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Compensatory Lengthening in OT and DOT: Loss of Dorsal Fricatives in Middle or Early Modern English

Abstract

The loss of dorsal fricatives in English held significant consequences for the adjacent tautosyllabic vowels, which underwent Compensatory Lengthening in order to preserve a syllable weight. While the process appears to be regular in descriptive terms, its evaluation handled within standard Optimality Theory highlights the ineffectiveness of the framework to parse both the segment deletion and two weight-related processes: Weight-by-Position and vowel lengthening due to mora preservation. As Optimality Theory has failed to analyse the data in a compelling manner, the introduction of derivation, benefiting from the legacy of Lexical Phonology, seems inevitable. The working solution is provided by Derivational Optimality Theory, which assumes a restrictive use of intermediate stages throughout the evaluation.

Keywords: Compensatory Lengthening, moraic phonology, Optimality Theory, Derivational Optimality Theory

1. Introduction

The history of velar, palatal, and glottal fricatives in English deserves special attention, certainly with regard to their gradual and non-uniform decline. The diversity of positions occupied by either of the segments within the syllable structure is presented below:

(1a) OE hring [hrïŋ] > ModE ring [rïŋ]
(1b) OE tōh [to:x] > ModE tough [tʌf]
(1c) OE niht [niçt] > ModE night [næt]

As can be deduced from the above-mentioned data, dorsal and glottal Old English fricatives were in complementary distribution (Opalińska 2004, 236). A glottal [h], although still present in the onset nowadays, ceased to occupy complex onset when
followed by a sonorant in Early Middle English (Minkova 2014, 108). Instances (1b) and (1c) demonstrate the disappearance of, respectively, a velar, and a palatal fricative in coda, which has been completed in the 15th-16th century (Minkova 2014, 114), i.e. in Late Middle or Early Modern English. The former has apparently changed its place of articulation, being pushed towards the lower lip and upper teeth, and hence becoming labiodental. The latter disappeared completely, yet caused a significant sound change in the vowel which is nowadays realised as a diphthong. In addition to consonantal changes, the discrepancies between the quality of Old English and Modern English vowels are worth mentioning. This phenomenon has its roots in the Great Vowel Shift (Denham and Lobeck 2009, 89), a chain shift, which began as early as in the 14th-15th century. While the details of this compound series of changes remain outside of the paper’s scope, the fact that it has affected exclusively long vowels helps to understand the mechanism lying behind the article. Namely, the vowels in (1bc) must have been long at a certain stage in the history of English in order to undergo the shift. This is undoubtedly true for tôh with the underlying long vowel in Old English, but less obvious for niht, whose neither surface representation attested in (1c) contains a long vowel. Therefore, we may assume that the high front [i] has once been lengthened, presumably compensating for the loss of a fricative.

2. Compensatory Lengthening

2.1. Theoretical background

The notion used to characterise the sound change from the previous section, dubbed Compensatory Lengthening (henceforth, CL), has been thoroughly covered in the generative literature since at least late 1970s (de Chene and Anderson 1979; Ingria 1980; Hyman 1985; Hayes 1989; to name a few). In basic terms, in order for the process to take place, two separate conditions should co-occur: the deletion of a segment (usually a consonant) followed by the lengthening of a left-hand neighbouring segment\(^2\) (Ingria 1980, 1). CL, as noted by Kavitskaya (2017, 1), must not introduce contrastive vowel length in a language in which it is absent. Such a distinction should already be present underlingly\(^3\). In addition, a language-specific prosody predicts whether the process might occur, and defines its contextual environment (de Chene and Anderson 1979). CL is thus mandated only in the case of a distinction between light and heavy syllables in a given language (Hayes 1989). Even though the concept of weight was well-known to de Chene and Anderson at the time of the publication of their influential paper, moraic phonology has not emerged until mid-1980s.
2.2. Moraic theory

In the late 1980s, three major theories of representation referring to the syllable structure competed with each other: the CV theory (McCarthy 1979; Clements and Keyser 1983) relying on the binary consonant-vowel division; a more abstract X-skeleton (Levin 1985; Lowenstamm and Kaye 1986) distinguished by its unified skeletal tier as well as enriched with nucleus and rhyme nodes; and a simplistic moraic theory (Hyman 1985) which focused on providing the weight distinction, as opposed to counting segments. Following the analysis provided by Hayes (1989, 253-254), the relevant example, to which the article is dedicated, is illustrated in (2a–c) on the basis of three theories:

\[
\begin{align*}
\sigma & \quad | \quad R \\
\sigma & \quad | \quad N \\
C V C C & \quad | \quad X X X X \\
| & \quad | \quad | \\
n i ç t & \quad | \quad n i ç t & \quad n i ç t
\end{align*}
\]

