1. Introduction
Syllable contact refers to the situation where two consonants come together over a syllable boundary, specifically where the coda of one syllable is adjacent to the onset of the following syllable. A language like English does not witness many syllable contact induced changes in its phonology. English has words with different types of syllable contact sequences both morpheme-internally and over a morpheme boundary as seen by the consonantal sequences in words like ‘acne’ [æk.ni], ‘candy’ [kæn.di], ‘likeness’ [layk.nis], and ‘relationship’ [ri.ˈlejn.ʃəp]. In Korean, though, there is an asymmetry in the patterning of syllable contact sequences. If the two consonants at the syllable boundary have falling sonority then the sequence is normally maintained. That is, when the consonant at the end of the first syllable is more sonorous than the consonant at the beginning of the following syllable the sequence is maintained as exemplified by [kal.pi] ‘ribs’, and [cal.mot] ‘fault’. However, if the sequence potentially has rising sonority then various phonological changes occur so that the output has equal or falling sonority over the syllable boundary. This is exemplified by underlying bimorphemic /kuk-mul/ which is realized as [kuŋ.mul] ‘broth’ and /kam-li/ which is realized as [kam.ni] ‘supervision’. Both inputs have a rising sonority medial cluster but both output clusters are equal sonority. Thus, Korean witnesses an asymmetry in syllable contact sequences: rising sonority clusters are strictly avoided while falling and equal sonority clusters are normally allowed.

In this paper we develop an optimality theoretic analysis of asymmetrical syllable contact phenomena in Korean by decomposing syllable contact into a hierarchy of constraints that reference syllable position. Our specific analysis is based on the proposal of Baertsch (2002) which divides the consonants within the syllable (i.e., the syllable margins) into a Margin-one (M₁) and a Margin-two (M₂) position. Specifically, under Baertsch’s split margin approach to the syllable, the M₁ position includes a syllable-initial onset consonant while the M₂ position includes both a second member of an onset and a coda consonant. What the M₂ consonants have in common is a preference for high sonority. In accounting for this from an
optimality-theoretic perspective, we augment Prince and Smolensky’s (1993/2004) original Margin Hierarchy (our \( M_1 \) hierarchy) with the \( M_2 \) hierarchy which gives preference to high sonority consonants. By tying together these two syllable positions, we can provide principled accounts of certain typological, phonotactic, and acquisitional phenomena, such as those described below. In Section 2 of this paper, we briefly provide background on the links that tie together the second member of an onset and a singleton coda. In Section 3, we introduce the split margin approach to the syllable by explaining how the approach is applied to the analysis of onset clusters. With this as background, Section 4 extends the split margin approach to syllable contact phenomena, first generally, then with specific reference to Korean. The split margin approach allows us to decompose syllable contact into sets of margin constraints thus enabling us to analyze syllable contact phenomena without requiring a specific syllable contact constraint (or additional hierarchy) or requiring reference to an external sonority scale. Section 5 concludes the paper.

2. The Links between the Second Member of an Onset and a Singleton Coda

There are a number of phonological phenomena from typology, acquisition and phonotactics that point to a similarity in patterning between a coda consonant and the second member of an onset within the same syllable. For example Clements (1990), among others, observes that there is a preference for low sonority segments as a singleton onset and high sonority consonants as a singleton coda. In onset clusters, though, the preference is for a low sonority consonant followed by one of high sonority. This follows from the Sonority Sequencing Principle (Selkirk 1982, Blevins 1995, among others) which holds that sonority rises in moving from the beginning of the syllable toward the peak. As a result, clusters of an obstruent plus a glide or liquid are common among languages that allow onset clusters, while obstruent plus nasal or nasal plus liquid clusters are less common. Consequently, the second member of an onset and a singleton coda both prefer consonants of high sonority.1

A further manifestation of the similarity of patterning between the second

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1 We do not consider the matter of sibilant-plus-stop clusters which we do not consider to be proper onset clusters. While these clusters can occur word-initially in many languages, they are frequently phonologically distinct from other syllable-initial clusters and are often best analyzed with the sibilant being adjoined at a higher level of prosody. See Bagemihl (1991), Davis (1990), Fujimura (2000), and Selkirk (1982) for analyses regarding s-clusters in different languages.
member of an onset and a coda comes from the structure of syllable inventories, both in fully developed languages and in first language acquisition. Kaye and Lowenstamm (1981) observe that if a language permits onset clusters (i.e., CCV syllables) then it must have CVC syllables, but the reverse is not true; a language can have CVC syllables without permitting CCV syllables. That is, the presence of an onset cluster in a language implies the presence of a coda consonant. This characteristic is also reflected in the first language acquisition of structural slots within the syllable. As noted by Lleó and Prinz (1996) and Levelt, Schiller, and Leveult (1999), CV syllables commonly appear first in acquisition, followed by CVC syllables and finally onset clusters. Once again, we see a similarity between coda segments and second onset segments. The link between onset cluster and coda in acquisition can also involve the specific quality of the segment. An interesting case of this comes from Fikkert (1994). In this study, Jarmo, a child acquiring Dutch as his first language, has liquids as second members of onsets and as singleton codas at around the age of 24 months, but does not have liquids as single onset consonants at this age. From one perspective, such a pattern seems odd since one might assume that the presence of a liquid as a second member of an onset cluster would imply its presence as a singleton onset, but that implication does not hold in acquisition. On a split margin analysis however, Jarmo’s acquisition is consistent with there being a link between the second member of an onset and a coda.

