# The laryngeal specification and distribution of fricatives in Germanic

## an Element Theoretical approach

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**Abstract**

The laryngeal specification of obstruents, especially in Germanic, has been the subject of extensive study. However, most work has focussed on the laryngeal contrast in stops, while fricatives have received comparatively little attention. This thesis presents a detailed examination of fricatives in Germanic languages from the perspective of Element Theory (ET), which, following the 'laryngeal realism' approach, distinguishes between H-languages ('aspiration languages') and L-languages ('voicing languages'). The results of this examination show that fricatives do not always show the same behaviour as stops. First, in laryngeal contrasts, stops can always be distinguished by a laryngeal specification, whereas this is not always the case for fricatives, as voiced fricatives are sometimes not laryngeally specified. This is particularly true in North Germanic languages, since many voiced fricatives are better described as approximants, i.e. sonorants. Furthermore, while the stops in German and Dutch employ a laryngeal contrast, fricatives are argued to possibly differ in length instead. Second, the distribution of fricatives in syllable structure does not always parallel that of stops. Fricatives are pervasive in rhymal adjunct positions, whereas stops are primarily favoured in onsets. Of the fricatives, sibilants are the most ubiquitous in the rhymal adjunct position, and can in some cases even occur in the rhymal adjuncts of empty-headed syllables.

**Keywords**

# Content

# 1. Introduction

## 1.1 Phonological properties of fricatives

As Vaux & Miller (2011) note, the phonological properties of fricatives have since the beginning of feature theories remained unchallenged by and large, which is in sharp contrast with their phonetic properties (cf. Vaux & Miller 2011: 669 for references). This lack of attention to their status seems odd, since fricatives occur frequently in languages of the world. For instance, in the UCLA Phonological Segment Inventory Database (UPSID, Maddieson 1984), which consists of 317 languages, there are only twenty-one languages containing no fricatives. There appears to be an areal bias here as fifteen of the languages with no fricatives are Australian languages. A search in P-base (cf. Mielke 2008), a more recent database of 628 language varieties, shows a similar picture for fricatives with fewer than forty languages containing no fricatives at all. In UPSID, most languages have one to four fricatives (58 per cent of the languages). There are 113 languages with more than four fricatives, but only twenty languages have more than eight fricatives and just four languages have more than twelve fricatives (Maddieson 1984: 43).

Vaux & Miller (2011) treat some of the challenging issues regarding the phonological properties of fricatives. They conclude that fricatives behave as a natural class (sometimes excluding the pharyngeal and glottal fricatives), are specified as [continuant], can but need not be specified for [spread glottis] or its equivalents and are generally obstruents. A possible exception to this are voiced fricatives in languages with no corresponding voiceless counterparts, but there it remains to be seen whether these sounds are really fricatives at all, because these frequently pattern as sonorants (cf. Botma & van 't Veer 2013). Similarly, voiced fricatives (but also voiced stops) have been described as sonorant obstruents (Rice 1993) for similar reasons.

There is another issue, stridency, which is not considered by Vaux & Miller (2011). However, strident or sibilant sounds are very common in languages of the world. 88.5% of the languages in UPSID has a sibilant sound of which /s/ is probably the most common (Maddieson 1984: 44). Furthermore, several non-sibilant fricatives, bilabial, dental and palatal ones, occur more often than not without a voiceless counterpart (Maddieson 1984: 48). The frequency of the fricatives in UPSID is given below in (1) (taken from Maddieson 1984: 45; sibilants in bold). *s and *z (and *ɬ and *ɮ) are used for grouping together dental fricatives, alveolar fricatives and fricatives which are either dental or alveolar and only in a handful cases do languages employ both. Pharyngeal and glottal fricatives are excluded and glottal fricatives are already not taken into account by Maddieson (1984).

(1)  Relative frequency of voiced and voiceless fricatives in UPSID

| voiceless | frequency | voiced | frequency |
|---|---|---|---|
| **\*/s/** | 266 | **\*/z/** | 96 |
| **/ʃ/** | 146 | /v/ | 67 |
| /f/ | 135 | **/ʒ/** | 51 |
| /x/ | 75 | /ɣ/ | 40 |
| \*/ɬ/ | 30 | /β/ | 32 |
| /χ/ | 29 | /ð/ | 21 |
| /ɸ/ | 21 | /ʁ/ | 13 |
| /θ/ | 18 | \*/ɬ/, /ɟ/ | 7 |
| **/ʂ/** | 17 | **/ʐ/** | 3 |
| /ç/ | 16 | | |

What becomes apparent is that coronal sibilant fricatives are very frequent compared to most other fricatives. The most occurring sibilant is in the phoneme inventory of twice as many languages as the most occurring non-sibilant in the voiceless series. Retroflex sibilants do not occur very frequently, but retroflex sounds are uncommon sounds in languages in the world in general. For instance, there are just 36 languages that have a retroflex stop (Maddieson 1984: 32). A search in P-base (cf. Mielke 2008) shows a comparable finding for the frequency of (coronal) sibilants. 563 of the 628 languages have a sibilant sound, with 500 of these being an /s/. I do not discuss affricates, as these are treated as stops in ET (Backley 2011: 208). It should however be noted that a subset of affricates is sometimes also referred to as sibilants (cf. Kim et al. 2015). Smith (2000: 250) notes that these sibilant affricates are less frequent than non-sibilant affricates and actually show a mirror-image of the frequency of sibilant fricatives, with 141 languages containing the most frequent affricate /ʧ/ and 263 languages containing the most frequent stop /p/ (cf. Maddieson 1984: 35, 38).

Besides sibilant fricatives being very frequent, it has also often been noted that sibilant fricatives, such as /s z/, display different phonological behaviour compared to non-sibilant fricatives, such as /f v θ ð x ɣ/. A good example of this is their distribution in many languages of the world (cf. Goad 2011). In English for example, it is the only consonant that can precede clusters at the beginning of a word (e.g. *strain* and *spleen*) and it is the only fricative that can precede nasals and stops (e.g. *snow* and *stop*). Usually, the sibilant in initial clusters is an /s/, but sometimes another sibilant is found in this position; a case in point is German, which generally uses /ʃ/ (e.g. *Spinne* [ʃpɪnə] 'spider'). Given the frequency and the sometimes distinct phonological behaviour of sibilants, sibilance should in my view at least be included in an analysis regarding fricatives beside other important aspects that Vaux & Miller (2011) already discussed.

