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# WHAT DO AFFRICATION AND VOWEL UNROUNDING HAVE IN COMMON? THE CASE OF VELAR PALATALIZATION IN OLD ENGLISH

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ABSTRACT

In this paper we look at two seemingly unrelated historical processes: affrication of the Old English (OE) palatalized velars [kʲ] > [tʃ], e.g., OE *cild* > PDE *child*, OE *cīosan* > PDE *choose*, and the Middle English (ME) vowel unrounding [y] > [i] and [ø] > [e]. More specifically, it is argued that the front rounded vowels [y] and [ø], as well as the palatalized velars [kʲ] and [ʝ], are complex melodic expressions containing two antagonistic resonance elements |I| and |U|. Furthermore, it is proposed here that the phonological system of ME witnessed a drastic change as a consequence of the introduction of the ban on the |I| and |U| merger. This *|I U| constraint is responsible for the loss of the resonance element |U| from the internal structure of both segments, which leads to the unrounding of the *i*-umlauted vowels and the affrication of the palatalized velars. This paper provides a detailed analysis of velar palatalization and its subsequent affrication, while additionally we address the questions of the lack of affrication before both *i*-umlauted and unrounded vowels, the palatalization and vocalization of the voiced velar fricative /ɣ/ and the chronology of affrication in the history of English.

Keywords: Old English; velars; palatalization; affrication; *i*-umlaut; vowel unrounding; Element Theory.

## 1. Introduction

This paper examines the nature and scope of velar palatalization in the Old English (OE) period. In more detail, it aims at determining the factors of velar palatalization which eventually leads to the Present-day English (PDE) affricates /tʃ/ and /dʒ/. Since, however, the developmental paths of both affricates differ considerably and they evidently consolidated their contrastive position at different periods (Minkova 2016, 2019; Stenbrenden 2019), the two changes are

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kept separate as far as possible.[2] Therefore, in what follows, special emphasis is put on the palatalization and affrication of the voiceless velar stop /k/. Needless to say, the discussion of the palatalization puzzle would remain incomplete without the voiced velar fricative /ɣ/ and its numerous developments, including the palatals [ʝ], [j], the palatalized [gʲ], and obviously the affricate [dʒ]. Because they are directly related to the subject matter, the latter contextual realizations are also included in the investigation.

The analysis of the palatalization of velars and their eventual affrication in the history of English is a particularly complex task as it has to incorporate a number of seemingly unrelated phenomena. Thus, apart from the various intermediate stages in the developmental path of velars leading to affrication such as [kʲ], [ʝ], [gʲ], the discussion must also refer, at least briefly, to such historical processes as West Germanic (Consonant) Gemination (WGG), *i*-mutation and vowel unrounding. Moreover, an inquiry that covers such well-trodden ground must grow rich with a large number of studies representing a broad spectrum of linguistic tradition and thought, and this may become potentially discouraging for a researcher. For this reason, Section 2, which is thought of as a general introduction to the topic and the presentation of the data, is based mainly on Minkova's (2003, 2014, 2016, 2019) publications. This choice is fully intentional as it is Minkova who has recently challenged the firmly-established view on the status of velars and palatals, including affricates, in the consonantal system of OE. To put it briefly, Minkova formulates a rather bold hypothesis[3] according to which the palatal fricative /ʃ/ and the affricates /tʃ/ and /dʒ/ were not part of the phonemic inventory of English until the end of the tenth century, or even somewhat later.[4] In a similar fashion, she advocates the idea of a late split of the early OE /ɣ/ into two separate contrastive segments /j/ and /g/ and the merger of the voiced palatal fricative [ʝ] with the pre-existing Germanic (Gmc) /j/, both of which are thought to have occurred in the middle of the tenth century. The confirmation of her hypothesis comes from hard evidence obtained basically from alliteration, but also verse structure and paradigmatic allomorphy.

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2 For example, it has been pointed out (Stenbrenden 2019: 687) that the developments towards the terminal /dʒ/ and /tʃ/ were not parallel; the evolution of the former may have been affected by the arrival of numerous French loans after the Conquest and it is relatively certain that the affricate did not acquire the contrastive status before the thirteenth century (cf. also Lass 1994 and Minkova 2016).

3 The hypothesis is bold inasmuch as it challenges a long tradition which takes for granted the full contrastive affrication in OE. This standard reconstruction is presented as an unquestionable fact in many textbooks. Note, however, that the idea of late affrication in English has also been postulated in earlier works, e.g., Wright & Wright (1925) and Luick (1964).

4 Minkova (2016: 54) argues that the phonemicization of /tʃ/ was still under way in Early ME. Moreover, she assumes a bisegmental structure of the affricate well into the fourteenth century which means that in her analysis the contour (singleton) /tʃ/ is even later.

The analysis presented in this paper has been inspired by her work. To be more specific, it is exactly the proposed chronology which serves as a starting point of the discussion concerning the velar palatalization and affrication in the history of English.

In spite of the manifold significant breakthroughs we have witnessed in the previous exploration of the subject matter, there are many pressing problems still awaiting solution. Some of them, which will be addressed in this study, are enumerated below:

1) Why can't the velar stops undergo affrication in the palatalizing environment anymore, unlike alveolars which can be freely affected by it, e.g., PDE *seek you* [si:k jə] vs. *meet you* [mi:tʃ ə]?
2) Why have the labial stops never been affricated?
3) In the light of recent findings pointing to the late affrication of velars (Minkova 2003, 2016; Stenbrenden 2019), why were velars not affricated before *i*-umlauted vowels?
4) What links the velar palatalizations [k] > [kʲ] and [ɣ] > [j] with the process of *i*-mutation in the history of English?
5) Why does velar affrication overlap chronologically with vowel unrounding?

Section 2 discusses the most important facts concerning velar palatalization and affrication in the history of English together with a brief survey of the previous studies. Section 3 introduces the theoretical model used for the analysis and considers the representation of affricates. The sub-segmental structure of velars, including the palatalized velars and the palatal glide plus the affricates, is proposed in this section. On top of this, Section 3 provides information on the internal composition of vowels engaged in the process of palatalization and *i*-mutation. Section 4 offers my analysis of the palatalization and affrication of the velars in the history of English. Both processes are examined with a view to answering the above mentioned questions. Section 5 gives a summary of the findings in this paper.

