

Cooccurrence Restrictions and Optimal Syllabification in English

Shinsook Lee and Mi-Hui Cho

(Hoseo University and Pukyong National University)

Lee, Shinsook and Cho, Mi-hui. 2000. Cooccurrence Restrictions and Optimal Syllabification in English. *Journal of the Linguistic Association of Korea*, 8(3), 123-138. In this paper, we examine the cooccurrence restrictions in American English: coronals are prohibited from occurring before [y] in syllable-initial position; the sequence of a coronal and [y] occurs only in unstressed medial position, and the vowel which follows the sequence must be [u] but not others. First of all, we show that the cooccurrence restrictions can be accounted for within Correspondence Theory, without a strict rule ordering. In particular, we show that optimal syllabification, which is determined by a constraint hierarchy where markedness constraints dominate relevant faithfulness constraints, provides a unified account of the cooccurrence facts without several derivational steps. We also demonstrate that the occurrence of the sequence of a consonant plus [y] only before the vowel [u] can be accounted for by positing the input representation of the vowel [u] as /u/, thus dispensing with an abstract underlying representation or ad-hoc rules for [yu]. Moreover, we do not need to employ controversial resyllabification in order to account for the distributional facts concerning the sequence of coronal-yu in unstressed medial position. (Hoseo University and Pukyong National University)

1. Introduction

It is well-known that many dialects of American English such as the North American dialect show cooccurrence restrictions which hold on the sequence of a syllable-initial consonant plus the high front glide followed by a vowel. For instance, coronals are prohibited from occurring before the high front glide in syllable-initial position. Also, when the sequence of a consonant and the high front glide occurs in

syllable-initial position, the following vowel should be the high back rounded vowel /u/ but not others. In addition, the sequence of a coronal plus the high front glide followed by the vowel /u/ can occur only in unstressed medial positions. That is, if the sequence occurs in word-initial or stressed position, the high front glide /y/ should delete.

Cooccurrence restrictions in English have been analyzed by many phonologists under rule-based derivational models. For example, Halle and Mohanan (1985) and Jensen (1993) account for the occurrence of glide [y] preceding [u] in unstressed medial position by a rule of [y] insertion which is ordered among several phonological rules. In contrast, Borowsky (1986) and Davis and Hammond (1995) analyze the same data by assuming that the glide [y] is underlyingly present and by appealing to a strict ordering among several phonological rules and resyllabification. Thus, the cooccurrence restriction facts seem to challenge the parallelistic Correspondence Theory (McCarthy and Prince 1995, hereafter CT) which does not recognize intermediate steps.

In this paper, however, we will show that there is no motivation for the strict rule ordering among phonological rules including resyllabification, in order to account for the cooccurrence restrictions. Specifically, we will show that CT provides a principled account of the cooccurrence restrictions in terms of optimal syllabification which is determined by a constraint hierarchy. Moreover, we will contend that, by regarding [y] which precedes [u] as part of the input nucleus as in Borowsky (1986) and Davis and Hammond (1995), the occurrence of the sequence of a consonant(C)yu can receive a principled account. That is, we can get rid of an abstract underlying representation and ad-hoc rules for [yu]. Unlike Borowsky (1986) and Davis and Hammond (1995), however, we do not need resyllabification in order to account for the cooccurrence data.

The paper is organized as follows: Section 2 presents data on cooccurrence restrictions. Section 3 examines previous analyses and their problems. Section 4 provides a unified account of the cooccurrence restrictions in terms of optimal syllabification. Section 5 summarizes the

paper.

2. Data

In English the sequence of CyV is disallowed if the following vowel is not [u], as in (1). Thus, only the *Cyu* sequences are allowed. However, the distribution of *Cyu* is very restricted. The *Cyu* sequences occur when the consonant before [y] is a labial or a velar, as in (2).

(1) The non-occurrence of CyV (Davis and Hammond 1995)

*Cyi, *CyI, *Cye, *Cyɛ, *Cyæ, *Cyo, *Cya

(2) Examples of *Cyu* sequences

puny, beauty, mute, music, computer, fume, view, cute, argue

The high front glide [y] after a coronal obstruent neither appears in coronal-*yu* sequences in initial position nor in a stressed syllable, as shown in (3). All data are from Borowsky (1986) and Jensen (1993).

(3) [+cor, -son][y] in stressed, & unstressed initials in dialects of American English :

*[ty] tune, attune

tuition, tutorial

*[dy] duke, adduce

duplicity, duration

*[sy] suicide, assume

superlative, superior

*[zy] Zeus, zeugma, resume

When coronal-*yu* sequences are not in initial position, the occurrence of [y] is affected by stress, as in (4).

