Abstract

Old English has several strategies of hiatus resolution, which have received a lot of attention in different theoretical approaches. This article discusses these strategies from a constraint-based approach within Optimality Theory. The analysis relies mainly on the solutions proposed by Opalińska (2002; 2004; 2006), and reveals the hierarchy of preference between 4 strategies of hiatus resolution: contraction, diphthongisation, gliding, and glide insertion. It is shown that all mechanisms are a result of the interaction of different constraints. The article reveals that diphthongisation is the most optimal mechanism, whereas contraction occupies the last position due to the violation of weight preservation principle. The goal of this article is to advance Opaliń ska’s solution by demonstrating that the preference for a given hiatus resolution strategy results from the fact which particular subset of constraints is needed to activate this strategy.

Keywords: moraic phonology, Optimality Theory, hiatus, diphthongization, weight preservation principle

1. Introduction

Old English belongs to the western branch of Germanic languages. Like other languages in this group, Old English is weight-sensitive with a strong preference for filled onsets, which in turn results in different strategies of hiatus resolution. This pattern has been long known in linguistics. For example, Kiparsky (1998, 1) claims that in Germanic languages

Syllable structure is also constrained more directly by a preference for simple onsets, which entails avoidance both of hiatus and syllable-initial consonant clusters. Processes of syllabification, deletion, shortening and lengthening in the Germanic languages favour those quantitative and syllabic patterns that fit these prosodic conditions...
As a member of the Germanic language family, Old English shares the same basic phonological conditioning. Similarly to Modern English, its ancestor maximises onsets, as shown in the words: [ˈknɪçt] ‘knight’, [ˈprovjan] ‘to prove’, [ˈdruɣoθ] ‘drought’. However, intervocalic clusters are heterosyllabic, for example in the [vj] cluster in [provjan] the consonant falls into the coda of the preceding syllable whereas [j] occupies the onset of the following syllable. Such syllabification results from a different organisation of rules within the Syllable Structure Algorithm (SSA). Specifically, Old English right after the erection of the syllable proceeds to the erection of the rhyme, instead of maximising the onset. Technically, these facts are translated into the statement that in Old English Coda Rule precedes Complex Onset Rule, unlike in Modern English, where the ordering is reverse (Opalińska 2002, 56).

As shown above, the syllable structure in Old English is predictable and subject to SSA. Consequently, it is assumed that it cannot be underlying. However, as for the moraic structure, it needs to be encoded in the UR. To clarify, Old English has a contrast between long and short vowels, which in turn has implications for the stress placement. Additionally, a syllable is counted as long when its vowel is followed by more than one consonant (Campbell 1959; Hogg 1992). This fact suggests that consonants can contribute to syllable weight. However, onsets do not bear any moras in Old English (Opalińska 2002, 59). Another important feature is that Old English permits maximally bimoraic syllables (Dresher and Lahiri 1999) – a fact that has implications for hiatus resolution strategies, which have received much attention in the literature. SPE phonology (Chomsky and Halle 1968) has analysed them linearly in terms of language-specific rules (see Keyser 1975; Lass and Anderson 1975; Hogg 1992), whereas Optimality Theory approach (OT; Prince and Smolensky 1993; McCarthy and Prince 1995) has discussed contraction in terms of universal constraints (Opalińska 2002; 2004; 2006). The following sections present the details of the latter analysis, specifically that of Opalińska (2002).

2. Diphthongization

One of the hiatus resolution mechanisms is diphthongisation. Old English distinguishes between short (1a) and long diphthongs (1b). The former are monomoraic, the latter – bimoraic. Let us consider the examples in (1) (from Lass 1994, 45).

(1) Long and short diphthongs in Old English

(a) *eolh* [eolx] ‘elk’
    *fleax* [fleaks] ‘flax’
(b) *fœond* [fœ:ond] ‘fiend’
    *sēam* [se:am] ‘seam’
Long diphthongs may be formed due to a merger of two vowels. This is illustrated on the development of the Old English verb *bēo* (‘I am’). Historically, the underlying representation is //be//+//o//¹. In order to arrive at the form *bēo*, the two forms needed to coalesce. This did not, however, lead to the deletion of a mora, which is a manifestation of the principle of *weight preservation* (Opalińska 2002, after Hayes 1989), according to which the moraic structure in Old English has a strong tendency to preserve the same number of moras between the input and the output. Consequently, the coalesced *bēo* still has two moras, thus achieving the optimal bimoraic structure. The motivation behind coalescence lies in the syllable structure. Without diphthongisation, there would emerge an onsetless syllable in /be.o/: a prohibited structure in Old English.

