Post-vocalic /r/ in English and dialect variation:
A lexicon-dependent OT account[*]

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Lee, Jae-Young. 2007. Post-vocalic /r/ in English and dialect variation: A lexicon-dependent OT account. *Studies in Phonetics, Phonology and Morphology.* 13.2. 325-351. English dialects show a variety of variation with regard to post-vocalic /r/. This paper gives a description of diverse realizations of English post-vocalic /r/ across dialects. In addition, this paper offers a more straightforward account of the English dialect variation on post-vocalic /r/. This account is couched within the framework of Optimality Theory (Prince and Smolensky 1993) by falling back on a lexicon-dependent approach (Lee 2004). The account proposed here adopts the view that the underlying representation of post-vocalic /r/ is dialect-sensitive, not dialect-neutrally homogenous. This view on underlying representation is different from the widely-held panlectal view that English has the same underlying representation regardless of dialect difference. (Seoul National University)

Keywords: English, dialect variation, (non-)rhotic accent, Optimality Theory, constraint ranking, underlying representation, lexicon, Richness of the Base, Lexicon Optimization, linking /r/, intrusive /r/

1. Introduction

This paper examines post-vocalic /r/ in English. Post-vocalic /r/ is related to the phonological phenomena of /r/-deletion, /r/-linking (also called linking /r/) and /r/-intrusion (also termed intrusive /r/) (Sweet 1908, Jespersen 1913, Wells 1982, and Carr 1999). These phonological phenomena have been continuous research topics in English phonology. Many diverse accounts have been proposed for these phenomena. For example, rule-based accounts of linking /r/ and intrusive /r/ are offered by Kahn (1976), Gutch (1992), and Harris (1994). Gesture-based accounts of these phenomena, for example, are advanced by McMahon et al. (1994) and Gick (1999). Optimality Theoretic accounts include McCarthy (1993), Kang (1998), Hwangbo (1998), Bakovic (1999), Ortmann (1999), Orgun (2001), Hong (2004), and Uffmann (2005), to name just a few. The purpose of this paper is to make a contribution to a more comprehensive understanding of English /r/-deletion, linking /r/ and intrusive /r/ and to provide an analysis of dialect variation on /r/-deletion, linking /r/ and intrusive /r/ from an Optimality Theoretic perspective combined with a lexicon-dependent approach. Previous Optimality Theoretic works, which deal mainly with /r/-intrusion, have aimed at explaining why /r/ is

epenthesized among other consonants or glides.[1] They, moreover, have restricted their focus on the non-rhotic dialects such as Received Pronunciation and Eastern Massachusetts English.

This paper, on the other hand, deals with a combination of the /r/-deletion, /r/-linking and /r/-intrusion phenomena taking into account a wide variety of English dialects including both rhotic and non-rhotic ones. A dialectal typology of post-vocalic /r/ sheds a new light on a better understanding of the nature of English post-vocalic /r/ and leads to a comprehensive analysis of /r/-deletion, /r/-linking and /r/-intrusion. This paper also shows that the intrusive /r/ phenomenon takes place only in a certain type of /r/-less dialects, not in all /r/-less dialects. I follow here Harris' (1994) classification of English dialects into four types (A, B, C, D). Type A stands for rhotic dialects. Types B, C, and D represent non-rhotic dialects. It is only Type C which exhibits intrusive /r/ among the three types of non-rhotic dialects. In addition, this paper argues that the so-called intrusive /r/ phenomenon is analyzed better under the deletion approach than under the insertion approach adopted by most of previous OT works.

The organization of this paper is as follows. Section 2 explores the typology of dialect variation concerning English post-vocalic /r/. In section 3, I discuss the phenomena of /r/-deletion, /r/-linking and /r/-intrusion. Section 4 claims that underlying representations are dialect-sensitive, not dialect-neutral and argues that the deletion approach needs to be adopted in stead of the insertion approach to intrusive /r/. Section 5 offers a lexicon-dependent OT account of the various realizations of post-vocalic /r/ and discusses the issue centering on the Richness of the Base principle. Justification for the view of underlying representations as dialect-sensitive is also advanced in this section. Section 6 summarizes the discussions and concludes this paper.

2. Dialectal typology of English post-vocalic /r/

It is well known that English dialects can be classified into two groups, /r/-less (non-rhotic) and /r/-ful (rhotic), depending on the pronunciation of post-vocalic /r/.[2] In /r/-less dialects, orthographic post-vocalic /r/ is not pronounced. For example, the post-vocalic /r/ in *car* does not surface in these dialects. On the other hand, /r/-ful dialects retain etymologic post-

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[1] The phoneme /r/ in English can be phonetically implemented in various ways depending on dialects. To keep discussions in question simpler, I usually employ the slash rather than the bracket in representing the surface form [r] or [ɹ]. Sometimes, however, the bracket is used in referring to surface forms if detailed discussion or unnecessary misunderstanding is avoidable. This inconsistency in representations is due to the fact that a detailed analysis of phonetic implementations of /r/ is not the main concern of this paper.

[2] As for prevocalic /r/ as in *rain, red,* and *retain,* the two groups of English have no phonological distinction beyond detailed phonetic implementations: The pre-vocalic /r/ is pronounced in all varieties of English even though it may be realized as alveolar or retroflex depending on dialects.

vocalic /r/. The post-vocalic /r/ in *car* is pronounced by the speakers of /r/-ful dialects.

As for English post-vocalic /r/, Harris (1994: 232) proposes four systems: A, B, C, and D.[3] Type A represents rhotic dialects. This type of dialects includes Canadian English, Irish English, Scottish English, most of the dialects in the United States except East Massachusetts English and Southern English, and part of Caribbean English. In Type A, according to Harris, etymologic /r/ is pronounced in morpheme-final position as well as in pre-vocalic and pre-consonantal position of a morpheme, as illustrated in (1). The illustrative data given in this section are mainly taken from Harris (1994: 233-234).

(1) a. very, carry, dairy
    b. beard, card, warn, source
    c. bear, star, poor, clear, alter

In cross-morpheme contexts, Type A shows that etymologic /r/ is pronounced before both a consonant and a vowel. Non-etymologic /r/, on the other hand, is not inserted before a vowel. Non-existence of /r/ is denoted by the symbol "ø".

(2) a. bear to, star sign, poor man, clear view, alter the
    b. bearing, starry, altering
    c. bear up, star of, poor Eva, clear up, alter a, after all
    d. sofa[ø] and, Sheena[ø] Easton, idea[ø] of

In other words, Type A exhibits linking /r/, but not intrusive /r/. This is a very important fact because many recent works on English linking /r/ and intrusive /r/ might lead to a misunderstanding that intrusive /r/ occurs wherever linking /r/ takes place. The importance of this point will become clearer as discussion proceeds below.