## 2. General overview of velar palatalization and affrication in the history of English

Basically, the velar obstruents (stops and fricatives) underwent palatalization in several different contexts in OE. These are, however, reducible to a position in the close proximity of a front vowel and/or the glide /j/ – the palatalization triggers. Another general observation is that the palatalization was the initial step in the process of velar affrication. Without going into too much detail, there were three major sources of velar palatalization and the subsequent affrication. The first one

is the West Germanic (Consonant) Gemination, a process during which a velar consonant in front of the glide /j/ undergoes palatalization and then affrication, e.g., Gmc **klukjan* > OE *clycc(e)an* 'clutch', Gmc **agja* > OE *ecg(g)* 'edge'.[5] In much the same fashion, the glide interacts with the preceding velar consonant in the post-nasal position, e.g., Gmc **drankjan* > OE *drencan* 'drench' and Gmc **sangjan* > OE *sengan* 'singe'. Finally, the affrication also takes place in a situation when a velar consonant is adjacent to a front vowel, e.g., */k/ > *dīces* 'ditch' and *lǣce* 'leech'. Crucially, the affrication is always preceded by the palatalization stage in all of the above forms. It follows that in the pre-affricate stage, the orthographic <c> in, for example, *reced* 'hall' and *mycel* 'big, much', was realized phonetically as the palatalized velar stop [kʲ]. Similarly, the alleged intervocalic geminate affricates <cc> and <cg> are argued to have begun their developmental path as bisegmental palatalized sequences. In the case of <cc> it would be [cj]/[tj], [cc] or a non-contour sequential realization [t+ʃ].[6] As for the voiced velar fricative <g> /ɣ/, it remains a fricative in the intervocalic position and is subsequently vocalized to the palatal glide /j/ as in, for example, *dæges* 'day', *drȳge* 'dry'. Generally speaking, palatalization affected all velar consonants in the close vicinity of the front vowel [i] and/or the glide occurring within the same syllable, which explains the lack of palatalization in, e.g., *gelīcung* 'liking', *sēcan* 'seek', and *dīcas* 'ditch, pl.' (Hogg 1992a: 253). To sum up the discussion so far, the phonetic realizations of /k/ and /ɣ/ in OE were context-specific. They were palatalized in the palatalizing context but the process was blocked in a situation when the velar was adjacent to a back vowel or another consonant.

Broadly speaking, the velar affrication is strictly dependent on the prosodic structure. It has been argued that the process was initiated in the syllable coda position, and only later did it affect the onset position. Moreover, it was more advanced in the onset of a prosodically weak syllable (due to the absence of stress) than in the word-initial stressed onset (Minkova 2003: 110). In a nutshell, Minkova (2016) argues that in the consonantal inventory of OE there was no phonemic singleton voiceless palato-alveolar affricate /tʃ/.[7] In typical lenition

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5 Most of the examples in this and the following sections have been taken from Minkova (2003, 2014, 2016) and Stenbrenden (2019).

6 Minkova (2016) is convinced that the orthographic <cc> could not be a contour segment (affricate) in OE. For the bisegmental realization of <cg> in OE, see Stenbrenden (2019). The question concerning the initial status of the affricates, i.e., whether they started their existence as a sequence of two consonant phonemes /t+ʃ/ and only later evolved into singletons /tʃ/, is not addressed here as it is considered irrelevant to the following discussion. For more information on the bisegmental stage of affricates, see Minkova (2016: 45ff, 2019) and Stenbrenden (2019: 708ff).

7 Similarly, Stenbrenden (2019) argues that the voiced affricate /dʒ/ did not appear stem-initially until after the Conquest.

sites, however, the palatalized velars may have been realized phonetically as affricates, e.g., *dīc* 'ditch' and *pic* 'pitch'. This in turn contributes to the widely accepted view that the progressive coronalization of the velars and their affrication is a lenition process (Lavoie 2009). The findings in Section 4 below point in the same direction. Furthermore, this affricate phonetic realization was supposedly facilitated by the independent development of the affricate [tʃ] from the word-internal voiceless dental stop + /j/, e.g., **fetjan* > <*(ge)fecc(e)an*> 'to fetch' and <*orce(a)rd*>/<*ort-geard*> 'orchard'. In such forms, an etymological dental stop in the context of a following /j/ underwent palatalization and subsequent affrication arguably as early as the beginning of the OE period (cf. Stenbrenden 2019). The latter observation was widely used to suggest that the palatalized voiceless velar stop developed into an affricate at about the same time (e.g., Hogg 1992a). In conclusion, Minkova (2016: 56) admits that OE must have contained intervocalic geminate palatal stops, perhaps even pre-affricate bisegmental clusters, but claims that it did not contain contour affricate segments with the properties identical to the PDE affricates /tʃ/ and /dʒ/.

Finally, it must be pointed out before going further that the gradual evolution of velars or, to be more specific, their various intermediate stages, are not given any explanation in the present study. Reconstructions such as /*k(k)/ > [c(c)] > [tj] > [tʃ] and /ɣ/ > [j(ʝ)] > [dj] > [dʒ] (Campbell 1959: 176) or similar ones have been frequently proposed in the literature so far, e.g., in Lass & Anderson (1975) and Hogg (1992b). Since, however, exact phonetic realizations of intermediate stages so distant in time cannot be determined with any certainty, as there is no orthography-based evidence, the detailed gradual development is not addressed here. But the internal structure of velars to be proposed in Section 3 can be applied to explain most of the intermediate stages postulated in the previous studies. Moreover, the analysis presented in Section 4 concentrates on basically two major stages: velar palatalization and affrication. To be more specific, affrication is understood here as a process involving the interaction of velar consonants with front, high vowels and the palatal glide /j/ which leads, in the case of the voiceless velar stop, to secondary palatal articulation [kʲ] and in consequence to affrication [tʃ].[8] To put it differently, for the purpose of this study I assume that on the road to PDE affricates, OE velars went through one major stage, that is, palatalization, hence /k/ > [kʲ] > /tʃ/ and /g/ > [gʲ] > /dʒ/.[9] Needless to say, velar palatalization is

[8] Since the palatalization encompasses various types of alternations which depend on the type of triggers, targets, and outputs, several different terms are used in the literature and this may cause confusion, e.g., coronalization, spirantization, and assibilation, among some others. Therefore, for the sake of clarity and uniformity, the main two stages in the process under investigation are referred to as palatalization and affrication.