Finally, we find phonotactic phenomena that suggest a link between the second member of an onset and a coda as well. There are some fairly well-known examples of constraints against words with identical consonants flanking the nuclear vowel only when the word begins with an onset cluster, not when the word begins with a single consonant. For example, as noted by researchers such as Clements and Keyser (1983), Davis (1988), and Fudge (1969), English lacks syllables like *[pll̩] but allows for ones like [l̩lt]. In other words, the constraint is against a syllable where the second onset segment and the first coda segment are identical.

In the cases cited in the above paragraphs the coda and the second member of an onset pattern together and show a preference for consonants of high sonority. Prince and Smolensky’s Margin Hierarchy is unable to account for this since it is forced to treat all margin segments, regardless of position in the syllable as the same. In the next section we will briefly present our proposal whereby the similarity in patterning between coda segments and the second segment of onset clusters is formally captured by the split margin hierarchy approach to the syllable. In this
3. Syllable Margins in Optimality Theory—The Split Margin Proposal

In order to put our split margin proposal in context, we will begin with a short overview of Prince and Smolensky’s (1993/2004) analysis of onset segments. Prince and Smolensky (henceforth, P&S) give us the familiar constraints in (1a) along with their Margin Hierarchy in (1b). This accounts nicely for the behavior of onsets, encoding both the preference to have an onset in the first place (the \textsc{onset} constraint) and the preference for low sonority segments to fill onset position (the Margin Hierarchy). P&S’s Margin Hierarchy is the equivalent of our \textsc{m1} hierarchy.\footnote{Note here that we do not include glides as a separate category in the \textsc{m1} hierarchy. We treat glides and high vowels both as [+hi] vocalic segments.}

\begin{enumerate}
  \item Syllable margins (onsets)
    \begin{enumerate}
      \item \textsc{onset} encourages syllables with onsets
        \begin{align*}
        \text{ONSET} & >> \text{FAITH} \text{ onsets are required} \\
        \text{FAITH} & >> \text{ONSET} \text{ onsets are optional}
        \end{align*}
      \item Margin Hierarchy (\textsc{m1}) incorporates the preference for low sonority onsets.
        \begin{align*}
        \text{*M}_i/[^{[lo]}] & >> \text{*M}_i/[^{[hi]}] >> \text{*M}_i/[^{[r]}] >> \text{*M}_i/[^{[l]}] >> \text{*M}_i/\text{Nas} >> \text{*M}_i/\text{Obs}
        \end{align*}
      \end{enumerate}
\end{enumerate}

A constraint ranking whereby the \textsc{onset} constraint dominates a relevant \textsc{faith} constraint results in the language requiring onsets for all syllables. A constraint ranking whereby \textsc{onset} is dominated by \textsc{faith} results in optional onsets. The preference for low sonority onsets results from the inherent ranking of the \textsc{m1} hierarchy. Low-sonority obstruents violate the lowest-ranking constraint in this hierarchy. Very high-sonority segments like liquids and glides violate the highest ranking constraints in the hierarchy.\footnote{The constraint governing non-high vowels would presumably never be demoted below a relevant faithfulness constraint in the language acquisition process. Therefore, such vowels cannot occur in syllable onset positions.} A relevant Faithfulness constraint may be located anywhere along this hierarchy, influencing the segments that can occur in onset position. For example, English allows glides in onset position, indicating that \textsc{faith} dominates \text{*M}_i/[^{[hi]}] and the remainder of the \textsc{m1} hierarchy. The Siberian Turkic language Yakut, on the other hand, does not allow rhotics or glides in onset position, indicating that \textsc{faith} dominates \text{*M}_i/[^{[l]}] but is dominated by \text{*M}_i/[^{[r]}]

\[2 \]
(Baertsch 2003b, based on data from Schönig 1988, Krueger 1962, and Kharitonov 1982). The difference between English and Yakut is shown in (2).

(2) Ranking of \textsc{Faith} amidst the M₁ hierarchy

\begin{itemize}
  \item a. English: *M₁/[+lo] >> \textsc{Faith} >> *M₁/[+hi] >> *M₁/[r] >> *M₁/[l] >> *M₁/Nas >> *M₁/Obs
  \item b. Yakut: *M₁/[+lo] >> *M₁/[+hi] >> *M₁/[r] >> \textsc{Faith} >> *M₁/[l] >> *M₁/Nas >> *M₁/Obs
\end{itemize}

The facts regarding initial singleton glides in Korean are quite similar to the English situation, as we see in (3a). A single glide can occur at the beginning of a Korean word as long as the vowel is not homorganic with the following vowel (*[wu], *[wo], *[ji], etc.), indicating that Korean does allow glides in onset position. Thus \textsc{Faith} >> *M₁/[+hi], as it does in English, as shown in (3).