(2a) CV theory (2b) X-theory (2c) Moraic theory

The CV and X-theory experienced a crisis in the late 1980s, becoming dispreferred in favour of weight-oriented moraic theory (Shaw 2009), whose mechanics match the lengthening processes present in different types of CL. Essentially, it assumes weight as the only CL trigger, and hence allows for the occurrence of CL only when a deleted segment has been assigned a mora. It also limits the application of CL to weight-sensitive languages (Hayes 1989). Such conclusions could not be reached by the two competing theories, which do not possess necessary tools to determine the syllable weight and have to rely on partial arbitrariness to yield the attested surface forms.

As exemplified by (2c), moras may be associated exclusively with the rhyme node. Onsets cross-linguistically do not contribute to the overall weight of the syllable\(^4\) (Hayes 1989). In quantitative terms, one mora assigned to a vowel is sufficient\(^5\), and renders such a syllable monomoraic (light), while either two moras attached to a vowel or an additional moraic coda makes it bimoraic (heavy)\(^6\), as in (2c). At this moment, one particular question arises – if vowels are innately moraic, but codas are not (McCarthy and Prince 1986), is there an independent process, which assigns a mora to the codas of weight-sensitive languages? The answer comes with the Weight-by-Position principle (henceforth, WbP).
2.3. Weight-by-Position and partial conclusions

As the name suggests, the application of WbP is strictly linked to the position occupied by a segment in the syllable structure, i.e. a coda. It is not attested in languages which treat CVC syllables as light (Hayes 1989). WbP has traditionally been described as a parameter, either active or not in a given language (Rosenthal and van der Hulst 1999). In English, one of the major criteria supporting the performance of WbP comes from CL, presented in (3):

\[
\begin{array}{ccccccc}
\mu & \mu & \mu & | & \mu & \mu & | \\
\end{array}
\]

\( n\ i\ ç\ t \rightarrow n\ i\ ç\ t \rightarrow n\ i\ t \rightarrow n \ i\ t \)

WbP ç-loss Vowel Lengthening

Please note that the crucial analysis stops right after the action performed by CL. A later development into Modern English [naɪt] is related solely to the Great Vowel Shift, and has no contribution to the outcomes emerging from the paper. Nevertheless, the diphthongisation would not take place unless the second mora had been erected beforehand by means of WbP, providing the context for vowel lengthening.

So far, we have established the basic tenets governing CL: weight distinction within languages it affects, the importance of moraic representation, and the dominant role of WbP. The following two sections will struggle to find a valid constraint-based generative model of analysis, which is able to provide a solution for the relevant issue. CL has recently enjoyed a substantial amount of research within various frameworks, including Turbidity Theory (Goldrick 2000), Sympathy Theory (McCarthy 2003), Candidate Chains (Shaw 2009), Stratal Optimality Theory (Kiparsky 2011), a containment-based parallel Optimality Theory (Zimmermann 2013), and Harmonic Serialism (Torres-Tamarit 2016). Although the study conducted by Opalińska (2004) is based upon Derivational Optimality Theory (adopted in this paper in section 4), it relies on the Old English data and is concerned with the inflectionally-driven segment deletion, which did not affect the overall sound inventory of the language. That being said, CL from the perspective of a complete loss of dorsal fricatives needs further research.

3. Optimality Theory

The first analysis performed in this article will be handled within standard Optimality Theory (Prince and Smolensky 1993; McCarthy and Prince 1995; henceforth, OT). Unlike in derivational phonology, its doctrine rejects serialism in favor of a simultaneous evaluation of all hypothetical candidates without reference to intermediate
Compensatory Lengthening in OT and DOT... 51

stages. OT assumes the universality of cross-linguistic constraints interacting with each other. Since, by definition, there is no contender that satisfies all the constraints, the main goal is to select the candidate which violates only the lower-ranked constraints or exhibits the least significant number of violations. The ranking is both language-specific and fixed internally; the actual hierarchy must not be shuffled.

So as to proceed with the analysis, we adopt the following input and output representations:

\[
\mu \quad \mu \mu \\
\top \quad \downarrow
\]

(4) //n i x t/ → [n i t]

The first striking difference between the two forms concerns their moraicity. In order for the vowel to lengthen, and hence for CL to apply, it seems inevitable to provide the second mora. Its presence is guaranteed by WbP, formulated in OT terms in (5):

(5) WbP: Codas must be moraic.

