SYLLABLES AND CONSONANTS

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ABSTRACT

Syllables are projections of vowels.
The first projection licenses a consonant
position (coda) which is optional. The
second projection licenses a consonant
position (onset) which is obligatory.
Consonantal phenomena such as assimilation
and deletion are the consequence of
'fitting' consonants into syllable
structure positions licensed by vowel
projections.

Korean

In Korean there is widespread deletion
of consonants at morpheme boundaries where
two consonants compete for a single
syllable structure position. For example,
consider the alternation of [s] and Ø in
[kap] 'price', [kapto] (foc), and [kapsi]
(subj). The focus ending is [to], the
subject ending is [i], and the basic noun
is /kaps/. Where the two final consonants
(/p/ and /s/) compete for a single coda
position word finally or before an onset
consonant, then /s/ invariably deletes.
Where a vowel follows the consonant
cluster, both are retained. Similarly,
there is an alternation between [l] and Ø
in [samki] 'to steam', [salmini] 'as one
steams'. Here in lexical /salm/, /l/ and
/m/ compete for a single coda position
before an onset consonant and /l/
deletes. Again, where the cluster is
followed by a vowel both consonants are
retained. In the case of /kaps/ it is the
second consonant of the cluster that
deletes, in the case of /salm/ it is the
first. Both the fact that a consonant
deletes in the particular context, and the
particular consonant that deletes in a
given cluster follow from syllable
structure principles.

Let us assume an account of syllable
structure where syllables are projections
of vowels: that is, a vowel is the head
of a syllable. The first vowel projection
(V' or rhyme) can optionally license a
consonant position (coda). The second
vowel projection (V" or syllable)
obligatorily licenses a consonant position
(onset). Onset positions, which are
obligatory, are filled first.

Furthermore, a syllable has a single
sonority peak. In this framework, the
consonant cluster reduction phenomena in
Korean follows from the fact that the
onset and coda positions can be filled by
no more than one consonant each. The
consonant that wins the position where two
compete for it is the consonant with the
lowest sonority value. If we assume that
the syllable structure principles outlined
above are universal, then all that a
Korean child must learn is that the
consonant positions licensed by syllable
structure in Korean are limited to single
consonants. Which consonants delete, and
under what circumstances, will follow from
universal principles of syllabification
and general considerations of sonority.
The evidence that the child will need to
arrive at the language particular property
of Korean that only a single consonant can
fill a syllable structure position is
readily available from the fact that words
end in no more than one consonant. The
fact that it is the lowest sonority member
of the pair is the unmarked case if
syllables tend to maximize the single
sonority curve. In this way a fairly
restricted, but general theory of syllable
structure and sonority, not only gives an
account of cluster reduction in Korean,
but suggests a way that the learnability
question (how complex grammatical facts
can be mastered so rapidly with the
limited data available to the child) can
be addressed in phonology.

There is one additional aspect of
Korean consonant cluster reduction that I
will consider here. The combination of
/ilk+ta/ gives [ikta] 'to read' as
expected. That is where /l/ and /k/
compete for the single coda position of
the first syllable, the lower sonority /k/
wins. However, the combination of
/ilk+ki/ gives [ilki]. Here it appears
that /l/ has won the coda position and /k/
has been deleted in violation of the
sonority principle. It seems that when
two of the three consonants in the
sequence are a geminate cluster, that
degemination takes precedence in cluster
reduction. This appears to be a strictly
linear fact that has nothing to do with
syllable structure positions. However, if

consider that consonant clusters can also be analyzed as hierarchical structures and that deletion is a last resort to "fit" a sequence of consonants into positions licensed by syllable structure, then there is a syllable structure account of degemination. The analysis is as follows: consonant clusters are C-projections, where the first projection C dominates the head C and a complement C. The single consonant for each C-position in Korean syllable structure can then be seen as a requirement that C' have a single interpretation. Where two different consonants are dominated by C', then C' takes the lowest sonority interpretation in the unmarked case. Where the two C's are identical (i.e. geminate clusters), then C' still gets a single interpretation since the two C's it dominates send up nondistinct feature representations. Thus, degemination is automatic where geminate clusters must be interpreted in a single syllable structure position, and the facts in question here do not contradict the syllable structure and sonority approach to cluster reduction in Korean [1].