## 1.2 Fricatives in Germanic

The laryngeal contrast in Germanic languages has been subject to extensive investigations and the phonetic facts are well-studied (e.g. Iverson & Samsons 1995; Honeybone 2005; Beckman et al. 2013). There is quite a lot of variation in the phonological behaviour of obstruents (cf. Allen 2016). Germanic languages are usually analysed as aspiration languages, where the laryngeal contrast is between the aspirated and the unaspirated series. There are also some notable exceptions, such as Dutch, which is traditionally seen as a voicing language (e.g. Iverson & Salmons 2003; Backley 2011) and in which there is a laryngeal contrast between voiced and voiceless. For the aspiration languages, there seems to be a difference regarding stops: some languages have aspirated stops, voiceless stops and voiced stops, such as English, whereas in other languages, such as Icelandic, Faroese and Danish, there are only aspirated stops and voiceless stops. The fricative contrast in the latter category seems to be between voiceless fricatives and voiced fricatives however, although there is some doubt whether these voiced fricatives are actually fricatives (cf. Basbøll 2005; Árnason 2011). Swedish is argued to have both voiced obstruents and aspirated obstruents (cf. Riad 2014), where the voiced series does not seem to be unmarked, like it is in English. The characterization of voiced fricatives in Swedish is also ambiguous, but these sounds are nonetheless characterized as obstruents by Riad (2014). Norwegian, on the other hand, has no voiced fricatives at all (cf. Kristoffersen 2000). Finally, there are language varieties such as Swiss German, which have a contrast based on duration rather than voicing or aspiration. The variety of laryngeal contrast in these obstruents provides ample reasons to do an analysis on fricatives.

The main languages that are examined here are the North Germanic languages Icelandic, Faroese, Danish, Norwegian and Swedish and the West Germanic languages English, Dutch and German. Regional varieties are included in phonological analyses when they are relevant. The fricative inventories of these languages are given below in (2). Pharyngeal and glottal fricatives are excluded.

(2) The fricatives of the Germanic languages

Icelandic (cf. Árnason 2011)

|  | labial | dental/alveolar | palatal | velar |
|---|---|---|---|---|
| Voiceless: | f | θ, s | ç | x |
| 'Voiced': | v | ð | j/ ʝ | ɣ |

Faroese (cf. Árnason 2011)

|  | labial | dental/alveolar | retroflex | palato-alveolar |
|---|---|---|---|---|
| Voiceless: | f | s | ʂ | ʃ |
| 'Voiced': | v |  |  | j |

Danish (cf. Basbøll 2005)[1]

|  | labial | alveolar | (alveo)palatal | uvular |
|---|---|---|---|---|
| Voiceless: | f | s | ɕ | |
| 'Voiced': | v | | | ʁ |


Swedish (cf. Riad 2014)

|  | labiodental | dental, alveolar | alveolar, palatal |
|---|---|---|---|
| Voiceless: | f | s, ʂ[2] | ɕ |
| Voiced: | v | | ʝ |


Norwegian (cf. Kristoffersen 2000)

|  | labiodental | dental/alveolar | retroflex | palatal |
|---|---|---|---|---|
| Voiceless | f | s | ʂ | ç |
| Voiced: | | | | |


English (cf. Hammond 1999)

|  | labial | dental | alveolar | coronal-dorsal |
|---|---|---|---|---|
| Voiceless | f | θ | s | ʃ |
| Voiced: | v | ð | z | ʒ |


Dutch (cf. Booij 1995)

|  | labiodental | alveolar | velar |
|---|---|---|---|
| Voiceless | f | s | x |
| Voiced: | v | z | ɣ |


German (cf. Wiese 1996)[3]

|  | labiodental | alveolar | palato-alveolar | palatal | velar | uvular |
|---|---|---|---|---|---|---|
| Voiceless | f | s | ʃ | ç | x | χ |
| Voiced: | v | z | (ʒ) | ʝ | ɣ | ʁ |

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[1] Haberland (1994: 320) also includes [j] as a voiced fricative. [j] is not consistently considered to be a voiced fricative by Basbøll (2005), but he does note that it sometimes patterns as one (Basbøll 2005: 216-217, 239).

[2] The main allophones of this sound are the retroflex [ʂ] (or [ʃ]) as light allophone and the dorsovelar or dorsopostpalatal fricative [ɧ] (or [x]) as dark allophone. Swedish varieties either have only the light allophone, only the dark allophone or both (as in Central Swedish) and in the latter case these sounds are often in complementary distribution (Riad 2014: 60-62).

[3] Not all fricatives are separate phonemes. [ç], [x] and [χ] are often regarded as allophones (Wiese 1996: 209-210) and the uvular fricatives can be seen as derived segments from the uvular trill [ʀ] (Hall 1992: 14-15).

## 1.3  Aim of the study

The laryngeal specification of obstruents has been studied extensively (cf. section 1.2). In the framework called 'laryngeal realism' (e.g. Honeybone 2005; Beckman et al. 2013), it has been argued extensively that the laryngeal contrast of obstruents is not always a contrast between [+voice] or [voice] and [-voice] or [ø] (a lack of specifications), but either a contrast between [voice] and [ø] or between [spread glottis] and [ø], depending on the language. Languages with a larger laryngeal contrast can then make use of both of these contrasts (simultaneously), as can be seen in (3) (adapted from Iverson & Salmons 1995: 383; '-' stands for not occurring in the language). Icelandic is added to give an example of a language with only aspirated and voiceless stops. Interestingly, Iverson & Salmons (1995: 383) note that while in almost all languages the unmarked stop is the voiceless (unaspirated) one, in a number of Germanic languages (e.g. English) it is actually the voiced stop that is unmarked.

(3)  Laryngeal contrast exemplified by labial stops

|  | /p/ | /b/ | /pʰ/ | /bʰ/ |
|---|---|---|---|---|
| English |  | [ ] | [spread glottis] | - |
| Icelandic | [ ] | - | [spread glottis] | - |
| Spanish | [ ] | [voice] | - | - |
| Thai | [ ] | [voice] | [spread glottis] | - |
| Hindi | [ ] | [voice] | [spread glottis] | [spread glottis] & [voice] |

In this thesis I investigate the phonological status of fricatives in Germanic languages in order to establish to what extent their phonological behaviour matches the 'laryngeal realism' framework that is usually based on the behaviour of stops. My hypothesis is that the contrast in fricatives is the same as in stops. Special attention is given to the difference between sibilant and non-sibilant fricatives, which, as noted earlier, has not been discussed in the recent overview of Vaux & Miller (2011: 670), who dealt with a lot of representational issues for fricatives, but not with the behaviour of sibilant fricatives versus non-sibilant fricatives. Sibilant fricatives occupy a special position in the phonological structure, as they can, for instance, occur as first member of an onset more frequently than other fricatives and even precede stops at the beginning of words. Therefore, I also claim here that sibilant fricatives are more obstruent-like than non-sibilant fricatives, which are thus more sonorant-like.[4]

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[4] It is important to note that the term sonorant is an informal label and does not describe a phonological class. The details on ET are described in section 2.2, but for now it should be noted that the only thing that characterizes sonorants is the lack of |H| according to Backley (2011: 149), although they also do not have |L|. To be obstruent-like is thus to have |L| or (headed) |H| (or just |ʔ| in the case of a neutral stop). More generally, obstruents always have one or more manner elements, giving them more elementary content, whereas for sonorants the manner elements are available to a lesser extent.