[9] For the sake of clarity and uniformity I stick to the [kʲ] and [gʲ] representations instead of the IPA symbols [c] and [ɟ].

also responsible for other offshoots such as /j/ in the case of the voiced velar fricative /ɣ/. The two-step affrication assumed for the purpose of this study overlaps with the two stages defined by Bateman (2007) as 'secondary palatalization' and 'full palatalization'. The former describes a situation in which the velar stop becomes co-articulated with the following palatal offglide, and the latter refers to the following step in which [kʲ] shifts its primary place and manner of articulation towards the palatal region. In this sense, velar palatalization here is treated as secondary palatal articulation and it is the initial stage of later affrication (full palatalization).

### 2.1 The voiceless velar stop /k/

It is fairly uncontroversial to assume that the Proto-Germanic voiceless velar stop /k/ had two major phonetic variants. In the initial position it was realized as the palatalized [kʲ] before front vowels and palatal consonants, and as the velar [k] in the context of the following back vowels and non-palatal consonants. The same contextual variation is proposed for the early OE period (Hogg 1992a: 258ff). More specifically, at this stage we can find the palatalized [kʲ] before etymological front vowels, as in Gmc **kinn* > EOE *cinu* 'chin', and velar [k] before back vowels and consonants, as in Gmc **kōlu-z* > EOE *cōl* 'cool' and WGmc **klimban* > EOE *climban* 'climb'. Finally, another widely accepted observation is that before the end of the OE period, the palatalized variant [kʲ] in such Germanic words evolved into an affricate /tʃ/ with a contrastive status, e.g., *cinn* 'chin', *cild* 'child', *cisten* 'chestnut', etc.[10] Now, what is more important for the present analysis is that Minkova (2003: 98) recognizes three contextual variants of the initial /k/ in OE. Quite predictably, the velar stop is realized as [k] before etymologically back vowels, e.g., *corn* 'corn', and as the palatalized velar [kʲ] (secondary articulation) before etymologically front vowels. Later on, the latter variant develops into an affricate [tʃ], e.g., *cinn* 'chin'. However, Minkova (2003: 97) argues for yet another variant, the slightly palatalized/fronted velar [k'] which is found in the context before the *i*-umlauted vowels, e.g., *cyrnel* 'kernel'.[11] In the analysis proposed in Section 4 below I adopt a similar solution inasmuch as the palatalized [kʲ] is assumed to be a doubly articulated variant of the velar stop. However, I argue that velar fronting merely describes a phonetic effect without any phonological significance which means that the initial velar stops in PDE *keen* [ki:n] and *cool*

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10 See Minkova (2003) for a detailed survey of the literature related to the phonemic split of Gmc /k/ in the history of English.

11 In a nutshell, *i*-mutation describes a situation in which back vowels are fronted under the assimilatory influence of the front vowel /i/ or the palatal glide /j/ in the following syllable. This process was responsible for vocalic changes such as [y(:)] < [u(:)] and [ø(:)] < [o(:)] which occurred in Early OE.

[ku:l] are phonologically identical segments. Other differences between Minkova's (2003) and my analysis must be postponed until Section 4.

Crucially, in Minkova's (2003) account, the fronted [k'], which we recall occurs before the newly formed front (*i*-umlaut) vowels, must be kept distinct from the Germanic palatal [k$^{j}$]. Given the late affrication which is advocated in Minkova's theory, the split into [k'] and [k$^{j}$] seems necessary for her solution to work. In other words, without the additional variant it would be difficult to explain why velars which occur before umlauted vowels were not confused with the velars before the etymological front vowels, i.e., why a word like *cynu* 'kin' did not merge with *cinu* 'chin.' Moreover, since *i*-umlaut is an early OE change, the traditional accounts have to resort to early phonemicization of the etymological [k$^{j}$] > /tʃ/. More specifically, in order to explain the lack of affrication before the *i*-umlauted vowels, a traditional account heavily depends on the strictly ordered procedure. The first affrication then *i*-umlaut solution is an inevitable reconstruction in such an account. It simply means that *i*-umlaut was active when affrication had already become disactivated and so the velars which got palatalized before *i*-umlauted vowels did not have the chance to wind up as affricates. In short, the development of the contrastive segment /tʃ/ has to precede *i*-umlaut, otherwise *cinn* and *cynn* would have an identical result, that is, the affricate /tʃ/ (Penzl 1947; Hogg 1979, 1992a, 1992b).

Recall from the discussion above that Minkova's (2003) solution boils down to a differentiation between the palatalized velar [k$^{j}$] which was always present in Germanic and the one emerging after Early OE *i*-umlaut, i.e., the fronted [k']. Interestingly, it is pointed out (Minkova 2003: 98) that the front rounded vowels [y] and [ø], which arose due to the operation of *i*-umlaut in Early OE, were endowed with a different palatalizing force than the etymological front vowels. Moreover, it is stressed that the derived palatalizing environment, due to the operation of *i*-umlaut, is a two-step process which includes both fronting and unrounding. Finally, since [y] and [ø] were surely entities phonetically distinct from the corresponding unrounded [i] and [e] at least into the ninth century, the velarity of the consonants preceding such front rounded vowels is suggested to have been sustained much longer than before the fully unrounded vowels. The split into two palatalized variants [k$^{j}$] and [k'] existing side by side at the same stage of language development is put into question in Section 4. It is argued there that the reason why velars before the *i*-umlauted vowels escaped the affrication is that they were not palatalized or even fronted in the first place. Velar fronting, which, we recall, is perceived here merely as a phonetic effect, occurs much later, after the vowels faced unrounding.