After the action performed by WbP, moras on the surface outnumber their underlying counterparts. Therefore, a faithfulness constraint militating against the insertion comes into sight:

(6) DEp-μ: Do not insert a mora.

WbP must outrank DEp-μ in English; otherwise, an opportunity to gain the second mora would be lost, precluding WbP from being applicable in any context. As regards the sound inventory, it is clear that the output is missing a segment present in the input. This violation needs to be regulated by a following markedness constraint:

(7) *ç: A voiceless palatal fricative is not allowed.

The above-mentioned constraint must occupy an undominated position due to the fact that the palatal fricative had completely disappeared from English. The context-free deletion of [ç] needs to be counterbalanced by an opposing constraint, mandating against segment removal:

(8) Max-Seg: Do not delete a segment.

For the deletion to take effect, it is necessary to assume that *ç dominates Max-Seg. The interaction of constraints used up to this point is presented in (9):
Tableau for //n i x t// → [n i t] (failed evaluation)

<table>
<thead>
<tr>
<th></th>
<th>*ç</th>
<th>WbP</th>
<th>DEP-µ</th>
<th>Max-Seg</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. n i ç t</td>
<td>µ</td>
<td>*!</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>b. n i t</td>
<td>µ</td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>c. n i t</td>
<td>µ µ</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>d. n i t</td>
<td>µ µ</td>
<td>*!</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

Candidate (9a) is rejected immediately as it violates the undominated faithfulness constraint (the same fate would meet any candidate with a palatal fricative). Both (9b) and (9d) incur fatal violations of WbP. It is noteworthy that even though the latter contender is bimoraic, its second mora is assigned directly to the vowel, leaving the coda moraless. A candidate (9c) pulls out victory since, as the only contender in the game, it obeys WbP. At this point, the evaluation exhibits an insoluble paradox, caused by three contradictory facts: the demand for an additional mora assigned to the vowel, the actual mora assignment enabled by WbP (which affects codas exclusively), and penalisation of any instance of not obeying WbP, regardless of the vowel moraicity. With the help comes the notion of Extrametricality (Hayes 1982), thanks to which the final consonant becomes invisible at the tier, and, as a result, cannot be granted a mora. The adoption of NON-FINALITY (henceforth, NON-FIN), an equivalent to Extrametricality in OT, tames the overapplication of WbP:

(10) NON-FIN: Word-final consonants cannot be moraic.

With the introduction of NON-FIN ranked above WbP, the hierarchy is now as follows: *ç >> NON-FIN >> WbP >> DEP-µ, Max-Seg. The final ranking is illustrated in the form of a tableau down below.
\( \mu \mu \mu \)
\( \mu \)
\( \mu \)
\( \sqrt{ } \)

\( (11) \) Tableau for \(^{/ n\, i\, x\, t/} \rightarrow [n\, i\, t] \) (failed evaluation)

<table>
<thead>
<tr>
<th></th>
<th>*ç</th>
<th>NON-FIN</th>
<th>WbP</th>
<th>DEP-( \mu )</th>
<th>MAX-Seg</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. n i ç t</td>
<td>*!</td>
<td>**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. n i t</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>c. n i t</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>d. n i t</td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td>*!</td>
</tr>
</tbody>
</table>

The improved evaluation in (11) still cannot yield correct results. Although the introduction of NON-FIN wipes out (11c), it does not fare much better for candidate (11d), the desired winner. There is no eligible constraint hierarchy which would act in favour of (11d), since the candidate has a superset of violations of (11b), the undesired winner. As it can be deduced, a standard version of Optimality Theory cannot account for the data emerged after the application of CL. The framework does not endure the assignment of WbP, the deletion of a segment, and a vowel lengthening through mora preservation\(^8\), all occurring at the same time. The principle of Strict Parallelism (McCarthy and Prince 1993, 2) needs to be abandoned, and at least a single derivational step introduced.