In order to arrive at the form with a diphthong, in OT terms there has to be a constraint promoting diphthongisation. This function is fulfilled by *Onset* (Syllables must have onsets), the position of which must be high in the ranking, crucially higher than *NoDiphthong* (*NoDiph*), a constraint prohibiting diphthongisation² (Opalińska 2002, 170). As argued above, the number of moras in the output was preserved, which could be ensured by a high-ranked *Maxμ* (*Input moras must have output correspondents*). Consequently, the ranking for *bēo* is as follows.

(2) *Onset, Maxμ >> NoDiph*

It is not only important to ensure that no moras were deleted but also that no segmental content was erased. Consequently, the ranking should include *Max-V* (*Input vowels must have output correspondents*). This is shown in the tableau below.

(3) Tableau for *bēo*

<table>
<thead>
<tr>
<th>μ</th>
<th>μ</th>
<th>Onset</th>
<th>Max-V</th>
<th>Maxμ</th>
<th>NoDiph</th>
</tr>
</thead>
<tbody>
<tr>
<td>/be// + //o//</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>μ μ</td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. be.o</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>μ μ _/ b. beo</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>μ</td>
<td>c. be</td>
<td></td>
<td>*!</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>μ</td>
<td>d. beo</td>
<td></td>
<td></td>
<td>*!</td>
<td></td>
</tr>
</tbody>
</table>

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¹ Historical representation.
² Opalińska 2002, 170.
The faithful candidate (3a) is eliminated by undominated Onset due to having an onsetless syllable. Candidate (3c) commits a fatal violation due to the deletions of a vowel and a mora. The deletion of a mora in candidate (3d) also proves fatal, and thus leads to its elimination. The optimal candidate (3b) incurs the least costly violation of NoDiph and thus wins in the evaluation.

It is worth noting that thanks to diphthongisation the optimal candidate actually avoids the hiatus of two vowels. It is done at the lowest possible cost to faithfulness because no material is deleted in the output. Both moras and vowels are preserved. Consequently, diphthongisation was suggested to be the most optimal method of avoiding onsetless syllables (Opalińska 2002, 173).

3. Gliding

Despite its advantages, diphthongisation turns out not to be the most frequent strategy of hiatus resolution in Old English, especially in verbal declension. Let us consider the data in (4) (from Opalińska 2002), which represent class I weak verbs.

(4) Class I weak verbs

| nerian | [nerjan] | ‘to save’ |
| herian | [herjan] | ‘to praise’ |
| derian | [derjan] | ‘to hurt’ |

Historically, these verbs are built of the following morphemes: a root, a stem extension suffix -i- and an inflectional ending -an. Given this structure, the surface /j/ derives from the underlying //i//. Consequently, a hiatus arises at the stem-suffix boundary. For example, in the word [nerjan] ‘save’, the morphological structure is as follows /ner+i+an/ and yields a vocalic sequence /ia/. Since there is no */ia/ diphthong in OE, diphthongization is precluded. As a matter of fact, the absence of /ia/ in the inventory is not accidental because Old English disfavors diphthongs whose constituents are of different feature specification for height (Opalińska 2002, 171). In OT terms, this implies an undominated constraint Diphthong Height (DH: Constituents of a diphthong must agree in height). The change from /i/ to /j/ suggests that class I weak verbs resolve hiatus by gliding.

To further complicate the image, a change from a vowel to a glide implies the loss of a mora. Perhaps, the motivation for gliding and at the same time for preserving the vowel [a] lies then in the fact that it is more costly to delete a vowel than to delete a mora. Technically, such a statement would imply a dominance of Max-V over Maxμ, and would thus promote gliding. In [nerjan] no vowel is actually deleted because //i// corresponds to /j/. Consequently, neither /nerian/ nor /nerjan/ would violate Max-V but it seems that the latter would incur a violation of Maxμ. However, in actuality there would be no violation of Maxμ due to some
additional facts of moraic conditioning. Namely, Old English is a weight-sensitive language which has Weight-by-Position (see Opalińska 2006 and references therein); in other words, the coda in Old English receives a mora (5).

(5) **Weight-by-Position:** All segments in syllable coda receive a mora (Hayes 1989).

What is more, Old English disfavors clusters of a consonant and [j]: *Cj* (Barber 2013, and references therein), which results from OE syllabification. Consequently, the syllable division in nerjan compels the /r/ into the coda, which in turn triggers mora addition by Weight-by-Position. Importantly, the word-final consonants cannot receive moras due to an undominated restriction in Old English not to attract stress to final syllables. This is translated into OT as NonFinality (NonFin) (No moras on the word-final consonant) (Prince and Smolensky 1993). As a result, both */nerian/ and /nerjan/ have 3 moras each, as shown in (6) below.

