

The English Rhymes and the Foot-internal Clusters*

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0. Introduction

Since Kahn's (1976) monumental study on phonological phenomena sensitive to syllable structure, many phonologists have recognized the importance of the syllable as a phonological entity. As for the syllabification, among the topics related to the syllable, many scholars (e.g. Selkirk (1982)) assume that intervocalic clusters tend to be syllabified in order to maximize the size of onsets. This approach has been the "standard" theory of syllabification. Cairns (1988) dubs this approach *onsetmax*. Cairns (1988), on the other hand, shows that there is an opposite tendency for maximizing consonant clusters into rhymes within English trochaic feet, based on limited sets of evidence. He calls this tendency *codamax*. More specifically, the *codamax* approach states that the class of the foot-internal consonant clusters is basically identical to the class of the consonant clusters observed in the word-final rhymes, and consequently that unstressed second syllables in feet are without onsets.

This paper will be devoted to providing an account for the phonotactics of intervocalic consonant clusters within feet of English and will claim that the *codamax* approach is essentially correct, based on broader sets of evidence. Throughout this paper, by 'foot' I mean trochaic one, a foot with one stressed syllable followed by an unstressed (or less stressed) syllable. Monomorphemic, trochaic, (non-function) native¹ words will be used as primary data.

This paper is organized as follows. In section 1, we will review the theory of syllable phonotactics proposed by Cairns (1988). In section 2, we will discuss that the set of foot-internal consonant clusters is basically identical to the set of the consonant clusters observed in the word-final rhymes. In section 3, we will argue that, just like the word-final

clusters, the foot-internal consonant clusters are restricted by the pansyllabic constraints, or the constraints which restrict recurrences of the same or similar segments within a syllable. This fact strongly suggests that the foot-internal consonant clusters are tautosyllabic with the preceding vowels. In section 4, we will discuss the impacts of this paper on the previous proposals. In section 5, we will make concluding remarks.

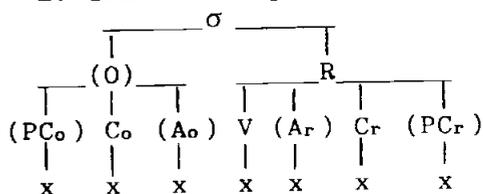
1. Theory of Syllable Phonotactics

In this section, we will review the theory of syllable phonotactics proposed by Cairns (1988). This theory has three subtheories; theory of syllable structure, theory of inventory and theory of neutralization. We will discuss these theories in turn.

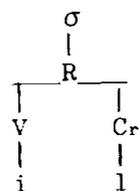
1.1. Theory of Syllable Structure

Each language is assumed to have a general template for syllables of the language. English syllables are assumed to be mapped to the general template (1a). (1b-f) are the specific examples.

