Chapter 2
Against Syllable-based Accounts of Spanish Rhotics

Contemporary generative accounts have consistently invoked syllable structure and/or sonority in attempts to explain the distribution of the tap and trill in Spanish. I present the basic distributional facts in Section 2.1 and then review previous analyses of this pattern in Section 2.2. The discussion assumes a basic knowledge of syllable structure in Spanish, as described in Harris (1983). Section 2.3 presents data from beyond Spanish in order to demonstrate that not all aspects of the behavior of rhotics can be adequately captured with reference to syllable structure alone, thereby setting the stage for the phonetically-based OT analysis to be developed and illustrated in the remainder of this dissertation.

2.1 Distribution

Two types of rhotics are found in the phonological inventory of general Spanish: a voiced alveolar tap [r] versus an alveolar trill [r] (Harris 1983; Núñez Cedeño 1994). These rhotics appear in complementary distribution in all contexts within the morpheme except intervocalic, where they are phonologically contrastive, as shown in (2.1):\(^7\)

\(^7\) The following symbols are used in phonetic transcriptions: periods for syllable-boundaries, double vertical lines for phrase edges (initial or final), and single vertical lines for word boundaries.
(2.1) Tap and trill contrast in morpheme-internal intervocalic position

| [ka.ro]  | caro  | 'dear, expensive' |
| [fo.ro]  | foro  | 'forum' |
| [pe.ro]  | pero  | 'but' |
| [ka.ro]  | carro | 'car' |
| [fo.ro]  | forro | 'lining' |
| [pe.ro]  | perro | 'dog' |

The pairs listed in (2.1) are representative rather than exhaustive, but they suffice to demonstrate that the tap and trill surface contrastively as syllable onsets between vowels.

The contrast is neutralized elsewhere, with either predictable realization or stylistically-controlled variation. The trill occurs in syllable-initial position after the sonorants /n/, /l/ and the fricative /s/, as shown in (2.2):\(^8\)

(2.2) Trill is obligatory in syllable-initial postconsonantal position

a. *[on.ra]  [on.ra]  honra  'honor'

b. *[al.re.\oe.\\textcircled{\oe}.o]  [al.re.\oe.\\textcircled{\oe}.o]  alrededor  'around'

c. *[iz.ra.el]  [iz.ra.el]  Israel  'Israel'

Word-initial rhotics are also neutralized to trill. The examples in (2.3) show that the trill is obligatory not only after pause (a), but in any word-initial position at the phrasal level, including postconsonantal (b) and postvocalic (c):

(2.3) Trill is obligatory in word-initial position

a. *[[ro.sa]  [ro.sa]  Rosa  'Rose'

b. *[konl.ro.sa]  [konl.ro.sa]  con Rosa  'with Rose'

c. *[lal.ro.sa]  [lal.ro.sa]  la rosa  'the rose'

\(^8\) The alveolar fricative /s/ surfaces as [z] in coda position in (2.2c) due to regressive voicing assimilation before voiced consonants. Furthermore, in Spanish dialects that retain syllable-final /s/, /sr/ clusters may be realized as a coalesced retroflex fricative [z], e.g., Israel [izæel] (Harris 1969).
While the environments in (2.1) and (2.3c) are both intervocalic, tap/trill contrast is licensed only morpheme-internally, as in (2.1). Obligatory fortition is truly word-initial as opposed to phrase-initial in (2.3a) and syllable-initial after a consonant in (2.2).

The data in (2.4) show that the tap occurs as the second member of a complex onset, where the first member is an obstruent:

(2.4) Tap is obligatory after tautosyllabic obstruents

a. After labials
   
   \[
   \begin{array}{llll}
   \text{[pre.sjo]} & \ast \text{[pre.sjo]} & \text{precio} & \text{'price'} \\
   \text{[bra.so]} & \ast \text{[bra.so]} & \text{brazo} & \text{'arm'} \\
   \text{[fri.to]} & \ast \text{[fri.to]} & \text{frito} & \text{'fried'}
   \end{array}
   \]

b. Afterdentals
   
   \[
   \begin{array}{llll}
   \text{[t.res]} & \ast \text{[t.res]} & \text{tres} & \text{'three'} \\
   \text{[dra.ma]} & \ast \text{[dra.ma]} & \text{drama} & \text{'drama'}
   \end{array}
   \]

b. After velars

\[
\begin{array}{llll}
\text{[kre.a]} & \ast \text{[kre.a]} & \text{crea} & \text{'s/he creates'} \\
\text{[gri.to]} & \ast \text{[gri.to]} & \text{grito} & \text{'scream'} \\
\text{[xrus.tʃef]} & \ast \text{[xrus.tʃef]} & \text{Kruschef} & \text{'Khrushchev'}
\end{array}
\]

Harris (1983) observes little dialectal variation in the realization of rhotics in onset clusters, apart from some assimilation in /t/ + rhotic clusters in some dialects. "Singers occasionally trill the r in Cr onsets for stylistic effect, but this is no more representative of normal speech than the trilling of rs in song by English speakers" (144, Fn. 14).

However, Morales-Front (1994:167) observes that the trill can surface in complex onsets

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9 Harris (1969:52, 1983:33) singles out the foreign word \textit{Jruschef} as the only instance of [xr] in Spanish.
in Spanish under conditions of highly emphatic speech (e.g., ¡inc[r]eíbles p[r]ecios! ‘incredible prices!’).\(^{10}\)

In rhyme position, the phonetic realization of rhotics is variable. The basic generalization is that the tap in casual speech alternates with the trill in highly emphatic speech before consonants and pause, as the examples in (2.5) demonstrate:

(2.5) Tap varies stylistically with trill before consonants and before pause

<table>
<thead>
<tr>
<th>Casual speech</th>
<th>Emphatic speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>[mar.ɾes]</td>
<td>[mar.ɾes]</td>
</tr>
<tr>
<td>[mar]</td>
<td>[mar]</td>
</tr>
</tbody>
</table>

An interesting restriction on the variable realization of word-final rhotics is that when the following word begins with a vowel, neutralization to tap is obligatory. This is illustrated by the grammaticality contrasts in (2.6):

(2.6) Word-final trill is prohibited before a vowel-initial word

<table>
<thead>
<tr>
<th>Casual speech</th>
<th>Emphatic speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>[mar.ɾeɾde]</td>
<td>[mar.ɾeɾde]</td>
</tr>
<tr>
<td>[ma.ɾasul]</td>
<td>* [ma.ɾasul]</td>
</tr>
</tbody>
</table>

Rhotics pattern asymmetrically at the edges of words. As shown in (2.3), only the trill appears word-initially, regardless of the final segment of the previous word. The data in (2.6) demonstrate that either the tap or trill may appear word-finally, unless the following word begins with a vowel, in which case the trill is disallowed.

\(^{10}\) In addition, José Hualde (personal communication) notes that some Spanish speakers in Northern Spain occasionally pronounce a trill in adconsonantal positions. This is presumably the result of language contact with Basque, in which rhotics are realized as trills in non-intervocalic positions. The rhotic pattern of Basque is analyzed in Chapter 4.
2.2 Previous Accounts

This section reviews previous accounts of Spanish rhotics. As we will see, both the intervocalic contrast and the otherwise complementary distribution of rhotics can be explained in various ways under different theoretical frameworks. The common denominator of all accounts, however, is the assumption that syllable structure plays an important role in capturing the distribution of rhotics.

2.2.1 Harris (1983)

According to Harris (1983), the tap /ɾ/ is the only underlying rhotic of Spanish, and its alternation with the surface trill [ɾ] is predictable, i.e., rule-governed as follows:

(2.7) Representations

a. Intervocalic trill: /ɾɾ/
b. All other contexts: /ɾ/

(2.8) Rules

a.  \( r \rightarrow r / X^o[\_\_] \)
b.  \( r \rightarrow r / [+cons] \_ \_ \)
   \| Rhyme
c.  \( r \rightarrow r \) (in emphatic speech)
   \| Rhyme
d.  \( r \rightarrow \emptyset / \_ \_ r \)

As made clear in (2.7a,b), an underlying geminate tap is posited for the intervocalic surface trill, while a single tap is posited for all other contexts. Intervocalic
contrast is thereby accounted for in terms of a singleton-geminate distinction. Evidence for the representation of the trill as an underlying cluster of taps comes from a restriction on stress assignment. Harris (1983) observes that in Spanish, when a penultimate syllable is closed by a consonant or a glide, stress cannot be assigned to the antepenultimate syllable. Accordingly, a native speaker would accept the nonce words mulangá or mulánga, but not *múlanga. The fact that native informants judge both nonce tamárro and tamarró to be possible but not *támarro is problematic for an analysis in which the surface trill is singly-linked to an underlying trill. This suggests the existence of an underlying heterosyllabic cluster /tt/ in which the first tap closes the penultimate syllable, thus making antepenultimate stress impossible.