(6) Moraic structure of [nerjan] (6a) and *[nerian] (6b)

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σ σ σ σ σ μ μ μ μ
(a) n e r j a n   (b) n e r i a n
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The graphs in (6) show that all input moras are retained in both candidates, so Maxμ cannot decide which is the optimal candidate. The difference lies in the association of moras to segments. Namely, in (6a) the high vowel /i/ loses its mora, which turns out to be a more optimal solution than preserving it, as in *[nerian]. This would technically imply the dominance of Maxμ over Identμ (The association between the underlying mora and the segment it dominates must be retained in the output form.). To sum up our discussion so far, the ranking of constraints is given in (7). For expository purposes, the undominated constraint NonFinality is excluded from the rankings in this article.

(7) **DH, Max-V, Maxμ >> Identμ**

It is worth noting that like in the case of diphthongisation, gliding is also triggered by the need to fill the onset position. *[nerian] has an onsetless syllable [an], and that is the reason why it is dispreferred. In OT terms this implies the dominance of Onset. The glided candidate /nerjan/ still incurs a violation of faithfulness because /i/ loses its mora, but it is still a more optimal solution than leaving an onsetless syllable.
With reference to the constraints on weight, it must be emphasised that the ranking should include the constraint \textit{Weight-by-Position} (WxP), which must be ranked higher than faithfulness \textit{Dep}µ, a constraint militating against any addition of a mora. WxP in turn should be ranked lower than undominated \textit{Nonfin} because it would be a more costly operation to insert moras on all codas than to leave the word-final coda moraless. To sum up, the partial ranking should take the shape of \textit{Nonfin} \textgreater\textgreater WxP \textgreater\textgreater \textit{Dep}µ. For expository purposes, the highest and the lowest ranked constraints will not be included in the tableau as they would be never violated in candidates which do not add moras. No mora-insertion is in line with the principle of \textit{weight preservation} (see section 2).

As a final point, it must be also emphasised that the discussed ranking of constraints permits the possibility of both gliding and glide insertion. In other words, both candidates [nerjan] and *[nerijan] would be selected as optimal. Neither of them violate \textit{Onset} or weight preservation principle. Worse still, the candidate *[nerijan] turns out not to violate \textit{Ident}µ, as opposed to the candidate with gliding. Consequently, the candidate with glide insertion seems to be more harmonic than the desired output. In order to ensure the selection of [nerjan], the ranking should include a constraint which bans insertion of segments. This function could be achieved by a faithfulness constraint \textit{Dep(seg)} (No insertion of segments). Importantly, such a constraint should be ranked higher than \textit{Ident}µ. In other words, it should be a more costly operation to insert a segment than to change the association of a mora. To conclude, the ranking of constraints presents itself as shown in (8), and the evaluation follows in (9).

\[(8) \text{ DH, *Cj, Onset, Max-V, Max}µ, \text{ WxP, Dep(seg)} \textgreater\textgreater \textit{Ident}µ \]
(9) Tableau for *nerian*

<table>
<thead>
<tr>
<th></th>
<th>DH</th>
<th>*Cj</th>
<th>ONSET</th>
<th>MAX-V</th>
<th>MAX$\mu$</th>
<th>WxP</th>
<th>Dep (SEG)</th>
<th>Ident$\mu$</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. <em>nerian</em></td>
<td></td>
<td></td>
<td></td>
<td>⋆</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>b. <em>nerjan</em></td>
<td></td>
<td></td>
<td></td>
<td>⋆</td>
<td>⋆</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>c. <em>nerjan</em></td>
<td></td>
<td></td>
<td></td>
<td>⋆</td>
<td>⋆</td>
<td>⋆</td>
<td>⋆</td>
<td></td>
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<tr>
<td>d. <em>nerian</em></td>
<td></td>
<td></td>
<td></td>
<td>⋆</td>
<td>⋆</td>
<td>⋆</td>
<td>⋆</td>
<td></td>
</tr>
<tr>
<td>e. <em>neran</em></td>
<td></td>
<td></td>
<td></td>
<td>⋆</td>
<td>⋆</td>
<td>⋆</td>
<td>⋆</td>
<td></td>
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<tr>
<td>f. <em>nerin</em></td>
<td></td>
<td></td>
<td></td>
<td>⋆</td>
<td>⋆</td>
<td>⋆</td>
<td>⋆</td>
<td></td>
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<tr>
<td>g. <em>nerjan</em></td>
<td></td>
<td></td>
<td></td>
<td>⋆</td>
<td>⋆</td>
<td></td>
<td>⋆</td>
<td></td>
</tr>
<tr>
<td>h. <em>nerijan</em></td>
<td></td>
<td></td>
<td></td>
<td>⋆</td>
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<td></td>
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<td></td>
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</tbody>
</table>
The tableau in (9) illustrates an OT evaluation of nerian. As shown above, the candidate which imposes gliding (9b) to satisfy Onset is optimal. It violates IDENTμ, but such violation of faithfulness is the least costly option in a given ranking. The faithful candidate (9a) is eliminated as a result of committing a fatal violation of Onset. Candidate (9c) uses gliding but builds an illicit onset. Consequently, it is eliminated by *Cj. Candidate (9d) uses a diphthong /ia/, which is forbidden in the system. Other candidates, namely (9e) and (9f), fatally violate MAX-V AND MAXμ, whereas candidate (9g) violates WEIGHT-BY-POSITION (WxP) due to the lack of a mora in the coda of the first syllable. Finally, candidate (9h) with glide insertion is eliminated by a higher ranked DEP(SEG).