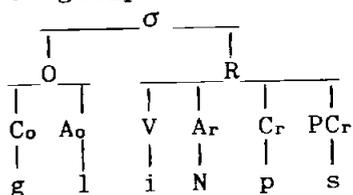
(1) a. General Template



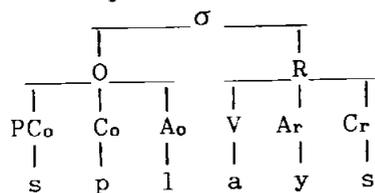
b. *ill*

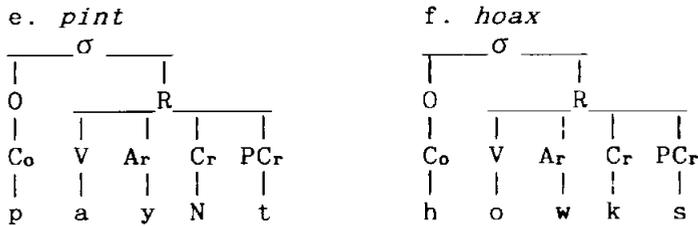


c. *glimpse*



d. *splice*





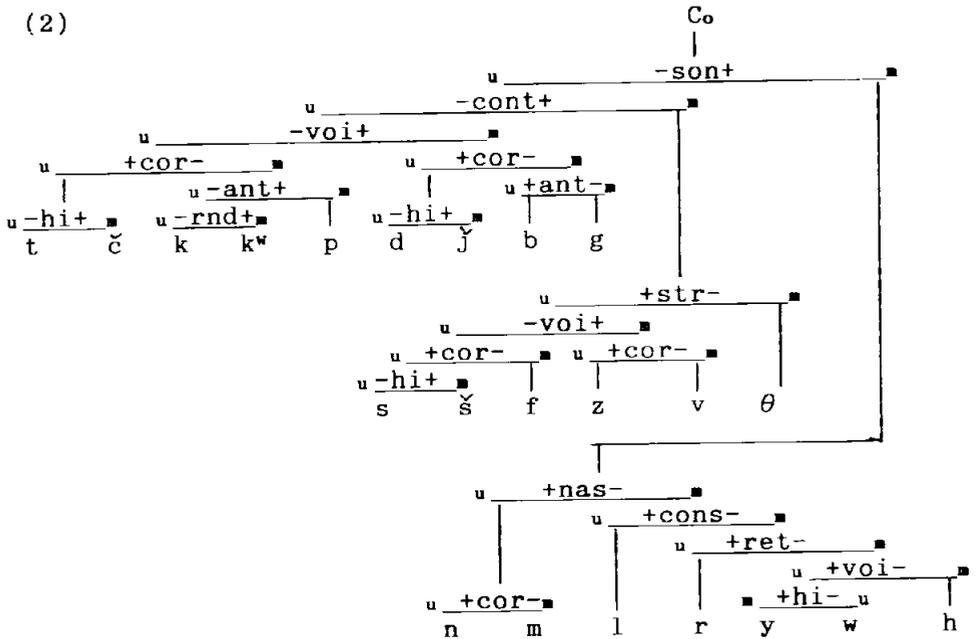
Where O=Onset, R=Rhyme, $X_o=X$ is a member in onset, $X_r=X$ is a member in rhyme, PC_o =PreCore, C=Core, A=Adjunct, V=Vowel, PC_r =PostCore, the parenthesis=optionality

The general template distinguishes two major constituents, the onset and the rhyme, within a syllable. Within the onset, three positions, PC_o , C_o , and A_o , are assumed to be distinguished. Within the rhyme, three positions, A_r , C_r , and PC_r , as well as the V position are postulated.

Labelling of nodes is essential to this theory. Each position in the syllable has its own subinventory of the total phoneme inventory of the language. The position within the syllable is defined in terms of preterminal node labels. Next, we will discuss the theory of inventory.

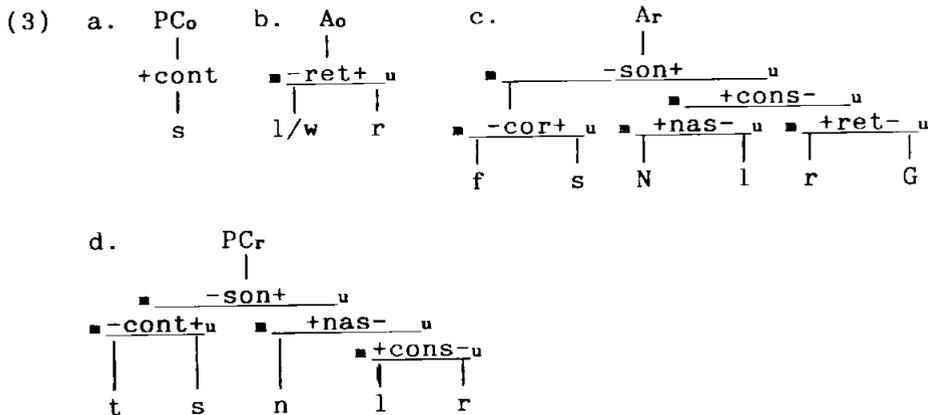
1.2. Theory of Inventory

It is assumed that the inventories which appear in the PC and A positions are always proper subsets of the inventories available for the C positions, though languages sometimes permit phonemes which are not allowed in C_r position to appear in C_o (e.g. English /h/) and *vice versa*. (2) shows the total inventory of phonemes which are allowed to occur in the C_o position in English. The markedness values of a feature are indicated by subscripts 'm' (for marked) and 'u' (for unmarked). For example, + is the marked value, and - is the unmarked value, of a feature [son].



The coding tree (2) is a part of the theory in the sense that the neutralization discussed below is expressed as removing of the marked node and its dependents from the tree.

The following subinventories for optional positions are assumed for English:



The Neutralization Rules (NRs) in (4) play a crucial role in deriving the subinventories. These subinventories are

derived from the full coding tree of inventory (2) in two steps. First, we must change the markedness values in (2) to make them appropriate for the defined positions. (For the A position, we must change markedness values of the features [son], [cont], [str], [cons], and [nasal]. For the Ar position, the markedness values of [ret] must be changed. For the PC_o position, we must change the markedness values of [cont]. For the PC_r position, we must change the markedness values of [son], [cont], [nas] and [cons].) Then each NR is applied to the full coding tree and prunes the branches which are marked '■' for the feature(s) indicated in the NR.

- (4) a. $N(\text{cont}, \text{voi}, \text{str}, \langle \text{high} \rangle) / \left[\begin{array}{c} \text{A} \\ \langle \text{son} \rangle \end{array} \right]$
 b. $N(\text{son}, \text{nas}) / \overline{\text{A}_o}$
 c. $N(\text{son}, \text{cont}, \text{str}, \text{voi}, \text{cor}, \text{high}) / \overline{\text{PC}_o}$
 d. $N(\text{str}, \text{cor}, \text{high}, \text{voi}, \text{ret}) / \overline{\text{PC}_r}$

In order to show how the NRs in (4) derive the trees in (3) from the tree (2), let us examine the functioning of (4a). (4a) is applied to both of the two A positions. Note that the markedness values are changed as we have suggested above. The feature [cont] in (4a) removes (non-sonorant) stops from both A positions. [voi] in the rule eliminates voiced obstruents and /h/; [str] eliminates /θ/ and [high], /š/. The other NRs derive the trees in (3) in similar ways. For further details, readers are referred to Cairns (1988).