### 2.2 The voiced velar fricative /ɣ/

In early OE the voiced velar fricative /ɣ/ < IE /*gh/ enjoyed distributional freedom in that it occurred in all syllable positions: initially, medially, and finally (Hogg 1992a; Minkova 2003; cf. Lass 1994). Similarly to the voiceless velar stop, /ɣ/ is argued to have three major contextual variants. Apart from the [ɣ] variant, the fricative is realized as the voiced velar stop [g] after nasals and in geminates and the voiced palatal fricative [ʝ] in the initial position before front vowels other than the umlauted vowels, e.g., *gieldan* 'yield' (Minkova 2003).[12] In the tenth century the palatal fricative [ʝ] was conflated with the etymological (Germanic) palatal approximant /j/, while the earlier /ɣ/ was strengthened to /g/ (Campbell 1959; Jordan 1974; cf. Lass & Anderson 1975). One of the reasons why Minkova (2003) argues for the presence of the transitional variant in OE, i.e., the palatalized fricative [ʝ], is that this step allows her to bridge the gap between the approximant /j/ and the fricative /ɣ/ evident in the alliteration of *gēar* 'year' and *gold* 'gold'.[13] Crucially, she holds that in Late OE the fricative /ɣ/ was realized as a stop before umlauted vowels, e.g., *gyldan* 'gild', *gylden* 'gold, *gēs* 'geese', etc. To be more precise, the fronted variant [g'] is postulated in this position, which brings to mind the case of the voiceless velar stop discussed in the above section. It follows that /ɣ/ was realized as [ʝ] before front vowels and as [g'] before front rounded vowels. The fronted [g'], over time, merges with the velar stop /g/.[14] What is important for us here, however, is that the rounded quality of the mid and high *i*-umlauted vowels ban the occurrence of both the palatalized stop [kʲ] and the palatalized fricative [ʝ]. In this position, the fronted/slightly palatalized stops [k'] and [g'] are posited which, over time, are strengthened to full-blooded stops /k/ and /g/ and thus avoid the fate of, respectively, affrication to /tʃ/ and vocalization to /j/.

To sum up the discussion in Section 2, Minkova (2003) argues that there was only one contrastive segment /k/ in OE which had two main contextual variants: the post-*i*-umlaut fronted velar [k'] and the more strongly palatalized velar [kʲ] involving double articulation.[15] While the latter, over time, gave rise to the phonemic split into /k/ and /tʃ/, the former, under the influence of the *i*-umlauted vowels, stayed weakly palatalized and hence did not face affrication but instead

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12 It must be noted here that the letter <g> or <ȝ>, which represents /ɣ/, in OE can also stand for the palatal glide /j/ inherited from Gmc, e.g. *gēar* 'year'.

13 Bear in mind that in Minkova's (2003) account the velar fricative in initial position is hardened to /g/ in the second half of the tenth century rather than in Early OE.

14 The evolution of /g/ is complicated by the existence of later borrowings from Scandinavian, e.g., *gear* < ON *gervi* and French (see Minkova 2003: 119–120).

15 Needless to say, the voiceless velar plosive was realized as the plain stop [k] in the context before consonants and back vowels, which makes it another contextual variant of /k/.

has remained a full-blooded velar stop /k/ to this day. The split into /k/ and /tʃ/ is assumed to have started around the eleventh century. Similarly, the phonemic split of /ɣ/ into /j/ and /g/ and the merger of the voiced palatal fricative [ʝ] with the pre-existing /j/ occurred at more or less the same time.

In her conclusions, Minkova (2003) grapples with some remaining puzzles. For example, she wonders why the word initial voiceless velar stop in the *cynn* type of words did not go through further palatalization (secondary articulation) and subsequent affrication when the rounded vowels became fully fronted and unrounded.[16] The new angle which the present study (Section 4) adds to the above discussion sheds some light on this and several other traditional problems.

## 3. Theoretical model

### 3.1 Element Theory

I adopt the Element Theory framework for the analysis of the OE palatalization and affrication in Section 4. Element Theory (ET) is a phonological model of feature organization which employs a set of monovalent cognitive elements to the representation of segments (Kaye, Lowenstamm & Vergnaud 1985, 1990; Harris 1994; Harris & Lindsey 1995, 2000; Backley 2011). These cognitive elements represent internalized patterns (auditory images) which are directly associated with certain acoustic properties in the speech signal. Since these patterns contain linguistic information, there is a direct mapping between them and phonological categories in the grammar, i.e., elements. In the version of ET adopted in this study (Backley 2011), the number of elements has been limited to a set of six primes |I U A ʔ H L|, which are associated with consonant and vowel structure.[17] Crucially, the elements may appear in the melodic make-up of vocalic as well as consonantal segments. For example, a single element |I| linked to a vocalic slot is realized as the vowel [i]. The same element attached to the consonantal position is pronounced as the palatal glide [j]. This means that the distinction between a consonant and a vowel is sometimes expressed only by the

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16 Apart from the alleged influence of borrowings from Scandinavian and other Germanic languages, e.g., *kid*, *kill*, and *kitten*, Minkova (2003) suggests that it may have been the morphological uniformity that was responsible for the lack of affrication of velars before unrounded vowels. However, she admits that a more comprehensive answer to such a question is impossible. A reviewer points to a prolonged allophonic variation in the realization of velars as a possible cause of the lack of affrication in this context.

17 While the |I U A| elements are responsible for vowel quality, they also represent resonance properties in consonants. Similarly, the |ʔ H L| elements provide manner and laryngeal properties in consonants and also represent secondary properties such as tone, nasality, and creakiness in vowels (Backley 2011: 161).

syllabic affiliation of a segment. As a consequence, each element has at least two different interpretations depending on the affiliation: a vocalic interpretation or a consonantal one. More generally, the same elements that are associated with vowel quality, i.e., |I U A| (resonance elements), provide information about the place of articulation in consonants. For example, the difference between [p] and [ʃ] boils down to the distinction between |U| resonance and |I| resonance (labial and palatal in articulatory terms). Furthermore, elements may combine with one another and appear in a single segment, forming a complex expression as in the two front rounded vowels [y] and [ø], which are combinations of |I U| and |I A U|, respectively. Apart from the element combination, the expressive power of ET is increased by the asymmetric status ascribed to the elements. This asymmetry is expressed in terms of head-dependent relations. By convention, the underlined elements represent heads. Thus, the contrast between the voiceless aspirated stops [$p^h$] and [$k^h$] in the consonantal system of English is captured by the head-dependent relation in that the labial stop is represented as |U ʔ H|, while the velar one as |U ʔ H|.[18] Moreover, headedness is assumed to affect the element strength in the sense that a headed element displays a stronger and more prominent acoustic pattern than a dependent element. Finally, the elemental make-up of vocalic as well as consonantal segments may be affected by the position they occupy in the prosodic structure. The internal structure of a segment may be altered by adding a locally present element or by reducing the internal composition of a segment.