The thesis consists of two parts. Part I contains the theoretical background. First, chapter 2 gives an overview of the theoretical framework. Here I argue why I use elements instead of features, which elements are used for which sounds and their occurrence in the segmental structure. Next, chapter 3 outlines the approach known as 'laryngeal realism'. I review the contrast in stops, in fricatives and also discuss sibilant fricatives. Part II examines the distribution and behaviour of fricatives in Germanic languages. Chapter 4 investigates the laryngeal specification of obstruents in H-languages. Chapter 5 offers a detailed examination on the behaviour of sibilants. Chapter 6 focusses on voiced fricatives in North Germanic languages, which, as we will see, pattern with sonorants in some processes, and with obstruents in others. Chapter 7 provides a comparison of Dutch fricatives and German fricatives, since the laryngeal contrast in Dutch is often seen as different from Germanic languages, although fricatives pattern quite similarly in both languages.

# Part I: Theoretical background

## 2. Theoretical framework

### 2.1 Primitives

In this thesis I use the phonological model of Element Theory (henceforth ET) of Backley (2011), which is based on an earlier proposal in Harris & Lindsey (1995).[5] In this theory elements are used as characteristics of segments instead of features. Elements are monovalent primes that refer only to positive values. Privative primes are preferred over the bivalent features that theories traditionally use, because the negative value, i.e. the one that is not 'active' in the grammar, cannot explain natural class behaviour of sounds that have nothing in common with each other except for the fact that they lack a common feature and would predict phonological processes that are unattested. A case in point is the feature [±nasal] (cf. Backley 2011: 8-9). Although [+nasal] can describe nasal sounds which can, for instance, trigger nasal harmony, the feature [-nasal] cannot group other sounds together in phonological processes, as processes like oral harmony do not exist. Because bivalency both cannot correctly classify groups of sounds and leads to overgeneration, it should in my view be disregarded all together, as has been done by a number of scholars who argue for privative features, especially in the more recent decades (e.g. Harris 1994; Avery & Idsardi 2001; Iverson & Salmons 2011; Beckman et al. 2013; van der Hulst 2016; Nicolae & Nevins 2016; Cyran 2017). Monovalent versions of feature theories handle these problems better, but are still problematic when they introduce polar opposite features like [stop] and [continuant]. More generally, van der Hulst (2016: 87-88) discusses several issues which are all fundamental to the unary/binary debate when comparing theories of primes.

First, features are solely based on articulation. Because articulation in speech is not available to the listener and because perception is (maybe even more) important in language transfer (Backley 2011: 2-4; Ohala 1981), it is rather odd that the primacy of linguistic knowledge is put on the speaker. Instead, ET opts for a focus on the speech signal, which is available to both the speaker and the listener. Elements then are both mental objects present in phonological representations representing lexical

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[5] Versions of ET that differ from the standard version regarding the number of elements can broadly be divided in models which use less elements and models which use more elements, which Backley (2012) refers to as conservative ET and progressive ET respectively. Conservative ET makes use of several elements which existed in earlier versions of ET, such as separate elements for nasality and voicing (e.g. |N| and |L|), separate elements for frication and voicelessness (e.g. |h| and |H|) and a neutral element |@|. Although natural classes and phonological processes can be described more easily in conservative ET, some natural classes are harder to formalize (e.g. voicelessness and aspiration are independent properties in conservative ET, while they are both closely linked to obstruents) and the possibility of overgeneration is increased greatly. Progressive ET on the other hand, assumes less elements and replaces some of them by structural properties, since some elements display untypical behaviour compared to other elements. However, it might be difficult to envisage how structural properties are tied to the speech signal like elements are. Because of the fallacies of both conservative and progressive ET, I adopt the framework of standard ET and agree with Backley (2012: 94) who notes that 'the expectation is that standard ET will continue to be viewed as the most accessible and workable approach to element-based structure'.

contrast and physical objects in the sense that they have their own acoustical pattern in the speech signal (Backley 2011: 6).

Secondly, a major advantage of a focus on acoustics is that elements can be used in both consonants and vowels and thus capture a consonant-vowel unity, which feature theories are generally unable to do. Even versions of feature theories which try to capture a consonant-vowel unity can only capture a unity in place features as their articulatory bias renders them unable to have features in common that are not place features (Backley 2011: 62-64, 69-70; Backley 2012: 63-64).

Lastly, elements are units which, contrary to features, can occur on their own, which means that the grammar has no need to add unmarked properties. The phonetic identity of units with the same element(s) can vary across languages. This can be illustrated by the vowel systems of Tamazight and Quechua, which both have minimal vowel inventories, (e.g. Backley 2011: 19). Tamazight has the vowels [i u a] and Quechua has the vowels [ɪ ʊ ɐ]. Although these vowels are phonetically different, phonologically [i ɪ], [u ʊ] and [a ɐ] contain the same element, viz. |I|, |U| and |A| respectively. Instead of being attributes of phonetic segments, elements are building blocks which make up a segment. This means that they rather emerge on the basis of phonological patterning and are not an innate property of sounds. Even though the phonetic realizations are different, phonological categories are still universal (Mielke 2008).

A short caveat is in order here. Although features are disregarded in favour of elements, it should be noted that many insights from Feature Theory are still relevant and, in a way, adopted in ET. For instance, the features [voice], [spread glottis] and [constricted glottis] (e.g. Iverson & Salmons 1995) or the features [voice], [aspiration] and [glottalization] (e.g. Honeybone 2005) find quite some overlap in the elements |L|, |H| and |ʔ| respectively and are sometimes also used in upcoming analyses.

## 2.2 Element Theory

The standard version of ET (cf. Backley 2011) makes uses of six elements, the place or resonance elements |I U A| and the manner or non-resonance elements |H L ʔ|. Place elements are sometimes called vowel elements and manner elements are sometimes called consonant elements. I refer to these as place (or resonance) and manner (or non-resonance) elements as place elements are quite often present in consonants and manner elements can also occur in vowels, although they do not occur in vowels in every language. The acoustic properties and broad phonological categories of those six elements are given in (4) (adapted from Backley 2011; Backley 2012: 66-67; Backley 2017: 3; F stands for Formant).