The NRs in (4) define the subinventories for optional syllabic positions by neutralizing the marked value of feature(s). In other words, the NRs in (4) account for the positional neutralization. We have another type of NRs which account for neutralization caused by the presence of adjacent segments. We will discuss this topic in the next section.

1.3. Theory of Neutralization

In this section, we will discuss NRs of a rather different type from those discussed above. To illustrate this type of NRs, we will review the analysis of the English onset presented by Cairns (1988).

(5) illustrates the subsets of the C_0 inventory with the NRs. When C_0 alone is in the onset, the full C_0 inventory may appear (by definition), as is shown in (5a). If, on the other hand, PC_0 appears, only one of /t k k^w p N l r w/ is allowed in C_0 ; e.g. *stop, skull, squeeze, spot, snow, small, slow, shrimp³, swim*. The NR in (5b) derives this subset from the C_0 inventory (2) by removing those branches which are marked for [continuant], [high] and [voice] from the tree in (2). When A_0 appears, only one of /t k p d b g s f θ/ is allowed in C_0 . This subset is derived by the application of the NR in (5c)⁴. When both PC_0 and A_0 appear in the onset, both of the NRs apply and derive the subset /t k p/ as in (5d):

(5)	PC_0	C_0	A_0	NRs applicable to C_0
a.	-	All	-	No NRs
b.	+	t k k ^w p N l r w	-	N(cnt,hi,voi)/ PC_0 _____
c.	-	t k p d b g s f θ	+	N(son,hi,rnd,<voi>)/<cnt> A_0
d.	+	t k p	+	Both of the above

For the readers convenience, the list of all two- or three-member onsets of English is given in (6).

- (6) a. PC_0 - C_0 Onsets
st sp sk sk^w sn sm sw
- b. C_0 - A_0 Onsets
tr dr θr pr br kr gr sr fr
tw dw θw pl bl kl gl sl fl
- c. PC_0 - C_0 - A_0 Onsets
str spr skr
(stw) spl skl

1.4. Summary

Summarizing the discussion so far, the theory of syllable phonotactics adopted in this paper consists of three parts.

The theory of syllable structure defines the positions within a syllable. For each position, the theory of inventory specifies the subinventory that may occur in the position. The theory of neutralization has two parts to play. On the one hand, NRs derive the subinventories for syllabic positions from the total inventory of a language. On the other hand, NRs of other type define the subsets of subinventories in C_0 and C_r when neutralizations caused by adjacent segments are in effect.

2. The English Rhymes and the Foot-internal Clusters

In this section, we will discuss the English rhymes and will argue that the class of the foot-internal consonant clusters is basically identical to the class of the consonant clusters observed in the word-final rhymes. In section 2.1., we will review the analysis of the English (word-final) rhymes given in Cairns (1988), and then examine some specific predictions in turn.

2.1. The English Rhymes

In (7), the constraints on A_r - C_r sequences and the NRs expressing the constraints are illustrated. (7a) shows that, when A_r does not appear, the full C_r subinventory is allowed. If unmarked A_r (that is, glides /y w/) appears, as in (7b), the glide segments /y w/⁵ cannot occur in the C_r position. (7c) shows the fact that, if A_r is occupied with /r/, or in other words, marked for the feature [retroflex], the segments /r y w/⁶ cannot appear in the C_r position. As is shown in (7d), if /l/ appears in A_r , the segments /l r y w/ must be excluded from the C_r . (7e) describes the fact that a nasal segment in A_r can only be followed by an obstruent in C_r . We need further comments on the case where a nasal occupies A_r , which will be discussed immediately below. Obstruents in A_r , that is /s f/, exclude all the segments in C_r but /p t k/, as shown in (7f).

(7)	Ar	Cr	NRs applicable to Cr	Examples
	G r l N S	G r l N Obs		
a.	- - - - -	+ + + + +	No NRs apply to Cr	boy, far, fill fan, fit
b.	+ - - - -	- + + + +	N(ret)/Ar	*-GG, fire file, fine, fight
c.	+ + - - -	- - + + +	N(cns)/ $\begin{bmatrix} \text{Ar} \\ \text{ret} \end{bmatrix}$	*-rG, -rr, snarl, farm smart
d.	+ + + - -	- - - + +	N(nas)/ $\begin{bmatrix} \text{Ar} \\ \text{cns} \end{bmatrix}$	*-lG, *-lr, *-ll film, silt
e.	+ + + + -	- - - - +	N(son)/ $\begin{bmatrix} \text{Ar} \\ \text{nas} \end{bmatrix}$	*-NG, *-Nr, *-Nl *-NN, lint
f.	+ + + + +	only {p t k}	N(Fi)/ $\begin{bmatrix} \text{Ar} \\ \text{son} \end{bmatrix}$	*-sG, *-sr, *-sl *-sN, wrist