The rules in (2.8) operate on underlying taps in various positions within the word, as shown in the sample derivations (2.9a–g):

(2.9)

<table>
<thead>
<tr>
<th></th>
<th>a.</th>
<th>b.</th>
<th>c.</th>
<th>d.</th>
<th>e.</th>
<th>f.</th>
<th>g.</th>
</tr>
</thead>
<tbody>
<tr>
<td>UR:</td>
<td>/rosa/</td>
<td>/onra/</td>
<td>/karro/</td>
<td>/mar/</td>
<td>/mar asul/</td>
<td>/brasol/</td>
<td>/karo/</td>
</tr>
</tbody>
</table>

Lexical

<table>
<thead>
<tr>
<th>Syllab.</th>
<th>ro sa</th>
<th>on ra</th>
<th>kar ro</th>
<th>mar</th>
<th>mar la sul</th>
<th>bra so</th>
<th>ka ro</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2.8a)</td>
<td>ro sa</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>(2.8b)</td>
<td>—</td>
<td>on ra</td>
<td>kar ro</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Postlexical

<table>
<thead>
<tr>
<th>Resyllab.</th>
<th>—</th>
<th>—</th>
<th>—</th>
<th>—</th>
<th>ma r la sul</th>
<th>—</th>
<th>—</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2.8c)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>mar</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>(2.8d)</td>
<td>—</td>
<td>—</td>
<td>ka ro</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

SR: [ro sa] [on ra] [ka ro] [mar] [ma r la sul] [bra so] [ka ro]

'rose' 'honor' 'car' 'sea' 'blue sea' 'arm' 'dear'
Once rhotics undergo word-level Syllabification, rules then apply to determine the surface realization of rhotics as a function of their prosodic position. Rule (2.8a) generates word-initial trills, as in (2.9a), while rule (2.8b) generates syllable-initial postconsonantal trills, as in (2.9b,c). Derivation (2.9c) illustrates the origin of the phonetic trill in intervocalic position: rules (2.8b,d) derive the trill from the intervocalic cluster by strengthening the second tap and subsequently deleting the first. Rule (2.8d) operates in an across-the-board fashion at the postlexical level to ensure that [rr] sequences neutralize to [r]. The fact that clusters of tap and trill do not yield distinctively longer vibrations is evidenced by pairs such as salí rápido 'I left rapidly' versus salir rápido 'to leave rapidly', which are both realized as [sa.li-ra.pi.ðo]. The expression salir rápido is never realized as *[sa.lir-ra.pi.ðo] (Harris 1983:63).

The derivation in (2.9d) shows the optional postlexical rule (2.8c) strengthening the tap in rhyme position. Another possible surface form for the derivation in (2.9d) is [mar], given that rule (2.8c) fails to apply in casual speech. The rule also fails to apply when it is bled by postlexical Resyllabification, as demonstrated in (2.9e). When the word-final tap is resyllabified as the onset of a following vowel-initial word, the structural description for rule (2.8c) is no longer met. Finally, the underlying tap surfaces unchanged in complex onsets (2.9f) and in intervocalic position (2.9g).
2.2.2 Núñez Cedeño (1988, 1994)

In Dominican Spanish, consonantal reduction in the syllable rhyme is so severe that syllable-final /s/ is arguably absent from the lexical representations of illiterate speakers (Terrell 1986). Núñez Cedeño (1988, 1994) documents a hypercorrection phenomenon in the speech of some Dominicans whereby /s/ is inserted in the syllable rhyme, yielding forms such as those in (2.10):

(2.10) Hypercorrective syllable-final [s] in Dominican Spanish (Núñez Cedeño 1988, 1994)

<table>
<thead>
<tr>
<th>asbogado</th>
<th>&lt; abogado</th>
<th>'lawyer'</th>
</tr>
</thead>
<tbody>
<tr>
<td>abosgado</td>
<td></td>
<td></td>
</tr>
<tr>
<td>abogasdo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>abogados</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>bosfe</th>
<th>&lt; bofe</th>
<th>'lung'</th>
</tr>
</thead>
<tbody>
<tr>
<td>bofes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This phenomenon is observed in the speech of semi-illiterates, illiterates, and even some educated speakers. Those who pronounce syllable-final /s/ are said to speak "fisno" < fino 'refined'.

One restriction on epenthesis stems from the lack of hypercorrect forms in which [s] appears immediately before an intervocalic tap or trill, as shown in (2.11) and (2.12):

(2.11) Epenthetic [s] unattested before intervocalic tap

a. caros < caro 'expensive; dear'

b. *casro
(2.12)  Epenthetic [s] unattested before intervocalic trill

a. carresta < carreta 'cart'
carretas

b. *casrreta

While caros in (2.11a) and carresta/carretas in (2.12a) are possible hypercorrect forms for caro and carreta, respectively, *casro in (2.11b) and *casrreta in (2.12b) are totally unattested.

To account for the fact that hypercorrection involves insertion of /s/ at the end of a syllable, Núñez Cedeño (1988) posits the rule in (2.13):

(2.13)  /s/-epenthesis rule (Núñez Cedeño 1988:324)

\[ \emptyset \rightarrow s / \_ \_ ]_{\sigma} \]

Epenthesis does not apply in an arbitrary manner. Rather, the process is structure-preserving, failing to apply if general syllabic or prosodic constraints would be violated. Specifically, application of the rule in (2.13) is blocked if the result would either create structures not otherwise generated by phonological rules or alter the phonological features of immediately adjacent segments.

If the forms in (2.11b) and (2.12b) are unattested because of the structure-preserving nature of the epenthesis rule in (2.13), then this is evidence in support of Harris' (1983) analysis of the intervocalic trill as an underlying heterosyllabic sequence of taps. Given the Obligatory Contour Principle (OCP; Leben 1973, 1980, Kenstowicz 1982, McCarthy 1986, Hayes 1986), which prohibits identical sequences of melodic segments, Núñez Cedeño (1988, 1994) further argues that the proper representation of the
intervocalic trill involves a one-to-many association of a single underlying tap to two timing slots, shown in (2.14):

(2.14)  Geminate representation of intervocalic trill in Spanish (Núñez Cedeño 1994:24)

\[
\begin{array}{c}
C \\
C \\
r
\end{array}
\]

Motivation for the representation in (2.14) comes from the epenthesis-blocking facts seen in (2.12b). On the assumption that crossing of association lines is prohibited, configurations like those in (2.15) are universally ill-formed, and rules are blocked when such configurations would be derived:

(2.15)  Prohibition on crossing association lines (Hayes 1986)

\[
\begin{array}{c}
* C \\
V \\
a \\
t
\end{array}
\]

Specifically, /s/-epenthesis before an intervocalic trill would violate this universal constraint on crossing association lines. The application of (2.13) in the first syllable of a word like \textit{carreta} 'cart' would yield the structure in (2.16), in which coda [s] illegally splits the heterosyllabic geminate tap:
Epenthesis before trill generates an ill-formed prosodic structure in which association lines are crossed (Núñez Cedeño 1994:31)

\[ \sigma \quad \sigma \quad \sigma \quad \sigma \quad \sigma \quad \sigma \]

\[ \text{Rule (2.13)} \]

\[ \text{C} \quad \text{V} \quad \text{C} \quad \text{C} \quad \text{V} \quad \text{C} \quad \text{V} \]

\[ k \quad a \quad \text{t} \quad e \quad t \quad a \]

\[ *k \quad a \quad s \quad r \quad e \quad t \quad a \]

Structure preservation also explains epenthesis blocking before intervocalic taps, since the result would alter the phonological features of the adjacent rhotic. The application of (2.13) in the first syllable of caro 'expensive; dear' would trigger fortition of /r/ to a trill, by the independent rule shown in (2.8b). Although not explicitly mentioned by Núñez Cedeño (1988), /s/-epenthesis must be ordered before postconsonantal strengthening in order for the structure preservation account to go through. The derivations in (2.17) show how epenthesis triggers postconsonantal strengthening of the adjacent tap in caro 'expensive; dear', while no such modification takes place in a word like bofe 'lung', which lacks an intervocalic tap:

\[ \text{Epenthesis before tap feeds postconsonantal fortition} \]

\[ \text{UR: } /karo/ \quad \text{cf. } /bofe/ \]

\[ \text{Syllab.} \quad \text{ka.ro} \quad \text{bo.fe} \]

\[ (2.13) \quad \text{kas.ro} \quad \text{bos.fe} \]

\[ (2.8b) \quad \text{kas.ro} \quad - \]

\[ \text{SR: } [*\text{kas.ro}] \quad \text{[bos.fe]} \]

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11 As Eric Bakovic (personal communication) points out, there is an inherent circularity in any account that relies on structure preservation with rule ordering. For a rule to be structure-preserving, it must be ordered before other rules that it potentially affects, but then it fails to affect those rules precisely because it is structure-preserving.
On the assumption that epenthesis is a structure-preserving rule, the ill-formed prosodic structure in (2.16) and the gratuitous modification of the underlying tap induced by the application of (2.8b) both serve to block /s/-epenthesis before rhotics in intervocalic position. The lack of epenthesis in this environment suggests that the heterosyllabic cluster proposed by Harris (1983) should be represented as a one-to-many association of a single underlying /r/ to two timing slots, as shown in (2.14).

One remaining problem is that it is unclear how the doubly-linked representation becomes a phonetic trill. Harris (1983) derives the trill from an underlying intervocalic cluster by rules (2.8b) and (2.8d), which strengthen the second tap and then delete the first, respectively. In the theory of Schein and Steriade (1986:693), a distinction is made between structure-dependent rules, which refer to both syllable and segmental structure, and segmental rules, which refer only to the latter. Segmental rules may affect dually-linked geminates, whereas structure-dependent rules may not. Since the structural description of the strengthening rule in (2.8b) refers to rhyme position, this rule is structure-dependent and, therefore, cannot apply to the segmental melody of the second C in (2.14). Although rule (2.8d) is a segmental rule and should be able to apply to geminates, it fails to apply in this case because its structural description is not met. Since rule (2.8b) cannot strengthen the second tap to a trill, rule (2.8d) is subsequently incapable of deleting the first tap. Presumably, a separate rule is required to convert the

\[ \text{-----------------------} \]

\[ ^{12} \text{Specifically, the restricted applicability of structure-dependent rules is argued to stem from the Uniform Applicability Condition (see Schein and Steriade 1986). For a related proposal of geminate inalterability, cf. the Linking Constraint of Hayes (1986).} \]
dually-linked structure in (2.14) to a phonetic trill—in addition to the tap deletion rule (2.8d), which is still needed to explain the reduction of postlexical tap + trill sequences. The apparent necessity of these two redundant rules has the undesirable effect of complicating the grammar.