Types B, C, D are non-rhotic dialects. However, there are some differences among these non-rhotic dialects. In Type B, which according to Harris (1994: 232) contains standard southern England English, etymologic /r/ is pronounced before a vowel within a morpheme, but not before a consonant or pause:

(3) a. very, carry, dairy
    b. bea[ø]d, ca[ø]t, wa[ø]n, sou[ø]ce
    c. bea[ø], sta[ø], poo[ø], clea[ø], alte[ø]

In hetero-morphemic contexts, Type B shows that etymologic /r/ is not pronounced before a consonant-initial morpheme (4a) while it is pronounced before a vowel-initial morpheme (4b and c). However, non-

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[3] I use the more theory-neutral and more ordinary term "type" rather than "system" here.

etymologic /r/ is not introduced before a vowel-initial morpheme, as exemplified in (4d).

(4) a. bea[ø] to, sta[ø] sign, poo[ø] man, clea[ø] view, alte[ø] the
    b. bearing, starry, altering
    c. bear up, star of, poor Eva, clear up, alter a, after all
    d. sofa[ø] and, Sheena[ø] Easton, idea[ø] of

As in Type A, this type of dialects allows linking /r/ but disallows intrusive /r/.

Type C shows morpheme-internal realizations of /r/ in the same way as Type B, as evidenced in (5). Etymologic /r/ is pronounced before a vowel while it is not before a consonant or pause.

(5) a. very, carry, dairy
    b. bea[ø]d, car[ø], wa[ø], sou[ø]ce
    c. bea[ø], sta[ø], poo[ø], clea[ø], alte[ø]

In cross-morpheme contexts, /r/ does not surface before a consonant-initial morpheme:

(6) bea[ø] to, sta[ø] sign, poo[ø] man, clea[ø] view, alte[ø] the

So far, there seems to be no difference between Type B and C. However, unlike Type B, non-etymologic /r/ pops up before a vowel-initial morpheme, as seen in (7b).

(7) a. bear up, star of, poor Eva, clear up, alter a, after all
    b. sofa_r and, Sheena_r Easton, idea_r of

Type C shows both linking /r/ and intrusive /r/. Type C dialects include non-rhotic British English and Eastern Massachusetts English. If we consider only this type of dialects in order to analyze /r/-linking and /r/-intrusion in English, we are tempted to hastily conclude that /r/-intrusion goes hand in hand with /r/-linking in English. This conclusion, however, cannot be maintained due to the asymmetry between /r/-linking and /r/-intrusion in Type A and Type B.

The fourth type, Type D, is very interesting. In this type, post-vocalic /r/ does not surface at all either in morpheme-final position or before another morpheme. It is pronounced only in crisp onset position. The illustration is given in (8).

(8) a. red, rack, rude, tray, dread, prime, fry
    b. ve[ø]y, ca[ø]y, dai[ø]y
    c. bea[ø]d, ca[ø]d, wa[ø]n, sou[ø]ce

d. bea[ø], sta[ø], poo[ø], clea[ø], alte[ø]
e. bea[ø] to, sta[ø] sign, poo[ø] man, clea[ø] view, alte[ø] the
f. bear[ø]ing, star[ø]y, alte[ø]ing
g. bea[ø] up, sta[ø] of, poo[ø] Eva, clea[ø] up, alte[ø] a, afte[ø] all
h. sofa[ø] and, Sheena[ø] Easton, idea[ø] of

Neither linking /r/ nor intrusive /r/ is permitted in this type of dialects. According to Harris (1994), Type D includes the English of Upper South of the United States.

We can summarize the four types of English dialects limiting our focus on /r/-deletion, /r/-linking and /r/-intrusion. By /r/-deletion I mean the surface deletion of etymologic /r/ in morpheme-final (coda) position. The "O" means the existence of each phenomenon, and "X" the non-existence of it.

(9)

Dialect Type	/r/-linking	/r/-intrusion	/r/-deletion
A	O	X	X
B	O	X	O
C	O	O	O
D	X	X	O

The four types in (9) are subparts of the theoretically potential permutations of /r/-deletion, /r/-linking and /r/-intrusion.

(10)

Dialect Type	/r/-linking	/r/-intrusion	/r/-deletion
A	O	X	X
B	O	X	O
C	O	O	O
D	X	X	O
E	X	O	O
F	O	O	X
G	X	O	X
H	X	X	X

The hypothetical E type refers to the non-rhotic dialects which permits /r/-intrusion without /r/-linking. Type F represents the rhotic dialects which allow /r/-intrusion and /r/-linking. The next hypothetical dialect type, Type G, corresponds to the rhotic dialects where only /r/-intrusion occurs without /r/-linking. Type H subsumes rhotic dialects in which both /r/-linking and /r/-intrusion are disallowed. The existence of these four potential types may be confirmed or denied empirically. I do not take up

this issue here and keep focusing on the four types A, B, C, and D whose existence is verified by Harris (1994).

Previous OT works implicitly assume that /r/-intrusion goes hand in hand with /r/-linking. This assumption leads to the exclusion of Types A and B in analyzing post-vocalic /r/ in English. Both /r/-intrusion and /r/-linking should occur together; otherwise, neither of them occurs.

(11) Exclusion of two types under the implicit assumption

Dialect Type	/r/-linking	/r/-intrusion	/r/-retention
A	O	X	O
B	O	X	X

In addition, previous works focus on /r/-linking and /r/-intrusion in non-rhotic dialects. Type D does not show /r/-linking and /r/-intrusion. Thus, this type is also excluded from serious consideration in the literature.

(12)

Dialect Type	/r/-linking	/r/-intrusion	/r/-retention
D	X	X	X

This paper, on the other hand, takes into account these thus-far-neglected types of dialects along with Type C, and covers a comprehensive picture of /r/-deletion, /r/-linking, and /r/-intrusion in English.

3. More on English /r/-deletion, /r/-linking and /r/-intrusion

As discussed above, in many English dialects including Type B, C, and D, the orthographic post-vocalic /r/ does not surface in morpheme-final position, as exemplified in (13). The data in this section are mainly drawn from Gick (1999:32).

(13) /r/-deletion
    a. after ɑ : mar
    b. after ɔ : lore
    c. after ə : coder
    d. after iə: deer

The post-vocalic /r/, however, is pronounced in non-rhotic when it is linked to the following vowel-initial morpheme, as illustrated in (14). This phenomenon, as discussed above, is observed in Types B and C, but not in D, among the non-rhotic dialects.

(14) /r/-linking
    a. after ɑ : mar is
    b. after ɔ : lore is
    c. after ə : coder is
    d. after iə: deer is

In some dialects such as Type C, non-etymologic /r/ surfaces before a vowel-initial morpheme.

(15) r-intrusion
a. after ɑ	[mɑrɪz]	'ma is'
b. after ɔ	[lɔrɪz]	'law is'
c. after ə	[kodərɪz]	'coda is'
d. after iə	[aydiərɪz]	'idea is'

As for the preceding vowel before /r/, it has been claimed in the literature (for example, Sweet 1908, Wells 1982, McMahon et al. 1994, Carr 1999, Gick 1999) that the vowel should be one of non-high vowels. Some scholars (for example, Gick 1999: 32) limit the set of non-high vowels to [ɑ, ɔ, ə] while others (for example, Hughes and Trudgill 1982: 60) add [ɜ] to the nonhigh vowel set.