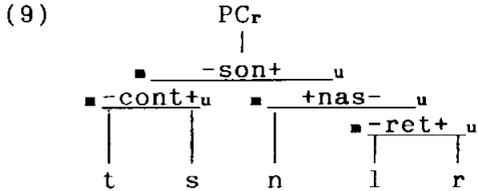
Fi=(cont, voi, high)⁷

Now, we return to the discussion of the case where nasals occur in the Ar position. (7e) alone permits the subset /t č k p d ʃ g s š f z v θ/ to appear in Cr after /N/. Alternations such as *bomb/bombard* support the claim that /Nb/ sequence can be a rhyme at least lexically, and some phonologists assume that word-final [-ŋ] is underlyingly /-Ng/. Cairns (1988), however, claims that /N/ does not occur before /v/ or /f/, on the basis of the observation that we have no word-final /-Nv/ sequence and that the forms such as *lymph* with /-Nf/ sequence can be assumed to be irregular. Then, he formulates the following additional NR for Ar-Cr sequence:

$$(8) \quad N(\text{cor}) / \begin{bmatrix} \text{Ar} \\ \text{nas} \end{bmatrix} \begin{bmatrix} \overline{\text{Cr}} \\ \text{cont} \end{bmatrix}$$

NR (8) reads as follows: Neutralize a continuant segments in Cr as to the feature [coronal] if nasal segments appear in Ar, or in other words, only coronal segments can appear in Cr, when the segment is continuant and preceded by /N/. In section 2.3., however, we will observe that /-Nv/ as well as /-Nf/ is in principle allowed as an underlying Ar-Cr sequence and claim that the lack of the word-final /-Nv/ sequence is due to other factor.

Next, we go on to the topics of PC_r. Among the subinventory for PC_r (3d) repeated here as (9), the sonorants /n l r/ can occur rather freely after any Ar-C_r sequence. They phonetically realize as syllabic consonant; *bas[in]*, *scalp[el]*, *clust[er]*.



As for the obstruents in the subinventory (9), their occurrence restricts the subsets of C_r to /t p k s n l/. The forms in (10) illustrate this point, and this observation can be expressed by (11):

(10) quartz, traipse, hoax, baste, bounce, wild^a

(11) $N(\text{voi,hi,rnd,str,cons},\langle\text{cor}\rangle) / \left[\begin{array}{c} \overline{\text{C}_r} \\ \langle \langle \text{cont} \rangle \rangle \\ \langle \langle \text{son} \rangle \rangle \end{array} \right] \left[\text{PC}_r \right]$

Summarizing the discussion above, we can obtain the following list of the English rhymes:

(12) a. Ar-C_r Rhymes

<u>st</u>	<u>sp</u>	<u>sk</u>										
<u>ft</u>	(fp)	(fk)										
<u>Nt</u>	<u>Np</u>	<u>Nk</u>	Nč	<u>Ns</u>	Nš	—	Nθ					
Nd	Nb	Ng	Nĵ	Nz	--	—						
<u>lt</u>	<u>lp</u>	<u>lk</u>	lč	<u>ls</u>	lš	lf	lθ	lm	<u>ln</u>			
ld	lb	lg	lĵ	lz	--	lv						
<u>rt</u>	<u>rp</u>	<u>rk</u>	rč	<u>rs</u>	rš	rf	rθ	rm	<u>rn</u>	<u>rl</u>		
rd	rb	rg	rĵ	rz	--	rv						
<u>Gt</u>	<u>Gp</u>	<u>Gk</u>	Gč	<u>Gs</u>	Gš	Gf	Gθ	Gm	<u>Gn</u>	<u>Gl</u>	Gr	
Gd	Gb	Gg	Gĵ	Gz	--	Gv	(G)					

Where G=/y/ or /w/.

b. $A_r-C_r-PC_r$ Rhymes

(i) If $PC_r = \{n \ l \ r\}$, all the A_r-C_r sequences above can appear.

(ii) If $PC_r = \{t \ s\}$, all the A_r-C_r sequences with underline above can appear.

Provided that adjacent identical segments must be excluded in each case⁹.

Some comments are in order. $/-fp/$ and $/-fk/$ are predicted to occur as the English rhymes, which is contrary to the fact. We must have some device to exclude them from the rhyme position. $/-lg/$ does not occur as a word-final rhyme, though this fact seems to be accidental, as the discussion below will show. The interdental voiced fricative, $/ð/$, shows a rather strange behavior in the phonology of English. The distribution of this segment is nearly predictable. Kiparsky (1982) discusses this topic.