2.2.3 Lipski (1990)

Lipski (1990) provides an analysis of the Spanish rhotic distribution based on syllabic templates. Manifestation of the trill is analyzed as maximizing the syllabic template, while the intervocalic tap is derived from a more marked underlying structure, lexically preattached to the prosodic skeleton. Representations and rules are shown in (2.18) and (2.19), respectively, while sample derivations are given in (2.20) below:

(2.18) Representations

a. Intervocalic tap: \[ V C V \]
   \[
   \begin{array}{c}
   | \\
   /\gamma/ \\
   \end{array}
   \]

b. All other contexts: \[ /\gamma/ \]
(2.19) Rules

a. 
\[ \sigma \]
\[ \emptyset \rightarrow C / O \]
\[ C \]
\[ r \]

b. (in emphatic speech)
\[ \sigma \]
\[ \emptyset \rightarrow C / O \]
\[ R \]
\[ C \]
\[ r \]

c. \[ C \]
\[ C \]
\[ [r] \]

(2.20) 

<table>
<thead>
<tr>
<th>a.</th>
<th>b.</th>
<th>c.</th>
<th>d.</th>
<th>e.</th>
<th>f.</th>
<th>g.</th>
</tr>
</thead>
<tbody>
<tr>
<td>UR: /rosa/ /onra/ /karo/ /mar/ /mar asul/ /braso/ /karo/</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lexical Syllab.</td>
<td>ro.sa on.ra ka.ro mar mar</td>
<td>a.sul bra.so ka.ro</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2.19a)</td>
<td>rro.sa on.rra ka.rro — — — —</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postlexical Resyllab.</td>
<td>— — — — ma.</td>
<td>a.sul — —</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2.19b)</td>
<td>— — — — marr — — — —</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2.19c)</td>
<td>ro.sa on.ra ka.ro mar — — — —</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SR: [ro.sa] [on.ra] [ka.ro] [mar] [mar</td>
<td>a.sul] [bra.so] [ka.ro]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'rose' 'honor' 'car' 'sea' 'blue sea' 'arm' 'dear'</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

After lexical Syllabification, rule (2.19a) derives all syllable-initial trills via C-slot adjunction and subsequent auto-segmental spreading of the tap, as illustrated in derivations (2.20a–c). The derivation in (2.20d) shows that optional strengthening in the syllable rhyme stems from the application of rule (2.19b) in emphatic speech. Following
the account of Harris (1983), we may also assume that emphatic strengthening is bled by postlexical Resyllabification, as shown in (2.20e). The phonetic interpretation rule (2.19c) converts the dually-linked /r/ to a phonetic trill in onset and rhyme position, as seen in (2.20a–c) and (2.20d), respectively. Derivations (2.20f) and (2.20g) show how the underlying tap surfaces unchanged in complex onsets and between vowels, respectively. Crucially, lexical preattachment of the tap in the UR of (2.20g) blocks the application of rule (2.19a), on the assumption that association lines are interpreted as exhaustive (see the Linking Constraint of Hayes 1986).

The main insight of this analysis is that it captures the correlation between the duration of rhotics and their position within the syllable. In Spanish, syllabic templates permit a maximum of two elements in the onset (Harris 1986; Núñez Cedeño 1985, 1986). When the tap occurs as the second member of a complex onset, the onset contains the maximum number of elements, as shown in derivation (2.20f), and rule (2.19a) cannot apply. However, when the tap occurs as a single onset, rule (2.19a) adjoins a C-slot to the left of the slot dominating /r/ because the syllable template is not already filled. On this account, word-initial and syllable-initial postconsonantal trill emerges as the default realization of rhotics in onset-initial position. Contrast this account with that of Harris (1983), which requires two separate rules: one for word-initial onsets (2.8a) and one for postconsonantal onsets (2.8b). These two processes are unified as one by rule (2.19a) under Lipski's account.

The phonological representation of rhotic contrast is another point of difference between Lipski (1990) and previous accounts. The lexically preattached structure in
(2.18a) makes the intervocalic tap the exception, in contrast to Harris’ heterosyllabic cluster in (2.7a) and to Núñez Cedeño's dually-linked geminate structure in (2.14). Lipski (1990) argues that "Spanish intervocalic [r] constitutes an idiosyncrasy, not predictable from independent principles of Spanish phonology" (164). Specifically, the tap appears intervocalically in many words in a manner not predicted by the C-slot adjunction rule in (2.19a), which blindly strengthens all syllable-initial taps. Lexical preattachment of the intervocalic tap offers a way to constrain template maximization in the onset, thereby capturing the fact that onset-initial tap is possible intervocalically but not word-initially or postconsonantally.

The template maximization approach to Spanish tap and trill is not without its potential criticisms. First, Lipski (1990) does not take into account the fact that postlexical tap + trill clusters are reduced to a single onset-initial trill. As in the case of Núñez Cedeño (1988, 1994), two redundant rules must be assumed, thereby complicating the grammar. While rule (2.19a) converts the dually-linked word-medial geminate to a single phonetic trill, a rule such as Harris' (2.8) is still necessary in order to ensure neutralization of postlexical clusters.

Second, Harris (1983) argued that the lack of proparoxytonic words with a trill in the onset of the final syllable suggests the existence of an underlying heterosyllabic geminate whose first /r/ closes the penultimate syllable, thereby precluding antepenultimate stress assignment. The same explanation is no longer possible in Lipski's account, since at no point in the derivation does the first tap of the dually-linked geminate structure close the penultimate syllable. Lipski provides a counterargument whereby the
putative restriction on antepenultimate stress in contemporary Spanish is merely a carryover from Latin:

"Latin contained some type of geminate /rr/, either heterosyllabic or amabisyllabic; the 'quantity rule' would then exclude geminate consonants from straddling the last two syllables of proparoxytones. When Spanish evolved this geminate to onset-initial [r], the original motivation for the limitation disappeared, but there was no stock of proparoxytones containing [r] in the final syllable which could enter the language under the new situation" (168).

On this interpretation, the restriction on antepenultimate stress emerges as an historical accident rather than a productive synchronic restriction. Bonet and Mascaró (1997) also eschew the heterosyllabic geminate representation and lend further evidence in support of Lipski's counterargument:

"[I]t is not at all clear why trills, which seem to attract stress, should be related to weight in this sense. If this were the case, we should also have to posit a similar type of structure for /ʎ/, /x/ and /ɲ/, for instance, given that these segments also 'attract stress'" (122).

These arguments may be readily assumed for other analyses positing a single underlying trill.

A final and related drawback to assuming that the trill is a tautosyllabic geminate is that the blocking hypercorrective /s/-epenthesis in Dominican Spanish cannot be explained in terms of structure preservation. As Núñez Cedeño (1994:30) points out, epenthesis should be possible before an intervocalic trill on an analysis that does not assume the heterosyllabic geminate representation, since no line-crossing violation would be produced. Lipski's analysis could be modified by having a rule of resyllabification move the initial C-slot of the dual structure into the preceding coda prior to /s/-insertion.
However, blocking of epenthesis before tap is still unexplained. Given that the strengthening rule in (2.19a) is not triggered by the presence of a preceding coda segment, insertion should be possible before intervocalic tap.

2.2.4 Morales-Front (1994)

Morales-Front (1994) analyzes Spanish rhotics from a constraint-based perspective, incorporating markedness constraints that refer to the prosodic position of rhotics. The difference between the tap and trill is posited to be one involving intensity of articulation, captured phonologically by the feature [ATR], or Advanced Tongue Root. Morales-Front argues that such a contrast is rare in non-rhotic consonants because a difference in tension normally has insufficient perceptibility. "Nevertheless in the case of rhotics, given that their articulation is vibrant, an increase in tension results in a distinctive increase in the number of vibrations" (Morales-Front 1994:168). On the assumption that [ATR] is unspecified when predictable from context, the underlying specifications shown in (2.21), together with the surface-constraints in (2.22), determine the phonetic realization of rhotics as tap or trill:13

(2.21) Representations

a. Tap: [son, –ATR]
b. Trill: [son]

13 See Chapter 4 of Morales-Front (1994) for more on the filling-in of feature values as a function of predictability.
(2.22) Constraints

a. ALIGN(PrWd, L, [+ATR]) (abbreviated ALIGNL)

b. Coda  (abbreviated FORTITION)

<table>
<thead>
<tr>
<th>x</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>[+ATR]</td>
</tr>
</tbody>
</table>

c. TENSION

[+ATR] cannot appear in a branching direct dependent of the syllable (onset or rhyme).

d. PARSE(feature)

Any feature in the input must be parsed as part of higher units.

e. Ranking:

ALIGNL, FORTITION, TENSION » PARSE(feature)

Constraint (2.22a) ensures that only the [+ATR] trill may be aligned with the left edge of the prosodic word. This constraint is equivalent to Harris' rule of word-initial fortition in (2.8a). Constraint (2.22b), which corresponds to rule (2.8b), guarantees [+ATR] in postconsonantal syllable-initial position. TENSION in (2.22c) bans the [+ATR] trill from the second position of complex onsets and from rhyme position. Finally, PARSE(feature) is a faithfulness constraint which seeks to preserve underlying values of [ATR]. In Spanish, PARSE(feature) ranks below the constraints in (2.22a–c), as shown in (2.22e). The results of this ranking are shown in the following tableaux, beginning with syllable-initial fortition in (2.23). (N.B.: In this and subsequent tableaux, the →

---

14 The TENSION constraint is also argued to play a role in the distribution of tense and lax vowels, which are distinguished with the feature [ATR]. See Morales-Front (1994:175–178).