(4)    acoustic property                    phonological categories

|I|   high F2 (F2-F3 converge)            (some) coronals, palatals, front Vs

|U|   low frequency energy in F1-F3       labials, velars, rounded Vs

|A|   high F1 (F1-F2 converge)            (some) coronals, retroflexes, pharyngeals, low Vs

|H|   aperiodic (high-frequency) noise    (voiceless/aspirated) obstruents, high tone Vs

|L|   periodic (low-frequency) murmur     voiced obstruents, nasals, low tone/nasal Vs

|ʔ|   sudden drop in amplitude            stops, ejectives, implosives, laryngealized Vs

If a sound has more than one element, the relation between those elements is sometimes asymmetric. This asymmetry is usually seen as a head-dependency relation where one element is the head, which is marked by an underscore, and one or more elements are the dependent(s) or non-head(s). An example of this can be seen in the Dutch minimal vowel pairs in (5), where a difference in headedness allows the language to differentiate between two mid-vowels and where a headed element contributes to a greater extent to the acoustic signal.[6]

(5)  examples              vowel       elemental structure

     *beek* [bek] 'brook'   [e]         |I̲ A|

     *bek* [bɛk] 'beak'     [ɛ]         |I A̲|

     *boot* [bot] 'boat'    [o]         |U̲ A|

     *bot* [bɔt] 'bone'     [ɔ]         |U A̲|

Backley (2011) offers an alternative view where headedness is a property of elements rather than sounds and thus allows for sounds with multiple headed elements, for instance an aspirated voiceless labial stop [pʰ] |U̲ ʔ H̲| or a fully voiced labial stop [b] |U̲ ʔ L̲|. This does not mean that an element can always be combined with any other element. Some combinations of elements, |U| and |I|, |A| and |ʔ| and |L| and |H|, are more marked, because they have opposing acoustic properties (respectively dark versus light, resonant versus non-resonant and low versus high). Therefore Backley (2011) calls these antagonistic pairs. These three pairs denote three separate fundamentals, which Backley (2017: 8) names colour, resonance and frequency. Headedness, according to Backley's view, is a property of a fundamental and thus sounds can potentially have up to three headed elements, though segmental categories can usually be established with just non-headed, single-headed and double-headed structures. Some examples are given in (6) (adapted from Backley 2017).

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[6] Some versions of ET require sounds to have at least one headed element, as there is always one element that contributes the most to the acoustic signal, whereas other versions of ET allow for non-headed expressions too (Backley 2011: 40-42). I follow Backley (2011) here, who assumes that sounds need not have a headed element.

(6)  expression          sound                              elemental structure

    non-headed           coronal voiceless stop [t]         |A H ʔ|

    single-headed        pharyngeal voiceless stop [ʔ]      |A̲ H ʔ|

    single-headed        velar voiceless fricative [x]      |U H̲|

    double-headed        coronal voiced fricative [ʒ]       |A I̲ H L̲|

    double-headed        pharyngeal ejective stop [ʔ']      |A̲ H ʔ̲|[7]

A neutral element |@| was part of the element set in earlier versions of ET (e.g. Harris & Lindsey 1995). This resonance element was seen a baseline reference that latently exists in vowels if the structure of the vowel consisted of neither of the three other resonance elements. That vowel is called a neutral vowel, which is often schwa, to which elements could be added, thus suppressing the neutral element (cf. Harris & Lindsey 1995). In later versions of ET however, scholars such as Backley (2011: 31-38) assume an empty representation | |, because elements provide important linguistic information, are phonologically active primes and provide phonological contrast. Botma & van 't Veer (2013: 55-56) applied this notion of a baseline resonance to the carrier signal from the Modulation Theory of Speech (Traunmüller 1994), which provides non-linguistic information and is roughly schwa-like in nature. Considering a consonant-vowel unity, this seems like a promising endeavour, as it can not only explain a baseline in vowels, but also in consonants. Because this signal provides voicing, it is inherent in all consonants, thus explaining why sonorants are generally voiced, even though voicing is usually not contrastive in sonorants. Voicing can only describe obstruents, since these sounds can be inhibited by articulatory constrictions such as a spread glottis (|H|).

Consonants usually consist of place and manner elements. A notable exception to this are glides, which have no manner elements. In ET, liquids are considered to be glides as well because they also lack manner elements. The structure of these sounds is given in (7) (cf. Backley 2011: 65, 165).[8]

(7) j sounds      |I|

    w sounds     |U|

    r sounds     |A|[9]

    l sounds     |A I| or |A U|

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[7] Generally, only one headed element can exist per fundamental, but this claim is somewhat weakened for the fundamental resonance, as some languages have sounds with both |A̲| and |ʔ̲|, such as pharyngeal ejective stops, although these sounds are quite rare in languages of the world (Backley 2017: 13-14). It could possibly have to do with the fact that one of elements is a place element and the other one is a manner element, but even then Backley's claims about headedness in fundamentals would have to be reworked or at least refined.

[8] Lieburg (2019) provides an alternative account for the representation of rhotics and laterals, where the |A|-element is replaced by |L|, because they are characterized as a whole by low frequency energy whilst their place of articulation varies. This is turn means that they are not glides and that they are distinct from j and w sounds.

[9] The tap [ɾ] is not always part of the rhotics. Therefore, it does not always have |A| in its elemental structure.

Glides occur in non-nuclear positions, so therefore they are considered to be consonants. They are considered to be the most vowel-like consonants, which makes sense since they are acoustically quite similar to vowels and because they contain only place elements, like vowels. There are also some consonants which contain no place elements, as shown in (8) (cf. Backley 2011: 115-116, 131, 150).

(8) Glottal stop          [ʔ]                  |ʔ|

       Glottal fricative       [h]                  |H|

       Placeless nasal      [ŋ] ~ [ɴ] ~ [ɰ̃]     |L|

Place elements were first devised for vowels and were already used in Dependency Phonology since the publication of Anderson and Jones (1974) as |i|, |a| and |u|. ET later adopted these in its framework. Languages with minimal vowel inventories have three vowels, which are phonologically made up of three elements |I|, |U| and |A|. |I| is present in front vowels, |U| in back vowels and |A| in low vowels. Since elements can be present both in consonants and in vowels, one should look at the phonological interaction between these two to see which consonants also have these elements. Palatals generally interact strongly with front vowels. Because of this prominent relation, |I̱| is present in palatal sounds, such as [ʃ] and [j]. In some languages coronals and palatals pattern together, which means that these coronals have |I|. The types of fricatives with |I| are given in (9).

(9)

| Place of articulation | Element | Voiceless Fricatives | Voiced fricatives |
|---|---|---|---|
| dental/alveolar | \|I\| | [θ], [s] | [ð], [z] |
| palatal | \|I̱\| | [ʃ] | [ʒ] |

Labial sounds such as [k] and [w] have |U̱|, because they quite often interact with rounded vowels. Velars and labials pattern as a natural class in quite a number of languages and acoustically these sounds are also similar. Velars are represented by |U|, because they are regularly targeted by assimilation processes and occur in weak positions. Some scholars (e.g. Harris & Lindsey 1995: 29; Huber 2003) also claim that velars contain no place elements. This is however not possible in languages which have both velar fricatives and glottal fricatives as their representation would become the same. This difference between languages does not pose a real problem for ET, as the representation of velars could be different in those languages. The types of fricatives with |U| are given in (10).

(10)

| Place of articulation | Element | Voiceless Fricatives | Voiced fricatives |
|---|---|---|---|
| labial | \|U̱\| | [ɸ] | [β] |
| velar | \|U\| | [x] | [ɣ] |

|A̱| is present in gutturals and retroflexes. This means that they cannot be contrastive in languages of the world, since they have the same representation. In some languages the coronal resonance is

represented by |A|. This is for instance the case in languages where retroflexes pattern strongly with alveolars and in other languages where gutturals interact with low vowels. The types of fricatives with |A| are given in (11).