(4) [+cor, -son][y] in unstressed medials in dialects of American English

a. perpetual	[tʃyu] ¹⁾	b. perpetuity	[tú]
residual	[dʒyu]	residue	[dù]
constitutive	[tʃyu]	constitute	[tù]
fortune	[tʃyu]	fortuitous	[tú]
incredulous	[dʒyu]		

In (4a) [y] does appear in an unstressed syllable, whereas in (4b) [y] does not appear in a stressed syllable. Similarly, [y] before a coronal nasal or a liquid does not occur in initial position, as in (5).

(5) [+cor, +son][y] in stressed, & unstressed initials in dialects of American English:

- *[ny] news
numerical
- *[ly] lute, lucid
lugubrious
- *[ry] rude, ruby
ruthless

[y] can appear in non-initial position after a coronal nasal or liquid as in (6), but only in an unstressed syllable.

(6) [+cor, +son][y] in unstressed medials in dialects of American English:

a. unstressed	b. stressed
[ny]	*[ny]
continue	continuity
annual	annuity
[ly]	*[ly]
volume	voluminous

1. Coronal obstruents followed by the high front glide [y] become palatalized in non-initial unstressed positions.

solute	solution
salutation	salute
voluble	absolute
[ry]	*[ry]
querulous	querulity
erudite	peruse
virulent	cherubic
garrulous	garrulity
erubescence	ruby

Thus, [y] in an unstressed syllable shows up as in (6a) whereas that in a stressed syllable does not appear in (6b).

3. Previous analyses and Problems

Borowsky (1986) accounts for the cooccurrence restrictions mentioned above within the model of Lexical Phonology (Kiparsky, 1982, 1985). Specifically, in order to account for the fact that the sequence of coronal-*yu* only occurs in unstressed medial position, she contends that the vowel in *volume*, *residual*, *perpetual*, *habitual*, etc. is underlyingly a type of complex nucleus /*iu*/, which has the structure given in (7).

(7) The underlying representation of [yu]: /*iu*/ (Borowsky, 1986: 281)

$$\begin{array}{c} x \\ | \\ iu \end{array}$$

According to Borowsky, the [i] of the complex vowel has no skeletal slot to attach to and it cannot be syllabified during the lexical phonology, since if it is interpreted as an onset (i.e., glide) it violates the constraint $*\sigma(C_1^2y)$, which prohibits the occurrence of /*y*/ in a complex onset (**pyes*, **byatl*, **fyard*, **cyep*, etc.). She further argues that, in words like *volume* and *valuable*, after resyllabification which

resyllabifies a coronal onset as a coda of a preceding stressed syllable at the postlexical level, the syllabification of the [ɪ] into an empty syllable onset in unstressed medial position takes place by /y/ Insertion. However, the syllabification of the [ɪ] into the syllable onset is not possible in words like *voluminous*, *residue*, *perpetuity* since the complex vowel /ɪu/ is stressed, and thus resyllabification is not possible and [ɪ] should be deleted by Stray Erasure. A sample derivation for the interaction among resyllabification, /y/ Insertion, and other processes is given in (8).

(8) A sample derivation (Borowsky, 1986: 292-3)²⁾

	/volum/	/volum+məs/
syllabification & stress	vá.lum	va.lú.mi.nəs
resyllabification	vál.um	va.lúm.i.nəs
y insertion	yu	---
stray erasure	---	ɪ--> ∅
other rules	[vál.yum]	[va.lúm.i.nəs]

In (8) the vowel [a] but not [u] is stressed in *volume*, and thus the coronal consonant [l] resyllabifies as the coda of a preceding stressed syllable. As a result, [ɪ] syllabifies as an onset by /y/ Insertion, and the sequence of coronal-yu occurs since the coronal [l] and the glide [y] are heterosyllabic. In contrast, resyllabification does not apply to the coronal [l] of *voluminous* because of stress. Thus, /y/ Insertion does not apply and [ɪ] deletes by Stray Erasure since it is not syllabified. In sum, Borowsky depends on a strict rule ordering among resyllabification, /y/ Insertion, and Stray Erasure. Further, she crucially relies on resyllabification, in order to account for the fact that the sequence of coronal-yu only occurs in unstressed medial position.