15 The equivalent constraint under the Correspondence Theory (McCarthy and Prince 1995) version of faithfulness would be MAX(feature). I retain the PARSE(feature) constraint of Morales-Front's analysis for present purposes, since nothing crucial hinges on this distinction.
symbol denotes a mapping between input and output forms. This is an alternative to putting the input form in the first cell of the table.)

(2.23) Input tap strengthens to trill in word-initial and syllable-initial postconsonantal positions

<table>
<thead>
<tr>
<th></th>
<th>ALIGNL</th>
<th>FORTITION</th>
<th>PARSE(feature)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. rosa → ro.sa</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. rosa → ro.sa</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>c. onra → on.ra</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. onra → on.ra</td>
<td></td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

As shown by the input-output mappings in (2.23b,d), word-initial and syllable-initial postconsonantal taps in the input are forced to strengthen to trills by the ranking of ALIGNL and FORTITION over PARSE(feature). Since ALIGNL makes reference to the prosodic word edge, [+ATR] is ensured in any word-initial position, regardless of the final segment of the preceding word (see the data in (2.3)).

The ranking of TENSION over PARSE(feature) guarantees that only the [–ATR] tap can appear in complex onsets and in rhyme position. This is true even if the [+ATR] trill is posited in the input, as shown in (2.24a,c):

(2.24) Input trill lenites to tap in C2 of complex onset and in rhyme position

<table>
<thead>
<tr>
<th></th>
<th>TENSION</th>
<th>PARSE(feature)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. braso → bra.so</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. braso → bra.so</td>
<td>*!</td>
<td></td>
</tr>
<tr>
<td>c. mar → mar</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>d. mar → mar</td>
<td>*!</td>
<td></td>
</tr>
</tbody>
</table>
Although Morales-Front (1994) does not attempt to account for optional emphatic strengthening in the syllable rhyme, let us consider a possible approach. The appearance of both tap and trill in rhyme position and in C2 of complex onsets means that these are positions of neutralization in which contrast gives way to stylistically-controlled free variation. If TENSION and PARSE(feature) are unranked with respect to each other, then both values of [ATR] may surface in the output. This is illustrated in tableau (2.25):

(2.25) Free ranking between TENSION and PARSE(feature) predicts free variation

<table>
<thead>
<tr>
<th></th>
<th>TENSION</th>
<th>PARSE(feature)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. braso → bra.so</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>
| b. braso → bra.so | * | *
| c. mar → mar | * | *
| d. mar → mar | * | *

Since the four input-output mappings in (2.25) each receive the same number of violations, none of the output candidates is ruled out. Both the tap and trill may both occur in rhyme position or in C2 of complex onsets, but contrast between the two rhotics is neutralized in these positions.

A shortcoming of this approach to emphatic strengthening is that it is not immediately obvious how to constrain an input trill from surfacing before a following vowel-initial word (recall the pattern illustrated in (2.6)). Under the rule-based approach

---

16 Recall the observation made by Morales-Front (1994:167) that trill can surface in complex onsets in Spanish under conditions of highly emphatic speech (e.g., ¡inc[r]eíbles p[r]ecios! ‘incredible prices!’). This phenomenon is not explicitly addressed in the analyses of Harris (1983) and Lipski (1990).
of Harris (1983), this restriction is accounted for via rule ordering, whereby Resyllabification bleeds optional fortition at the postlexical level. For present purposes, let us assume that phrasal Resyllabification is the result of the ONSET constraint in (2.26):

\[
\text{(2.26) } \text{ONSET}
\]
\[
\text{Syllables must have onsets.}
\]

The problem is that nothing prevents an input trill in word-final position from surfacing in the onset of the following word, as shown in tableau (2.27):

\[
\text{(2.27) Word-final trill is incorrectly allowed to surface before vowel-initial word}
\]

<table>
<thead>
<tr>
<th></th>
<th>ONSET</th>
<th>TENSION</th>
<th>PARSE(feature)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. mar asul $\rightarrow$ mar.</td>
<td>a.sul</td>
<td>*!</td>
<td>*</td>
</tr>
<tr>
<td>b. mar asul $\rightarrow$ mar.</td>
<td>a.sul</td>
<td>*!</td>
<td>*</td>
</tr>
<tr>
<td>c. mar asul $\rightarrow$ ma.r</td>
<td>a.sul</td>
<td></td>
<td>*!</td>
</tr>
<tr>
<td>d. mar asul $\rightarrow$ ma.r</td>
<td>a.sul</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ONSET rules out candidates (2.27a,b) because the initial syllable of [a.sul] 'blue' lacks an onset consonant. In candidates (2.27c,d), the word-final rhotic is resyllabified to satisfy ONSET. However, TENSION is irrelevant when the rhotic is in onset position because the constraint bans [+ATR] rhotics only from branching direct dependents of the syllable, i.e., in rhymes and in the second position of complex onsets. The decision is made by PARSE(feature), which forces input [+ATR] to surface intact. The $\bullet$ symbol in tableau (2.27) denotes the fact that candidate (d) is incorrectly selected as the optimal output. The crucial point emerging from this discussion is that any constraint-based account attempting to capture free variation in terms of unranked constraints must be
supplemented with a mechanism to ensure obligatory neutralization to tap in word-final prevocalic contexts.

With respect to word-medial intervocalic contrast, however, lowest-ranked \textsc{parse(feature)} makes the correct prediction, as shown in tableau (2.28):

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|}
\hline
& \textsc{alignl} & \textsc{fortition} & \textsc{tension} & \textsc{parse(feature)} \\
\hline
a. karo & $\rightarrow$ ka.ro & & & \\
\hline
b. karo & $\rightarrow$ ka.ro & & & \\
\hline
c. karo & $\rightarrow$ ka.ro & & & \\
\hline
d. karo & $\rightarrow$ ka.ro & & & \\
\hline
\end{tabular}
\end{table}

Since none of the higher-ranked constraints applies in intervocalic position, \textsc{parse(feature)} forces underlying [ATR] specifications to surface faithfully in the output.

Two final criticisms involve the resolution of postlexical rhotic clusters and the blocking of hypercorrective /s/-epenthesis in Dominican Spanish. First, Morales-Front (1994) makes no provision for a constraint ensuring the neutralization of postlexical tap + trill sequences to a single trill. Second, the analysis posits that the intervocalic trill is a single unit instead of an heterosyllabic geminate sequence. Therefore, it is not possible to explain the absence of hypercorrective [s] before trill in Dominican Spanish in terms of the structure-preservation account proposed by Núñez Cedeño (1988, 1994).
2.2.5 Bakovic (1994)

Another constraint-based account of Spanish rhotics is proposed by Bakovic (1994). Tap/trill contrast is represented in terms of Aperture Theory (Steriade 1993, 1994), which encodes stricture via three degrees of oral aperture: closure ($A_0$), release ($A_{\text{max}}$) and an intermediate aperture generating fricative turbulence ($A_I$). Following Padgett (1994), Bakovic assumes that stricture features are dominated by Place in the feature geometry, which yields the representations of tap and trill shown in (2.29). (N.B.: The ® symbol denotes the Root node of the consonant.)

(2.29) Representations

a. Tap = rhotic approximant

\[ \begin{array}{c}
\text{[cor]} \\
\text{[rho]} = [r] \\
A_{\text{max}}
\end{array} \]

b. Trill = rhotic stop

\[ \begin{array}{c}
\text{[cor]} \\
\text{[rho]} = [r] \\
A_0 \quad A_{\text{max}}
\end{array} \]

Given the ROTB hypothesis that no restrictions may be placed on the input specifications, we must assume that either of the structures in (2.29) may be present in the input. The constraints in (2.30) determine where these structures occur in the output:
(2.30) Constraints

a. CONTIGUITY
   The output is a contiguous parse of the input string.

b. ALIGN(σ, L, A₀) (abbreviated STRONG ONSET)
   Every syllable must be left-aligned with an A₀ oral closure.

c. Ranking:
   CONTIGUITY » STRONG ONSET

CONTIGUITY is a faithfulness constraint ensuring that the output is a contiguous parse of the input.¹⁷ This constraint is violated by the deletion of underlying material or by the insertion of material not present underlyingly. STRONG ONSET is an alignment constraint that prefers syllables to begin with A₀ oral closure. Word-initial fortition is illustrated in tableau (2.31). (N.B.: Inserted elements are indicated by the use of [ ] brackets.)