To conclude, the discussion so far has revealed several interesting facts about hiatus resolution in Old English. Firstly, Old English has a dispreference against onsetless syllables, manifested as the constraint Onset. This constraint has been shown to be the driver for both strategies discussed above: diphthongisation and gliding. Secondly, both strategies show that Old English has a preference for mora preservation, which is technically expressed as the ranking of MAXμ >> IDENTμ. Thirdly, in the verbal declension pattern of class I weak verbs a strategy of gliding is used due to high-ranked constraints DH, *Cj, and DEP(SEG), which ensure that neither diphthongisation nor glide insertion are applicable to nerian.

4. Glide insertion

Heavy stems of class II weak verbs instantiate yet another scenario of hiatus resolution in Old English. The relevance of this verbal category to the problem of hiatus in Old English first came to light in Kiparsky and O’Neil (1976), whilst the first OT analysis was presented in Opalińska (2002), upon which is the following discussion based. Let us consider the data in (10).

(10) Class II weak verbs

<table>
<thead>
<tr>
<th>verb</th>
<th>pronunciation</th>
<th>translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>lōcian</td>
<td>[loːkijan]</td>
<td>‘to look’</td>
</tr>
<tr>
<td>rēafian</td>
<td>[reːafijan]</td>
<td>‘to plunder’</td>
</tr>
<tr>
<td>langian</td>
<td>[langijan]</td>
<td>‘to long’</td>
</tr>
</tbody>
</table>

It is interesting to observe that similarly to class I weak verbs, the verbs have trimorphemic structure. They consist of a root, a stem extension suffix -i- and an inflectional ending -an. Therefore, structurally they are parallel to the class II light stems. The difference lies in the position of /j/. Specifically, in [nerjan] /j/ comes from the suffix /i/. In [loːkijan] however /i/ is still on the surface together with /j/ following it. A question arises whether this /j/ could belong to the underlying form of any of the suffixes. Such a hypothesis can be rejected with the form [nerjan], where there would be no independent rule in Old English to delete the
/i/ suffix. There would also be no reason for gliding, which would in turn cause complications to the moraic structure. Consequently, it must be assumed that /j/ is inserted in [lo:kijan], and that the UR is resultingly //lo:k+i+an//. Interestingly, the insertion of /j/ resolves the ia hiatus.

But why glide insertion is preferred in this case over gliding? The same sequence in section 3 was resolved precisely by the latter strategy. The answer needs to be sought in the moraic structure of the stems. For example, in [ner.jan] the stem //ner// is monomoraic in the UR, whereas in [lo:.ki.jan] the stem //lo:k// contains two underlying moras due to a long vowel. After syllabification and the application of Weight-by-Position, both syllables [ner] and [lo:] have a bimoraic structure. Were lōcian to be realised as *[lo:k.jan], the syllable [lo:k] would contain three moras, thanks to the additional mora attached to the coda. Such a scenario would be impossible in Old English, which is a language allowing at most a bimoraic structure of syllables (Opalińska 2006, 120). This requirement translates in OT into the constraint *μμμ, as shown in (11):

(11) *μμμ: No trimoraic syllables.

Consequently, it is a less costly solution to resyllabify /k/ into the following syllable than to allow a trimoraic syllable. For this reason, gliding is forbidden because /k/ needs to be an onset of the following syllable. In this scenario, glide insertion violates a faithfulness constraint against any segment insertion, Dep(seg), but as argued above it is the least costly violation. If gliding had actually taken place, there would have emerged an onset /kj/, which would in turn violate a high-ranked ban on Cj clusters, *Cj.