(3) Korean

\begin{itemize}
  \item a. initial glide data
    \begin{itemize}
      \item yak ‘medicine’
      \item wanpul ‘paid in full’
      \item yuin ‘incentive’
      \item wipu ‘abandonment’
    \end{itemize}
  \item b. The M₁ ranking in Korean
    *M₁/[+lo] >> \textsc{Faith} >> *M₁/[+hi] >> *M₁/[r] >> *M₁/Nas >> *M₁/Obs
\end{itemize}

But the situation is not identical. In Korean, glides do not occur at the beginning of a word internal syllable after a coda since that would violate syllable contact.\(^5\) The difference between Korean and English word-internally is not due to the ranking of the M₁ constraints with respect to \textsc{Faith}, it results from a difference in the interaction of the constraints governing coda segments with the constraints in the M₁ hierarchy, as we discuss below.

Codas, in general, display a preference for high sonority segments rather than low sonority segments, which we assume to be independent of the issue of coda moraicity (for example, the presence of a coda in Yakut does not interact with stress placement or vowel length). Because P&S’s Margin Hierarchy encodes the (onset) preference for low sonority consonants only, analyses of coda sonority present a difficulty. This is mentioned by P&S (§8.3.2) who conclude that the treatment of

\(^4\) Because Korean does not distinguish between /r/ and /l/, we collapse *M₁/[r] and *M₁/[l] into *M₁/[r] when discussing Korean. We collapse later hierarchies correspondingly when discussing Korean but maintain the distinction when discussing other languages.

\(^5\) This ignores certain Sino-Korean compounds where rising sonority can occur over word boundaries within a compound as in [yaŋ-yak] ‘western medicine’. See Han 1994 for discussion.
the coda is yet to be fully explored in OT. Our solution to this problem is the \( M_2 \) hierarchy in (4b). This hierarchy supplements the NOCODA constraint (NOCODA reflecting the preference for a language not to allow codas of any sonority level and the \( M_2 \) hierarchy governing the segmental content of codas when they are allowed by a language). NOCODA is in many ways analogous to the ONSET constraint in that it makes a categorical determination about codas as a unit (shown in 4a), but is not a direct counterpart to ONSET. The ranking of NOCODA with respect to FAITH determines whether codas are allowed or banned while the ranking of ONSET vs. FAITH determines whether onsets are required or optional.

(4) The \( M_2 \) hierarchy

a. NOCODA discourages or bans codas
   \[ \text{NOCODA} \gg \text{FAITH} \text{ codas are banned} \]
   \[ \text{FAITH} \gg \text{NOCODA} \text{ codas are optional} \]

b. NOCODA explodes into the \( M_2 \) hierarchy
   \[ \ast M_2/\text{Obs} \gg \ast M_2/\text{Nas} \gg \ast M_2/[l] \gg \ast M_2/[r] \gg \ast M_2/[+hi] \gg \ast M_2/[+lo] \]

The \( M_2 \) hierarchy (4b) governs the segmental sonority level of codas and will be shown to govern the second member of an onset cluster as well. Both of these syllable positions prefer high sonority consonants over low sonority consonants. The ranking of this hierarchy is the reverse of the \( M_1 \) hierarchy, making obstruents the most marked segments in coda position and high sonority segments the least marked codas (Baertsch 2002). Exploding NOCODA in this way gives us the tools we need to analyze the segmental content of codas while the absence of a coda counterpart to the ONSET constraint (a constraint that would encourage syllables with codas as ONSET encourages syllables with onsets) still ensures that codas are dispreferred in general.\(^6\) That low-sonority codas would violate high ranking \( M_2 \) constraints captures the preference for high-sonority segments in coda position. It is not uncommon to find languages in which low sonority segments are banned from coda position while high sonority segments are acceptable codas. Examples include

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\(^6\) We want to be clear that our proposed \( M_2 \) hierarchy in (4b) does not give preference for vowels in the coda, even though the \( M_2 \) constraint governing low vowels is the lowest ranked constraint in the hierarchy. The \( M_2 \) hierarchy interacts with the Peak hierarchy, and the comparatively low ranking nature of the \( \ast P/Vowel \) constraints causes a vowel to be pulled into the nucleus rather than being parsed as a coda. However, we do find in some languages, like English and Dutch, that long vowels and diphthongs seem to spill over into the \( M_2 \) position rather than being encased completely in the nucleus (cf. Baertsch 2002 for more detailed discussion of this point).
Decomposing the Syllable Contact Asymmetry in Korean Ponapean (Goodman 1995) and Sranan (Alber and Plag 2001, based largely on data from Smith 1987). Consider the Sranan data in (5).

(5) Sranan codas

\.ku.ne.ti.  goodnight  \.tran.ga.  strong  \.shar.ki.  shark
\.sa.fri.  softly  \.mem.re.  remember  \.mar.ki.  mark

Here, obstruents but not sonorants are banned from coda position. Nasals are apparently the most common coda segments in Sranan, but several examples of coda [r] are given as well. Since English is the lexifier language for this Creole, it is faced with many illicit obstruent codas that must be eliminated. Medially, coda obstruents in Sranan are often deleted and word-finally, they are made syllabifiable by the addition of a nuclear vowel, as in the ‘goodnight’ example in (5). On our approach, the *M₂/Obs constraint in Sranan dominates FAITH and the remainder of the M₂ hierarchy is dominated by FAITH (*M₂/Obs >> FAITH >> *M₂/Nas).