4. Derivational Optimality Theory

One of the most influential extensions to the classic OT, and, in fact, a brand new model of analysis, has been proposed by Kiparsky (1997; 2000) and Rubach (1997; 2000a; 2000b). Derivational Optimality Theory (henceforth, DOT) rejects the one-level approach, and instead assumes a gradual change within at most four derivational steps\(^9\), which resemble those associated with Lexical Phonology (Kiparsky 1982; Booij and Rubach 1987). The analysis is provided in such a manner that an output of Level\(_n\) constitutes an input for Level\(_{n+1}\). The idea is that each level may possess a unique language-specific constraint ranking.
The evaluation in (11) has proved itself to be ineffective due to the overload of various triggers leading to the desired output simultaneously. Thus, the following evaluation must first assume a reasonable intermediate stage. Since CL would not manage to operate without WbP, it is now clear that the selection of a bimoraic candidate prior to the context-free deletion of a fricative belongs to the domain of Level 1. On the other hand, Level 2 will ensure that WbP does not reapply, and that the second mora, which is the source of lengthening, is adjoined directly to the vowel.

4.1. Evaluation at Level 1

Evaluation at Level 1 makes use of the same set of constraints as in (11), but because of a different optimal output, a new ranking is to be introduced. In addition, certain contenders with a palatal fricative should be taken into consideration. Because of the undominated position occupied by *ç in previous evaluations, such candidates would pose no threat to the eventual winners. This time, they may play a significant role since the fricative must be preserved until Level 2, and hence the constraint prohibiting its presence finds itself at the bottom of the ranking. For the same reason, Max-Seg, which ensures that the fricative is preserved, relocates to the undominated position. As it was established before, WbP must interact with Dep-µ in such a way that the addition of moraicity to the coda will be achievable. Consequently, the hierarchy between the two remains unaffected. Unfortunately, trimoraic candidates would escape the current pitfall by satisfying WbP in contrast to the rest of contenders. Their eventual selection must be made impossible via Non-Fin placed higher than WbP, just as in previous evaluations. Such an analysis is economical, as it does not need to make a reference to a constraint that militates against the use of trimoraic candidates. The ultimate ranking is presented in (12):
Compensatory Lengthening in OT and DOT...

At the beginning, NON-FIN renders trimoraic (12c) and (12f) hors de combat. Monomoraic (12a) incurs a double violation of WbP, while candidates (12d) and (12e) do not satisfy both WbP and Max-Seg. As it was predicted, the surviving candidate (12b) becomes an input for the evaluation at Level 2.

### 4.2. Evaluation at Level 2

At Level 2, the hierarchy needs to be reshuffled, which is possible due to the Reranking Minimalism principle (Rubach 2000b, 313), in order to ensure that WbP does not intervene in the application of CL. This means that the driving force behind CL, in this case – *ç, must occupy a leading position. Since the input and the desired output share the same number of moras, it must be assumed that WbP, in order not to reapply, becomes a low-ranked constraint, along with a contradictorily-acting Dep-µ. It is noteworthy that there are only two legitimate contenders which could violate the ban on mora insertion. One of them, a trimoraic [niçt], is not included in the tableau, mostly due to its rapid defeat by the undominated...
*ç. That is why all the candidates with a fricative have been purposefully missed, besides the faithful one, which is subject to further investigation.

As there is no primary reason to downgrade Max-Seg, it may be situated just below Non-Fin, as in Level 1. When the two take effect, both candidates [nit] with moraic codas are eliminated. Such a premature judgement will finally turn out to be correct. So far, the following order has been established: *ç >> Non-Fin, Max-Seg >> WbP, Dep-μ, and a tableau is given below:

(13) Tableau for Level 2: /n i ç t/ → [n i t] (tie)

<table>
<thead>
<tr>
<th></th>
<th>*ç</th>
<th>Non-Fin</th>
<th>Max-Seg</th>
<th>WbP</th>
<th>Dep-μ</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>♦ µ</td>
<td>µ µ</td>
<td>µ µ</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>♦ µ</td>
<td>µ µ</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c</td>
<td>♦ µ</td>
<td>µ µ</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>d</td>
<td>µ µ</td>
<td>µ µ</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>e</td>
<td>µ µ</td>
<td>µ µ µ</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

Partial evaluation proved helpful in eliminating a candidate with a palatal fricative, as well as candidates (13d) and (13e) affected by WbP. Nevertheless, monomoraic (13b) as well as bimoraic (13c) with a long vowel are still in the game. To solve the conundrum, it is now time to introduce two necessary constraints, which, hopefully, will conduct the analysis appropriately. First, the optimal candidate distinguishes itself by the vowel length. This faithfulness violation comes from (14):

(14) IDENT-V([±long]): Input [±long] on a vowel must be preserved as output [±long] on that vowel.
Second, the undesired light-weighted [nit] evidently misses one mora. Such an occurrence will be banned based on (15):

(15) **Max μ:** Do not delete a mora.