Interestingly, with glide insertion it becomes apparent that there must be 3 levels of constraints. By this we mean that so far in the discussion of gliding and diphthongisation it has been necessary to introduce only 2 levels; hence there has been only 1 dominance relationship. To clarify, diphthongisation is essentially based on the relationship Onset >> NoDiph, whereas gliding relies on the ranking Onset, Maxμ >> Identμ. In glide insertion there is a need to introduce yet another level. From the discussion of nerian, it is necessary to have a dominance relationship Dep(seg) >> Identμ in order to stop glide insertion. Conversely, to promote this strategy, there is a need to outrank these constraints with *μμμ. Consequently, the essential ranking for glide insertion is *μμμ >> Dep(seg) >> Identμ.

The three levels of constraints have already been shown to be relevant for the constraints on weight: Nonfin >> Wxp >> Depμ. This argument will be developed with the help of the new data in the following section. However, it is relevant for the current discussion on glide insertion to revise the position of Onset in the ranking. Specifically, the faithful and the winning candidates incur just a single violation. The former violates Onset, whereas the latter does Dep(seg),...
as shown in the tableau below. If these two constraints were at the same level in the ranking, there would be no way to select the desired output with glide insertion. Consequently, Onset must be ranked higher than Dep(seg), thus joining the level of other nonviolable constraints: *mmμ and Nonfin.

For convenience, a revised ranking of constraints is presented in (12) and the evaluation follows in (13) below.

(12) *mmμ, Onset >> DH, *Cj, Max-V, Maxμ, WXP, Dep(seg) >> Identμ,

(13) Tableau for lōcian

<table>
<thead>
<tr>
<th></th>
<th>*mmμ</th>
<th>Onset</th>
<th>*Cj</th>
<th>Max-V</th>
<th>Maxμ</th>
<th>WXP</th>
<th>Dep (seg)</th>
<th>Identμ</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. l o k i a n</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>b. l o k i j a n</td>
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<td>*!</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>c. l o k j a n</td>
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<td>*!</td>
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<td></td>
<td></td>
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<tr>
<td>d. l o k j a n</td>
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<td>*!</td>
<td>*</td>
<td></td>
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<tr>
<td>e. l o k a n</td>
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<td>*</td>
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<td>f. l o k j a n</td>
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</table>
The evaluation of lōcian shows that only glide insertion is the optimal strategy of hiatus resolution in class II weak verbs. Gliding is forbidden by a ban on trimoraic syllables, as in candidate (13c), and by the constraint *Cj, as shown in candidate (13d). At the same time, gliding is not sufficient if the coda lacks a mora, as in candidate (13f), due to the violation of WxP. Vowel deletion is also penalised (13e) due to the fatal violation of Max-V and mora preservation principle. The faithful candidate (13a) lacks gliding but has an onsetsless syllable, for which it is eliminated. Candidate (13b) turns out to fare best in the evaluation. It satisfies all high ranked constraints and incurs a less costly violation of faithfulness DeP(SEG). Consequently, it is selected as the optimal candidate.

To conclude, the discussion of glide insertion has confirmed the leading role of Onset in hiatus resolution. Moreover, it has been shown that, unlike in diphthongisation or gliding, the dominance relationships need to be revised. As a result, there emerged a class of constraints which turn out to be inviolable in outputs.

5. Contraction

The fourth strategy of hiatus resolution in Old English is contraction. The phenomenon is based on the principle that “a word… is reduced by removal of some internal material, possibly with application of some other phonological processes” (Trask 1996, 92). This is exactly the case of Old English, where descriptive sources show that the deletion of a fricative resulted either in compensatory lengthening (Hogg 2011, 170) or additionally in contraction (Hogg 2011, 179). In OT the analysis of contraction (and of compensatory lengthening) has been presented in the works by Opalińska (2002; 2004; 2006), upon which the following discussion is based.

She illustrates the mechanism of contraction on the example feohes [fe:os] ‘money (gen. sg.)’. In the genitive the word takes the shape feoh [feox]. Since the OE genitive morpheme is [es], the output lacks the suffixal vowel and the velar fricative. Additionally, the diphthong gets lengthened. Consequently, she runs an analysis of both contraction and compensatory lengthening. For the purposes of this article, however, it is sufficient to focus only on the former strategy. This can be achieved in an analysis of the example lēon [leːon] ‘to lend’ given by Lass and Anderson (1975). This move is also motivated by technical reasons; namely, only verbal declension can provide arguments to support (or remodel) the established ranking of constraints.

The verb lēon belongs to class I strong declension. Consequently, it needs to have an inflectional ending -an at some stage. Moreover, the past form in the 1st person sg. is lāh [laːx]. This implies that there might be an underlying fricative in the form [leːon]. This claim is further corroborated by Old Saxon and Old High German, where [leːon] corresponds to [li:han]. It is also interesting that the verb ‘to lend’ in the ancestral language, Proto-Germanic, has the form [‘liː.xʷɑ.nᵃ]. To sum up, the form [leːon] in Old English needs to have an underlying fricative in the
stem; specifically, this must be a velar fricative, as shown in the past form of \[\text{leːon}\].