In addition to its application to coda segments, the M₂ hierarchy also governs the second member of an onset cluster, following the syllable structure diagram in (6). In this way, we capture the general preference for high sonority segments in second onset position.

(6) Complex onsets and codas

\[ \sigma \\
\text{Onset} \quad \text{Rhyme} \\
\text{M₁} \quad \text{Nuc} \quad \text{M₂} \]

In their preference for high sonority, codas and the second onset segment are similar. This is not the whole story with regard to onset clusters, however. In addition to a preference for high sonority in the second onset position, languages that allow onset clusters at all generally require that the sonority relationship between the first and second segment of the cluster be rising and rising by a minimal degree (the minimal distance requirement).

The minimal distance requirement has posed some difficulty for optimality theoretic analyses in the past. Minimum distance constraints have been posited to cope with this phenomenon, but such constraints are problematic because they must crucially reference a sonority scale outside of the constraint hierarchy and they must
reference an acceptable distance level that is language-specific and outside of the
constraint hierarchy as well. However, with the split margin hierarchy approach
presented here, no reference to outside constraints is required. The sonority scale is
capsulated in the M₂ hierarchy and the sonority distance relationship is captured
through the conjunction of M₁ and M₂ constraints.

Conjunction of the M₁ and M₂ hierarchies results in a set of derived constraints
that carry with them some of the ranking relationships inherent in the unconjoined
constraints, as shown in (7) below (Baertsch 2002). The local domain over which
these constraints apply for onset clusters is the syllable.

(7) Ranking of conjoined constraints

```
(*A₁T₂)ₜ
| (*A₁N₂)ₜ (*I₁T₂)ₜ
| | (*A₁L₂)ₜ (*I₁N₂)ₜ (*R₁T₂)ₜ
| | | (*A₁R₂)ₜ (*I₁L₂)ₜ (*R₁N₂)ₜ (*L₁T₂)ₜ
| | | | (*A₁I₂)ₜ (*I₁R₂)ₜ (*R₁L₂)ₜ (*N₁T₂)ₜ
| | | | | (*A₁A₂)ₜ (*I₁I₂)ₜ (*R₁R₂)ₜ (*L₁L₂)ₜ (*T₁T₂)ₜ
| | | | | | (*M₁/a) (*I₁A₂)ₜ (*R₁I₂)ₜ (*L₁I₂)ₜ (*N₁R₂)ₜ (*T₁L₂)ₜ (*M₂/t)
| | | | | | | (*M₁/i) (*R₁A₂)ₜ (*L₁L₂)ₜ (*N₁I₂)ₜ (*T₁R₂)ₜ (*M₂/n)
| | | | | | | | (*M₁/r) (*L₁A₂)ₜ (*N₁L₂)ₜ (*T₁I₂)ₜ (*M₂/l)
| | | | | | | | | (*M₁/I) (*N₁A₂)ₜ (*T₁A₂)ₜ (*M₂/r)
| | | | | | | | | | (*M₁/n) (*T₁A₂)ₜ (*M₂/i)
| | | | | | | | | | | (*M₁/t) (*M₂/a)
```
Any sequence of adjacent M₁ and M₂ segments within a syllable (an onset cluster or a coda cluster) would violate the relevant conjoined constraint in addition to the relevant simple M₁ and M₂ constraints. A [tr] onset cluster, for example, would violate [*T₁R₂]σ, that is, *M₁/Obs, and *M₂/[r].⁷ It is crucial to note here that while onset clusters consist of an M₁ segment followed by an M₂ segment, the conjunction of these two hierarchies does not impose a linear order on the M₁ and M₂ segments. The same conjoined constraint would apply to either an M₁M₂ sequence or to an M₂M₁ sequence if the segments filling the M₁ position in both sequences were identical and the segments filling the M₂ position in both sequences were also identical. In other words, it would treat the sequence [t₁r₂] the same as the sequence [r₂t₁] (where subscript ‘1’ indicates the segment fills an M₁ position and subscript ‘2’ indicates the segment fills an M₂ position) as long as both sequences satisfied the local domain requirement. Under the domain of the syllable, the conjoined constraint could potentially refer to either an onset cluster (M₁M₂) or a coda cluster (M₂M₁) as both sequences are completely within a single syllable. This will become important when we begin discussing the syllable contact environment where the two segments are in different syllables.

In English, onset clusters consisting of obstruents followed by liquids are allowed, indicating that FAITH dominates [*T₁L₂]σ as well as the conjunctions that [*T₁L₂]σ dominates. Onset clusters with a more shallow sonority profile, such as obstruent-nasal clusters, are disallowed. This indicates that the conjunction [*T₁N₂]σ dominates FAITH, as we see in (8). In some ways, this ranking is similar to identifying a ‘minimal sonority distance of 2’ as would have been done in earlier approaches, but it has several advantages over the minimal sonority distance approach. For example, it does not require reference to an outside construct such as the sonority scale or a sonority distance threshold, an important tenet of OT. It also does not treat potential sonorant-sonorant onset clusters as exceptional. In a minimal sonority distance approach, sonorant-sonorant clusters that met the minimal distance requirement were prevented from surfacing via an OCP constraint banning sonorant-sonorant clusters. In the current approach, such a constraint is unnecessary.