There are still unsettled controversies over linking /r/ and intrusive /r/ even though these phenomena have been treated in the literature for such a long time. Many scholars, as exemplified in section 1, have been trying to offer new proposals about these phenomena. However, most previous works do not give their concern to the issue of underlying representation, to the exclusion of a very few non-OT accounts such as Gutch (1992), Harris (1994) and Gick (1999). Interestingly, almost all of the previous OT works including McCarthy (1993) do not take underlying representation into serious consideration: They do not regard underlying representation as a worthwhile subject matter. On the other hand, I claim that underlying representation is worth discussing in analyzing English /r/-deletion, /r/-linking and /r/-intrusion even within the OT framework.

4. Previous OT accounts of /r/-intrusion: the insertion approach

After McCarthy (1993) proposed an Optimality Theoretic account of the linking /r/ and intrusive /r/ phenomena in Eastern Massachusetts, the succeeding OT works on intrusive /r/ such as Kang (1998), Hwangbo (1998), Bakovic (1999), Ortmann (1999), Orgun (2001), Hong (2004), and Uffmann (2005) have implicitly or explicitly adopted the hypothesis that etymologic /r/ exist in underlying representation while non-etymologic /r/ does not. According to this hypothesis, intrusive /r/ is a result of insertion even though the procedural term "insertion" is not directly employed in the OT accounts. Thus, the approach with the hypothesis can be termed the insertion approach for the sake of convenience.

One of the most recent insertion accounts, which offer some level of explanatory depth, is proposed by Uffmann (2005).[4] Thus, I will mainly discuss Uffmann's account as a representative one of the insertion approach. In analyzing intrusive /r/, Uffmann (2005), like other previous works, focuses his attention on the reason why /r/ is inserted rather than /ʔ/, /t/, /y/, or /w/. Uffmann (2005) proposes a prominence-based account criticizing Bakovic (1999), Ortmann (1999), and Orgun (2001).

As for Bakovic (1999), who claims that the inserted /r/ is a glide resulting from spreading of the feature of a preceding non-high vowel, Uffmann (2005) points out as a drawback the lack of evidence for considering post-vocalic /r/ as a glide.[5] The second problem with Bakovic's account, according to` Uffmann (2005), is the main claim that schwa is a unique source of the inserted glide /r/. Contrary to Bakovic's (1999) claim, inserted /r/ should correspond not only to schwa but also to /ɛ/ and /ɔ/ in /r/-intrusion. Uffmann says that /ɛ/ and /ɔ/ cannot be the source of glide /r/. The segment /r/ has many features in common with schwa, but not with /ɛ/ and /ɔ/. Therefore, inserted /r/ cannot inherit the relevant features from /ɛ/ and /ɔ/. In short, according to Uffmann (1999), the essential question why /r/ is inserted still remains unanswered in Bakovic (1999).

Uffmann (2005: 23-24) also criticizes Orgun's (2001) account. Orgun (2001) proposes a family of the markedness constraints like *CODA-r and a family of prominence-based constraints. The constraint NUC-i,u, a prominence-based constraint, states that /i/ and /u/ should stand in nucleus position. The glides /y/ and /w/ in non-nuclear position violate NUC-i,u.

(16)   a. *CODA-t >> *CODA-n >> *CODA-r >> *CODA-w,j
         b. NUC-a >> NUC-e >> NUC-i,u

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[4] Of course, there are a lot of OT works on which I do not make in-depth comments here due to the limitation of space. See Hong (2004), which adopts the insertion approach within the OT framework, for more detailed and critical reviews on previous OT works like McCarthy (1993), Kang (1998), and Hwangbo (1999). I find it unnecessary to repeat the critical review on previous works here. In advancing an alternative OT account, Hong (2004) proposes two important constraints, $C_{unmarked} \supset V[-hi, +bk]C_{unmarked}$ and *SHARINGF. The $C_{unmarked} \supset V[-hi, +bk]C_{unmarked}$ constraint demands that "$C_{unmarked}$ be allowed at the right PrWD edge only if preceded by a non-high back vowel" (Hong 2004: 297). The other constraint, *SHARINGF, requires that [F] cannot be shared across a PrWD. He also assumes without further discussion that /r/ is an unmarked segment in epenthesis. This assumption, however, needs to be discussed and justified further. It is because this assumption contains the most significant substance of controversies in the previous analyses of intrusive /r/. The issue of why /r/ is an unmarked epenthetic segment has been at the heart of debates about intrusive /r/ since McCarthy (1993). Teeple (2005) advances an OT account using an ill-defined, poorly-justified constraint PrWd]ONS, which requires that a prosodic word should be followed by an onset. See Teeple (2005) also for criticism on McCarthy's (1993) constraint FINAL-C.

[5] This criticism is not legitimate since some scholars like Kahn (1976) and Harris (1994) argue well that English postvocalic /r/ is a glide.

Orgun also employs McCarthy's (1993) FINAL-C to trigger epenthesis. Orgun thus claims that the constraint hierarchy, FINAL-C >> NUC-i,u >> *CODA >> *CODA-r, guarantees the insertion of /r/, as illustrated in (17).

(17)

Input: /lɔː ɪz/	FINAL-C	NUC-i,u	*CODA-r	*r
a. [lɔː ɪz]	*!			
☞b. [lɔrɪz]			*	*
c. [lɔyɪz]		*!		
Input: /siyɪt/				
a. [siyrɪt]		*		*!
☞b. [siyɪt]		*		

The insertion of glide /y/ is more marked than /r/-insertion in *law is*. Candidate (17c) with /y/ violates NUC-i,u while candidate (17b) with /r/ satisfies it. In the case of *see it*, where underlying representation has a glide, a general prohibition against /r/ plays a crucial role in selecting the candidate without /r/, [siyɪt], as the winner.

Against the Orgun's (2001) seemingly simple account which is also based on prominence, Uffmann (2005) first raises the problem of the constraint ranking where NUC-i,u dominates *Coda-r. This ranking implies that glides are more marked than /r/ in post-nucleus position. This implication is in contradiction with English data. According to Uffmann, the distributional fact that glides occur without restriction in /r/-less dialects whereas coda /r/ does not surface in those dialects contradicts the implication deriving from the constraint ranking. Second, Uffmann (2005) criticizes Orgun's account by appealing to the Richness of the Base principle. Orgun assumes that forms like *see* contain an underlying glide. If the underlying form of *see* had no glide, the constraint NUC-i,u would not be violated: /r/ could be inserted if there were no glide in input, according to the Orgun's analysis. Thus, Orgun must assume that a glide is prespecified in the underlying representation for *see*. Third, Uffman points out that the Orgun's analysis employs ambisyllabicity. However, the use of ambisyllabicity in English phonology is well-defended in Kahn (1976). Fourth, Uffmann says that the markedness scale adopted by Orgun (2001), *CODA-t >> *CODA-n >> *CODA-r >> *CODA-[w, j], is problematic. Uffmann suggests that /r/ is a more marked coda consonant than other consonants like /t/ or /n/ by relying on the observation that /r/ is deleted from coda position in non-rhotic dialects, but not /t/ and /n/.