At this stage a question arises with regards to the vowel in the stem. In related languages, this vowel is realised as \([i:]\), whereas in Old English it is a diphthong \([eːo]\). Furthermore, the declension pattern in present tense in Old English contains \([i:]\), as shown in \([\text{līːe}]\ ‘(I) lend’, \([\text{līːxst}]\ ‘(you) lend’. Lass and Anderson (1975) claim that this is a result of Ablaut, regular vowel variations, as a result of which the form \([eːo]\) in the infinitive is related to the sound \([i:]\) in the first person singular. They conclude that a common denominator for these sounds is a diphthong \([eɪ]\). Consequently, the underlying representation of \([\text{leːon}]\) takes the shape of \(\text{/leːix+an/}\).

At this stage it is possible to descriptively present the differences between the underlying and the surface form. Firstly, \([\text{leːon}]\) lacks the velar fricative and the suffixal vowel. Secondly, the quality (but not the quantity) of the vowel is different. These observations can be expressed by means of a set of OT constraints. Let us first consider \([x]\)-deletion. In Old English, voiceless velar fricatives are not found in the onset position. This can be expressed by the constraint *Ons-x, as shown in (14).

(14) *Ons-x: Voiceless velar fricative is disallowed in the onsets.

The constraint in (14) follows from a syllable-based generalisation which warrants complementary distribution between /h/ and /x/: the former appears in onsets, the latter in codas (cf. Opalińska 2006, 117).

The deletion of the suffixal vowel \([a]\) is motivated by the main driver of hiatus resolution: the constraint Onset. Importantly, both Onset and *Ons-x promote deletions; hence they need to be counterbalanced by faithfulness constraints, which preserve input segments in the output. Onset needs to dominate Max-V (Input vowels must have output correspondents), whereas *Ons-x must be ranked higher than Max-C (Input consonants must have output correspondents).

The last difference between the input and the output is the qualitative change of the diphthong. It can be addressed with the constraint Diphthong Height (DH) from the section on gliding. Specifically, the second part of the diphthong will have to adjust in height to \([e]\), thus yielding a diphthong \([eo]\).

It is also interesting to investigate an alternative scenario, where only the fricative is deleted, and the suffixal vowel joins with a diphthong \([eːi]\) to form a triphthong \([eːia]\). Such a candidate would not violate Onset, but it would incur two other serious violations. First, it would violate *μμμ due to the fact that the diphthong \([eːi]\) is already bimoraic, so with an extra vowel the triphthong would contain 3 moras. Second, \([eːia]\) would incur a double violation of DH, since each vowel is of different height.

To sum up our discussion so far, let us present the cumulative ranking of constraints relevant for contraction and the tableau for \(\text{léon}\). Certain constraints are not included in the tableau because they do not contribute to the evaluation of
léon. For example, since there are no consonantal clusters, *Cj cannot be violated. The same scenario holds for IDENTμ, which cannot be violated in the absence of gliding. Additionally, WxP is excluded because it assigns a single violation to all candidates; hence it has no discriminatory force in this evaluation.

(15) Ranking of constraints for contraction

\*μμμ, Onset, *Ons-X >> DH, *Cj, Max-V, Max-C, Maxμ, WxP, Dep(seg) >> IDENTμ

Before we proceed to the tableau there are still two issues that require discussion. The first one concerns the dominance relationships in the given ranking. The topic has been already started in the discussion of glide insertion. It turns out that all undominated constraints are never violated in any output forms. Interestingly, this feature of non-violability is also shared by two other constraints in this ranking: DH and *Cj. Consequently, they should be by analogy counted as undominated constraints, all the more there is no counterevidence against it. As for the middle level, all remaining constraints are at some point violated in order to help promote a given hiatus resolution strategy. Finally, the lowest level contains constraints which counterbalance the constraints from the highest level. For example, Onset promotes gliding in nerian, whereas IDENTμ militates against it.

The second issue has been raised by a reviewer with respect to a candidate in the analysis of contraction. Specifically, the reviewer asked how the ranking of constraints can eliminate a candidate with a glide instead of a velar fricative. Importantly, a potential glide would not be a result of gliding; however, it could be potentially a glide from insertion, as in a candidate [le:ijan]. Such a form would be eliminated by DH. A complication emerges in a potential candidate [le:ojan], where none of the discussed constraints are violated. In order to address such a problem, the ranking needs to be supplemented with an extra constraint IDENT-C, which ensures that the velar fricative is preserved in the output. Since [j] is a corresponding sound, it violates IDENT-C. Importantly, the constraint needs to be ranked higher than all Max constraints in order to allow the selection of the candidate [le:on].