⁷ The constraints as given in this diagram and throughout the paper are read in the following way. The constraint [*T₁R₂]σ is shorthand for the conjunction of the *M₁/Obs (T₁) constraint with the *M₂/[r] (R₂) constraint over the local domain of the syllable (σ).
(8) Ranking of conjoined constraints for English onset clusters

\[
\begin{align*}
\{[*A_1T_2]_o, \} \\
\{[*A_1N_2]_o, [*I_1T_2]_o, \} \\
\{[*A_1L_2]_o, [*I_1N_2]_o, [*R_1T_2]_o, \} \\
\{[*A_1R_2]_o, [*I_1L_2]_o, [*R_1N_2]_o, [*L_1T_2]_o, \} \\
\{[*A_1I_2]_o, [*I_1R_2]_o, [*R_1L_2]_o, [*N_1N_2]_o, [*T_1T_2]_o, \} \\
\{[*A_1A_2]_o, [*I_1I_2]_o, [*R_1R_2]_o, [*L_1L_2]_o, [*N_1N_2]_o, [*T_1N_2]_o, [*M_2/t, \} \\
\{[*M_1/a]_o, [*I_1A_2]_o, [*R_1I_2]_o, [*L_1R_2]_o, [*N_1I_2]_o, [*T_1L_2]_o, \} \\
\{[*M_1/i]_o, [*I_1A_2]_o, [*R_1i]_o, [*L_1L_2]_o, [*N_1I_2]_o, [*T_1R_2]_o, \} \\
\{[*M_1/r]_o, [*I_1A_2]_o, [*N_1I_2]_o, [*T_1I_2]_o, \} \\
\{[*M_1/n]_o, [*I_1A_2]_o, [*T_1A_2]_o, \} \\
\{[*M_1/t, [*M_2/a] \}
\end{align*}
\]

The constraint ranking reflects the generalization that sonorant-sonorant clusters are more marked than obstruent-sonorant clusters and the implication is that if a language allows sonorant-sonorant clusters (like [mr-]), it will also allow obstruent-sonorant clusters (like [tr-]) but not the reverse. OCP constraints then target clusters that are too similar in place of articulation, for example ([pw-], [tl-], etc.), rather than major class features like [±sonorant].

Onset clusters consisting of obstruents followed by the high back glide [w] are also allowed in English, but clusters consisting of obstruents followed by the high front glide [j] are disallowed. In the current analysis, this situation results from the interaction of conjoined constraints with the corresponding Peak constraints. The high front glide makes a better peak than an M_2 segment in English and the
high front glide gets pulled into the peak, preventing it from surfacing in an onset cluster. The high back glide, on the other hand, makes a slightly better M₂ segment and is allowed to surface in an onset cluster. This situation is difficult to deal with using traditional minimal sonority distance terms as it would constitute a ‘maximum sonority distance parameter’ in addition to the minimum sonority distance parameter that has long been accepted, but it is readily explainable in the context of the split margin hierarchy approach. The analysis of obstruent-[j] sequences surfacing as a singleton onset (M₁) followed by a nuclear segment is supported by phonotactic restrictions. The only complex nucleus allowed in English that includes [j] as an onglide is [ju]. Other sequences of obstruent-high vowel-vowel surface as bisyllabic (compare [kjur] ‘cute’ vs. [ki.ask] ‘kiosk’). This restriction combined with the lack of restriction on the initial consonants in such sequences (‘mute’, etc.) indicate that the glide is indeed part of the nucleus. (See Davis and Hammond 1995 and Baertsch 2003a for further discussion.)

In Korean, onset clusters are normally disallowed. However, a glide can appear in a syllable after an initial consonant and before the vowel. The question arises as to whether this glide is part of a complex onset, as obstruent-[w] sequences are in English, or whether the glide is part of a complex nucleus, similar to the [ju] sequence in English. There are no phonotactic restrictions on the consonants that can occur before the glide, as we see in (9), suggesting that glides in Korean are in nuclear position.

(9) Korean consonant-glide-vowel sequences

<table>
<thead>
<tr>
<th>Syllable</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>kyəca</td>
<td>‘mustard’</td>
</tr>
<tr>
<td>kwənse</td>
<td>‘power’</td>
</tr>
<tr>
<td>myənili</td>
<td>‘daughter -in-in-law’</td>
</tr>
<tr>
<td>mwa</td>
<td>‘to gather’</td>
</tr>
<tr>
<td>u.rwe</td>
<td>‘rain and thunder’</td>
</tr>
</tbody>
</table>

We have already established the relative position of FAITH with respect to the M₁ hierarchy (glides are allowed in M₁ position), and we know that obstruents are allowed as coda segments in Korean as well, indicating that FAITH dominates the entire M₂ hierarchy in this language, as shown in (10).
(10) Ranking of conjoined constraints for Korean onset clusters

Because onset clusters are categorically disallowed in Korean, we know as well that all of the M_1M_2 conjunctions in the syllable domain dominate FAITH. Any of the constraints above the dotted line in (10) are constraints that are essentially undominated in Korean. This includes all the conjoined constraints which reflect the possible onset clusters. Such clusters are consequently disallowed in Korean. With this preliminary analysis in hand, we are ready to move to a discussion of the syllable contact phenomena in Korean.