As an alternative account, Uffmann (2005) proposes another prominence-based analysis of /r/-epenthesis making some assumptions. First, he assumes

that the most prominent segment is optimal in intervocalic position because "it can minimize the contrast to the following or preceding vowel and thus the perceptual salience of the epenthetic segment" (Uffmann 2005:10). He makes another assumption that the least prominent segment, i.e. glottal stop, is inserted in marginal position to maximize the prominence contrast to the following vowel. Third, he assumes that intervocalic onsets like intrusive /r/ are treated as peaks, not as margins.

He also falls back on the segmental prominence scale in (18). Vowels are the most prominent segments and laryngeals the least prominent ones.

(18) Vowels > r > l > nasals > obstruents > laryngeals

The combination of the segmental prominence scale and those assumptions is translated into the fixed hierarchy of a family of context-sensitive markedness constrains:[6]

(19) *V_V/lar >> *V_V/obs >> *V_V/nas >> *V_V/l >> *V_V/r >> *V_V/V

Another important constraint for Uffmann's analysis is the one prohibiting a non-high glide.

(20) $*G_{[-hi]}$ Glides are [+high].

The driving force breaking hiatus is implemented by the ONSET constraint which requires syllables to have onsets. The faithfulness constraint, DEP-IO, is also needed in his account.

(21) DEP-IO   Output segments must have a correspondent in the input.
       DEP(hi)   The feature [high] must have a correspondent in the input.

Through these constraints, Uffmann explains the phenomenon of intrusive /r/. The illustrative tableau showing the constraint ranking proffered by Uffmann (2005:20) is repeated in (22), where [ɣ] denotes a non-high glide.

(22)

Input: /lɔː ɪz/	Onset	$*G_{[-hi]}$	DEP (hi)	DEP	*V_V/ lar	*V_V/ r	*V_V/ V
a. [lɔː ɪz]	*!						
b.[lɔwɪz]			*!	*			*
c. [lɔɣɪz]	*!			*			*
☞d.[lɔrɪz]				*		*	
e. [lɔʔɪz]				*	*!		

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[6] Uffmann adopts the well-held view that glides have the same features as vowels.

Candidate (a) violates the higher-ranked constraint ONSET and thus is immediately excluded from consideration. Other remaining candidates have epenthetic segments as a hiatus breaker satisfying ONSET and violating DEP-IO. Candidate (b) violates DEP(high) as well since it has a high glide [w]. Candidate (c) contains a non-high glide, which violates the higher-ranked constraint *G$_{[-hi]}$. The resulting glide [ɣ] is an illicit segment in English. Glide formation is impossible. Thus, the next most prominent segment /r/ is chosen. Glottal insertion violates the *V_V/lar constraint. As a result, intrusive /r/, in Uffmann's account, is an example of "a prominence or sonority-driven insertion process" (Uffmann 2005:20).

Uffmann's account also has some drawbacks. First, in order to justify the epenthesis of /r/ in intervocalic position, Uffmann must assume that the epenthesized /r/ in intervocalic position is not treated as a margin but as a peak. Uffmann, however, invokes the constraint ONSET to trigger epenthesis, which means that the inserted segment plays a role of the onset, i.e. margin, of the following syllable. The inserted segment /r/ has a dubious role in his account. It is taken to be part of a peak in regards to prominence while it is considerd to be a margin (onset) of the following syllable with regard to syllabification. It is, however, noted that both prominence and syllabification are defined by a single criterion of sonority. Therefore, the independent and dual role of /r/ for prominence and syllabification has no justification in a single system of using the same criterion as an important theoretical concept.

Second, under Uffmann's analysis, /r/-insertion occurs as the most optimal rescue strategy when glide formation is blocked. This analysis gives a natural explanation for why /r/ is a legitimate segment in the case of intrusive /r/ in the sense that the markedness constraints are universally fixed in ranking: *V_V/lar >> *V_V/obs >> *V_V/nas >> *V_V/l >> *V_V/r >> *V_V/V.

However, this analysis has a shortcoming because it has difficulty in explaining the case in which the inserted segment is not /r/. As an illustration, let us consider the case of "Bristol /l/", where the inserted segment is not *r*, but *l*. This case could not be explained by the Uffmann's constraint ranking unless the fixed ranking of the context-senstive markedness constraints be reshuffled. If we were forced to admit that the markedness constraints are freely ranked depending on dialects, the naturalness of Uffmann's explanation for why /r/ is inserted could disappear immediately. Moreover, the Uffmann's constraint ranking predicts that glottal insertion in intervocalic position is not allowed. However, this is not the case. In some dialects, glottal stops are found in intervocalic position. According to Bowerman (2004: 940), in White South African English, the inserted segment to break hiatus is a glottal stop [ʔ]: for example, [loʔəno:də] 'law and order'.

The universally fixed ranking of the context-sensitive markedness constraints does not hold for other languages. For example, according to

Yip (1993: 20), vowel hiatus is not resolved in Cantonese Chinese by /r/-insertion after non-high vowels when glide formation is blocked, as exemplified in (23b).

(23) a. tsi a   tsi ya   'to know'
         fu a   fu wa   'bitter'
      b. ta a   ta a   'to hit'
         tʰɔ a   tʰɔ a   'fine'
         tsʰe a   tsʰe a   'to go away'

Vowel hiatus is broken by the insertion of glide [y] or [w] when the preceding vowel is [i] or [u], respectively. When [y] or [w] is blocked after non-high vowels, Uffmann's universal constraint hierarchy incorrectly predicts that /r/ is inserted. However, this is not the case, which is thus a problem with Uffmann's account.

It is also predicted by Uffmann's (2005) account that both linking /r/ and intrusive /r/ happen simultaneously or both do not happen at all since the triggering environment for the two phenomena is identical: flanked by a pre-/r/ nonhigh vowel and a post-/r/ vowel. The collapse of linking /r/ and intrusive /r/ into a single phenomenon is first advocated by McCarthy (1993). However, as mentioned above, Type A and Type B show asymmetry between linking /r/ and intrusive /r/. This asymmetry cannot be explained by Uffmann's account.

In sum, a lot of insertion accounts of intrusive /r/ have been proposed within the framework of OT. Each account has its own voice over the question of why /r/ is inserted. The insertion approach has burden of explaining why /r/ is inserted.   However, as revealed above, there is still no consensus under the insertion accounts on why /r/ is inserted. So much energy has been wasted only on trying to find answers to the question, sidestepping a comprehensive analysis of dialect variation with regard to post-vocalic /r/.

5. Dialect variation on post-vocalic /r/:
A lexicon-dependent OT approach

5.1 Issues on the nature of underlying representation

It is noteworthy to remind ourselves that only Type C is clearly attested to have /r/-deletion, /r/-linking, and /r/-intrusion. The insertion approach implicitly or explicitly assume that the word *mar*, for example, has the underlying representation /mɑr/ in Type C dialects. The hypothesized underlying representation /mɑr/ has not been seriously challenged in the literature on English phonology. It is because alternation can justify the underlying representation. Even though the post-vocalic /r/ does not surface in an isolated form in Type C dialects, it survives in a connected form:

(24) Underlying representation (UR)   /mɑr/   /mɑr/ + /ɪz/
     Surface representation (SR)   [mɑ:]   [mɑrɪz]

When the hypothesized morpheme-final /r/ is followed by a vowel-initial morpheme, it is realized in surface representation (SR). Orthography seems to reflect the historical development. Note, however, that orthography has not been used in synchronic English phonology as a credible criterion of justifying an underlying representation (UR). Instead, alternation can be employed as a convincing criterion of justifying the postulation of underlying /r/ in *mar*.