(2.31) Input tap strengthens to trill in word-initial position

<table>
<thead>
<tr>
<th>/rosa/</th>
<th>CONTIGUITY</th>
<th>STRONG ONSET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aₘₐₓ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| a. ro.sa |             |              |
| A₀Aₘₐₓ   |             |              |

| b. ro.sa |             | *!           |
| Aₘₐₓ    |             |              |

The input in tableau (2.31) contains a single Aₘₐₓ position in the word-initial onset. STRONG ONSET forces the insertion of an initial A₀ position, thus favoring candidate (a) over candidate (b). Candidate (a) does not violate CONTIGUITY because this

¹⁷ Bakovic (1994) also incorporates the faithfulness constraint PARSE in a more extensive analysis of the distribution of continuant and noncontinuant voiced obstruents. However, CONTIGUITY is sufficient for the purpose of demonstrating the analysis of rhotics.
constraint bans insertion of non-underlying elements in *string-medial* but not *string-initial* position. Since the $A_0$ is inserted in initial position, it does not interrupt the contiguous parse of the input string. In sum, candidate (a) is optimal because the insertion of a word-initial $A_0$ position permits satisfaction of *Strong Onset* without violation of *Contiguity*.

The reason syllable-initial rhotics undergo fortition after a preceding coda nasal and lateral is that Place/stricture-sharing in this context derives the Aperture-theoretic representation of the trill in (2.29a). Consider the tableau in (2.32). (N.B.: Underparsed elements are indicated by the use of ⟨ ⟩ brackets.)

\[(2.32) \text{ Input tap strengthens to trill in syllable-initial position after a preceding nasal} \]

<table>
<thead>
<tr>
<th>/on ra/</th>
<th>CONTIGUITY</th>
<th>STRONG ONSET</th>
</tr>
</thead>
<tbody>
<tr>
<td>$A_0$</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>$A_\text{max}$</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b. ŭra</td>
<td>*!</td>
<td>*</td>
</tr>
<tr>
<td>$\langle A_0 \rangle A_\text{max}$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The input rhotic contains a single $A_\text{max}$ position, which surfaces in syllable-initial position in both output candidates (a) and (b). The representation of the underlying nasal as a single, unreleased $A_0$ closure ensures the representation of the trill shown in (2.29b),
given that the nasal + rhotic sequence shares a single [coronal] Place specification. Candidate (b) violates CONTIGUITY because the underlying nasal A₀ fails to surface in the output. (Here, I assume that the nasal A₀ position is lost but that nasality would be shifted to the previous vowel.) Candidate (a) is optimal because both the A₀ and A_max positions surface faithfully. CONTIGUITY is not violated by the presence of A₀ in candidate (a), since this aperture position was already present in the input.

Input sequences of /s/ followed by a rhotic, which Bakovic (1994) does not consider, turn out to be problematic under this account. Recall the data in (2.2), in which surface trill occurs in syllable-initial position after the sonorants /n/, /l/ and the fricative /s/. If we assume that the input contains a trill, then CONTIGUITY would correctly guarantee its presence in the output. However, if the input contains a tap—a logical possibility, given the ROTB hypothesis—then CONTIGUITY would forbid trill from surfacing because a nonunderlying A₀ position would have to be inserted in order to satisfy STRONG ONSET. This undesired result is shown in tableau (2.33). (N.B.: Recall that /s/ surfaces as [z] before voiced consonants due to regressive voicing assimilation.)

---

18 Bakovic (1994) speculates that the lack of A_max release in alveolar nasals and laterals stems from the fact that the release of air is inherent in the segment: "[nasal] indicates lowering of the velum, releasing the air through the nose. [lateral] indicates lowering of the side(s) of the tongue, releasing the air through the side(s) of the mouth" (9, Fn. 11).
Input tap surfaces incorrectly in the output after [z]

<table>
<thead>
<tr>
<th></th>
<th>CONTIGUITY</th>
<th>STRONG ONSET</th>
</tr>
</thead>
<tbody>
<tr>
<td>/is rael/ $A_rA_{\text{max}}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. iz.ræl $\sqrt{\text{cor}}$ $A_rA_{\text{max}}$</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b. iz.ræl $\sqrt{\text{cor}}$ $A_r[A_0]A_{\text{max}}$</td>
<td>*!</td>
<td></td>
</tr>
</tbody>
</table>

Candidate (a) is incorrectly selected as the winner, since the insertion of an $A_0$ in candidate (b) violates CONTIGUITY. In sum, Place/stricture-sharing does not derive the Aperture-theoretic representation of the trill in an /sr/ cluster as it does in /nr/ and /lr/ clusters.¹⁹

The CONTIGUITY constraint correctly guarantees that underlying rhotic contrast is recovered in morpheme-internal intervocalic position, as shown in tableaux (2.34) and (2.35):

¹⁹ Note, however, that this analysis may be on the right track with respect to those Spanish dialects in which /st/ clusters may be realized as a coalesced retroflex fricative [z], e.g., *Israel* [izæl] (Harris 1969). This assumes, of course, that $A_rA_{\text{max}}$ constitutes a licit aperture sequence and that some provision can be made for the resulting shift in place of articulation from alveolar to retroflex.
(2.34) Underlying tap surfaces faithfully in intervocalic position

<table>
<thead>
<tr>
<th></th>
<th>CONTIGUITY</th>
<th>STRONG ONSET</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ka.ro [A_0]A_max</td>
<td>![]</td>
<td></td>
</tr>
<tr>
<td>b. ka.&amp;o [A_0]A_max</td>
<td>![]</td>
<td></td>
</tr>
</tbody>
</table>

As shown by the optimal candidate (2.34a), CONTIGUITY forbids the insertion of string-medial A_0, thereby forcing the input A\_max to surface as such in the output. The requirement that the intervocalic onset be realized with oral closure A_0 is overridden by faithfulness in this context. CONTIGUITY fulfills a similar role when the input contains a trill, as shown in (2.35):

(2.35) Underlying trill surfaces faithfully in intervocalic position

<table>
<thead>
<tr>
<th></th>
<th>CONTIGUITY</th>
<th>STRONG ONSET</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ka.ro [A_0]A_max</td>
<td>![]</td>
<td></td>
</tr>
<tr>
<td>b. ka.&amp;o [A_0]A_max</td>
<td>![]</td>
<td></td>
</tr>
</tbody>
</table>

Since the A_0 position is underparsed in (2.35b), CONTIGUITY gives this candidate a fatal violation mark and prefers the faithful candidate (a). Faithfulness guarantees that the tap and trill contrast in morpheme-internal intervocalic position.

To account for the fact that the trill is prohibited from the second position of complex onsets and from rhyme position at the word-level, Bakovic (1994) appeals to
sonority principles. An important fact regarding Spanish syllable structure is that only the liquids [l] and [r] may surface after tautosyllabic obstruents in onset position. According to Bakovic,

"...[a] possible explanation for the exclusion of [r] from this environment [i.e., complex onsets] is that it is not as sonorous, in the sense of the phonological universal sonority scale, as the liquids [l] and [r]. The constraint or interacting constraints that define possible onsets based on relative sonority in Spanish should thus be ranked high enough to exclude [r] from this position, presumably having the effect of reducing it to [r] by underparsing the posited A₀" (14).

Similarly, sonority constraints on possible coda segments must achieve the same effect, since [r] is a possible word-level coda consonant, but not [r]. For present purposes, I assume the constraint SONORITY as an expository convenience which captures that fact that the less sonorous trill is not allowed in complex onsets and in rhyme position at the word-level. If this constraint is ranked above CONTIGUITY, then the A₀ of an input trill will fail to be parsed in the appropriate environments, as illustrated in tableaux (2.36) and (2.37):

(2.36) Less sonorous trill is banned from complex onsets

<table>
<thead>
<tr>
<th>/braso/</th>
<th>SONORITY</th>
<th>CONTIGUITY</th>
<th>STRONG ONSET</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. bra.so</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. bra.so</td>
<td>*!</td>
<td></td>
</tr>
</tbody>
</table>
The input $A_0$ surfaces faithfully in candidate (2.36b), satisfying CONTIGUITY. However, higher-ranked SONORITY favors the more sonorous tap of candidate (a), in which $A_0$ is underparsed. The same ranking guarantees similar results for rhyme position:

\[(2.37)\] Less sonorous trill is banned from rhyme position

<table>
<thead>
<tr>
<th>/mar/ $\overset{A_0A_{\text{max}}}{\wedge}$</th>
<th>SONORITY</th>
<th>CONTIGUITY</th>
<th>STRONG ONSET</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. mar $\langle A_0 \rangle A_{\text{max}}$</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b. mar $\overset{A_0A_{\text{max}}}{\wedge}$</td>
<td></td>
<td>*!</td>
<td></td>
</tr>
</tbody>
</table>

Bakovic (1994) does not attempt to provide an account of optional emphatic strengthening in rhyme position. One possibility would be to have SONORITY unranked with respect to CONTIGUITY in emphatic speech, in a manner similar to the modification of Morales-Front's analysis pursued above (cf. the discussion surrounding (2.25)):

\[(2.38)\] Free ranking between SONORITY and CONTIGUITY predicts free variation

<table>
<thead>
<tr>
<th>/mar/ $\overset{A_0A_{\text{max}}}{\wedge}$</th>
<th>SONORITY</th>
<th>CONTIGUITY</th>
<th>STRONG ONSET</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. mar $\langle A_0 \rangle A_{\text{max}}$</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b. mar $\overset{A_0A_{\text{max}}}{\wedge}$</td>
<td></td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

Neither candidate in tableau (2.38) is optimal since each receives the same number of total violations. As a result, the tap may vary but not contrast with the trill in rhyme position and in $C_2$ of complex onsets.
However, the problem remains that nothing prevents an input trill from surfacing in word-final prevocalic contexts, as seen in tableau (2.39):

(2.39) Word-final trill is incorrectly allowed to surface before vowel-initial word