(11)

| Place of articulation | Element | Voiceless Fricatives | Voiced fricatives |
|---|---|---|---|
| dental/alveolar | \|A\| | [θ], [s] | [ð], [z] |
| retroflex | \|A̠\| | [ʂ] | [ʐ] |
| pharyngeal | \|A̲\| | [ħ] | [ʕ] |

Of course, consonants can also contain multiple place elements. The types of fricatives containing multiple elements are given in (12).

(12)

| Place of articulation | Elements | Voiceless Fricatives | Voiced fricatives |
|---|---|---|---|
| labiodental | \|U̲ A\| | [f] | [v] |
| dental/alveolar | \|I A\| | [θ], [s] | [ð], [z] |
| alveolo-palatal | \|I̲ A\| | [ɕ] | [ʑ] |
| palato-velar | \|I̲ U\| | [ç] | [ʝ] |
| uvular | \|U A̲\| | [χ] | [ʁ] |

It is important to note that the representations above are not universal. This has already become clear from the fact that coronal fricatives sometimes have |I|, sometimes |A|, and sometimes coronals can also have both. Furthermore, if a language does not contrast sounds like labial and labiodental fricatives, there is no need to give [f] an elemental structure |U̲ A| instead of just |U̲|. To sum up this section, the contrasts in fricatives regarding place of articulation are large, but ET allows for an adequate description to differentiate between them.

Most consonants also have manner elements. The |ʔ|-element signals a sudden drop in amplitude. It is present in stops and optionally in nasals and laterals, if they pattern with stops. It is headed in ejectives and implosives, because of a prolonged drop in amplitude. The types of sounds with their elemental structure and some example segments are given in (13).

(13)

| Category | Element(s) | Example segments |
|---|---|---|
| neutral stops | \|ʔ\| | [p], [t], [k] / [b̥], [d̥], [g̥] |
| laterals | \|(ʔ)\| | [l], [ʎ] |
| nasals | \|L (ʔ)\| | [m], [n], [ŋ] |
| laryngealized nasals | \|L ʔ̲\| | [m̰], [n̰] |
| ejectives | \|ʔ̲ H\| | [pʼ], [tʼ], [kʼ] |
| implosives | \|ʔ̲ L\| | [ɓ], [ɗ], [ɠ] |

The |H|-element is a cue of aperiodic noise energy, which is present in fricatives because of the aperiodic high-frequency acoustic energy. This element is usually headed in aspirated sounds and voiceless fricatives in aspiration languages. In languages where aspiration is an active property, non-headed |H| is also present in voiceless stops according to Backley (2011: 126). Although this release is usually not contrastive, there are important acoustic cues in place of articulation for perceptual reasons. Furthermore, when a stop lenites to a fricative it contains the element |H|. Therefore, this element must have already been present in the stop. However, this analysis can only hold for Germanic languages like English, where the voiceless stop is not the unmarked one, and not for other (Germanic) languages, like Icelandic, where the voiceless stop is the unmarked category (cf. (3)). |H| is also present in other sounds with aperiodic noise, such as voiceless nasals and laterals. The types of sounds with their elemental structure and some example segments are given in (14).

(14)

| Category | Element(s) | Example segments |
|---|---|---|
| neutral fricatives | \|H\| | [f], [s], [x] / [v̥], [z̥], [ɣ̊] |
| unaspirated stops | \|ʔ H\| | [p], [t], [k] |
| voiceless laterals / lateral fricatives | \|H (ʔ)\| | [ɬ], [l̥] |
| voiceless nasals | \|L H (ʔ)\| | [m̥], [n̥], [ŋ̊] |
| aspirated stops | \|ʔ H̲\| | [pʰ], [tʰ], [kʰ] |
| aspirated/fortis fricatives | \|H̲\| | [f], [s], [x] |

The |L|-element is used for both nasality and voicing, because both are characterized by low acoustic energy and because nasals and voiced obstruents interact with each other in several languages.[10] The types of sounds with their elemental structure and some example segments are given in (15).

(15)

| Category | Elements | Example segment(s) |
|---|---|---|
| nasals | \|L (ʔ)\| | [m], [n], [ŋ] |
| breathy-voiced nasals | \|L̲ H (ʔ)\| | [m̤], [n̤] |
| voiced/prenasalized stops | \|ʔ L̲\| | [⁽ᵐ⁾b], [⁽ⁿ⁾d], [⁽ŋ⁾g] |
| breathy-voiced stops | \|ʔ H L̲\|[11] | [bʰ], [dʰ], [gʰ] |
| voiced fricatives | \|H L̲\| | [v], [z], [ɣ] |
| voiced lateral fricatives | \|H L̲ (ʔ)\| | [ɮ] |

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[10] |L̲| is assumed to be present in voiced obstruents according to Backley (2011), but Breit (2017) argues that this cannot be correct, because nasals are more salient and phonologically stronger. Therefore, nasals rather than voiced obstruents, should be headed or it at least depends on the language which element is headed. This issue is not taken into account in the present analysis, as it largely deals with aspiration languages.

[11] Backley (2011: 160) notes that in the traditional view |H| cannot be headed too, as *|ʔ H̲ L̲| has two heads in the same fundamental. He chooses to demote |H̲|, because in voiced aspirates |H| seems to have a less prominent role than in voiceless ones. Nevertheless |ʔ H̲ L| is not necessarily a priori excluded as possibility.

A note on markedness is in order here. The term is widely used in phonology, yet it is not always clear what is meant by it because of the wide array of often contradicting terms that have been used in the literature. Hume (2011: 80) gives a list of fifteen such descriptors giving unmarked categories descriptions such as simple, predictable, perceptually strong and perceptually weak and marked categories descriptions such as complex, unpredictable, perceptually weak and perceptually strong respectively. In ET, markedness has to do with the elemental complexity of segments. The more elements a segment contains, the more marked it is. This means that ET can easily capture processes such as lenition, as it can be explained as sounds losing one or more elements in certain environments, which thus become less complex. For instance, tapping in Australian English, where a [t] lenites to [r], can be seen as a loss of melodic material from |I H ʔ| to just |I| (cf. Backley 2011: 132). Markedness therefore does not necessarily have to with perceptual prominence or complexity of similar segments as the difference in these cues (such as aspirated voiceless stops versus unaspirated voiceless stops) is already capsulated in the speech signal and thus in terms of headedness. Headedness can thus be seen as some kind of acoustic strengthening without making a segment more marked.

## 2.3 A note on syllable structure

While ET describes the internal structure of sounds, sounds themselves are also structured in higher prosodic domains. I follow Harris (1994) in the representation of syllabic structure, although Backley (2011) also adheres to the central assumptions of Harris (1994) in this regard.