What about the UR for the intrusive /r/ case? Under the insertion approach, the morpheme *ma* has the UR /mɑ:/.[7] This UR seems to have no problem. However, there is no independent justification for this UR except recourse to orthography, which is an unacceptable criterion as mentioned above. On the other hand, alternation does not justify the UR /mɑ/, as evidenced in (25). Exactly in the same way as the morpheme *mar*, there is surface alternation between zero and [r] for the morpheme *ma*. The /r/ appears before a vowel, but not before a pause.

(25) Underlying representation (UR)   /mɑ:/   /mɑ:/ + /ɪz/
     Surface representation (SR)   [mɑ:]   [mɑrɪz]

If the insertion approach were adopted, alternation should be invoked for justifying the URs of such morphemes as *mar* while it should not invoked for motivating the URs of such morphemes as *ma*. We would need to rely either on arbitrary criterion, whatever it might be, or diacritic mark for differentiating the two types of morphemes with respect to URs. This is a problem facing the insertion approach which is adopted by the dominant majority of the previous OT works.

An opposing alternative approach is to assume that post-vocalic /r/ in Type C dialects exists in the URs of both etymologic /r/ and non-etymologic /r/ cases. Under this approach, underlying /r/ is deleted in morpheme-final position. Thus, this approach can be referred to as the deletion approach. Under the deletion approach, alternation can be used as a single criterion for positing URs. In Type C dialects, regardless of the cases of linking /r/ and intrusive /r/, morphemes show alternation between [ø] and [r], as illustrated in (24 and 25).

Theoretically speaking, all things being equal, an approach depending on a consistent and single criterion is better than a competing one with inconsistent and multiple criteria. In this respect, the deletion approach is better than the insertion approach.

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[7] Lexicon Optimization allows the more harmonic pair /mɑ:/ - [mɑ:] than /mɑ/ - [mɑ:]. However, the main issue here is whether the morpheme-final ends with /r/ or not, but not whether a vowel is bimoraic or not. Thus, the representation of the vowel is not dealt with in this paper.

A piece of empirical evidence also shows that the insertion approach is problematic. Consider the following data:

(26) a. formula ~ *formularic (formulaic)
     b. satire~ satirical

The insertion approach predicts incorrectly the existence of /r/-intrusion before a vowel-initial morpheme in the juxtaposition of *formula* + *ic*. When schwa-final morpheme is followed by a vowel-initial morpheme, intrusive /r/ is predicted to appear in the insertion approach. However, this is not the case in morphology. Even though we can explain the non-existence of /r/ in (26a) focusing on the juxtaposition of two morphemes, i.e. *formula+ic*, we have difficulty in explaining (26b). The realization of /r/ in *satir+ical* cannot be explained since the /r/ is preceded by [i], not by non-high vowels. On the other hand, a no-insertion approach can explain this paradoxical situation in such a simpler way that there is no underlying /r/ for *formula* while there is underlying /r/ for *satire*.

Indirect evidence for the assumption that /r/ exists in the URs for so-called intrusive /r/ words comes from an observation of nineteenth century English data. The /r/-intrusion was widely accepted in lexical level in the nineteenth century London English, as evidenced in (27). The data are replicated from Jones (2006:340). The /r/-insertion occurred in a variety of contexts. In addition, the hiatus context is not a necessary condition for the epenthesis.

(27) /r/-insertion in the nineteenth century London English
     advarntage 'advantage', arskes 'asks', boerth 'both', bonnerfieder 'bona fide', circumstarnce 'circumstance', contrarst 'contrast'
     darter   'daughter',   debburty   'deputy',   diermunt   'diamond', disadvarntageous 'disadvantageous', drawring 'drawing', duberous 'dubious', fantarstical 'fantastical',   frenertic   'frenetic',   garp 'gape',
     hakmer 'acme', hampertated 'amputated', harer one 'either one', harnch 'haunch', harnselled 'hanselled', harsp 'hasp', hollor 'halloo', horsler 'holster', jarnders 'jaundice', jarnt 'jaunt', Jennerwery 'January', larder 'lather', larnch 'launch', marsculyne 'masculine', mourn 'moan', lorth 'loath', mezzertint 'mezzotint', parnch 'paunch', piller 'pillow', porched 'poached', porlt 'pelt', pruherns 'prunes', Porterghee 'Portuguese', rarther 'rather', romarnce 'romance', sarce 'sauce', sarsepan 'sausepan', sarser 'saucer', shadder 'shadwo', shrorft 'shrove', St Petersburrer 'St Petersburgh', starnch 'staunch', substarntial 'substantial', torsels 'tassels', trarnsaction 'transaction', trarnsient 'transient', yaller 'yellow'

Based on these data, there is no evidence that so-called intrusive /r/ does not exist in lexicon.

As illustrated in (28), orthoepy also shows a preponderance of /r/-insertion, regardless of the position in a morpheme. The data and terms are taken from Jones (2006:341).

(28) a. Morpheme-medial position

Vulgarism	Orthography	Orthoepy
buggaurnets	bayonets	bay-yur-nets
debbertchee	debauchee	deb-ber-shee
drort	draught	drarft
harnted house	haunted	hornted
larfture	laughter	larfter
larndry	laundry	lorn-dry
ordossity	audacity	ordassity

b. Morpheme-final position

Vulgarism	Orthography	Orthoepy
garla	gala	gayler
salliver	saliva	sa-ly-ver
serpeeny	subpoena	subpener

The data show that /r/-insertion was very active in the nineteenth century. The examples, at least, open the possibility that the next generations of the nineteenth speakers can store the /r/-adding forms in memory, i.e. in their lexicon.

Thus far, I have argued for the assumption that both etymologic /r/ and non-etymologic /r/ exists in UR in the dialects showing linking /r/ and intrusive /r/. The synchronic /r/-intrusion phenomenon needs to be analyzed under the deletion approach.

In the dialects with no intrusive /r/ (Type A, B, and C), morphemes like *ma* does not show alternation between zero and [r]. Thus, the alternation criterion, which is subsumed under the notion of surface predictability discussed by Kenstowicz and Kisseberth (1979), gives no justification for positing the UR /mɑr/ for *ma* in these dialects. In the case of linking /r/, alternation takes place in Type A and Type B, but not in Type D. In the former, there is enough justification for positing the UR /mar/ for the word *mar*. In the latter, however, the postulation of underlying /r/ cannot be justified because there is no alternation between zero and [r]. Etymologic /r/ does not surface before pause and before a vowel-initial morpheme in this type of dialects. Alternation is used as a criterion for justifying UR under the deletion approach while it is not uniformly used as a criterion for postulating UR under the insertion approach.

Keep in mind that the URs are different across dialects: they are dialect-sensitive. In the next subsection I incorporate the dialect-sensitive URs into

the OT framework in analyzing post-vocalic /r/ variation across English dialects.