Borowsky's analysis, however, has several problems. First, like many

2. In initial syllabification, the [ɪ] of the complex vowel is not syllabified because it has no skeletal slot to attach to.

phonologists, she posits a strict rule ordering among resyllabification, /y/ Insertion, and Stray Erasure, which is a burden on a learner's grammar. Second, Borowsky relies on resyllabification in order to account for the cooccurrence restrictions involving the sequence of coronal-yu, but resyllabification produces bizarre syllabifications in some cases, as pointed out by Jensen (1994). For example, resyllabification produces *tinct.[y]ure* for *tincture*, which seems fairly counterintuitive. Third, resyllabification would predict a glottalized allophone for the syllable-final [t] in *tincture* and for other similar cases, but it is not an option.

Now, let us briefly examine Jensen's (1993) analysis. Based on Halle and Mohanan (1985), Jensen assumes that the high back unrounded vowel /i/ is the underlying vowel for [u] of *volume/voluminous*, *perpetual/perpetuity*, and *continue/continuity*, in order to account for the occurrence of the sequence of a consonant plus y only before the vowel [u]. Further, he argues that /y/ Insertion applies before the vowel /i/, and accounts for the deletion of [y] after a foot-initial coronal in the North American dialect by a rule of /y/ Deletion. Unlike Borowsky, however, he does not have recourse to resyllabification, although he appeals to a strict rule ordering among the above mentioned rules. A sample derivation for *volume/voluminous* is given in (9).

(9) A sample derivation (Jensen, 1993: 208)

	/volim/	/volim+inɔs/
y insertion	yi	yi
i rounding	yu	yu
dialectal y deletion	---	y--> ∅
other rules	[vályum]	[valúmməs]

Although Jensen tries to provide an account of cooccurrence restrictions without resyllabification, his analysis also has several drawbacks. First, like Borowsky (1986), he crucially relies on a strict rule ordering among /y/ Insertion, /i/ Rounding, and /y/ Deletion.

Second, he assumes an abstract underlying representation with /i/ and an absolute neutralization rule which neutralizes /i/ to [u], in order to account for the fact that the sequence of a consonant plus y occurs only before the vowel [u]. However, such an abstract underlying representation and ad-hoc rules should be avoided in phonology proper.

Finally, let us briefly consider Davis and Hammond's (1995) analysis. Like Borowsky (1986), they also employ resyllabification in order to account for the cooccurrence restrictions. They also follow Borowsky in that the glide [y] in [yu] sequence is underlyingly present. Unlike Borowsky, however, they assume that the glide is part of a diphthong, given in (10), and further that it is syllabified as an onset by I-to-y Rule, which is a rule at a very late stage. A sample derivation from their analysis is given in (11).

(10) Structure of /iu/



(11) A sample derivation for volume/voluminous

UR	/volum/	/volum+mɔs/
initial syllabification	va.lum	va.liu.mi.nɔs
stress	á	ú
resyllabification	vál.rum	va.lúm.i.nɔs
/y/ deletion	---	i--> ∅
I-to-y rule	vál.yum	---
PR	[vál.yum]	[va.lúm.i.nɔs]

As the derivation in (11) demonstrates, Davis and Hammond's (1995) analysis is almost the same as that of Borowsky (1986). As noted in their analysis, Davis and Hammond can account for words such as *tuition*, *Agnew*, *affluent*, etc, which Halle and Mohanan's (1985) analysis fails to explain. That is, [y] would occur in *tuition*, *Agnew*, and *affluent*

under Halle and Mohanan's analysis since /y/ is inserted between a coronal and an unstressed vowel in their analysis. By appealing to resyllabification and by assuming that [y] is part of a diphthong, however, Davis and Hammond account for the lack of [y] in the words mentioned above. Nonetheless, like Borowsky's analysis, their analysis has the following drawbacks. First, they posit a strict rule ordering among syllabification, stress, resyllabification, /y/ Deletion, and I-to-y Rule. Second, their I-to-y Rule applies in a later stage of derivation, although it can be regarded as part of syllabification. Third, as noted above, resyllabification produces bizarre syllabifications in words like *tincture*.

In sum, we have examined some of the rule-based approaches to cooccurrence restrictions in English. None of the analyses, however, are satisfactory, and we will provide a constraint-based account of cooccurrence restrictions in the following section.

4. A Constraint-Based Analysis

4.1 The Correspondence Theory Framework

CT (McCarthy and Prince 1995) is a model of constraints and constraint interaction which claims that Universal Grammar consists of a ranked set of violable constraints and that an optimal form is selected through the evaluation of an array of candidate outputs in a parallel mode. The optimal output is the one that incurs the fewest violations of highly ranked constraints. In this model the constraints are of two types: faithfulness constraints and markedness constraints. The tension between these constraints is resolved by language-specific constraint rankings. While the input representations and the constraint rankings are free to vary within the model, faithfulness constraints are defined as constraints on correspondence, as in (12) (McCarthy and Prince 1995: 16):

(12) a. The Max Constraint Family

Every element of the input has a correspondent in the output.