In the light of the above discussion the ranking of constraints needs to be revised. It is later presented in the evaluation of léon.

(16) Revised ranking of constraints

\*μμμ, Onset, *Ons-X, DH, *Cj, IDENT-C >> Max-V, Max-C, Maxμ, WxP, Dep(seg) >> IDENTμ
The most faithful candidate (17a) incurs a fatal violation *ONS-x, and is thus eliminated. Similarly, candidate (17c) fatally violates a high ranked ONSET. Because no trimoraic syllables are allowed, candidate (17d) loses in the evaluation. Both candidates (17e) and (17f) contain a glide, and thus are eliminated by IDENT-C. The optimal candidate (17b) incurs a double violation of faithfulness but due to the satisfaction of high ranked markedness, it wins in the given ranking of constraints, and is thus selected as the optimal output.
To conclude, the analysis of contraction has revealed additional facts of hiatus resolution strategies. It has turned out that mora preservation principle can be violated in order to satisfy a ban on trimoraic syllables. Interestingly, none of the other strategies can suspend this principle, which shows that contraction is the most demanding strategy of hiatus resolution (Opalińska 2002, 187).

6. Discussion

Old English is a language that applies multiple hiatus resolution strategies. This article has attempted to offer a unified approach to all 4 strategies: diphthongisation, contraction, gliding, and glide insertion. To this end, the OT model has been employed, predominantly due to its potential to reveal the motivation behind various strategies. Similarly to other OT analyses, we have argued that the main driver for hiatus resolution is Onset (Opalińska 2002; 2004; 2006). This fact comes as no surprise, because Old English is a member of the family of Germanic languages, which are known for the disprefrence against empty onset position.

This article has confirmed the scale of preference, proposed by Opalińska (2002), for all 4 strategies of hiatus resolution in Old English: diphthongisation, contraction, gliding, and glide insertion. It turns out that diphthongisation functions as the most optimal strategy to resolve hiatus. The reason lies in the fact that the change takes place at the least cost to faithfulness. No melodic elements are changed but their association to higher levels of representation. Other strategies of hiatus resolution are activated when diphthongisation is blocked by other conditioning. Contraction is chosen in cases where otherwise diphthongisation would lead to the formation of a triphthong (/leːːi.xan/ → *[leo.an]), a highly marked structure in Old English. Gliding is a more optimal solution when diphthongisation is blocked by phonotactic restrictions. Namely, Old English lacks diphthongs where both constituents vary in value specifications for backness (Opalińska 2002, 171). Consequently, the diphthong /ia/ is prohibited (/ne.ri.an/ → *[ne.rian]). Due to the fact that the sequence contains a high vowel, gliding turns out to be a more preferred strategy. As far as glide insertion is concerned, it is also motivated by the restriction not to have /ia/ diphthongs (/loː.ki.an/ → *[loː.ki.an]). Similarly to gliding, it benefits from the presence of a high vowel. However, gliding cannot be used there due to two additional restrictions. First, Old English does not tolerate trimoraic syllables, and such a syllable would be formed if [k] became the coda of the syllable [loː]. Second, even if a restriction on 3 moras were obeyed, gliding would yield a sequence [kj], which is an illicit cluster in Old English. Consequently, glide insertion turns out to be the only viable option.

The above conditioning reveals that in terms of optimality diphthongisation is most preferable among all other strategies. Additionally, gliding turns out to
be less restricted than glide formation. The place of contraction in this ranking of preference is at the last position, as has been shown by the interaction of constraints. Contraction is the only strategy that can violate mora preservation principle. In the case of other strategies, such a violation would lead to the elimination of candidates. In other words, contraction is used when other strategies are for some reasons inapplicable. Opalińska (2002, 207) makes a similar observation in that she says that contraction is used when “the remaining [hiatus resolution strategies] are blocked by higher-ranked constraints”. Consequently, she implies that contraction is the least preferable strategy.

As shown in section 5, contraction is the only strategy where the violation of Max does not lead to the elimination of the candidate. This argument is mute in the works by Opalińska. Most possibly the reason is her choice of analysed examples. She chose only words where contraction is accompanied by compensatory lengthening. In other words, in such examples mora preservation principle is always obeyed: a point already raised by Hayes (1989).