There are differences between the positions in which sounds occur and in which they are allowed (cf. Harris 1994). Backley (2011: 184) notes that this distribution can be affected by the type of elements, the number of elements and the presence or absence of headed elements. Strong positions are the left edge of prosodic domains like the word and the syllable, but also of lower domains. These positions provide rich acoustic cues and are therefore generally more marked, thus allowing for a greater complexity in these segments. Weak positions are then the right edge of prosodic domains. These usually have fewer elements and thus there are fewer contrasts here.

Usually four constituents are posited below the foot or syllable constituent[12]: the onset, the rhyme, the nucleus and the coda. Harris (1994) examines the possible constituents and notes that a constituent can be maximally binary branching. When a constituent branches, one of the positions is stronger and one is weaker. This can be seen as a head-dependency relation, similar to elemental structure. Within a constituent the left part is the head and the right part is the dependent. Harris concludes that the coda cannot be a constituent, as it cannot be binary branching. Instead, there is a

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[12] Harris (1994) does not assume that the syllable itself is a constituent. This is not pivotal to the focus of this thesis, however.
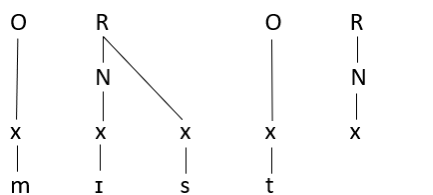
second position of the rhyme, the rhymal adjunct, which can be seen as the traditional coda and which can maximally consist of one consonant. The template for subsyllabic constituents is given in (16).

(16) The maximally allowed representational structure of subsyllabic constituents

```
    O              R
   / \             |
  /   \            N
 /     \          / \
 x      x        x   x   x
```
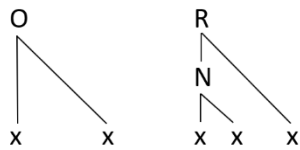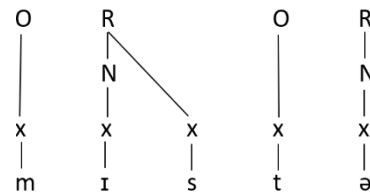
Harris & Gussmann (2002) argue that the traditional final-coda view can only explain languages with either both internal codas and final consonants or neither. A final-onset view however, can explain why there are languages with internal closed syllables, but no final consonants, as branching rhymes are allowed, but final empty nuclei are not. Similarly, it provides a reason why there are languages with no internal closed syllables but with final consonants, as branching rhymes are not allowed, but final empty nuclei are. Harris (1994) also notes that the final consonant of a word like *mist* behaves the same as an onset consonant of a word which has a similar structure like *mister*. This leads him to conclude that these final consonants are actually onsets of empty-headed syllables. The representations of *mist* and *mister* are given in (17) (cf. Harris 1994: 74).
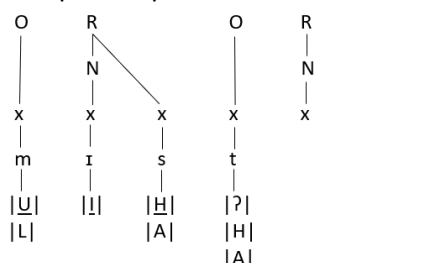
(17) representation of *mist*          representation of *mister*

```
O    R         O   R          O    R        O   R
|    |         |   |          |    |        |   |
|    N         |   N          |    N        |   N
|    |         |   |          |    |        |   |
x    x   x     x   x          x    x   x    x   x
|    |   |     |   |          |    |   |    |   |
m    ɪ   s     t              m    ɪ   s    t   ə
```
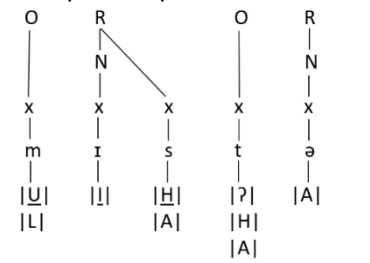
What is important for the upcoming analyses is that final consonants like the /t/ in *mist* do not occupy the coda, which is a weak position, but rather an onset. This also explains why these consonants can contain a large number of elements, since onsets allow for greater complexity in their melodic structure. This can be seen below in the more complete representation of *mist* and *mister* in (18) with elements of the sounds included.[13]

(18) complete representation of *mist*          complete representation of *mister*[14]

```
O    R          O   R          O    R          O   R
|    |          |   |          |    |          |   |
|    N          |   N          |    N          |   N
|    |          |   |          |    |          |   |
x    x   x      x   x          x    x   x      x   x
|    |   |      |              |    |   |      |   |
m    ɪ   s      t              m    ɪ   s      t   ə
|    |   |      |              |    |   |      |   |
|U|  |I| |H|    |ʔ|            |U|  |I| |H|    |ʔ|  |A|
|L|      |A|    |H|            |L|      |A|    |H|
               |A|                            |A|
```

Lastly, one implication of allowing some constituents to be empty, is that other constituents might be empty as well. I return to this in section 5.1.

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[13] In what follows, I focus only on the melodic structure of the relevant sounds.
[14] It should be noted that the neutral vowel in English is [ɨ] rather than [ə] (Backley 2011: 50).

# 3. 'Laryngeal realism'

In this chapter I examine the phonological status of stops and fricatives in the 'laryngeal realism' approach. This approach is used to establish which laryngeal specification, [voice]/|L| or [spread glottis]/|H|, is 'active' in the phonology of the two-way laryngeal systems of Germanic. Since 'laryngeal realism' has primarily focussed on stops, I discuss stops in this framework first. Following this examination, I discuss fricatives to see to what extend this approach applies to fricatives as well. Finally, I discuss sibilant fricatives in some detail.

## 3.1 Stops

There are six possible basic laryngeal contrasts in stops (e.g. Iverson & Salmons 1995: 384; Honeybone 2005: 324; Kehrein 2002: 77; Golston & Kehrein 2004: 6): voiceless, voiced, aspirated, voiced aspirated, voiceless glottalized (usually ejective) and voiced glottalized (usually implosive). Languages vary in the extent that they utilize this contrast. In the traditional view this is seen as a contrast between segments with [+voice] or [voice] and [-voice] or no specification for voice. However, it was observed by many scholars (e.g. Iverson & Samsons 1995; Honeybone 2005; Helgason & Ringen 2008; Backley 2011; Beckman et al. 2011; Beckman et al. 2013; Nicolae & Nevins 2016) that in languages with a two-way laryngeal system some languages make a distinction between voiced and voiceless stops whereas other languages make a distinction between voiced unaspirated and voiceless aspirated stops. Therefore, some languages use the feature [spread glottis] or |H| for the laryngeal contrast of stops, whereas other languages contrast stops with the feature [voice] or |L|. Arguments in favour of this new view include impossible sound changes in a [voice] analysis, no assimilation of [voice] in H-languages and a difficult analysis for processes such as lack of aspiration in sC-clusters and sonorant devoicing (cf. Beckman et al. 2013: 266-269 for a discussion). Whenever an obstruent in H-languages gets voiced it is seen as passive voicing, which occurs because neighbouring segments are (inherently) voiced and which does not add melodic material to the obstruent. This new view was coined as 'laryngeal realism' by Honeybone (2005) to denote a more realistic image of laryngeal contrast. The phonological representations can be read off from the phonetic signal directly as Voice Onset Time (henceforth VOT), which shows three distinct phonetic categories: stops with a voicing lead (fully voiced stops in L-languages), stops which are neutral (voiced stops in H-languages and voiceless stops in L-languages) and stops with a voicing lag (aspirated stops in H-languages). Languages with larger laryngeal contrasts may make use of both elements and may be even combine them. Therefore, they cannot be classified as either L- or H-languages and should rather be named as mixed languages. An

overview of the possible contrasts has already been described in (3), but is rewritten in elemental terms here in (19). Languages which do not contrast stops are excluded.