4. The Extension of the M_2 Hierarchy to Syllable Contact Phenomena

In addition to an analysis of singleton onsets, singleton codas, and onset clusters, the split margin hierarchy approach to syllable structure can also account for syllable contact phenomena as have been identified in a number of languages, including

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8 Because all of the [M_1,M_2]_σ constraints dominate FAITH in Korean, we collapse the set into *COMPLEX in the remainder of this paper except where necessary for exposition.
Korean. Syllable contact has also been traditionally analyzed utilizing sonority distance constraints (e.g., Bat-El 1996, Gouskova 2004). In the previous section we have shown that the sonority distance requirement on onset clusters can be decomposed into the conjunction of the individual constraints of the M1 and M2 hierarchies. In this section we will enlarge upon this analysis in order to explain the syllable contact asymmetry in Korean.

Like the general low-sonority (M1) followed by high-sonority (M2) preference displayed by onset clusters, the preference in medial clusters is to have a high-sonority coda (M2) followed by a low-sonority onset (M1). This general fact falls out from the preference that the M1 constraints give to low-sonority onsets and the preference that the M2 hierarchy gives to high-sonority codas. But once again, we need to capture the sonority slope relationship between these two consonants as well. And once again, constraint conjunction allows us to do this.

Onset clusters are governed by constraint conjunction in the local domain of the syllable. The syllable contact domain is larger than the syllable. The two margin segments are adjacent across a syllable boundary, and any process that occurs between them can be considered either a foot-level process or a word-level process. In our analysis, we consider this to be a phonological word-level process and the local domain relevant for syllable contact is correspondingly the phonological word. Onset clusters also consist of two margin segments that are adjacent within a word, therefore onset clusters will violate the conjunction of a relevant M1 and M2 constraint in the domain of the syllable and also in the domain of the word. Syllable contact phenomena, on the other hand, will violate the conjunction of a relevant M1 and M2 constraint only at the word level, as we see in (11) below.

(11) The syllable contact situation

\[
\begin{array}{c}
\omega \\
\sigma \\
\sigma \\
\text{Coda} \\
\text{Onset} \\
\text{M}_2 \\
\text{M}_1 \quad \text{M}_2
\end{array}
\]

The two domains, syllable and prosodic word, are in a hierarchical inclusion relation. Following Ito and Mester (1998), this relation can be captured with the ranking diagram in (12), where the conjunction in the smaller domain dominates the
conjunction of the same constraints in a larger domain.

(12) Locality ranking

\[
\begin{align*}
\Phi_{\text{syllable}} & \quad \Phi_{\text{word}} \\
\Phi_{\text{phrase}} &
\end{align*}
\]

The locality ranking captures the behavior of onset clusters and syllable contact clusters. A constraint which is violated in the syllable domain, as with onset clusters for example, is also violated in the word domain, but a constraint that is violated in the word domain, as with syllable contact clusters, may or may not be violated in the syllable domain.

In the context of the conjunction of \(M_1\) and \(M_2\) constraints across both domains (the syllable and the prosodic word), keeping the locality ranking in (12) in mind, we derive the ranking given partially in (13).

(13) Partial ranking schema

\[
\begin{align*}
[*R_1T_2]_o & \quad [T_1R_2]_o \\
[R_1T_2]_{wd} & \quad [T_1R_2]_{wd} \\
M_1/[r] & \quad [T_1R_2]_{wd} \\
M_2/Obs & \quad M_1/Obs \\
M_2/[r] &
\end{align*}
\]

Under this ranking, which shows all possibilities for rhotic-obstruent or obstruent-rhotic clusters, we see that onset clusters consisting of obstruent-rhotic (such clusters consist of an obstruent in \(M_1\) and an [r] in \(M_2\) position within both the syllable and the prosodic word) are much preferred over rhotic-obstruent onset clusters (which would consist of an [r] in \(M_1\) position and an obstruent in \(M_2\) position). The obstruent-rhotic onset cluster would violate \([*T_1R_2]_o\), \([*T_1R_2]_{wd}\), \([*M_1/Obs\), \(M_2/[r]\), while the rhotic-obstruent onset cluster would violate \([*R_1T_2]_o\), \([*R_1T_2]_{wd}\), \(M_1/[r]\), and \(M_2/Obs\). Of these violations, \([*R_1T_2]_o\) is the highest ranking, and would have the effect of eliminating the rhotic-obstruent cluster very early in
the evaluation if it dominates an appropriate Faithfulness constraint. This ranking captures the overwhelming preference for rising sonority within onset clusters and the rarity of falling sonority onset clusters.