5.2 Constraint rankings for dialect variation

I invoke the constraint of Coda-Cond[liquid, laminal], which is a specific version of the universally motivated constraint CODA-COND.

(29) CODA-COND[liquid, laminal]: The features [liquid, laminal] should not be licensed in coda position.

I follow Walsh (1997) in assuming that [liquid] and [laminal] are distinctive features for /r/. The necessity of [liquid] and [laminal] as phonological features is well justified by Walsh (1997). According to Walsh (1997), the feature [liquid] is a major class feature like [consonantal] and [+sonorant], and the feature [laminal] is a terminal feature under the node of [apical] which in turn is dominated by the place feature [coronal]. I simply use the term CODA-COND for CODA-COND[liquid, laminal] below.

The other two relevant constraints are IDENT(F) and ONSET. The IDENT(F) constraint is a faithfulness constraint, which requires output and input to be identical for features. The constraint ONSET requires a syllable to have an onset.

Permutations of these constraints lead to the four types of English dialects. Type A dialects have the constraint hierarchy in which IDENT(F) dominates CODA-COND, which is illustrated in tableau (30).[8] I employ the candidate comparison evaluation tableau because the focus here is on the ranking argument for each type of English dialects. In this kind of tableau, the left candidate in the pair is the winner in evaluation and the right one is the loser. "W" is used to mean that the winner (optimal candidate), which appears in the left of each pair, is better than the loser (suboptimal candidate) with respect to a satisfaction of the constraint in question. "L" indicates that the loser is more harmonic than the winner in pair-wise evaluation against the constraint under consideration.

(30)

Input: /mɑr/ 'mar'	ONSET	IDENT(F)	CODA-COND
mɑr ~ mɑ:		W	L

In tableau (30), the winner [mɑr] and the loser are tied on the constraint ONSET because they both satisfy it. Thus, the cell is left blank. However, as for IDENT(F), the winner satisfies it while the suboptimal form violates it, which means that the winner is better than the loser in regards to this

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[8] This paper does not invoke the constraint MAX(μ) for the clarity of presentation, as many previous OT works do.

constraint. The optimal candidate [mɑr] violates CODA-COND due to the existence of post-vocalic /r/. On the other hand, the suboptimal competitor [mɑ] satisfies this constraint, which means that the loser is better than the winner with regard to the constraint CODA-COND in evaluation.

This constraint ranking holds true of the connected form 'mar is'. The winner [mɑrɪz] satisfies ONSET.[9] Its competitor [mɑɪz] violates it. However, other competitors like [mɑtɪz] and [mɑʔɪz] satisfy ONSET owing to the replacement of /r/ with another segment. This replacement results in the violation of IDENT(F): all losers violate it while the winner satisfies it. With regard to the lowly-ranked constraint, the winner is tied with the losers.

(31)

Input: /mɑr + ɪz/ 'mar is'	ONSET	IDENT(F)	CODA-COND
a. mɑrɪz ~ mɑ:ɪz	W	W	
b. mɑrɪz ~ mɑtɪz		W	
c. mɑrɪz ~ mɑʔɪz		W	

The case of an underlying /r/-less morpheme is also explained by the same constraint hierarchy, as shown below:

(32)

Input: /spɑ:/ 'spa'	ONSET	IDENT(F)	CODA-COND
spɑ: ~ spɑr		W	W

However, the constraint ranking, ONSET, IDENT(F) >> CODA-COND is problematic with the connected speech, as revealed in (33).

(33)

Input: /spɑ: + ɪz/ 'spa is'	ONSET	IDENT(F)	CODA-COND
a. spɑ:ɪz ~ spɑrɪz	L	W	
b. spɑ:ɪz ~ spɑtɪz	L	W	
c. spɑ:ɪz ~ mɑʔɪz	L	W	

The losers are more harmonic in evaluation against ONSET than the winner. Here, the dominance in ranking of IDENT(F) over ONSET is motivated. The satisfaction of ONSET by the losers requires ONSET to be

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[9] I follow McCarthy (1993) in assuming that post-vocalic /r/ in intervocalic position is ambisyllabic. The ambisyllabic /r/ satisfies both the ONSET constraint and the CODA-COND[liquid, laminal] constraint because the consonantal features [liquid, laminal] are licensed in the onset of the following syllable.

dominated by IDENT(F). The ranking between ONSET and CODA-COND is not explicitly justified here:

(34) Input: /spɑ + ɪz/ 'spa is'	IDENT(F)	ONSET	CODA-COND
a. spɑ:ɪz ~ spɑrɪz	W	L	
b. spɑ:ɪz ~ spɑtɪz	W	L	
c. spɑ:ɪz ~ spɑʔɪz	W	L	

Let us now move on to the Type B dialects where morpheme-final /r/ does not surface. This is a distributional fact distinct from Type A in which morpheme-final /r/ survives. The ranking of CODA-COND over IDENT(F) is motivated, as evidenced in (35).

(35) Input: /mɑr/ 'mar'	ONSET	CODA-COND	IDENT(F)
mɑ: ~ mɑr		W	L

The winner [mɑ:] satisfies CODA-COND but the loser [mɑr] violates it. Conversely, as for IDENT(F), the winner violates it while the loser respects it.

However, the constraint hierarchy does not explain the connected form 'spa is', as revealed in (36).

(36) Input: /spɑ: + ɪz/ 'spa is'	CODA-COND	ONSET	IDENT(F)
a. spɑ: ~ spɑr	W		W
spɑ: ɪz ~ spɑrɪz		L	W
b. spɑ: ~ spɑr	W		W
spɑ: ɪz ~ spɑtɪz		L	W
c. spɑ: ~ spɑr	W		W
spɑ: ɪz ~ spɑʔɪz		L	W

The losers with an inserted segment, [spɑrɪz], [spɑtɪz] and [spɑʔɪz] have onsets satisfying the higher-ranked constraint ONSET while the winner [spɑ:ɪz] violates it and satisfies the lowly-ranked constraint IDENT(F). Therefore, we can argue that the constraint IDENT(F) should dominate ONSET. The ranking between CODA-COND and IDENT(F) is independently motivated above.

(37)

Input: /spɑ: + ɪz/ 'spa is'	CODA-COND	IDENT(F)	ONSET
a. spɑ: ɪz ~ spɑrɪz		W	L
b. spɑ: ɪz ~ spɑtɪz		W	L
c. spɑ: ɪz ~ spɑʔɪz		W	L

Type C is different from Type B in that intrusive /r/ occurs along with linking /r/. Bear in mind that /r/ in Type C exists in the URs for the two cases of linking /r/ and intrusive /r/. The underlying forms of 'mar' and 'spa' are /mɑr/ and /spɑr/, respectively. Dominance in ranking of CODA-COND over IDENT(F) leads to the constraint evaluation tableau where the winner is more harmonic than the loser in a satisfaction of higher-constraints, as seen in (38). The winner [mɑ:] satisfies CODA-COND violating the low-ranking constraint IDENT(F) whereas the loser [mɑr] violates the high-ranking constraint CODA-COND satisfying the IDENT(F).