(19)

| Language | Contrast | Neutral | Voiced | Aspirated | Voiced aspirated |
|----------|----------|---------|--------|-----------|------------------|
| Spanish | two-way | \| \| | \|<u>L</u>\| | | |
| Icelandic | two-way | \| \| | | \|<u>H</u>\| | |
| Thai | three-way | \| \| | \|<u>L</u>\| | \|<u>H</u>\| | |
| Nepali | four-way | \| \| | \|<u>L</u>\| | \|<u>H</u>\| | \|<u>L</u> H\| |

Although 'laryngeal realism' has gained ground throughout the last few decades and may even have become a mainstream approach, some questions have been raised. Three main issues regarding markedness, the use of both |H|&|L| and the need of |L| are discussed below.

One of these issues is that the unmarked stop has to be the plain stop and that the marked stop has to be the aspirated stop. Vaux & Samuels (2005) found that the reverse might also be the case. They observe that aspirated stops can occur in positions of neutralization in a large number of languages and give a sampling of twenty-four languages, such as German and Danish (cf. Vaux & Samuels 2005: 418-419 for references). Furthermore, they observe that aspirates might be easier to produce and that children in language acquisition sometimes more easily acquire aspirated or pre-voiced stops than voiceless stops. This is a critique on the use of VOT specifically, as there may be other phonetic cues that are important too. Icelandic, for instance, has a contrast between voiceless stops and voiceless aspirates, completely lacking neutral voiced stops like English. An interesting observation that perhaps ties in to this is the observation of Beckman et al. (2011) that some H-languages have passive voicing of neutral stops such as in English or German, whereas other languages such as Icelandic do not.[15] At some level prior to phonetics, they give a numerical specification for stops with [spread glottis] (on a scale of one to nine), where a large number stands for specification for the feature and a smaller number for no specification of the feature based on the glottal opening. German aspirated stops, like Icelandic stops, have a specification of [9 spread glottis]. German voiceless stops are specified for [1 spread glottis] and thus passive voicing is possible. In Icelandic, the weaker stops are specified for a larger glottal width, e.g. [5 spread glottis]. Since passive voicing can never apply to stops with too high of a value for [spread glottis], the weaker stops in Icelandic do not get voiced. A similar analysis could be made in ET by stating that voiceless segments in German are specified as |H| and thus could lose |H| and weaken intervocalically, whereas Icelandic voiceless stops are not specified as |H|, but as | |, and thus cannot weaken. Intervocalic voicing is thus seen as weakening,

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[15] It should be pointed out here that German has traditionally be seen as an L-language (e.g. Wiese 1996), but another view (that is not necessarily new), represented by e.g. Iverson & Salmons 1995, Honeybone 2005 and Beckman et al. 2009, has in my opinion convincingly argued that German is an H-language instead.

because there is a loss of melodic structure. Nevertheless, marking of stops need not be a problem in the current framework. Many of the cases of positions of neutralization describe final positions, which might just as well be onset positions based on the claims in section 2.3. Furthermore, the arguments of acquisition and production do not deal with markedness, since markedness here has to do with elemental complexity. Therefore, these problems are not markedness problems in the current analysis.

Another issue is that voicelessness sometimes appears to be active in L-languages. Dutch is traditionally seen as an L-language, perhaps due to extensive contact with Romance languages (cf. Iverson & Salmons 2003: 20-22). Dutch stops behave as L-segments because they undergo regressive voice assimilation, which is typical of L-languages, while at the same time fricatives do not. They devoice progressively instead (van Oostendorp 2007), which might hint at |H| being 'active' in the phonology. An opposite distinction, namely that voicing can also be active in H-languages, can be seen in Swedish. Swedish is traditionally seen as an H-language, but it might contrast |L| and |H| in stops, whereas there is no stop which has neither element in its representation (cf. Helgason & Ringen 2008 for phonetic evidence, Beckman et al. 2011 for phonological evidence). However, while Swedish does have [spread glottis] assimilation there appears to be no assimilation of [voice], as Riad (2014: 102) notes. Ringen & van Dommelen (2013), who did a phonetic study on the Norwegian Trøndelag dialect, concluded that the stops in this variety are specified either for [voice] or for [spread glottis] as well. Schwartz & Arndt (2018: 100-101) argue that stops cannot be binarily specified for laryngeal features, but in ET having both elements does not necessarily mean that a sound has a plus and minus value of the same feature, since both elements encode different acoustic information. These elements are disfavoured to occur together, since they are two opposites of the same fundamental (hence the rarity of voiced aspirated stops), but that does not necessarily mean a language cannot employ both cues separately, which can also be seen in languages with a three-way and a four-way contrast.

Some scholars also argue that voicing may not be an active property even in voicing languages (cf. Cyran 2017 on (some dialects of) Polish) and state that voicing may be a phonetic effect. Even so, Cyran (2017) states that elimination of this category would not be possible in his current model. Schwartz & Arndt (2018), following the Modulation Theory of Speech (Traunmüller 1994), also argue against the existence of a voicing element, since voicing does not constitute a separate moderation. They provide an alternative analysis in the framework of onset prominence where manner is represented as structural hierarchy, but it seems difficult to derive such a hierarchy consistently from the speech signal. Cyran (2017: 500-501) rejects his view because of its focus on phonetics which would superimpose phonetic coding on the phonological representation. Because voiced obstruents are 'active' in phonological processes in L-languages and because they do contrast from voiceless obstruents, whereas there is no contrast in sonorants (except for some voiceless consonants, to which

I return in section 3.2 and 4.1), it seems to me that they can constitute a modulation in the speech signal.

Although some valid issues have been raised about 'laryngeal realism', it seems that its basic tenets can still be upheld. It should be noted that the contrast in two-way laryngeal systems seems to be a bit broader than the bifurcation that is made based purely on VOT, as there are languages like English which have both aspirated and unaspirated stops allophonically next to no neutral stops and languages like Swedish which have both voiced and aspirated stops with no neutral stops at all.