I propose the following representation of English consonants (1) and vowels (2) which participate in the processes under discussion:

(1) Internal structure of selected consonants[19]

| | voiceless | | voiced | |
|---|---|---|---|---|
| velar stops | /k/ | \|U ʔ H\| | /g/ | \|U ʔ\| |
| velar fricatives | /x/ | \|U H\| | /ɣ/ | \|U H\| |
| palato-velar fricatives | [ç] | \|U I H\| | [ʝ] | \|U I H\| |
| palatalized velar stops (secondary articulation) | [$k^j$] | \|U I ʔ H\| | [$g^j$] | \|U I ʔ\| |
| palato-alveolar affricates | /tʃ/ | \|I ʔ H\| | /dʒ/ | \|I ʔ H\| |
| palatal glide | [j] | \|I\| | | |

[18] I follow Backley (2011) in that I allow the situation in which more than one element in a given segment plays the head function, as in the representation of the voiceless aspirated labial stop [$p^h$] above.

[19] Typical acoustic correlates of the elements in the consonantal system of English: |A I U| – resonance, |ʔ| – occlusion, |H| – continuous noise (fricatives), transient noise (stops), |H| – aspiration (stops). For a detailed discussion of the representation of English consonants in terms of manner elements, see Backley (2011: 134ff).

(2) Internal structure of selected vowels

| | | | | |
|---|---|---|---|---|
| front vowels | [i] | \|I\| | [e] | \|I A\| |
| front rounded vowels | [y] | \|I U\| | [ø] | \|I A U\| |
| back vowels | [u] | \|U\| | [o] | \|U A\| |

Some explanation of the proposed representations in (1) and (2) is in order here. First, in opposition to a general tendency which recognizes velars as exceptional segments in that they are deprived of any resonance elements (e.g., Gussmann 2007; Huber 2007; Cyran 2010), I assume velars, similarly to Backley & Nasukawa (2009) and Backley (2011), to be segments represented by the resonance element |U| in the dependent function.[20] This hypothesis has been independently confirmed by the analysis of numerous cross-linguistic phenomena (Kijak 2017). Secondly, while the palatal and palatalized consonants share the element |I| with the front vowels, velars and back vowels are represented by the element |U|, though in a different function. Finally, since both the palatalized velars (stops and fricatives) and the front rounded vowels are combinations of |U| and |I|, they are predicted to interact with both plain velars and palatals.

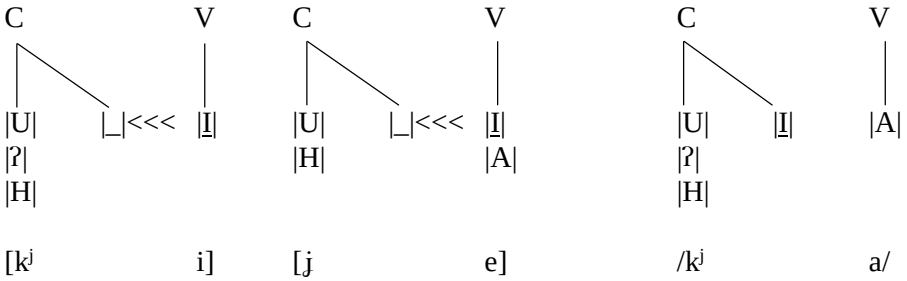
### 3.2 Secondary articulated segments and affricates

Since in ET the same set of elements is used to specify consonants and vowels, secondary articulated segments, which are normally the result of consonant-vowel interactions, are usually represented as complex expressions containing two resonance elements. From a diachronic perspective, contrastive segments with secondary articulation often evolve in response to an earlier phonetic co-articulation. Now, since in OE the palatalized velars occur before etymologically front vowels and thus are strictly dependent on their triggering environment, they must be recognized as being allophonic in nature rather than phonemic. In short, it is a front vowel which imposes a palatal quality on a preceding velar consonant. In what follows, I take the OE palato-velars [kʲ] and [j], e.g., *cild* 'child,' *gieldan* 'yield' to be complex segments in that they contain one additional resonant delivered by the following front vowel. To be more specific, it is the headed element |I| shared between the velar and the following front vowel which is responsible for the palatalization of velars in OE (3).

[20] It must be noted here that the idea that velars contain the element |U| was explored much earlier in Broadbent (1996) and Scheer (1999, 2004).

(3) Secondary articulated velars

a. allophonic secondary articulation b. phonemic secondary articulation



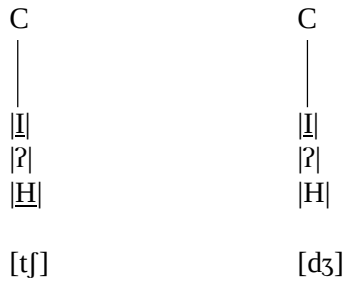

As represented in (3a), the palatalized velar is a complex segment as it contains two resonance elements: the original |U| (velarity) and the incoming |I| from the following front vowel. However, if the secondary articulation on the consonant becomes independent of the triggering vowel, its status becomes phonemic, which is a common diachronic scenario (3b), e.g., in Slavic languages. It should be noted here that the representation of the palatalized velars given in (3a) is in line with the solution posited in Minkova (2003). To put it briefly, she proposes to represent [kʲ] as a complex segment containing both coronal and dorsal place features. In a similar fashion, the voiced palato-velar fricative [ʝ] gets both the coronal and dorsal specification and as such is recognized as a complex segment too. Both of them are given branching representation in a similar manner to Clements & Hume (1995: 228). Minkova (2003: 100) argues for the dominant status of the dorsal place articulator in both segments until at least the year 1000. Finally, as already mentioned in the above discussion, the fronted velar is assumed here to be a plain velar |U ʔ H|, the fronting being just a phonetic effect without any influence on the phonological shape of the segment. This is the situation of the PDE forms such as *key* [kiː] and *keen* [kiːn], etc.[21]