Rhotic-obstruent syllable contact clusters, on the other hand, are much preferred over obstruent-rhotic clusters. Because syllable contact clusters do not violate any of the conjunctions over the syllable domain, each of these clusters violates three constraints. The rhotic-obstruent contact cluster, which consists of a rhotic in M₂ position followed by an obstruent in M₁ position, would violate [*T₁R₂]_{wd}, *M₂/[r], and *M₁/Obs (note here that [*T₁R₂]_{wd} is the lowest ranking of the four conjoined constraints presented in (13) above). The obstruent-rhotic contact cluster would violate higher ranking [*R₁T₂]_{wd} as well as the unconjoined *M₁/[r], and *M₂/Obs.

Thus, given the task of syllabifying a vowel-rhotic-obstruent-vowel sequence in a language in which codas are allowed and onset clusters are allowed, the most preferred syllabification would be as a singleton coda rhotic followed by a singleton onset obstruent ([*R₁T₂]_{o} >> [*T₁R₂]_{wd}), as we see in (14). The winning candidate in this tableau includes a typologically unmarked falling sonority syllable contact cluster and the losing candidate with an onset cluster would have contained an extremely marked falling sonority onset cluster.

(14) Syllabification of a vowel-rhotic-obstruent-vowel sequence

<table>
<thead>
<tr>
<th>/VṛtV/</th>
<th>Dep</th>
<th>[*R₁T₂]_{o}</th>
<th>[*R₁T₂]_{wd}</th>
<th>[*T₁R₂]_{o}</th>
<th>[*T₁R₂]_{wd}</th>
<th>*M₁/[r]</th>
<th>*M₂/Obs</th>
<th>*M₂/[r]</th>
<th>*M₁/Obs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vṛ₁t₂V</td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vṛ₁t₁V</td>
<td>*!</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vṛ₁V t₁V</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On the other hand, the preferred syllabification for a vowel-obstruent-rhotic-vowel sequence in a language allowing codas and onset clusters is less clear when we consider only the conjoined constraints as given in (13). There is no inherent ranking argument regarding [*R₁T₂]_{wd} and [*T₁R₂]_{o}, passing evaluation on to the next level at which it would appear that the candidate with the syllable contact cluster (rising sonority across the syllable boundary) fails due to the second violation.

---

9 The two constraints [*R₁T₂]_{wd} and [*T₁R₂]_{o} are ranked equally because the conjunction of the two hierarchies at the two different domains does not import a ranking between these two different domains does not import a ranking between these two constraints. Unconjoined constraints lower in the tableau are likewise unranked with respect to one another.
mark at that level (failure due to the relatively marked nature of the onset segment and relatively marked nature of the coda segment as indicated in tableau (15) in comparison to the single violation mark the onset cluster candidate incurs at this level (due to the rising sonority onset cluster).

(15) Syllabification of vowel-obstruent-rhotic-vowel sequence

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vt2 r1 V</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vt1 r2 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Vt1 Vr1 V</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

Given this ranking, we would expect that languages that allow onset clusters would not be overly concerned with the sonority contour of syllable contact clusters. This is because if DEP is higher-ranked than *[T1R2]o allowing for obstruent-rhotic clusters in word-initial position, then in word-internal position the obstruent and rhotic can syllabify heterosyllabically if *[T1R2]o outranks *[R1T2]wd, resulting in rising sonority over a syllable boundary. If, on the other hand, *[R1T2]wd outranks *[T1R2]o, the sequence would surface as a rising sonority onset cluster both word-initially and word-medially. An interesting result here is that a language allowing onset clusters would be predicted not to show syllable contact effects.

But in a language that does not allow onset clusters (FAITH is dominated by all of the conjoined constraints in the syllable domain, indicated in the tableau in (16) by the insertion of an undominated *COMPLEX), we see a very different picture.

(16) vowel-obstruent-rhotic-vowel sequence, no complex onset

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vt2 r1 V</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vt1 r2 V</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vt1 Vr1 V</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In this last tableau, we see that the syllable contact environment in which the cluster rises in sonority across the syllable boundary is much more susceptible to elimination under these circumstances. Unless DEP dominates *[R1T2]wd, the winner will be the candidate that violates FAITH. For this reason, languages that categorically disallow complex onsets are more likely to be sensitive to the sonority contour in the syllable
contact environment than languages that do allow complex onsets.

Korean, as a language that does not allow complex onsets, fits into this last category. It does not tolerate rising sonority across the syllable boundary, as we see in (17).