<table>
<thead>
<tr>
<th>/mar asul/</th>
<th>ONSET</th>
<th>SONORITY</th>
<th>CONTIGUITY</th>
<th>STRONG ONSET</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \overset{\wedge}{A_0A_{\text{max}}} )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. mar.</td>
<td>a.sul</td>
<td></td>
<td>*!</td>
<td>*</td>
</tr>
<tr>
<td>( \overset{\wedge}{A_0A_{\text{max}}} )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. mar.</td>
<td>a.sul</td>
<td></td>
<td>*!</td>
<td>*</td>
</tr>
<tr>
<td>( \overset{\wedge}{A_0A_{\text{max}}} )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. ma.</td>
<td>r.a.sul</td>
<td></td>
<td>*!</td>
<td>*</td>
</tr>
<tr>
<td>( \overset{\wedge}{A_0A_{\text{max}}} )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Candidates (a) and (b) violate ONSET because the first syllable of [a.sul] lacks an onset consonant. In candidates (c) and (d), the word-final rhotic is resyllabified as the onset of the following vowel-initial word. Now, if the constraints abbreviated by SONORITY are relevant only to complex onsets and rhyme position, then SONORITY remains silent on the realization of syllable-initial rhotics. Therefore, the decision is made by CONTIGUITY, which incorrectly selects candidate (d) as optimal because the underlying \( A_0 \) surfaces faithfully in the output. This is a problem similar to that of the TENSION constraint of Morales-Front (1994) (see tableau (2.27) and the following discussion). Some additional mechanism is required to ensure neutralization to tap in word-final prevocalic contexts.

Finally, as was shown to be the case for the analysis of Morales-Front (1994), the OT account of Bakovic (1994) requires some additional constraint to handle postlexical
rhotic clusters. Similarly, the representation of the trill as a single underlying unit precludes a structure-preservation account of epenthesis blocking in Dominican Spanish.

2.2.6 Bonet and Mascaró (1997)

Bonet and Mascaró (1997) provide a sonority-based account of the distribution of the tap and trill. As shown in (2.40), they assume that the value of the feature determining the realization of underspecified /R/ as a tap or trill is generally not present underlyingly, except in the case of intervocalic taps, which are marked underlyingly as taps:

(2.40) Representations

a. Intervocalic tap: V /r/ V

   | [+f]

b. All other contexts: /R/

This representational move is similar to Lipski's proposal in (2.18a) that intervocalic taps constitute the marked case underlyingly. The core proposal of Bonet and Mascaró is that the value determining the phonetic realization of underspecified /R/ in other contexts is assigned in accordance with sonority principles. Crucially, the trill is less sonorous, ranking with obstruents, while the flap is more sonorous, ranking with glides, as shown in (2.41):

(2.41) Sonority scale (cf. Bonet and Mascaró 1997:108)

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>obstruents</td>
<td>nasals</td>
<td>laterals</td>
<td>glides</td>
<td>vowels</td>
</tr>
</tbody>
</table>

| trill | tap |
According to this scale, the distribution of the tap and trill can now be seen to follow from the sonority principles in (2.42a,b) below. (See Clements (1990) for more on the theory of Core Syllabification.)

(2.42)  
a. Greater sonority jumps are preferred in initial demisyllables.

\[
\begin{array}{ccc}
\sqrt{[rV]} & (3 \rightarrow 4) & \sqrt{.rV} & (0 \rightarrow 4) \\
\sqrt{[Cr]} & (0 \rightarrow 3) & *[Cr] & (0 \rightarrow 0)
\end{array}
\]

b. Smaller sonority falls are preferred in final demisyllables.

\[
\begin{array}{ccc}
\sqrt{[Vr.]} & (4 \rightarrow 3) & *[Vr.] & (4 \rightarrow 0)
\end{array}
\]

As shown in (2.42a), the trill is preferred syllable-initially because it causes a greater sonority jump than does the tap. However, the tap is preferred as the second member of a complex onset because the trill is equivalent with obstruents in sonority and, therefore, causes no rise in sonority at all. The tap is also preferred in syllable-final position, as seen in (2.42b), since it causes a smaller sonority fall. Bonet and Mascaró argue that at the output of Lexical Phonology, all syllable-final rhotics are taps, which may be subsequently strengthened in emphatic speech at the postlexical level. As in the analysis of Harris (1983), emphatic strengthening is bled by postlexical Resyllabification. Sample derivations are given in (2.43):
Although they reject the representation of the surface trill as an underlying sequence of taps, Bonet and Mascaró still assume a postlexical deletion rule which deletes a word-final tap before a following trill (cf. Harris’ (2.8d)). As with other, previously examined accounts positing a non-geminate representation of trill, it is not obvious how the blocking of /s/-epenthesis in Dominican Spanish is to be explained on the sonority-based account.

2.2.7 Summary

As we have seen in this section, numerous approaches to the analysis of Spanish rhotics have been adopted over the past two decades. According to Harris (1983), the tap /r/ is the only rhotic in the segmental inventory of Spanish, and the surface trill [r] is the product of derivational rules. On this account, the contrastive intervocalic trill is derived from an underlying sequence of taps. On the basis of hypercorrection facts in Dominican
Spanish, Núñez Cedeño (1988, 1994) further proposed that the intervocalic trill should be represented phonologically as a single underlying tap dually associated to two timing slots. In contrast, Lipski (1990) argued that the phonetic trill is the default realization of a single underlying tap surfacing in syllable-initial position, while lexically preattached taps in intervocalic position are treated as exceptions to this generalization. In more recent analyses, the trill continues to be represented as a single phonological unit underlyingly, although different features have been invoked to distinguish it from the tap. In Morales-Front (1994) and Bakovic (1994), OT constraints determine the distribution of rhotic [ATR] values and Aperture configurations, respectively. In addition, sonority principles have become increasingly important in capturing the distribution of rhotics, especially in the most recent, rule-based account of Bonet and Mascaró (1997). Specifically, the trill is analyzed as being less sonorous than the tap, which accounts for the absence of the former segment from complex onsets and syllable rhymes in non-emphatic speech.

We have also seen several problems with respect to previous accounts. First, no provision is made by Lipski (1990), Morales-Front (1994) or Bakovic (1994) for a rule or constraint that ensures neutralization of postlexical tap + trill sequences to trill. Although the analysis of Núñez Cedeño (1988, 1994) might simply account for this by assuming Harris' (1983) tap deletion rule, a separate and somewhat redundant rule would still be necessary in order to convert the dually-linked geminate structure to a phonetic trill, which only complicates the grammar. Second, neither of the existing constraint-based analyses is capable of ensuring obligatory lenition to tap in word-final intervocalic
environments. Any OT account attempting to capture free variation in terms of unranked constraints must be supplemented with a mechanism to ensure taps in this context.

Finally, Núñez Cedeño (1994) argues that hypercorrective /s/-epenthesis in Dominican Spanish should be possible before intervocalic trills in an analysis positing a unitary underlying trill /r/. While recent accounts have posited that the trill is a single unit, they have failed to show how the Dominican facts might be explained without the assumption that the surface trill is an underlying geminate.

2.3 Problematic Data from Other Languages

In addition to the problems just summarized, previous prosodic accounts of the Spanish tap/trill distribution face other challenges when data from beyond Spanish are taken into consideration. The basic difficulties stem from the fact that not all aspects of the behavior of rhotics can be adequately captured with reference to syllable structure alone. In this section, I present the following arguments:

1. The surface trill is ambiguous, patterning as a single phonological unit in some languages (e.g., Ngizim, Kaliai-Kove, and Kairiru), and as a cluster in others (e.g., Palauan and Kurdish). It is, therefore, not always feasible to represent the tap/trill contrast in terms of a singleton-geminate pair. However, some account must be given of the fact that the trill can surface as the phonetic reflex of an underlying cluster of taps.
2. In Basque and Kaliai-Kove, neutralized trill behaves in a manner not predicted by sonority principles, surfacing to the exclusion of the tap in complex onsets and syllable rhymes.

3. In Kairiru and Ngizim, obligatory neutralization to trill is conditioned not by syllable position but by the Place/stricture-sharing configuration of the cluster.

Each case is examined in turn in the following sections.

2.3.1 Trill as A Single Phonological Unit

Inouye (1995) examines languages in which the tap is in contrast with the trill in order to determine whether the contrast can be represented in terms of a phonological singleton-geminate relationship. Evidence from the domain of syllable structure, namely tests of consonant cluster behavior and closed syllable effects, suggests that it is not always feasible to interpret the phonetic trill as a cluster of taps, nor as a phonological geminate tap that is dually linked to the timing tier. The implication is that some other way must be found to represent contrastive rhotic duration, namely one in which both rhotics are single phonological units.

2.3.1.1 Vowel Length Restrictions in Ngizim

The first piece of evidence against trill-as-geminate comes from Ngizim, a Chadic language spoken in northeast Nigeria which contrasts an alveolar tap and trill. Schuh (1981) observes that modulo a few rare exceptions, long vowels do not occur in closed
syllables in this language. Now, consider the data in (2.44) below, in which the trill surfaces after long vowels. (N.B.: The ř is Schuh's phonetic symbol for the alveolar trill.)