In what follows, we will provide arguments which support the claim that the class of the foot-internal consonant clusters is basically identical to the class of the consonant clusters observed in the word-final rhymes. Note that all the clusters we will deal with are tautomorphemic.

2.2. A_r-C_r , where $C_r = /m/$

Cairns (1988) shows that the class of the foot-internal clusters which end in $/m/$ is exactly identical to the class of consonant clusters in $/m/$ -final rhymes, with the exceptions of Greek loans (*plasma*, *magma*, *bregma*, *dogma*, *smegma*, *sigma*, *stigma*)¹⁰. We do not have $/m/$ in the subinventory for PC_r (9). Then, $/m/$ -final consonant clusters found in the rhymes are $/lm/$, $/rm/$, $/ym/$ and $/wm/$, as the list in (12a) shows. Forms in (13) are the examples with such rhymes:

- (13) elm, film, arm, farm, time, rhyme, bloom, room

We have the same set of sequences as the set of the foot-internal clusters which end in $/m/$:

(14) Wilma, Norma, lima, coma

This fact suggests that the foot-internal clusters are syllabified with the stressed vowels.

2.3. A_r-C_r , where $C_r = \{p, b, k, g, f, v\}$

Next, consider the rhymes which end in one of $\{p, b, k, g, f, v\}$.

We do not have $\{p, b, k, g, f, v\}$ in the subinventory for PC_r .

Then, all the consonant clusters in the rhymes which end in one of these segments must be A_r-C_r sequences. From the list (12) above, we can make the sub-list for these rhymes as in (15):

(15)	a.	sk	Nk	lk	rk	yk	wk
	b.		Ng	lg	rg	yg	wg
	c.	sp	Np	lp	rp	yp	wp
	d.		Nb	lb	rb	yb	wb
	e.		(Nf)	lf	rf	yf	wf
	f.		(Nv)	lv	rv	yv	wv

These sequences are realized in the word-final rhymes in the following forms:

(16)	a.	task	tank	milk	mark	break	oak
	b.		sing	_____	burg	vague	vogue
	c.	wasp	lamp	help	carp	tape	rope
	d.		bomb	bulb	herb	tribe	globe
	e.		(lymph)	self	scarf	life	loaf
	f.		_____	solve	carve	five	glove

Consider first the /k/-final clusters. The set of /k/-final foot-internal clusters is exactly identical to the set of /k/-final consonant clusters in the word-final rhymes with only one exception, *Bodkin*. Forms in (17) are examples with /k/-final foot-internal sequences:

(17) mascot, donkey, falcon, Arcady, trachea, trochee

Next, consider the set of /g/-final ones. In the word-

final rhymes, we find /Ng/, /rg/, /yg/ and /wg/ as we have seen in (16b). Foot-internally, we have /Ng/, /lg/, /rg/, /yg/ and /wg/. Examples are given in (18):

(18) linger, Elgar, argo, tiger, bogus

/-lg-/ is fairly regular as a foot-internal cluster as is shown in (19).

(19) alga, algol, algorism, amalgam, Bulgar, Calgary

If we assume that non-occurrence of /lg/ in the word-final rhyme is accidental, the set of /g/-final clusters in the rhymes is identical to the set of foot-internal clusters which end in /g/. We have one apparent exception *Asgard*, which is non-native.

The case of /p/-final rhymes is straightforward. With one exception *Elspeth*, the set of /p/-final sequences observed foot-internally is identical to the set of /p/-final consonant clusters in the rhymes. Examples in (20) illustrate the point:

(20) aspect, lampas, palpus, orpine, apish, Cowper

Forms in (21) show that the word-final clusters with final /b/ also appear as the foot-internal clusters which end in /b/:

(21) limber, album, arbor, labor, hobo

An apparent exception is *Akbar*, which is a loan word.

We have /Nf/, /lf/, /rf/, /yf/ and /wf/ as the foot-internal clusters. Examples are given in (22):

(22) comfit, dolphin, orphan, typhus, Brophy

Similarly, we have /Nv/, /lv/, /rv/, /yv/ and /wv/ as the foot-internal clusters. Examples are given in (23):

(23) canvas, Elva, carven, peavey, Grover

As we have discussed above, Cairns (1988) claims that /Nv/ and /Nf/ should be excluded from the set of (word-final) rhymes and formulates the NR (8). However, the fact that we have /Nf/ and /Nv/ as the foot-internal clusters suggests that their non-occurrence in the word-final rhymes is caused by other factor, as we will discuss immediately below. Additional examples are given in (24):

(24) a. Memphis, chamfer, comfort, fanfaron ...
b. anvil, canvey, Danvers, Denver, envoy, envy ...

As for /Nf/, it is not so irregular as Cairns (1988) suggests. We have following examples:

(25) lymph, nymph, triumph

Though they are all of foreign origin, they seem to be assimilated to the native vocabulary. We have no conclusive arguments, though.