Since the monomoraic (13b) does not satisfy **Max μ,** it appears to be helpful to rank the constraint higher than \( \text{IDENT-V([±long])} \), so that the candidate became unfavoured in the light of its major rival. The ultimate evaluation is shown in (16):

(16) **Tableau for Level 2: /n i ç t/ → [n i t]**

<table>
<thead>
<tr>
<th></th>
<th>*ç</th>
<th><strong>Max μ</strong></th>
<th><strong>NON-FIN</strong></th>
<th><strong>Max-Seg</strong></th>
<th><strong>IDENT-V([±long])</strong></th>
<th><strong>WbP</strong></th>
<th><strong>DEP-μ</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. n i ç t</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. n i t</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. n i t</td>
<td></td>
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<tr>
<td>d. n i t</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. n i t</td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

It seems that the architecture of DOT managed to provide a uniform analysis of CL owing to its partially serialist nature. The existence of an intermediate stage helped to separate the assignment of WbP from the direct application of CL.

5. Conclusions

The purpose of this article was to provide an account of Compensatory Lengthening (CL) in relation to Middle or Early Modern English loss of dorsal fricatives,
and, most importantly, to find a proper framework, which would allow for the correct analysis of the relevant data. The theoretical part has established that CL is a weight-oriented process, and hence it is best illustrated on the basis of moraic skeleton. A key role of Weight-by-Position (WbP), regulating coda moraicity, has been highlighted throughout the paper. An instance of CL crucial for the analysis, i.e. [niçt] → [ni:t], turned out to be a textbook example of mora preservation through segment deletion. The optimality-theoretic examination yielded unsatisfactory results, since, according to the principle of parallelism, WbP along with /ç/-loss and the lengthening of a vowel must interact with each other at the same time. Standard OT is therefore completely incapable of providing any proper generative explanation of this descriptively simple and uncontroversial issue. However, Derivational Optimality Theory (DOT) has reached the desired outcome to the apparently insoluble problem. The introduction of levels and a possibility of ranking reshuffling have come to help, thus providing an argument for the use of derivational steps within OT.

Notes

1. Actually, [h] occurs in complex onset in English nowadays, although its distribution is restricted to clusters such as [hj], and, in some dialects, [hw].
2. Strict adjacency is not necessary for CL to apply. Steriade (1982) notes that in East Ionic dialect of Ancient Greek the deletion of [w] in the onset triggered the lengthening of a preceding vowel through a consonant, as exemplified by *odwos → o:dos.
3. Hayes (1989, 290) indicates that in Ilokano, a language with no underlying length distinction, a process resembling CL takes place as a result of reduplication. In addition, Hock (1986, 453) gives an example of Andalusian Spanish, in which a similar situation is triggered by the word-final loss of an alveolar fricative, introducing vowel length. However, both of these languages differentiate between light and heavy syllables.
4. Topintzi argues that weightful onsets do exist e.g. in Samothraki Greek, Bella Coola, Marshallese (2010), or Arrernte (2017), to name a few. Moraicity of such onsets is restricted to those present in the UR (which later surface as geminates), and those participating in stress assignment. Her arguments do not question a standard theory elaborated by Hayes (1989), but rather supplements it on the basis of rare cases of moraic onsets.
5. Piggott (1995) has demonstrated that certain epenthetic vowels in Iraqi Arabic and Mohawk do not carry weight at some stages of phonological derivation.
6. In addition to that, trimoraic (superheavy) syllables have been reported in Dutch (van der Hulst 1984), certain Danish and German dialects (Hock 1986), Hindi (Hsieh 1993), as well as Estonian and Sami (Kavitskaya 2002).
The underlying representation contains a velar fricative, while its surface realisation is palatal, because of the preceding high front vowel [i] spreading the feature [-back].

Topintzi (2006) argues for “position preservation through a mora” rather than mora preservation. Her conclusions are drawn from a rare type of CL, which is motivated by the loss of onset, e.g. in Samothraki dialect of Greek.

Stratal OT follows a three-level pattern of derivation. The additional level in DOT was first introduced by Rubach (2011) in order to separate the newly-coined clitic level (Level 3) from the postlexical level derived by syntax (Level 4).

Bimoraic nuclei equal long vowels in this evaluation. A constraint IDENT-μ is not taken into account since it would not penalise the optimal candidate, which shares the same number of moras with the input. What matters here instead is the difference in vowel length.

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