(17) Korean syllable contact data (Data are from Davis and Shin 1999)

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>UR</td>
<td>SR</td>
<td>Gloss</td>
<td>Alternation</td>
</tr>
<tr>
<td>/kukmul/</td>
<td>[kuŋ.mul]</td>
<td>broth</td>
<td>k.m – [ŋ.m]</td>
</tr>
<tr>
<td>/kamli/</td>
<td>[kam.ni]</td>
<td>supervision</td>
<td>m.l – [m.n]</td>
</tr>
<tr>
<td>/pəpli/</td>
<td>[pəm.ni]</td>
<td>principle of law</td>
<td>p.l – [m.n]</td>
</tr>
<tr>
<td>/kamki/</td>
<td>[kam.ki]</td>
<td>flu</td>
<td>m.k – [m.k]</td>
</tr>
<tr>
<td>/kalmaŋ/</td>
<td>[kal.maŋ]</td>
<td>desire</td>
<td>l.m – [l.m]</td>
</tr>
<tr>
<td>/kalpi/</td>
<td>[kal.pi]</td>
<td>ribs</td>
<td>l.p – [l.p]</td>
</tr>
<tr>
<td>/maktæ/</td>
<td>[mak.t’æ]</td>
<td>stick</td>
<td>k.t – [k.t’]</td>
</tr>
</tbody>
</table>

Korean normally corrects such sequences by changing the manner feature of the offending coda segment but as we see in the second example in (17) an onset can change if a coda change is impossible. In terms of minimal distance in the prosodic word domain, Korean can be said to allow equal or falling sonority (a distance of 0 or lower) but disallow rising sonority (positive distances). The ranking of ID[manner] with respect to the conjunction of the two margin hierarchies in the domain of the word is shown in (18) for Korean.
(18) Ranking of conjoined constraints

```
*A1N2 *I1T2
[*A1I2]wd [*I1r2]wd [*r1N2]wd [*N1T2]wd
[*A1A2]wd [*I1I2]wd
*M1/A [*I1A2]wd
*M1/I
```

ID[manner] dominates the conjoined constraints that govern equal sonority syllable contact clusters and by transitivity, the constraints dominated by those constraints. Because these constraints are all dominated by ID[manner], clusters with equal or falling sonority across a syllable boundary will surface in Korean. Clusters with rising sonority across the syllable boundary (and clusters with glides as the onset to the second syllable) will be avoided in Korean. Moreover, recall from (10) that
the conjoined constraints within the domain of the syllable governing onset clusters are all ranked above the relevant faithfulness constraints and are consequently disallowed. The three tableaux in (19)-(21) make clear our analysis.

(19) /kukmul/ -- [kuŋ.mul] ‘broth’

<table>
<thead>
<tr>
<th>/kukmul/</th>
<th>*Complex</th>
<th>[*n₁t₂]wd</th>
<th>ID[manner]</th>
<th>[*n₁n₂]wd</th>
<th>[*t₁n₂]wd</th>
</tr>
</thead>
<tbody>
<tr>
<td>ku₂,m₁ul</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td>!</td>
</tr>
<tr>
<td>kuk₂,m₁ul</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td>!</td>
</tr>
<tr>
<td>kuŋ₂,m₁ul</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

(20) /kamli/ -- [kam.ni] ‘supervision’

<table>
<thead>
<tr>
<th>/kamli/</th>
<th>*Complex</th>
<th>[*r₁n₂]wd</th>
<th>ID[manner]</th>
<th>[*n₁n₂]wd</th>
<th>[*n₁r₂]wd</th>
</tr>
</thead>
<tbody>
<tr>
<td>ka₁,m₁i</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td>!</td>
</tr>
<tr>
<td>kam₂,l₁i</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td>!</td>
</tr>
<tr>
<td>kam₂,n₁i</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

(21) /kamki/ -- [kam.ki] ‘flu’

<table>
<thead>
<tr>
<th>/kamki/</th>
<th>[*n₁t₂]wd</th>
<th>*Complex</th>
<th>ID[manner]</th>
<th>[*n₁n₂]wd</th>
<th>[*t₁n₂]wd</th>
</tr>
</thead>
<tbody>
<tr>
<td>ka₁,m₁i</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>kam₂,k₁i</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>kam₂,ŋ₁i</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

What is noteworthy is the difference between (21) on the one hand, and (19)-(20) on the other hand. This difference reflects the asymmetry noted in the introduction to this paper that falling sonority sequences over a syllable boundary are usually faithfully maintained while potential rising sonority sequences undergo manner changes so as to avoid rising sonority over the syllable boundary. This asymmetry is captured in (19) by the decomposition of syllable contact into the conjunction of margin constraints from the $M_1$ and $M_2$ hierarchies. The analysis does not have to refer formally to an external sonority hierarchy (which Davis and Shin 1999 do) nor to specific syllable contact constraints on sonority distance.

5. Conclusion

In this paper we have focused on a theoretical exposition of the split margin hierarchy approach to the syllable with specific reference to syllable contact phenomena evident in Korean. We have decomposed syllable contact under the split margin approach into the conjunction of the individual $M_1$ and $M_2$ constraints. This
not only accounts for the Korean syllable contact asymmetry, but also accounts for
the lack of onset clusters in the language.

Moreover, the split margin approach also allows us to explain various
typological, phonotactic, and acquisitional observations that have defied previous
explanation, including the sonority relationship between segments within an onset
cluster.

There are a variety of implications that emerge from our approach that we
do not pursue here. For example, the possible analyses of on-glides in different
languages (and within the same language) as either onset segments or peak segments
given the tension between the low-ranking Peak and M₂ constraints, both of which
favor high vowels (see, for example, Davis and Hammond 1995 and Baertsch 2003a
for English.) This remains an open question in Korean with respect to obstruent-
glide-vowel sequences.

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