It is true at least at phonetic level that /Nv/ does not appear in the word-final rhymes. However, its non-occurrence in the word-final rhymes is no more irregular than the non-occurrence of /Nb/ or /Ng/. English grammar has a constraint on (word-final) rhymes to the effect that noncoronal voiced obstruents cannot appear after a nasal in A_r at phonetic level.

Assuming the discussion above, we have the following list of underlying nasal-obstruent sequences in A_r - C_r position:

(26) Nt Np Nk Nč̣ Ns Nṣ̌ Nf Nθ
 Nd Nb Ng Nj̣ Nz -- Nv

Summarizing the discussion so far, we can safely claim that the set of the foot-internal clusters which end in one of the noncoronal obstruents {p,b,k,g,f,v} is basically identical

to the set of the consonant clusters in the rhymes which end in one of these segments. As a byproduct, we observe that a nasal in A_r can be followed by any obstruent of English provided that the voiced noncoronals are excluded from the word-final position at phonetic level and claim that the NR (8) captures a false generalization.

2.4. /ft/ as an A_r - C_r sequence

In Cairns' (1988) framework, /-ft/ is unambiguously analyzed as an A_r - C_r sequence. Since the glides /y/ and /w/, which are the second halves of long vowels or diphthongs, are the members of the A_r subinventory (3c), it is explained that long vowels or true diphthongs cannot appear before a word-final /-ft/ sequence. (27) illustrates the situation:

- (27) shaft, raft, craft, draft, waft, deft, theft, left,
cleft, bereft, gift, shift, lift, rift, drift,
thrift, sift, swift, oft, loft, soft, tuft

Consider next the forms with foot-internal /ft/ cluster:

- (28) after, Afton, BAFTA, caftan, Clifton, Grafton,
kaftan, mufty, sefton, sifta

Each of these forms has a simple short vowel and English vocabulary has no word with a long and a diphthong followed by the foot-internal /ft/. This fact means that the foot-internal cluster /ft/ also occupies the A_r - C_r position.

2.6. Summary

To sum up, the discussions so far support the claim that the class of foot-internal consonant clusters is basically identical to the class of the consonant clusters observed in the word-final rhymes. A trochaic foot, therefore, consists of one full syllable followed by one onsetless syllable. In the next section, the arguments of different sort will be presented.

3. Pansyllabic Constraints and the Foot-internal Clusters

In the previous section, we have noticed the basic identity between the class of consonant cluster in the word-final rhymes and the class of foot-internal clusters. In this section, we use pansyllabic constraints as the basis of the arguments. In section 3.1., we will discuss the nature of pansyllabic constraints and then examine each specific constraint in turn.

3.1. Pansyllabic Constraints

The NRs proposed above are constraints on sequences within an onset or a rhyme. The pansyllabic constraints discussed below tend to limit recurrences of the same or similar segments within a syllable. These constraints may be better accounted for by some version of the Obligatory Contour Principle (OCP; see McCarthy (1986) among others).

3.2. $*(\sigma PC_o-C_o-X-V-A_r-C_r-Y)\sigma$, where $A_r=/s/$

The first constraint is that the A_r constituent may not be occupied by /s/, when the syllable begins with an sC_o- onset. This constraint is formulated as in (29) and (30) exemplifies the syllables that are excluded by (29):

$$(29) \quad *(\sigma PC_o-C_o-X-V-A_r-C_r-Y)\sigma^{11}$$

\downarrow
 s

- (30) a. *stVst *stVsp *stVsk
 *spVst *spVsp *spVsk
 *skVst *skVsp *skVsk
- b. *strVst *strVsp *strVsk
 *sprVst *sprVsp *sprVsk
 *splVst *splVsp *splVsk
 *skrVst *skrVsp *skrVsk
 *sklVst *sklVsp *sklVsk

Consider the sequences such that the sequences in (30) are followed by a weak vowel plus zero or more consonants, e.g.

**stasper*. The *codamax* approach predicts such sequences do not exist as the English word, since this approach considers the foot-internal clusters to be tautosyllabic with the strong syllables and, in this case, such syllables are filtered out by (29).

Within the *onsetmax* approach, such sequences are permitted, since the intervocalic clusters are regarded as the onsets of the weak syllables and (29) has no chance to filter out these sequences.

Only the prediction of the former is in accord with the fact.

3.3. $*(\sigma PC_0-C_0-X-V-C_r)\sigma$,

if $C_0=C_r$ and C_0 bears one marked feature

Next pansyllabic constraint prohibits a repetition of the C_0 segment in the C_r if PC_0 is present, the coda is simple, and C_0 is marked for some feature(s). This constraint can be formulated as in (31):

(31) $*(\sigma PC_0-C_0-X-V-C_r)\sigma$,
if $C_0=C_r$ and C_0 bears one marked feature

(31) blocks such forms as in (32a), while it permits the ones in (32b) (because PC_0 is not present), the ones in (32c) (because the codas are not simple), and the ones in (32d) (because /t/ in C_0 is not marked):

(32) a. **spVp, *skVk, *snVn, *smVm,*
**splVp, *sprVp, *skrVk, *sklVk*
b. pup, crack, none
c. skulk, smarm
d. stet, strut

Consider the sequences such that the sequences in (32) are followed by a weak vowel plus zero or more consonants. English vocabulary contains no trochaic words corresponding to the forms in (32a). The *codamax* approach explains this absence, while the *onsetmax* approach has no principled way to explain

the fact.