(2.44) Trill after long vowels in Ngizim (Schuh 1981)

\[
\begin{align*}
\text{[jiːɾe]} & \quad jiiɾe & \quad \text{'truth'} \\
\text{[maːɡiːɾa]} & \quad maɡiɾa & \quad \text{'leader of the women in a town'} \\
\text{[nasəɾa]} & \quad nasəɾa & \quad \text{'European'} \\
\text{[saɾu]} & \quad saɾu & \quad \text{'peer'}
\end{align*}
\]

On an analysis such as that of Núñez Cedeño (1988, 1994), the first half of the geminate would be syllabified as the coda of the preceding syllable, while the second half would constitute the onset of the following syllable, as shown in (2.45):

(2.45) Trill as heterosyllabic geminate tap

\[
\begin{array}{c}
* \quad \sigma \quad \sigma \\
\text{C V V C C V} \\
j \quad i \quad r \quad e
\end{array}
\]

Since long vowels do not occur in closed syllables, the fact that the trill surfaces after long vowels suggests that it is not an heterosyllabic geminate straddling the syllable boundary.

A possible alternative would be to assume that the surface trill is indeed an underlying heterosyllabic cluster of taps, but that the cluster is reduced to a single trill. In the analysis of Harris (1983), the intervocalic cluster is reduced to a single onset-initial trill by strengthening the second tap and subsequently deleting the first (see the rules in (2.8b) and (2.8d), respectively). Now, if the restriction against long vowels is enforced
after these rules have applied, then the trill could surface after long vowels without closing the preceding syllable. The problem with this alternative is that the relevant constraint is most likely one that holds at the lexical level, where syllable building takes place. On the other hand, the tap deletion rule must be postlexical in order to handle tap + trill clusters that span the word boundary. Since postlexical rules apply after lexical ones, an underlying cluster of taps could not be reduced to trill before violating the restriction against long vowels in closed syllables.

The fact that the trill can occur after long vowels in Ngizim suggests that it is patterning as a single phonological unit, shown in (2.46):

(2.46) Trill as single phonological unit

Lipski's representation of the trill as a tautosyllabic geminate is another potential alternative, since at no point does the first tap close the preceding syllable. The problem with this approach is that since Ngizim does not allow complex syllable margins (Schuh 1978:279), a tautosyllabic geminate cannot constitute an onset cluster. In the following sections, we will see that neither the heterosyllabic nor the tautosyllabic geminate analysis is adequate for Kaliai-Kove and Kairiru. Like Ngizim, these languages require a singleton representation of the trill, as shown in (2.46).
2.3.1.2 Reduplication and Consonant Clusters in Kalai-Kove

In Kalai-Kove, a language of the Austronesian family, reduplication serves the grammatical functions of durative and plural formation, among others (Counts 1969). The process is formalized and illustrated in (2.47):

(2.47)   Reduplication in Kalai-Kove

a. \[ \text{RED} + C_1 V C_2 V \rightarrow C_1 V C_2 C_1 V C_2 V \]

b. \[ /\text{bole}/ \rightarrow \text{[ bolbol ]} \]
   \[ /\text{RED} + \text{bole}/ \rightarrow \text{boar's tusks} \]

Reduplication involves copying the first CVC string of the base word, as illustrated in (2.47b). Evidence that the trill is a single phonological unit comes from the fact that an entire trill reduplicates as a single segment in the coda of the copied CVC syllable, as shown in (2.48a). If the trill were an underlying (heterosyllabic or tautosyllabic) sequence of taps, only the first tap would reduplicate, as in (2.48b):^20

(2.48)   a. Trill as a single phonological unit
   \[ /i\text{yare}/ \rightarrow \text{[ iyaryare ]} \]
   \[ /i + \text{RED} + \text{yare}/ \rightarrow \text{he copulates (durative)} \]

b. Trill as a cluster or dually-linked geminate
   \[ /i + \text{RED} + \text{yarre}/ \rightarrow *\text{iyaryare} \]

---

^20 Harris (1983) could circumvent this argument if the rules reducing the sequence of taps to a single trill could be made to apply prior to reduplication. However, this ordering is impossible given that reduplication is a word-formation (i.e., lexical) process, while tap deletion is postlexical.
Furthermore, among the consonant clusters not created by reduplication are three which contain a consonant and a trill, as shown in (2.49):

(2.49) Kalai-Kove trill in clusters

a. [yrem] ‘somewhat, slightly’

   [mokrup] ‘frog’

b. [mbarku] ‘spirit mask type’

Under an analysis of the trill as a sequence of taps, these would constitute three-consonant clusters in the underlying representation (e.g., /yyr/, /krr/, /rrk/). However, three-consonant clusters do not otherwise occur in Kalai-Kove, which suggests that the trill is a single phonological unit.

2.3.1.3 Syllable Structure in Kairiru

Kairiru, another language of the Austronesian family, provides more evidence of the trill patterning as a single phonological unit. Wivell (1981) argues that the syllable structure templates of Kairiru are as follows:

(2.50) Syllable structure templates for Kairiru

a. (C) (C) V (V) (C)

   (G)

b. CVVV

As made clear in (2.50), onset clusters are limited to no more than two consonants, while coda clusters are disallowed. In addition, Wivell notes that the only possible onset
clusters are of the form stop + liquid and fricative + non-fricative. While most consonants may combine across syllable boundaries, no geminate clusters have been observed in Kairiru.

Evidence that the trill is a phonological singleton comes from the fact that the tap and trill are contrastive in complex onsets and in coda position, as shown by the examples in (2.51):

(2.51) Kairiru tap/trill contrast in complex onsets and in coda position

a. [a.pri.ma.ru] 'he persuades them' [for.pru] 'spotted snake eel'
   [a.qrei] 'it is raining' [qra.p\^{am}] 'your shoulder'

b. [pur] 'pig' [nar] 'pebble'
   [wur] 'crayfish' [wur] 'banana'

The postconsonantal trills in (2.51a) cannot be geminate clusters because the complex onsets would consist of three consonants. Similarly, the final trills in (2.51b) must be single units because coda clusters are not allowed.

2.3.2 Trill as A Phonological Geminate Tap

In contrast to the evidence just presented, there are several languages in which the trill appears to behave like a geminate tap. In Palauan, surface trills can result from a liquid assimilation process that produces a cluster of taps during morphological derivation. In Kurdish, single underlying taps can become adjacent in the formation of passive verbal forms. In both cases, the tap + tap sequence is realized phonetically as a single trill. These cases argue in favor of an analysis of trill as an underlying geminate tap.
2.3.2.1 Liquid Assimilation in Palauan

Palauan exhibits a process of liquid assimilation in which a lateral assimilates either to an adjacent rhotic or to a nearby rhotic across an intervening vowel. This process is prevalent in verbal morphology and can generate sequences of adjacent taps. Let us examine past tense inflexion in perfective verbal forms as a representative case.

Perfective verbs in Palauan exhibit the following basic structure: verb marker + verb stem + object pronoun suffix (Josephs 1975:156). In (2.52), we find the verb marker /mə/, followed by the verb stem /dù/ 'burn, barbeque' which contains the infixed past tense marker /ɪl/, followed by the object pronoun suffix /uə/:  

(2.52) Liquid assimilation yields a cluster of taps in Palauan (Josephs 1975:166)

\[
/mə + d + il + ul + ûr/ \quad \text{(basic form, including infixed past tense marker –il)}
\]

\[
d + mə + il + ul + ûr \quad \text{(by metathesis)}
\]

\[
d + m + il + ul + ûr \quad \text{(by deletion of ə)}
\]

\[
d + u + il + ul + ûr \quad \text{(by change of verb marker to u in unstressed syllable)}
\]

\[
d + il + ul + ûr \quad \text{(by deletion of verb marker)}
\]

\[
d + il + l + ûr \quad \text{(by deletion of unstressed u)}
\]

\[
d + il + r + ûr \quad \text{(by assimilation of l to r)}
\]

\[
d + ir + r + ûr \quad \text{(by assimilation of l to r)}
\]

\[
[\text{dirúr}] \quad \text{'burned/barbequed it'}
\]

In the last step of the derivation, regressive assimilation changes the final lateral of the past tense inflexion to a tap, thereby producing a cluster with the final tap of the verb stem. This cluster is realized as a single trill in the phonetic representation. Josephs' account of
past tense infixation in (2.52) suggests that some Palauan trills result from morphologically derived tap clusters.

### 2.3.2.2 Passive Affixation in Kurdish

Abdulla and McCarus (1967) report that Kurdish \([\text{r}]\) is "a flapped consonant, the tongue tip striking against the alveolar ridge" (9). This rhotic contrasts with the trill \([r]\) in that the latter has a greater number of lingual vibrations. The two rhotics are contrastive in all positions within the word, except word-initially, where only the trill occurs. The trill is also morphologically derived when the passive tap morpheme is affixed to a verb stem which itself ends in tap. Passive affixation is illustrated in (2.53):

(2.53) Affixation of passive tap /r/ in Kurdish (Abdulla and McCarus 1967)

<table>
<thead>
<tr>
<th>Active form</th>
<th>Passive form</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ₪əzaŋe</td>
<td>₪əzaŋe</td>
</tr>
<tr>
<td>'he knows'</td>
<td>'he is known'</td>
</tr>
<tr>
<td>b. ₪əŋere</td>
<td>₪əŋere</td>
</tr>
<tr>
<td>'he sends'</td>
<td>'he is sent'</td>
</tr>
</tbody>
</table>

As shown in (2.53b), two taps that come to be adjacent in the derivation are realized as a single surface trill. This suggests that the trill is a cluster of taps phonologically.