Southern Paiute

Southern Paiute also has degemination, but under different circumstances from those in Korean. In Southern Paiute, geminate clusters are reduced before a stressed vowel. The interaction of stress and syllable structure in this case is quite deep. First, it is important to note that Southern Paiute has an alternating stress pattern where every even numbered vowel counting from the left is stressed (except for the last syllable of the word, or in bisyllabic words where the first syllable is stressed). The interaction of stress and syllable structure in Southern Paiute seems to be the following. Vowels project a syllabic category (V' or rhyme) which optionally licenses a consonant position (coda). In Southern Paiute, whether or not a coda position is licensed depends on stress. Specifically, a stressed syllable can have a coda, an unstressed syllable cannot. Thus, the syllable before a stressed syllable is always unstressed under the alternating stress pattern and cannot license a consonant as coda. If two consonants intervene between an unstressed syllable and a stressed syllable then the both must be interpreted under the onset C' of the stressed syllable. If they are nondistinct (i.e. a geminate cluster) and if C' in Southern Paiute (as in Korean) must have a single interpretation, then degemination once again is the single interpretation of nondistinct feature representations at C'. In Korean, degemination is forced in onset position when the coda of the preceding syllable is

filled by a consonant. In Southern Paiute it is forced when the preceding syllable is unstressed and, therefore, cannot license a coda position. In both cases cluster reduction follows automatically from the requirements of syllable structure. In Southern Paiute the learnability of degemination requires only that evidence of the alternating stress pattern in open and closed syllables be available. No particular rule of degemination need be learned.

Let us consider one other closely related aspect of Southern Paiute here: the other side of degemination, gemination. In Southern Paiute, as pointed out by Sapir [2], certain morphemes have the effect of geminating the initial consonant of following morphemes. The initial segment of the geminate cluster may be an obstruent or a nasal. Following Chomsky and Halle [3], let us assume that the geminating effect is the result of adjacency of the final consonant of the first morpheme and the initial consonant of the second morpheme. In the syllable structure framework under consideration, both consonants will be given an interpretation under C' in the onset of the second syllable. If the first consonant is unspecified, at C' it will be interpreted as nondistinct from the other, specified consonant. If the first consonant is specified only for nasality, at C' it will be interpreted as nondistinct for all other features from the other, fully specified consonant. Finally, if the preceding syllable is stressed and, therefore, licenses a coda position, this geminated consonant will receive an interpretation there. This will be the case of gemination. If the preceding syllable is unstressed and, therefore, cannot license a coda position, then the geminated consonants will receive a single interpretation in the onset position of the second syllable. This is the case of degemination. Thus, assimilation (in this case complete assimilation or gemination) can be seen to follow from the requirement of giving adjacent consonants an interpretation at the immediately dominating projection licensed by syllable structure. See Chomsky and Halle's [3] analysis of Sapir's [2] observations on Southern Paiute for further discussion.

Zoque

There is a similar gemination and degemination process at morpheme boundaries in Zoque (see Wonderly [4] for the data, Dell [5] for a generative analysis of the data). In morpheme combinations such as /kihp+u/ ([kihpu]) 'he fought', the /h/ appears to be realized as coda of the first syllable, the /p/ as onset of the second. When

lexical /kihp/ comes together with /pa/ (past tense), the resulting geminate /p/- cluster degeminates giving [kihpa]. Thus, where the coda position of the preceding syllable is filled as in Korean, the geminate cluster must be interpreted as a nondistinct single consonant in the onset C' position of the following syllable. However, where an /h/ is followed by two nonidentical consonants, then the /h/ deletes. For example, /kihp+yahu/ 'they fought' is realized as [kipyahu]. This case, too, can be analyzed in a similar way to cluster reduction in Korean. Thus, /p/ and /y/ being nonidentical cannot both be interpreted in the onset C' position of the second syllable. /p/, then, must compete with /h/ for the single coda position of the first syllable, where sonority determines which segment wins.