3.4. Summary

We can conclude that foot-internal consonant clusters are in fact tautosyllabic with the stressed vowels of the first syllables on the basis that pansyllabic constraints between the onsets and the rhymes of the monosyllables are also at work between the onsets of the feet and the foot-internal consonant clusters of the trochaic words.

4. Some Consequences

In this section, we will discuss the impacts of the results of this paper on the previous proposals. In section 4.1., we will be concerned with Ito's (1988) Universal Core Syllable Condition, and, in section 4.2., we will review the resyllabification approach proposed by Selkirk (1982).

4.1. Ito's (1988) Universal Core Syllable Condition

Ito (1988) claims, without any substantial arguments, that it is universally true that a single intervocalic consonant is always analyzed as an onset. She dubs this the Principle of CV-Precedence:

- (33) Principle of CV-Precedence
A consonant immediately preceding a vowel is
universally an onset.

She encodes this principle into Universal Grammar as a condition on the syllabic-template:

- (34) Universal Core Syllable Condition
IF $\frac{C \quad V}{\quad}$
THEN σ

This condition guides initial syllabification so that CV-sequences are always tautosyllabic. If this condition is violated during the derivation, some devices will change the representation in some way or another in order to remove the violation.

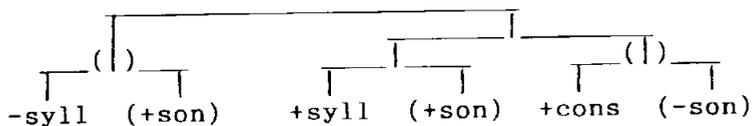
However, based on the discussions in section 2 and section 3 of this paper, we have concluded that the weak syllables of the English words with trochaic feet are without onsets. Therefore, (34) cannot be universal.

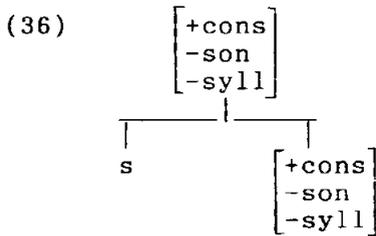
4.2. Resyllabification Approach

Some students of English syllabification (e.g. Kahn (1976), Kiparsky (1979), Selkirk (1982), Clements and Keyser (1983), etc.) assume that the English phonology contains a set of operations which is usually called resyllabification. The resyllabification approach is essentially a version of an *onsetmax* approach in that it presupposes that the initial syllabification maximizes the size of the onset. In this section, we will discuss the adequacy of this assumption. For the concreteness, we will examine the proposal of Selkirk (1982).

Selkirk (1982) assumes that the syllable structure of an underlying phonological representation must satisfy the principles of basic syllable composition (BSC) and the principle of Maximal Onset. The BSC for English consists of three components; a general template (35), an auxiliary template (36)¹², which expresses that /s/ plus obstruent may function like a single obstruent, and a set of collocational restrictions such as in (37):

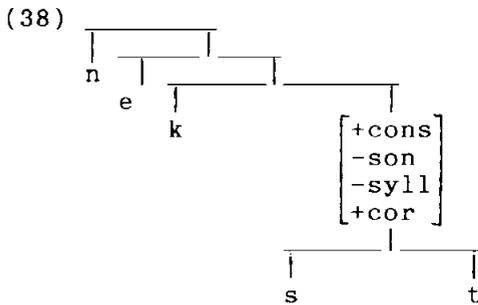
(35)





(37) The second consonant of the coda must be a coronal.

For example, a word *next* is analyzed to have a structure indicated in (38):



The Principle of Maximal Onset is stated as follows:

- (39) **Maximal Syllable Onset Principle**
 In the syllable structure of an utterance, the onsets of syllables are maximized, in conformance with the principles of basic syllable composition of the language.

The principle of Maximal Onset determines the syllable structure of a polysyllabic word which has two or more potential alternative syllable structures permitted by the BSC. For example, a word *allow* is syllablified as [ʌ.law] rather than [ʌl.aw].

The rules of resyllabification are the other mechanisms which account for the syllabification of polysyllabic words. Selkirk (1982) formulates the rules of resyllabification for English as transformational rules as in (40):

(40) Resyllabification									
X	{	[-cons]	}	[-syll]	[+syll]	Y	Obligatory
		{	[+cons]		-	stress]		Optional
1	2	3			4			5	
1	2+3	∅			4			5	

The first rule in (40) states that a single intervocalic consonant is obligatorily resyllabified into the preceding syllable if the consonant is followed by unstressed vowel. This obligatory rule accounts for the lack of aspiration in the examples in (41) provided that rule of aspiration makes voiceless stops aspirated in syllable-initial position:

- (41) happy, mightiest, accolade, goiter, wacky,
attitude, etc.