Before I delve into the specifics of palatalization and subsequent affrication of the OE velars, some issues concerning the representation of affricates need explanation. First, the dilemmas concerning the phonological representation of affricates, i.e., whether they pattern phonologically with stops or with fricatives, whether they constitute a class on their own, and whether they are contour structures with an asymmetrical relationship between the components which can be internally ordered or unordered, are beyond the scope of the present paper and

[21] It will be recalled that velar fronting describes a situation in which velars are pronounced more fronted before front vocoids but are not necessarily affected by secondary palatalization (Bateman 2011: 590).

are not pursued any further here.[22] Second, I simply proceed, without further justification, on the assumption that affricates are phonologically identical to simple stops (Backley 2011; cf. Harris 1994; Bloch-Rozmej 2008). The only difference between these two categories is the way they are phonetically interpreted. Thus, while in plain stops the release phase is short and may even be inaudible, in affricated stops the release of the constriction produces a prolonged friction, accompanied by audible resonance (Backley 2011: 108). The delayed release in the case of affricates is recognized as a mere cue enhancement and hence it is not reflected phonologically as a contour structure of any sort. The view that affricates should be treated as stops is a broadly accepted one, anyway (Cyran 2010; Lin 2011).

(4) The representation of affricates in ET




In (4) we can see the non-contour representation of the palato-alveolar affricates [tʃ] and [dʒ] which is adopted for the purposes of the following discussion.[23]

## 4. Palatalization and affrication of velars in the history of English

Contrary to Minkova's (2003) proposal which boils down to a gradient contextual fronting of the velar stop /k/, that is, [kʲ] and [k'] (see Section 2), it is argued here that the gradient nature of palatalization is basically the domain of phonetics and as such is not reflected phonologically.[24] More specifically, the analysis developed in

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22 For a review of different proposals concerning the representation of affricates, see Kehrein (2002) and Lin (2011).

23 One of the reviewers points to two possible scenarios concerning the status of affricates. First, the affrication might be the effect of phonological reinterpretation (in acquisition), which boils down to a following modification: |I U ʔ H| (palatalized velar) > |I ʔ H| (loss of velarity) > |A I ʔ H| (reinterpretation). According to the second solution, a segment represented as |I ʔ H| may be realized with a prolonged burst, a hypothesis which has been proposed for the affricates /ʧ/ and /ʤ/ in Polish (Cyran 2010). In what follows, I lean towards the latter solution.

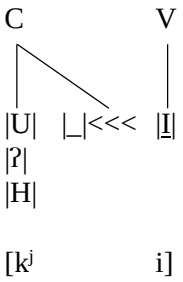
24 I agree with the opinion that the gradient fronting of /k/ before front vocoids is fully automatic and it is part of the universal phonetics, i.e., it is shared by all languages (Hyman 1975: 171).

this paper recognizes, similarly to Minkova (2003), the secondary articulated [kʲ] as a base for the later affrication; however, unlike in her proposal it is claimed here that the voiceless velar plosive was realized as a plain stop [k] before both etymologically back and *i*-umlauted vowels. This is the main reason why /k/ did not face affrication in the context before front rounded vowels. Only after the *i*-umlauted vowels had undergone unrounding did the velar stop acquire the phonetic fronting and was pronounced identically to PDE /k/ before front vowels. In other words, I argue that secondary articulated [kʲ] and the fronted velar stop differ in their melodic make-up. While the former contains the additional resonance element |I| which it shares with a neighboring vowel, the latter has the same representation as the plain velar stop and the fronting is just a phonetic effect. The above discussion leads us to the formulation of the first hypothesis.

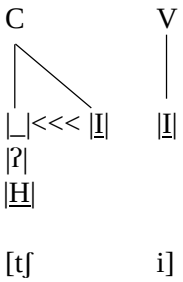
Hypothesis I: velar palatalization (and so also later affrication) is blocked before *i*-umlauted vowels because the velar and the etymologically back vowel share the element |U| (5c). In this situation the element |I| which triggers vowel umlauting is not able to spread further to the left and become part of the velar stop.[25]

(5) Interactions of the velar stop with the following vowels

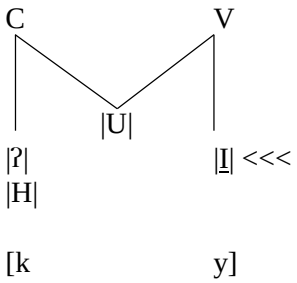
a. palatalization




b. affrication




c. before *i*-umlaut vowels




The representation in (5a) illustrates velar palatalization before etymologically front vowels, i.e., [k] > [kʲ]. In a subsequent step, the velar becomes affricated as the element |I| continues its migration to the left and replaces the original |U| element of the velar (5b). In (5c) the velar is not palatalized as it shares the

[25] A reviewer has rightly pointed out to me that the lack of palatalization before an umlauted vowel (5c) should be sought in the constraint against the spreading of elements such as *MULTIPLE (α) (Polgárdi 1998). Alternatively, when looked at from the perspective of the Harmonic Grammar model, it could be claimed that a single instance of spreading of |I| is acceptable, but two instances of spreading cause ungrammaticality due to the cumulative constraint interaction (Pater 2009, 2016). I leave this question open for discussion.

element |U| with the back vowel which later on undergoes mutation to [y].[26] The scenario discussed above accounts for the separation of the *cild* 'child' set of words from the *cyrnel* 'kernel' set. No reference to a questionable early affrication is needed here, nor is the positing of an equally doubtful affrication before *i*-umlauting rule ordering. Interestingly, a similar solution is applied in Hogg (1979: 101), who suggests that the feature [+grave] may account for the similarity of labial vowels and velars.[27]

Summing up the discussion so far, both velar palatalization [kʲ] and vowel umlauting are phonological processes which modify the internal structure of segments, in opposition to velar fronting which is just a phonetic effect without any phonological consequences. Moreover, the split into [kʲ] and [k'] in OE is not necessary, and it is actually called into question here. The reason why the velar stop /k/ did not evolve into /tʃ/ before the *i*-umlauted vowels is that /k/ in this context had not been palatalized in the first place as it shared the resonance |U| element with the following vowel (but see fn. 24 above). This explains the lack of affrication in the *cyrnel* 'kernel' group of words. The traditional reconstruction which assumes that the phonemicization of [kʲ] to /tʃ/ has to precede *i*-umlaut is both doubtful and unnecessary, since the velar and the following vowel share the element |U|, and the affrication is blocked in this context.

