foot. I conclude from this discussion that dependent vowels may receive the feature [high] by an optional phonetic spreading process, rather than by metaphony. My analysis additionally provides an explanation for why dependent vowels in Pasiego can be more variable than head vowels.

In summary, the facts of phonetic variation in Pasiego are consistent with my analysis, in which head vowels have more structure than dependent vowels. The variability facts show that, as predicted by my analysis of metaphony, dependent vowels behave differently than head vowels with respect to phonetic variation—dependent vowels are potentially more variable than head vowels.