The second rule in (40) states that a consonant preceded by another consonant is optionally resyllabified into the preceding syllable if the consonant is followed by unstressed vowel. This rule is optional because stops in this context exemplified in (42) are optionally (un)aspirated:

- (42) a. elliptical, aptitude, actor, after, ictus, hefty,
restrictive, napkin, Atkins
- b. contemplate, pantomime, winter, center, wimpy,
ampersand, contemporary, anchor, lanky, linkage
- c. filter, altitude, helter, skelter, poltergeist,
alcohol, Elka, Wilkins

Notice that both rules in (40) make a (non-initial) unstressed syllable onsetless. We will discuss this point below.

Selkirk (1982) also claims that the process of resyllabification is restricted by the principle of Syllable Structure Preservation stated in (43):

- (43) The Principle of Syllable Structure Preservation
The derived syllable structure produced by rules of

resyllabification must conform to the syllable template of the language.

Now we turn to the discussion of how the resyllabification approach discussed so far accounts for the fact that the set of foot-internal clusters is essentially identical to the set of the consonant clusters observed in the word-final position.

At first sight, it seems possible to account for the fact. Suppose English phonology contains the following statement:

- (44) Intervocalic consonant clusters must be *resyllabifiable* into the preceding syllable by means of the rules of resyllabification if they are followed by unstressed vowel.

(44), together with (43)¹³, has an effect to restrict the foot-internal clusters to the possible consonant clusters observed in word-final rhymes.

In spite of the effective restriction that (44) imposes on the intervocalic clusters, the status of the statement (44) is not so clear. (44) cannot be a restriction on the underlying representations, since it must check the output of the rules of resyllabification. (44) can neither be a restriction on the surface representations nor the one on the derived intermediate structures, since the second rule of resyllabification is an optional rule, and so the resyllabified structures cannot be realized in some derivations. A remaining possibility is that we regard (44) as a restriction on possible derivations but not on actual ones. The strange status of (44) suggests that the resyllabification approach is not on the right track.

5. Concluding Remarks

We have argued that the set of the consonant clusters within the trochaic words is basically identical to the set of the consonant clusters observed in the word-final rhymes and consequently the second unstressed syllables of the trochees are onsetless. In other words, we can conclude the *codamax* ap-

proach is more adequate than the *onsetmax* approach in order to account for the phonotactics of the consonant clusters in the trochaic words. We have demonstrated two sorts of evidence. In section 2, we have discussed the evidence based on the basic identity between the set of the foot-internal consonant clusters and the consonant clusters in the rhymes. In section 3, we have provided the evidence based on the fact that the pansyllabic constraints requires that the foot-internal clusters be tautosyllabic with the preceding stressed vowels.

Based on the conclusion above, we can safely conclude that Ito's (1988) Universal Core Syllable Condition cannot be universal, as we have discussed in section 4.1.. We have also demonstrated that the resyllabification approach, a version of the *onsetmax* approach, cannot provide principled explanation for the fact that the set of the foot-internal consonant clusters is identical to the set of the clusters in the rhymes.

NOTES

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¹ Or nativized or assimilated.

² Cairns (1988) provides evidence which suggests that the onset of such word as *quote* must be regarded as a simple segment rather than the sequence of /k/ and /w/.

³ The onset of this word is analyzed as the C₀-A₀ onset /sr/, though the exact analysis is irrelevant to the discussion here. See section 7 of Cairns (1988).

⁴ We need further restriction(s) on the C₀-A₀ onset that exclude /t d θ/ before /l/ and /k p g b s f/ before /w/. For further discussion, see Cairns (1988).

⁵ These segments are the ones which is under the marked branch of the node [ret] of the tree (2).

⁶ The segments under the marked branch of the tree (2).

⁷ These specification is mine, since the contents of F_1 here fail to be specified in Cairns (1988). Besides this, it seems to be assumed that /k^{*}/ is excluded from the full inventory for C_r , though Cairns (1988) is not clear on this point.

⁸ It seems to be assumed that the voicing of /d/ is accounted for by another rule, although Cairns (1988) are not clear on this point.

⁹ This constraint is not stated explicitly in Cairns (1988).

¹⁰ Note that /-zm/ can appear in the word-final rhyme (e.g. *prism*), while /-gm/ cannot.

¹¹ Since /s/ is the only one which can appear in PC_0 , we need no further specification that says PC_0 is /s/.

¹² In the model of Selkirk (1982), it is assumed that each node in the templates is assigned any features shared by the segments or constituents which the node in question immediately dominates.

¹³ As matter of fact, in order to obtain the desired effect, we must revise (43) as (i) below:

(i) The Principle of Syllable Structure Preservation

The derived syllable structure produced by rules of resyllabification must conform to the BSC of the language.

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