Two immediate questions arise, however: 1) why were velars not palatalized and affricated once the *i*-umlauted vowel had undergone unrounding, and 2) why are velars not affricated before front vowels in contemporary English, e.g., *keen* [kiːn] > *[tʃiːn]? These questions lead us to the postulation of the second hypothesis.

Hypothesis II: affrication of palatalized velars and vowel unrounding are two related processes in that they boil down to the ban on the merger of two resonance elements |I| and |U| within one segment.

This hypothesis is strengthened by the observation that both changes occurred at about the same period in the history of English (Minkova 2003: 107). Furthermore, it is worth noting that just like affrication and unrounding, which are related by the disappearance of |U| from velars and front rounded vowels, velar palatalization and *i*-mutation are related by addition of the element |I| to the internal make-up of velars and back vowels.

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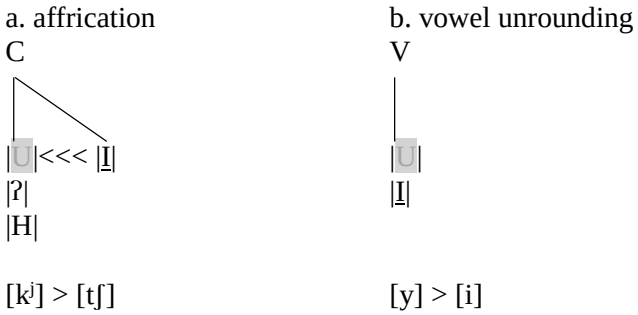
26 In (5c) the velar is predicted to be realized phonetically as a rounded/labialized variant rather than a palatalized one.

27 Hogg (1979) argues that a factor which prevented /k/ from being fronted prior to vowel unrounding was the blocking effect of continuous lip-rounding of the umlauted vowels on the preceding velar stop.

A significant contribution of Hypothesis II is that it explains the lack of affrication before both unrounded vowels and PDE front vowels. To be more specific, around Late OE/Early ME, the phonological system witnessed a radical change in that the ability to combine the elements |I| and |U| was switched off. It must be noted that the combination of these two elements is relatively marked cross-linguistically as they represent antagonistic acoustic properties (Backley 2011: 38ff).[28] Since the combination of such conflicting acoustic cues is articulatorily and perceptually more difficult, the two elements do not sit comfortably together within one segment and hence their universal marked status.

In brief, although the affrication of the palatalized velars [kʲ] proceeded simultaneously with the unrounding of the mutated high front vowels, e.g., [y] > [i], the latter scenario did not trigger affrication because the ability to combine |I| and |U| had already been switched off. This also explains the absence of velar affrication in contemporary English – the ban is still in operation.

(6) The result of *|I U| constraint



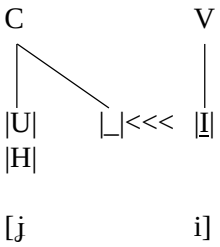

In (6) we can see that the two processes, i.e., affrication [kʲ] > [tʃ] = |U I ʔ H| > |U I ʔ H| and vowel unrounding [y] > [i] = |I U| > |I U| and [ø] > [e] = |I A U| > |I A U| are the result of the same constraint on the presence of two antagonistic elements in one segment. One of the consequences of the constraint activation is the loss of |U| in all such structures. In a similar fashion, velar palatalization and *i*-umlaut are two effects of the same parameter setting which allows for the |I| and |U| merger within a single segment. It is also worth mentioning that, similarly to Minkova (2003), the solution proposed here leans towards the lenition option. In other words, the affrication of the palatalized velar stop is simply the simplification of a segment containing two antagonistic elements [kʲ] > [tʃ] = |U I ʔ H| > |U I ʔ H|.

[28] Backley (2011: 39) points out that front rounded vowels such as [y ø] are found in less than 7 per cent of the world's languages. Similarly, both palato-velar stops [c ɟ] and fricatives [ç ʝ] are relatively rare cross-linguistically.

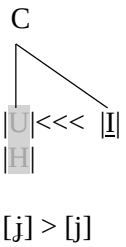
Exactly the same explanation can be applied to the development of the voiced velar fricative /ɣ/. Recall from Section 2 that /ɣ/ is assumed to be realized phonetically as the voiced palato-velar fricative [ʝ] before front vowels other than the *i*-umlauted vowels, e.g., *gieldan* 'yield', *giellan* 'yell', and *georn* 'yearning'. It follows that the umlauted vowels prohibit the palatovelar realization [ʝ] and what we find instead in this context is the regular velar fricative [ɣ], e.g., *gyldan* 'gild', *gēs* 'geese', and *gylden* 'golden'.[29] Now the reason why in the latter context /ɣ/ remains unpalatalized, just as in the case of /k/, is that the velar fricative shares the |U| element with the preceding (etymologically) back rounded vowel (7c).

(7) Development of the voiced velar fricative /ɣ/

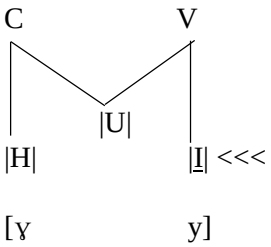
a. palatalization




b. vocalization




c. [ɣ] before umlauted vowels




Just as in the case of /k/ in (5a) above, the palatalization of the voiced velar fricative is represented as the |I| sharing with the following front vowel (7a). On the other hand, (7b) represents the later development of the palatovelar fricative, i.e., the vocalization to the palatal glide [j]. At this stage the etymological Gmc. [j], e.g., *gēar* 'year', *geoc* 'yoke' merged with the newly born [j] < [ʝ], e.g., *gieldan* 'yield', *giellan* 'yell'. Crucially, the [ʝ] > [j] development is a direct consequence of the activation of the *|I U| constraint[30] in ME similarly to vowel unrounding and the [kʲ] affrication illustrated in (6) above. In (7c), the velar fricative is not palatalized as it shares the element |U| with the etymological back vowel[31] and hence there is no need to introduce an additional variant here, the (slightly) fronted [g'] as in Minkova's (2003) account.