Despite convergent conclusions, the analysis presented in this article diverges in certain aspects from that of Opalińska. There are differences with respect to the ranking of constraints. For example, we argue that the position of WxP must be at the level of Max constraints, partly due to the fact that it must be ranked lower than NonFin, an inviolable constraint. However, Opalińska (2002, 177) places WxP unranked with respect to Onset, another inviolable constraint, thus elevating the position of WxP. Another example of a difference in the ranking concerns the constraint Dep(seg). We argue that this constraint should be parallel to the Max family. However, Opalińska (2002, 185) claims that its position in the ranking should be lower than Max. Interestingly, in both cases of WxP and Dep(seg), she manages to select the same outputs as in our analysis. This is because the same constraints but reranked would yield identical results. Such a scenario seems to be coincidental, all the more that ranking arguments come to light in an analysis of other examples that apply different strategies, as we have shown in our article.

Probably, one of the reasons for these ranking differences results from the order in which different hiatus resolution strategies were discussed. In this article, we have developed the discussion from the most preferable strategy: diphthongisation to the least preferable one: contraction. Opalińska (2002), however, started the discussion with contraction, later moved to diphthongisation, gliding and glide insertion. Consequently, the development of ranking arguments could differ between our analyses. Another reason for the differences may be also sought in the style of the analysis. Specifically, with each strategy in this article there was building on the previously established ranking of constraints. A disadvantage of this method is that the complexity of the analysis is increased; however, it is possible to notice more generalisations. Opalińska (2002) does not apply many constraints in a single evaluation, thus achieving clarity of exposition. However, certain ranking arguments may remain mute.
One of the main goals of this article was to establish the cumulative ranking of constraints, which would technically illustrate the scale of preference for hiatus resolution strategies. For ease of reference, let us present the ranking below in (18).

(18) Cumulative ranking of constraints for hiatus resolution in OE  

The ranking above contains constraints which function as conditions for the activation of a given hiatus resolution strategies. The core constraint which drives any hiatus resolution is Onset. Interestingly, the lower a given strategy is on the scale of preference, the more conditions it needs to fulfil. This is illustrated in (19).

(19) Hiatus resolution strategies and their corresponding constraints  
Diphthongisation: Onset  
Gliding: Onset, DH, *Cj  
Glide insertion: Onset, DH, *Cj, *μμμ  

The list above shows that the ranking of strategies is established on the basis of the subset of constraints activating a given strategy. Diphthongisation requires only one out of high-ranked constraints. When it is inapplicable due to some phonotactic restrictions (DH) or syllabification parameters (*Cj), gliding is chosen as the next strategy. However, when gliding would lead to a trimoraic syllable, it is preferable to opt for glide insertion. The last strategy on the scale is contraction. It additionally needs a ban on velar fricatives in the onset.

To conclude the discussion, the ranking of preference for hiatus resolution strategies takes the following shape: diphthongisation >> gliding >> glide insertion >> contraction. The ranking in this analysis is identical to the one presented in Opalińska (2002). However, the difference lies in the argumentation for the ranking. Specifically, Opalińska (2002) does not provide the cumulative ranking of constraints, and resultantly does not discuss the subsets of constraints. Consequently, the articulation of these arguments may cast new light on resolving hiatus in Old English data.

Notes

1 Opalińska (2002, 170) assumes after Prokosch (1939) that OE morpheme //ο// functions as a personal ending, and originated from the [u] inflectional morpheme. The word itself underwent evolution, starting from the form [bi:u]
and arriving at the form [be:o]. In our discussion we shall focus, like Opalińska (2002), on the final stage bēo.

2 A potential alternative to NoDIPH is a constraint against coalescence, UNIFORMITY, in that diphthongisation can be interpreted as an instance of coalescence. However, the introduction of UNIFORMITY would cause additional complications. If in the evaluation for bēo there was a bimoraic candidate [be], it could be assumed that two vowels coalesced to yield a long vowel [eː]. In order to exclude such a candidate, UNIFORMITY would have to be ranked high. Importantly, it would be ranked higher than NoDIPH, although the expectation would be that both constraints should occupy the same position in the ranking since they are supposed to fulfil the same function. Consequently, the inclusion of UNIFORMITY would obscure the analysis of diphthongisation, and therefore we will not use it in this article.

3 An output *[leohan] may be precluded due to the presence of a constraint *h (Opalińska 2006), which would eliminate candidates with word-medial instances of [h]. However, the constraint would also prohibit any word-initial instances of [h], thus eliminating such OE words as [huːs] ‘house’, [herjan] ‘to praise’ and many others. In order to reduce its effects, *h should be overranked by a constraint that would prohibit deletion at the edges. In this particular case, this would be ANCHORING (ANCHORING-IO (GrWd, L) Any segment at the left periphery of the output GrWd has a correspondent at the left periphery of the input GrWd).

4 IDENT-C should be actually made more specific because otherwise it would penalise any consonantal changes. However, the discussion in the article does not require such a level of specification. Consequently, we will keep the constraint IDENT-C in its general format.

References