Zoque also shows evidence of assimilation in onset position similar to that of Southern Paiute. Here, a morpheme apparently specified only for nasality essentially geminates with the initial consonant of the stem it is prefixed to. Thus we get the following pair: [puhtu] 'he went out', [mbuhtu] 'I am going out . If the stop consonants are unspecified for voicing and the nasal prefix is unspecified for place of articulation, the at C' in onset position, the nasal is interpreted with the place of articulation features of the stop and the stop is interpreted with the voicing feature of the nasal. Once again, if syllabification requires the two consonants to be interpreted in a single onset position, the assimilation follows from the requirement that each C be interpreted at C'. See Michaels and Tiedeman [6] for further discussion of consonantal alternations in Zoque within a syllable structure framework.

Japanese

The last set of examples is from Japanese. A verb such as [tabe] 'eat' is [taberu] in the present, [tabeta] in the past, which enables us to identify the present tense suffix as /ru/, the past tense suffix as /ta/. When these suffixes are added to consonant final verb stems, we get instances of degemination and gemination creating an interesting array of alternations. Thus, /wakar+ru/ 'understand' gives [wakaru] (degemination), and /wakar+ta/ gives [wakatta] (gemination). In the case of /wakar+ru/, if we assume that the final syllable of the stem does not license a coda, then both /r/s must be interpreted in the C' onset position of the suffix syllable giving degemination in circumstances similar to Southern Paiute. In the case of /wakar+ta/, the nonavailability of a coda position will force the interpretation of /r/ and /t/ in

the C' onset position of the suffix syllable. Here, however, because the two consonants are distinct, we would expect either deletion of one (presumably /r/ since it is more sonorous than /t/), or that /r/ is interpreted in the coda position of the preceding syllable. However, there are two things wrong with this analysis. First, if we've argued that degemination occurs in /wakar+ru/ because there is no coda position in the final syllable of the stem, then why does such a position show up to license the first member of the geminate cluster in [wakatta]. Second, if gemination is nondistinctness at C' how is it that /r/ and /t/ can have nondistinct feature representations.

Assuming that the general syllable structure account of deletion, assimilation, gemination and degemination that we have been outlining is correct, then we must make several assumptions about language particular representations in Japanese to get the analysis to come out right there. First, we must assume that the final stem syllable in the verbs in question license a coda position that is partially specified as either a nasal or a voiceless stop (i.e. [nasal, voice]). That is, any segment that is interpretable in that position will be interpreted as a voiced nasal or a voiceless nonnasal. Second, we must assume that /r/ is a maximally unmarked liquid. Then in the case of /wakar+ta/, /r/ is interpreted as nondistinct from /t/ at C' in the onset position of the suffix syllable. Once it has the interpretation of a voiceless stop it can be realized in the marked coda position of the final syllable of the stem. The fact that all stem final consonants are interpreted as either /n/ or /t/ in this position before the /ta/ suffix is consistent with the assumption that the position itself is partially marked for the features [nasal, voice] (e.g. /yom+ta/ [yonda], /yob+ta/ [yonda], /iu+ta/ [itta], etc.) See Kawai [7] for a detailed discussion of syllable structure and assimilation phenomena in Japanese.

In conclusion, it seems unlikely that similar phenomena in such disparate languages as those illustrated above are the result of accidental language particular rules. The syllable structure approach suggests why such phenomena might be expected to show up in again and again across languages. It is in the process of vowels gathering consonants up into syllables that adjustments to the consonants have to be made. The different adjustments made in different languages are the result of the particular configuration that syllables take in those languages. Once those configurations are identified, the range of adjustments

available to consonants can be predicted
to a large extent.

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