(No phonological deletion).

b. The Dep Constraint Family

Every element of the output has a correspondent in the input.

(No phonological insertion).

c. The Ident(F) Constraint Family

Correspondent segments in the input and output have identical values for some feature [F]. (No feature change).

4.2 Analysis

In the North American dialect, the high front glide [y] does not remain when the sequence of coronal-*yu* is in word-initial position or in stressed position. Based on this distributional fact, the following constraint family on coronal-*yu* cooccurrence restriction is proposed.

(13) Cooccurrence constraints of the coronal-*yu* sequence

a. *_{word}[cor+y: Post coronal high front glide [y] is prohibited in word-initial position.

b. *cor+y \check{V} : Post coronal high front glide [y] is not allowed in stressed position.

There is another cooccurrence constraint, which prohibits the occurrence of [y] in a complex onset.

(14) *_o(C₁²y (cf. Jensen 1993): In syllable-initial position the sequence of a consonant or two consonants followed by the high front glide [y] is prohibited.³⁾

3. The constraints *cor+y \check{V} and *_o(C₁²y cannot be collapsed into one constraint, since the former is sensitive to stress while the latter is sensitive to a syllable boundary.

The Sonority Sequencing constraint rules out both a rising coda and a falling onset.

(15) Sonority Sequencing (Selkirk 1982):

In any syllable, there is a segment constituting a sonority peak that is preceded and/or followed by a sequence of segments with progressively decreasing sonority values.

Finally, the Onset constraint accounts for the fact that every syllable begins with a consonant.

(16) Onset: Syllables should have an onset.

Based on the constraints given above, first, let us consider the nonoccurrence of [y] in the sequence of coronal-*yu*. Here, we follow Borowsky (1986) in that [y] which precedes [u] is part of the input nucleus. The tableau (17) shows that [y] deletes word-initially.

(17) Nonoccurrence of [y] in word-initial position⁴

tune /tun/	* _{word} [cor+y]	Max
a. [tyun]	*!	
b. ^ɹ [tun]		

In (17) candidate (a) fatally violates the cooccurrence constraint on the sequence of coronal-*yu* because [y] shows up in word-initial position. By contrast, candidate (b) in which [y] deletes only violates the low ranked Max constraint, and it becomes the winner. This shows that the cooccurrence constraint outranks the Max constraint.

The tableaux (18) and (19) illustrate the occurrence of [y] in an

4. The most faithful candidate [tun] can be eliminated by the high ranked constraint which prohibits the occurrence of [ɹu] within the same syllable. From now on, we will omit the most faithful candidate containing [ɹu] in the following tableaux for expository convenience.

unstressed syllable and the nonoccurrence of [y] in a stressed syllable. First, let us examine the occurrence of [y] in an unstressed syllable. In (18) the cooccurrence constraint family on the sequence of coronal-*yu* is not relevant because *lyu* here is neither in word-initial position nor in stressed position.

(18) Occurrence of [y] in an unstressed syllable

volume /valum/	Onset	* _o (C ₁ ² y	Max
a. vá.lyum		*!	
b. v ^h ál.yum			
c. vá.lum			*!
d. vál.um	*!		

Nonetheless, candidate (a) crucially violates another cooccurrence constraint *_o(C₁²y because [y] occurs after a consonant in syllable-initial position. Candidate (c) fatally violates the Max constraint since /y/ deletes in an unstressed syllable. Candidate (d) is ruled out due to the violations of the Onset and the Max constraints. Thus, candidate (b) where [y] is realized as the onset of the second syllable is the winner.

While /y/ remains in an unstressed syllable, it deletes in a stressed syllable because of the cooccurrence constraint *cor+yV̆.

(19) Nonoccurrence of [y] in a stressed syllable

volúminous /valuminəs/	Onset	* _{word} [cor+y	*cor+yV̆	* _o (C ₁ ² y	Max
a. va.lyú.mi.nəs			*!		
b. val.yú.mi.nəs			*!		
c. val.ú.mi.nəs	*!				*!
d. v ^h al.ú.mi.nəs					*!

In (19) candidates (a) and (b) are ruled out due to the fatal violation of the constraint *cor+yV̆ which disallows [y] in stressed position. In addition, candidate (a) violates another cooccurrence constraint *_o(C₁²y

because [y] and [l] occur within the same syllable. Candidate (c) crucially violates the Onset constraint as well as the Max constraint. Consequently, candidate (d), which deletes [y] at the expense of not violating the high ranked constraint $*_{\text{cor+y}}\check{V}$, emerges as optimal.