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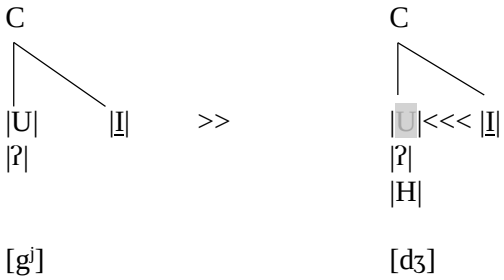
29 Minkova (2003) argues for the fronted [g'] variant in this context.

30 Recall that [ʝ] is defined by |I| and |U| and as such it is a rather marked segment cross-linguistically (see Kijak (2021) for the analysis of the voiceless palatovelar fricative [ç] in Modern German).

31 Just like in the case of [k] in (5c), the velar fricative is predicted to be labialized in this context.

In prosodically strong positions, e.g., Onset, the velar fricative, over time, is strengthened to the velar stop [ɣ] > [g] = |U H| > |U ʔ|. This development fits naturally into the general fate of English velar fricatives [x ɣ], which witnessed numerous modifications including labialization and vocalization, among others (Kijak 2017). As for the appearance of the voiced palato-alveolar affricate /dʒ/, the developmental path is obscured by the fact that voiced fricatives are generally late in the language and because of some later borrowings from French. Be this as it may, it seems safe to assume that the earliest possible instances of the voiced affricate are found in the context of WGG and that the evolution proceeded along the following path: Gmc *-gj- > OE [gʲ]/[gʲgʲ] > ME [dʒ] (cf. Hogg 1992a; Minkova 2016; Stenbrenden 2019).[32]

(8) The affrication of the palatalized voiced velar stop




Similarly to (6a) above, the palatalized velar stop undergoes simplification (lenition) due to the operation of the *|I U| constraint, the result of which is the appearance of the affricate [dʒ]. The idea that the affricate is a late development (ME) is in line with Stenbrenden's (2019) findings.

Finally, what deserves at least a short comment is the absence of labial stops affrication and the very spontaneous and natural affrication of the alveolar stops in contemporary English.[33] At this stage of discussion, the explanation for these emerges quite naturally as it is simply the result of the operation of the *|I U| constraint in the language. In short, while labial stops, which are defined by the headed |U| element, cannot be affricated due to the *|I U| constraint, there are no formal obstacles for alveolars to get affricated. Thus, although labials are (phonetically) fronted before front vowels, e.g., *bean* [biːn], they cannot become secondary articulated (palatalized) segments [bʲ] and hence cannot become

[32] See Stenbrenden (2019: 693ff) for a detailed presentation of the various developmental paths of PDE [dʒ] which have been proposed in the literature so far.

[33] Since labials are reported to hardly ever participate in palatalization processes cross-linguistically, their full palatalization, that is, affrication, is controversial (Bateman 2011).

affricates. On the other hand, the alveolar stops are defined by the resonance element |A| which can easily be merged with and replaced by |I|.[34] This observation explains why the [t/d] > [tʃ/dʒ] and [s/z] > [ʃ/ʒ] alternations are found so frequently in the contemporary language.

## 5. Conclusions

This paper has discussed certain aspects of the development of velar consonants in the Old and Middle English period. It has focused on velar palatalization which subsequently leads to affrication [kʲ] > [tʃ] and other modifications such as vocalization [ɣ] > [ʝ] > [j]. Additionally, it has been argued that just like velar palatalization and *i*-mutation, which are closely related by the merger of two antagonistic elements |I| and |U|, there is an intimate relationship between affrication and vowel unrounding in that they become subject to a constraint introduced in Middle English which bans the combination of these two elements within one segment. The analysis presented in this paper contributes to the understanding of some puzzles related to the historical development of velars which have been enumerated at the end of Section 1 above:

1. Why can't the velar stops undergo affrication in the palatalizing environment any more unlike alveolars which can be freely affected by it, e.g., PDE *seek you* [si:k jə] vs. *meet you* [mi:tʃ ə]?

PDE velar stops cannot undergo affrication due to the operation of the constraint introduced in ME which bans the merger of two antagonistic elements |I| and |U|. Since the combination of these two elements is not allowed any more in contemporary English, it is not possible for velars (|U| segments) to become palatalized (secondary articulated), which is a prerequisite for affrication. On the other hand, alveolars, which are |A| segments, readily surrender to affrication as they are not subject to the same constraint.

2. Why have the labial stops never been affricated?

Labial stops are segments which contain the headed resonance element |U|. This means that, similarly to velars, they are subject to the *|I U| constraint in PDE and hence they are not possible targets for affrication. The reason why labials were not affricated in the earlier periods of English history, for example

[34] This brings to mind the evolution of the ME diphthong [iu] after labials and alveolars which leads to PDE [pj] vs. [tj]/[tʃ] as in *pure* and *Tuesday*, respectively.

in OE, is that they are defined by the headed (and thus stronger) resonance element |U| which is not easily replaceable.

3. In the light of recent findings pointing to the late affrication of velars (Minkova 2003, 2016; Stenbrenden 2019), how come velars were not affricated before *i*-umlauted vowels?

The voiceless velar stop /k/ and the voiced velar fricative /ɣ/ are not palatalized and/or affricated in the context before *i*-umlauted vowels because the velars and the etymologically back rounded vowels share the element |U| and the spreading of the newcomer |I| responsible for the vowel mutation is inhibited (see also fn. 24).

4. What links the velar palatalizations [k] > [kʲ] and [ɣ] > [ʝ] with the process of *i*-umlauting in the history of English?

Both velar palatalization [k] > [kʲ] and [ɣ] > [ʝ] and the process of *i*-umlaut are instances of a combinatorial capacity of the OE system, i.e., the ability to merge two antagonistic elements |I| and |U| within one segment. The parameter setting is switched on.

5. Why does velar affrication overlap chronologically with vowel unrounding?

These changes overlap chronologically because both of them are a direct result of the constraint which starts to operate in ME. The parameter setting responsible for the ability to merge |I| and |U| is switched off. In consequence [kʲ] > [tʃ], [ʝ] > [j] and [y] > [i].

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