### 2.3.3 Sonority and Neutralization to Trill in Basque and Kaliai-Kove

One prediction of sonority-based accounts is that if the trill occurs as the second member of a complex onset or in rhyme position, then the tap should also be allowed to occur in
these same positions. To see this, let us assume the expository constraint SONORITY, which bans the less sonorous trill from complex onsets and rhyme position, and PARSE, which ensures faithful realization of underlying rhotics. If SONORITY outranks PARSE, then only the tap is allowed to occur. Tableau (2.54) illustrates this with respect to complex onsets:

(2.54) Ranking of SONORITY » PARSE ensures tap in C₂ of complex onsets

<table>
<thead>
<tr>
<th></th>
<th>SONORITY</th>
<th>PARSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. /Cr/ → Cr</td>
<td>⬤</td>
<td>⬤</td>
</tr>
<tr>
<td>b. /Cr/ → Cr</td>
<td>*!</td>
<td></td>
</tr>
<tr>
<td>c. /Cr/ → Cr</td>
<td>*!</td>
<td></td>
</tr>
<tr>
<td>d. /Cr/ → Cr</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

Regardless of which rhotic is in the input, SONORITY guarantees that only the tap will surface as the second member of complex onsets, as demonstrated by candidates (2.54b,d).

Under the reverse ranking of PARSE » SONORITY, the prediction is that the tap and trill should contrast. Tableau (2.55) illustrates this, again with respect to complex onsets only:

(2.55) Ranking of PARSE » SONORITY ensures tap/trill contrast in C₂ of complex onsets

<table>
<thead>
<tr>
<th></th>
<th>PARSE</th>
<th>SONORITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. /Cr/ → Cr</td>
<td>*!</td>
<td>⬤</td>
</tr>
<tr>
<td>b. /Cr/ → Cr</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. /Cr/ → Cr</td>
<td></td>
<td>⬤</td>
</tr>
<tr>
<td>d. /Cr/ → Cr</td>
<td>*!</td>
<td></td>
</tr>
</tbody>
</table>
If \textsc{parse} is top-ranked, then both an underlying tap and trill are allowed to surface faithfully, as shown by the optimal mappings in (2.55b,c).

The important observation here is that regardless of the ranking of \textsc{sonority} and \textsc{parse}, the faithful realization of an input trill in $C_2$ of a complex onset always entails the faithful realization of an input tap in the same position. That is, no ranking of these two constraints allows an input trill to surface without also allowing an input tap to surface. However, evidence from Basque and Kaliai-Kove suggests that this prediction is typologically inaccurate. In Basque, only the trill surfaces in onset clusters and in rhyme position, as shown in (2.56):

\begin{align*}
\text{(2.56) Basque trill in onset clusters and in rhyme position (Hualde 1991, Saltarelli 1988)}
\end{align*}

\begin{enumerate}
\item a. $\text{[pr]antziar}$ 'French'
  $\text{an[dr]e}$ 'woman'
\item b. $\text{a[r.t]o}$ 'corn'
  $\text{no[rk]}$ 'who–ERG'
  $\text{enbo[r]}$ 'trunk'
\end{enumerate}

In Kaliai-Kove, the trill patterns as it does in Basque, surfacing to the exclusion of tap in onset clusters and in rhymes:

\begin{align*}
\text{(2.57) Kaliai-Kove trill in onset clusters and in rhyme position (Counts 1969)}
\end{align*}

\begin{enumerate}
\item a. $\text{[yrem]}$ 'somewhat, slightly'
  $\text{[mo.krup]}$ 'frog'
\item b. $\text{[n"bar.ku]}$ 'spirit mask type'
  $\text{[na.par]}$ 'dog's tooth net bag'
  $\text{[tʰa.βur]}$ 'trumpet'
\end{enumerate}
In sum, neutralized trills in Basque and Kaliai-Kove behave in a manner not predicted by sonority principles. There must be some other factor responsible for the obligatory appearance of the trill in onset clusters and in rhyme position in these languages.\textsuperscript{21}

\textbf{2.3.4 Syllable Position and Neutralization to Trill in Kairiru and Ngizim}

Syllable-based accounts of Iberian Romance post that the neutralization of postconsonantal rhotics to trill is dependent upon the heterosyllabiclicity of the cluster. This is evident in the structural description of Harris' postconsonantal fortition rule (2.8b), which I repeat for convenience below:

\begin{equation}
(2.58) \quad r \rightarrow r / [+\text{cons}] \quad \bigg| \quad \text{Rhyme}
\end{equation}

This rule strengthens any tap occurring after an heterosyllabic consonant (e.g., /onra/ \rightarrow [on.ra] \textit{honra} 'honor'). Underlying taps surface unchanged after tautosyllabic consonants since the preceding consonant is no longer in rhyme position (e.g., /braso/ \rightarrow [bra.so] \textit{brazo} 'arm'). Note that Place specifications are not mentioned in the structural description of the rule in (2.58). On this analysis, the fact that the rhyme consonant shares Place with the following rhotic is treated as an incidental fact, irrelevant to the strengthening

\textsuperscript{21} The derivational account of Bonet and Mascaró (1997) faces a distinct and even more devastating problem. Recall that the trill is assumed to rank with obstruents on the sonority scale, as shown in (2.41). Since Clements' (1990) \textit{Core Syllabification} algorithm cannot parse two segments of identical sonority as members of an onset cluster, the trill should be universally banned from appearing in $C_2$ of complex onsets—contrary to fact.
process. Rather, syllable position—more specifically, heterosyllabicity—is the key determinant of postconsonantal neutralization to trill.

Two other languages of the rhotic duration typology also exhibit neutralization to trill in certain consonant-adjacent positions. In both cases, however, homorganicity—more specifically, Place/stricture-sharing—is the driving force behind neutralization, not syllable position. For instance, only the trill surfaces after alveolar consonants in Kairiru, as seen in (2.59):

(2.59) Neutralization to trill after tautosyllabic homorganic consonants, but contrast after tautosyllabic heterorganic consonants (Wivell 1981)

a. [al.sru] 'he chops them down'
   [sru] 'pair, brace'
   [wun.tru] 'I close the door'

b. [a.pri.ma.ru] 'he persuades them'
   [for.pru] 'spotted snake eel'
   [a.qrei] 'it is raining'
   [qra.pʰam] 'your shoulder'

While heterosyllabicity is argued to be crucial for postconsonantal strengthening in Iberian Romance, the same cannot be true for the examples in (2.59a) because the relevant clusters are all tautosyllabic. Rather, postconsonantal neutralization to trill in Kairiru depends on the homorganicity of the cluster—more specifically, the Place/stricture-sharing configuration present in the feature-geometric representation of the clustering segments. In contrast, the tautosyllabic clusters in (2.59b) involve heterorganic segments that do not share Place. Therefore, neutralization to trill is not
obligatory in non-Place/stricture sharing configurations, as shown by the fact that tap and trill are contrastive in these clusters.

Further evidence that syllable position does not condition neutralization to trill comes from Ngizim. This language contrasts an alveolar tap and trill in all positions except before coronal stops \([t, d, d', n]\) and lateral fricatives \([l, l']\) (Schuh 1981:xi). The examples in (2.60) show obligatory trills in these contexts, while contrast maintenance in other preconsonantal contexts is shown in (2.61):

(2.60)  Ngizim trill before coronal stops and lateral fricatives

- \(s\,a[r.t]u\) 'string beads'
- \(a[r.d]aatu\) 'agree to, approve of'
- \(g\,a[r.d]u\) 'cut notch in'
- \(k\,u[r.n]a\) 'a thorny tree'
- \(g\,a[r.l]a\) 'strong in taste, bitter'
- \(n\,g\,u[r.l]a\,d\,l\,i\,y\,a\) 'throat'

(2.61)  Ngizim tap/trill contrast before other consonants

a. Before labials
   - \(k\,a[r.m]u\) 'cut down'
   - \(k\,a[r.m]\,a\,i\) 'chieftainship'

b. Before alveolar fricatives
   - \(k\,u[r.s]a\,a\,s\,i\,y\,a\) 'kidney'
   - \(b\,a[r.z]a\,n\,z\,a\,n\) 'rolling around on the ground'

c. Before palatals
   - \(a\,a\,t\,a[r.j]a\,n\) 'perfume'
   - \(p\,a[r.j]\,i\) 'lip'

d. Before velars
   - \(t\,\,a[r.k]u\) 'orphan'
   - \(t\,\,a[r.k]\,a\,k\,d\,u\) 'repeatedly press on'
Following proposals by Holt (in press) and Walsh (1997), I assume that both coronal stops and lateral fricatives are specified as noncontinuant with respect to alveolar constriction, while the lateral fricatives are additionally specified for lateral fricative release. This assumption makes possible the following generalization about preconsonantal rhotics in Ngizim: the trill is obligatory before any consonant that has alveolar closure, as in (2.60), while either the tap or trill may surface before all other consonantal articulations, as in (2.61).

In sum, neutralization to trill in Kairiru and Ngizim is not dependent on syllable position, since neutralized trills occupy the same syllable position as their contrastive counterparts. Any account attempting to explain these instances of neutralization must make reference to the place specifications of the adjacent consonant.

2.4 Conclusion

The main focus of this chapter has been the distribution of the tap and trill in general Spanish. Previous accounts were reviewed and assessed, and problematic data were then presented from languages beyond the Iberian Romance family. In the following chapter, a phonetically-based OT account is developed which overcomes the inadequacies of syllable-based approaches. In Chapter 4, this account will be shown to capture the distribution of rhotics in languages beyond Spanish.

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22 See Section 4.4.2.1 of Chapter 4 for more on the feature geometry of lateral fricatives.