Now, let us examine the case in which [y] does not occur in a word-initial unstressed syllable that begins with a coronal.

(20) Nonoccurrence of [y] in a word-initial unstressed syllable

tuition /tʰu:ʃən/	Onset	$*_{\text{word}}[\text{cor+y}]$	$*_{\text{cor+y}}\check{V}$	$*_{\text{o}}(\text{C}_1^2\text{y})$	Sonority	Max
a. [tʰy.i.ʃən	*	*!				
b. tʰ [tʰ.u.i.ʃən	*					*

In (20) candidate (a) loses out due to the fatal violation of the cooccurrence constraint $*_{\text{word}}[\text{cor+y}]$. Additionally, it violates Onset and the constraint of $*_{\text{o}}(\text{C}_1^2\text{y})$. By contrast, candidate (b) that deletes [y] after the word-initial coronal consonant only violates the Onset and the Max constraints and thus becomes the optimal output.

Finally, let us consider the nonoccurrence of [y] even in an unstressed syllable. The sequence of (C)Cyu is not a possible sequence of English, since the $*_{\text{o}}(\text{C}_1^2\text{y})$ constraint penalizes the occurrence of [y] after a consonant within the same syllable, as shown in (21).

(21) Nonoccurrence of [y] in an unstressed syllable

affluent /æfluənt/	Onset	$*_{\text{word}}[\text{cor+y}]$	$*_{\text{cor+y}}\check{V}$	$*_{\text{o}}(\text{C}_1^2\text{y})$	Sonority	Max
a. æ.flyu.ənt	**			*!		
b. æf.lyu.ənt	**			*!		
c. f æ.flu.ənt	**					*
d. æfl.yu.ənt	**				*!	
e. æfl.u.ənt	***!					*

In (21) both candidates (a) and (b) incur a fatal violation of the constraint $*_{\text{o}}(\text{C}_1^2\text{y})$ because [y] is syllabified with [fl] and [l],

respectively. Candidate (d), on the other hand, does not violate the constraint $*_a(C_1^2y$ since [y] is syllabified as an onset. Nevertheless, it fatally violates the constraint of the Sonority Sequencing since [fl] in the coda has a rising sonority. Candidate (e) is ruled out due to a fatal violation of the Onset constraint. As a result, candidate (c) becomes the winner, even though it violates the Max constraint.

Here note that the cooccurrence constraints, the Onset constraint, and the Sonority Sequencing constraint are not crucially ordered among themselves. However these constraints crucially outrank the Max constraint, as shown above. Thus, we propose the following constraint hierarchy for the cooccurrence restrictions in English.

(22) Constraint ranking for the English cooccurrence restrictions

Onset, $*_{\text{word}}[\text{cor}+y$, $*_{\text{cor}+y}\check{V}$, $*_a(C_1^2y$, Sonority >> Max

5. Conclusion

In this paper, we have examined the cooccurrence restrictions in English. First of all, we have shown that the cooccurrence restrictions can be accounted for within CT, without a strict rule ordering. Specifically, we have shown that optimal syllabification, which is determined by a constraint hierarchy, provides a unified account of the cooccurrence facts without several derivational steps. We have also demonstrated that the occurrence of the sequence of a consonant plus [y] only before the vowel [u] can be accounted for by regarding the input representation of the vowel [u] as /u/, as in Borowsky (1986). In this way, we don't need an abstract underlying representation or ad-hoc rules for [yu], unlike Halle and Mohanan (1985) and Jensen (1993). However, unlike Borowsky (1986) and Davis and Hammond (1995), we do not employ resyllabification which produces some bizarre syllabifications (e.g., [tinct.yure] for *tincture*, [va.lum.i.nəs] for *voluminous*) in order to account for the fact that the sequence of coronal-yu occurs only in unstressed medial position, since it follows

from the constraint hierarchy.

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Lee, Shinsook
English Language & Literature
Hoseo University
San29-1, Sechul-Ri
Baebang-Myun, Asan-Si
Chungnam-Do, Korea
E-mail: leess@office.hoseo.ac.kr
FAX: +82-41-540-5650

Cho, Mi-Hui
English Language & Literature
Pukyong National University
599-1 Daeyeon3-Dong Nam-Gu
Pusan, 608-737 Korea
E-mail: mhcho@dolphin.pknu.ac.kr
FAX: +82-51-628-2791