(38)

Input: /mɑr/ 'mar' /mɑr + ɪz/ 'mar is'	ONSET	CODA-COND	IDENT(F)
a. mɑ: ~ mɑr mɑrɪz ~ mɑ:ɪz	W	W	L W
b. mɑ: ~ mɑr mɑrɪz ~ mɑtɪz		W	L W
c. mɑ: ~ mɑr mɑrɪz ~ mɑʔɪz		W	L W

Non-etymologic /r/ cases can also be explained by the same constraint hierarchy:

(39)

Input: /spɑr/ 'spa' /spɑr + ɪz/ 'ma is'	ONSET	CODA-COND	IDENT(F)
a. spɑ: ~ spɑr spɑrɪz ~ spɑ:ɪz	W	W	L W
b. spɑ: ~ spɑr spɑrɪz ~ spɑtɪz		W	L W
c. spɑ: ~ spɑr spɑrɪz ~ spɑʔɪz		W	L W

Type D is a non-rhotic dialect type in which there is neither linking /r/ nor intrusive /r/. There is no independent reason to assume that /r/ exists in lexicon for this dialect because there is no alternation at all and all lexical words have no post-vocalic /r/. The absence of morpheme-final /r/ can be enforced by the highly-ranked constraints CODA-COND and IDENT(F).

In the connected form, the competition between the winner and the loser is decided by lowly-ranked constraint ONSET.

(40)

Input: /mɑ:/ 'mar' /mɑ: + ɪz/ 'mar is'	CODA- COND	IDENT(F)	ONSET
☞a. mɑ: ~ mɑr mɑːɪz ~ mɑrɪz	W	W W	L
b. mɑ: ~ mɑr mɑ: ɪz ~ mɑtɪz	W	W W	L
c. mɑ: ~ mɑr mɑ: ɪz ~ mɑʔɪz	W	W W	L

Even when the underlying r-less morpheme is juxtaposed with a vowel-initial morpheme, there is no intrusive /r/. This case is also explained by the same constraint hierarchy, as shown in (41). The winner [spɑ: ɪz] satisfies IDENT(F) violating ONSET while the losers with an inserted segment observe ONSET violating IDENT(F).

(41)

Input: /spɑ:/ 'spa' /spɑ: + ɪz/ 'spa is'	CODA- COND	IDENT(F)	ONSET
a. spɑ: ~ spɑr spɑ: ɪz ~ spɑrɪz	W	W W	L
b. spɑ: ~ spɑr spɑ: ɪz ~ spɑtɪz	W	W W	L
c. spɑ: ~ spɑr spɑ: ɪz ~ spɑʔɪz	W	W W	L

As demonstrated above, the dynamic relations among the three constraints give rise to English dialect variation on post-vocalic /r/. The constraint rankings for the English dialects are summarized in (42).

(42) Constraint Ranking Summary
    a. Type A: IDENT(F) >> ONSET, CODA-COND
    b. Type B: CODA-COND >> IDENT(F) >> ONSET
    c. Type C: ONSET, CODA-COND >> IDENT(F)
    d. Type D: CODA-COND, IDENT(F) >> ONSET

Under this analysis, a complex combination of the three phonological phenomena of /r/-deletion, /r/-linking, and /r/-intrusion is easily captured through the OT mechanisms of constraint ranking and universal constraints by taking a lexicon-dependent approach where lexical information is highly considered.[10] It is shown that those phonological phenomena are

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[10] The reader is referred to Lee (2002, 2004) for arguments for the lexicon-dependent OT approach to allomorphy.

sensitive to the aspects of underlying representation. This lexicon-dependent approach subsumes the deletion approach to /r/-intrusion in Type C dialects. The deletion approach to intrusive /r/ has no serious difficulty explaining the case of intrusive /r/ in the dialects. At the same time, the lexicon-dependent OT account gives a comprehensive picture of dialect variation on post-vocalic /r/. A more important implication of the lexicon-dependent OT account is that the justification for UR should depend on an independent phonological system for each dialect, but not on an idealized homogeneous panlectal uniformity. Underlying representation, thus, can vary dialect after dialect. Different dialects can have different URs. Mainstream generative phonology assumes a panlectal uniform UR and thus claims that dialectal variation comes from differences in rules and/or rule ordering in derivation rule-based theory or from differences in constraint ranking within the framework of OT.

5.3 The lexicon-dependent OT approach and Richness of the Base

Most OT theorists regard the Richness of the Base (ROTB) principle as a central tenet of OT and an inviolable axiom. According to Kager (1999), this principle demands that no constraints hold in underlying representation.[11] The ROTB principle may be a reaction both to the excessive theoretical controversies in the 1970s and 1980s over the nature and manipulation of UR: for example, the abstractness vs. concreteness controversy and the Radical Underspecification vs. Contrastive Underspecification controversy.

OT researchers may reject the lexicon-dependent OT account embracing the deletion approach by relying on the ROTB principle. The main attack against this account might go toward the claim that specific underlying representations for each type of dialects are postulated: the ROTB principle is violated. Uffmann (2005:5), for example, immediately discards the deletion approach to intrusive /r/ appealing to the ROTB principle. However, it is worthwhile to note that empirical evidence for ROTB has not been independently advanced in the OT literature beyond allophony. Main argument for ROTB has come from allophony (Ito, Mester and Padgett 1993, and Kager 1999), but not from variation and exceptionality.

Theoretically, we can raise some questions regarding the ROTB principle. One of them, for example, is the question of why abstract and specific UR is intolerable in OT phonological theory which is a legitimate offspring of generative linguistics. Generative linguistics takes abstractness of UR as a fundamental departure from structural phonology. I do not delve into these issues here.[12]

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[11] Different versions of ROTB have been proposed in the OT literature. According to Prince and Smolensky (1993), ROTB states that all inputs are possible. Tesar and Smolensky (1998:252) defines ROTB as follows: The set of possible inputs to the grammar of all languages is the same.

[12] For more discussions on these issues, see Lee (2007).

Empirically, I show below that free inputs in the spirit of ROTB are problematic in analyzing English dialect variation on post-vocalic /r/. Let us first consider Type A dialects. Notice that this type is argued to have the constraint hierarchy, IDENT(F) >> ONSET, CODA-COND with the underlying representation /spɑ:/. However, if /spɑr/, for example, were taken to be an input form for 'spa' according to the ROTB, the constraint ranking could not be maintained anymore, as illustrated in (43).

(43)

Input: /spɑr+ ɪz/ 'spa is'	IDENT(F)	ONSET	CODA-COND
spɑ: ~ spɑr spɑ:ɪz ~ spɑrɪz	L L	L	W
spɑ: ~ spɑr spɑ: ɪz ~ spɑʔɪz	L	L	W

The losers satisfy the higher-ranked constraints IDENT(F) and ONSET while the winner violates them. On the other hand, the winner satisfies the lowly-ranked constraint CODA-COND which is violated by the losers. Therefore, to save the higher position in constraint ranking for the winner, another constraint hierarchy should be needed: CODA-COND >> IDENT(PLACE), ONSET. As a result, two opposing constraint hierarchies need to be invoked to deal with phonological facts in a single system:

(44) a. IDENT(F) >> ONSET, CODA-COND   (for input /spɑ:/)
    b. CODA-COND >> IDENT(PLACE), ONSET (for input /spɑr/)

Selection of the one out of the two constraint hierarchies cannot be securely made. This unsatisfactory result derives from the free UR approach conforming to the ROTB principle.

The indeterminacy of choosing a single one out of two opposing constraint rankings is also observed in Type B. In subsection 5.2 above, the constraint ranking, CODA-COND >> IDENT(F) >> ONSET, is well justified with the underlying representation, /mɑr/ 'mar'. In addition to this representation, however, another representation /mɑ:/ could be taken to be the input pursuing the spirit of ROTB. In this case, the constraint ranking justified for /mɑr/ could not be accepted, as evidenced in (45).

(45)

Input: /mɑ: + ɪz/	CODA-COND	IDENT(F)	ONSET
mɑ:~ mɑr mɑrɪz ~ mɑ:ɪz	W	L	W

Here, IDENT(F) should be dominated by ONSET to make the winner more harmonic than the loser in evaluation against IDENT(F) and ONSET.

Opposite rankings between IDENT(F) and ONSET are necessary if free inputs are admitted. One of the two conflicting constraint rankings cannot be selected based on any independently motivated criterion. Moreover, other high-ranking constraints cannot play a role in resolving the contradiction resulting from the ROTB principle.

The same kind of problem as Type A and Type B dialects occurs in Type D dialects if we assume free inputs. The constraint ranking with CODA-COND, IDENT(F) >> ONSET is justified for the underlying representation /spɑ:/. However, if another possible form /spɑr/ were taken to be the input, the constraint ranking could not be accepted, as revealed in (46). The losers are more harmonic for the constraint IDENT(F) than the winner. The constraint IDENT(F) is ranked higher than the constraint ONSET.

(46)

Input: /spɑr/ 'spa'' /spɑr + ɪz/ 'spa is'	CODA-COND	IDENT(F)	ONSET
a. spɑ: ~ spɑr spɑ: ɪz ~ spɑrɪz	W 	L L	 W
b. spɑ: ~ spɑr spɑ: ɪz ~ spɑrɪz	W 	L L	 W

For Type D dialects to be explained, two opposite rankings between IDENT(F) and ONSET would be necessary under the ROTB principle:

(47) a. CODA-COND, IDENT(F) >> ONSET (for /spɑ:/)
  b. COND-COND, ONSET >> IDENT(F) >> ONSET (for /spɑr/)

As for Type C dialects, when we assume /spɑr/ to be an underlying form, the following constraint following is motivated: ONSET, CODA-COND >> IDENT(F). This constraint ranking seems to work well when /spɑ:/ is taken to be the input, as shown in (48). There is no need of invoking two opposing constraint rankings.

(48)

Input: /spɑ:/ 'spa' /spɑ: + ɪz/ 'spa is'	ONSET	CODA-COND	IDENT(F)
a. spɑ: ~ spɑr spɑr ɪz ~ spɑ:ɪz	W W	W W	W L
b. spɑ: ~ spɑr spɑrɪz ~ spɑtɪz	W 	W 	W
c. spɑ: ~ spɑr spɑrɪz ~ spɑʔɪz	W 	W 	

However, the correct selection of /r/-intrusion over /t/-intrusion or /ʔ/-intrusion, as seen in (48b and c), could not be securely enforced with the ranking among the three constraints.

From the observations made above, it is safe to conclude that free inputs forced by the ROTB principle faces problems in explaining English post-vocalic /r/ variation. I have shown that free inputs in the spirit of ROTB do not go well with an analysis of English dialect variation on post-vocalic /r/.

It is also noteworthy that the insertion approach, which has been taken by previous OT accounts, makes an implicit assumption of specific inputs notwithstanding they do not admit it. They take /mɑr/ and /spɑ:/, for example, to be underlying representation for *mar* and *spa*, respectively in accounting for post-vocalic /r/ realizations in Type C dialects. Most of the previous OT works have not treated other types of dialects. However, it is high possibility that the previous insertion approach would assume the same underlying representations for other types of dialects even though there is no independent justification for each dialectal type. It is because other possible underlying representations would force the insertion approach to invoke totally different constraints and constraint rankings. Put the specific constraints and rankings aside, if the same specific underlying representations as Type C dialects are postulated, this approach is also prone to violate the so-called ROTB principle: no free inputs but specific underlying representations instead. Thus, we can say that underlying representations play an active role in phonological grammar even in the previous insertion approach.

5.4 More advantages of the proposed lexicon-dependent OT approach

Previous insertion accounts ignore the fact that /r/-insertion can also appear in morpheme-final position with no vowel hiatus, as observed in Southhampton English:

(49) China[r], banana[r]

Uffmann's prominence-based account, for example, has difficulties in accounting for word-final [r]: china[r], banana[r]. The context-sensitive markedness constraints like *V_V/r or *V_V/V cannot work for the morpheme-final intrusive /r/ in (49). On the other hand, the lexicon-dependent OT account with deletion approach has a possibility of explaining the data in (49). The final /r/ is stored in lexicon in such dialects as Southampton English. The survival of /r/ is explained in the same way as Type A dialects.

Next, /l/-intrusion rather than /r/-intrusion is observed in some dialects (for example, "Bristol /l/).[13] When this is the case, the previous insertion accounts regardless of spreading-based or prominence-based ones could

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[13] Gick (2002) examines /l/-linking in New York City and Philadelphia.

not explain the /l/-intrusion in an easy way. For example, the Uffmann's (2005) prominence account based on the markedness constraint ranking, *V_V/l >> *V_V/r >> *V_V/V, predicts /r/-insertion over /l/-intrusion when [y]- or [w]-insertion is blocked. The Ortmann's (1999) spreading account predicts that preceding schwa enforces a glide /r/ rather than /l/. On the other hand, the lexicon-dependent approach could have a possibility of accounting for /l/-insertion. It can be assumed under the lexicon-dependent account that in the dialects with /l/-insertion, /l/ rather than /r/ is stored in mental lexicon. With this assumption, the lexicon-dependent OT account can predict correctly the so-called /l/-insertion phenomenon through the same constraint hierarchy as Type C dialects.

6. Conclusion

I have argued in this paper that English dialect variation on post-vocalic /r/ can be explained in a simple and straightforward way under a lexicon-dependent OT approach. The view that intrusive /r/ is underlying has been adopted in some non-OT accounts like Gutch 1992, Harris 1994, Gick 1999. Surprisingly, however, OT accounts have neglected this view. The account given in this paper is on the side of the non-OT accounts in this sense. I have also claimed that each type of dialect can have different underlying representations which are independently motivated, and then I have shown that lexical information needs to be highly valued in OT which focuses its concern on output well-formedness. Consideration of lexical information leads to a more direct and simpler account of dialect variation on post-vocalic /r/. This result can serve as an additional justification for a lexicon-dependent OT, which was proposed to account for English allomorphy by Lee (2002, 2004), and might lead to a suggestion to take a more relaxed interpretation of the ROTB principle which has been too strictly interpreted in the OT literature. The lexicon-dependent OT account advanced here employs universal constraints and explains dialect variation through dynamic ranking permutations.

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