## 3.2 Fricatives

Most of the work in 'laryngeal realism' has dealt with the difference in stops. However, the claims about stops have often been used to make generalizations about the obstruent behaviour of these languages. The behaviour of fricatives has often not been taken into account separately and their phonological status has received comparatively little attention. Fricatives show differences between voiceless and voiced segments as well, suggesting that there is also a laryngeal contrast there. A question that could arise then is whether the same set of subsegmental units is possible in both types of sounds. It is quite clear here that the contrast in fricatives is more limited than in stops. Aspirated fricatives are very rare. Maddieson (1984) only mentions [s$^h$], which is only included in three languages out of the 317 languages mentioned. A more recent survey of aspirated fricatives by Jacques (2011) reveals that there exist maybe a few dozen more aspirated fricatives in languages of the world, but in comparison they are still quite rare. Glottalized fricatives are quite rare as well. There is no contrast between voiced and voiceless fricatives in the glottalized series. In Maddieson (1984: 109), only ten languages out of the 317 have ejective fricatives. Maddieson (1984: 111) mentions that the only glottalic ingressive segments reported are stops. It is quite possible that implosive fricatives do not occur in languages of the world because they are impossible to produce. Another notable difference is that fricatives do not allow for a combination of laryngeal contrasts, meaning that something like a breathy-voiced fricative does not exist (Botma 2011: 178).[16] Beside these differences, the general divide between active voicing in some languages and an active |H|-element in the other languages can also be upheld for fricatives. This leaves four possible contrasts available in fricatives: voiceless, voiced and the rarer ejective & aspirated series (cf. Kehrein 2002: 82; Golston & Kehrein 2004: 7-8). This is still a larger contrast than sonorants, since sonorants are not distinctive for voice (Golston & Kehrein 2004: 6-7). The neutral series always has the element |H| as it denotes frication, whereas a neutral

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[16] Jacques (2011: 1521) however, notes one reported instance of a dialect with both aspirated voiceless and aspirated voiced fricatives. This claim requires further analysis and is not further discussed here.

series for stops only contains the element |ʔ|. Although there are some mismatches between the laryngeal behaviour of stops and fricatives, there seems to be sufficient reason to extend the laryngeal specification of 'laryngeal realism' to fricatives as well.

Vaux (1998) argues that voiceless fricatives are specified as [spread glottis] in the unmarked case and that they pattern together with aspirated stops in the languages he examined, suggesting that both have |H̲|. Beckman & Ringen (2009) slightly modify this proposal, arguing that this appears to be the case only in languages where [spread glottis] is active in the phonology. They note that if a language makes use of [spread glottis] in stops, then it also makes use of [spread glottis] in fricatives. These principles are formalized in (20). Although Vaux (1998) refers to the specific characteristic of the fricative as [spread glottis], it can be rewritten as |H̲| in the current ET analysis.

(20) Vaux' Law: a voiceless fricative has the element |H̲|

Vaux' Law (modified): a voiceless fricative has the element |H̲|, if |H̲| is active in the phonology of the language

Vaux & Miller (2011: 687) note that the argument of Beckman & Ringen (2009) is based on the single assumption that |H̲| is spread from a fricative to a neighbouring sonorant. Beckman & Ringen (2009) observe that there is a devoicing of a neighbouring sonorant in H-languages, whereas for the L-languages Russian and Finnish there is no sonorant devoicing at all. Vaux & Miller (2011: 687) note that two languages are hardly proof of a cross-linguistic substance. Furthermore, they state that the modification of Vaux' Law implies that phonetically the vocal fold abduction from a fricative overshoots in a neighbouring sonorant in the same way that a stop does and they therefore question whether this can be used to state that such an overshoot is phonological. Whereas it is difficult to determine whether sonorant devoicing is phonological in most languages, it can be determined in languages which have separate phonemes for voiceless sonorants. I return to his in section 4.1.

For now, I briefly examine the phonetic data of Germanic languages based on the discussion in Beckman & Ringen (2009), who mainly focus on sibilants, but this devoicing can be extended to other fricatives as well. For English, it has often been claimed that there is a partial devoicing of the sonorant following an obstruent, but these claims are often not extended to fricatives, although Backley (2011: 137) does state that sonorant devoicing also applies to fricatives. Beckman & Ringen (2009) show that there is devoicing of the next sonorant in English and also in German. For Norwegian, Kristoffersen (2000) only describes a devoicing of sonorants following /f/ and no other fricatives. This claim is made without acoustic analysis however, as Beckman & Ringen (2009: 6) note, who show devoicing of sonorants of the Norwegian Trøndelag dialect following an /s/. Their findings are corroborated by Ringen & van Dommelen (2013), who conclude that voiceless stops in Norwegian are specified for

[spread glottis]. In a different study, Allen & Salmons (2015: 103-104) show a similar result with sonorant devoicing after /s/ for several Norwegian varieties with a large number of speakers, which might be an indicator that Norwegian fricatives are actually specified for |H̲| in all cases. For Swedish, Beckman & Ringen (2009: 5) observe no devoicing of a sonorant, but they note that Helgason (2002: 138) provides evidence that in Central Standard Swedish /s/ does seem to have [spread glottis], since word-medial and word-final voiceless fricatives devoice the preceding vowel. A possible reason for the varying results could lie in the fact that both |L̲| and |H̲| seem to be active in the phonology of the language. It seems that there is an indication in the speech signal that might warrant a use for a difference in status of the fricatives. For Dutch, Vaux & Miller (2011: 687) mention that devoicing of sonorants is a way to explore the theory of Beckman & Ringen (2009) further. Allen (2016: 206) however, reports variation of sonorant devoicing after both stops and fricatives, which suggests that the devoicing in Dutch s phonetic and indicates that |H̲| might not be phonologically active. I return to Dutch in chapter 7.

Another claim about |H̲| is made by Golston & Kehrein (2004), who state that all laryngeal features are not properties of segments, but rather of the onsets, nuclei and codas that contain these segments, because they occur at most once per constituent and the order is never contrastive. Nevertheless, the order of laryngeal features (e.g. /ʰp/ or /pʰ/) seems to be a phonetic implementation, which could also depend on the syllabic position. This is exemplified by Faroese, which shows aspiration in onsets, but preaspiration in the rhymal adjunct (cf. Árnason 2011). A laryngeal feature only occurs once per constituent since the right edge of the constituent allows for less contrast and because a laryngeal contrast is needed in ET anyway to disambiguate, for example, voiced and voiceless obstruents. Therefore, it appears that |H̲| is rather still part of a segment.

It has been argued that both stops and fricatives have a similar laryngeal specification. Since these two classes are traditionally defined as the whole class of obstruents, it can be stated that obstruents thus have one or more of these elements in their elemental structure. Nasals and laterals can also have a stop-element in their structure if they pattern with stops. Thus, in some languages they are, in a way, more obstruent-like than sounds that lack this element, though these sounds are generally still regarded as sonorants (Botma 2011: 178). Other sounds that are traditionally described as sonorants are the voiceless and breathy-voiced nasals and voiceless laterals. However, sonorants do not have |H| in their elemental structure, as already stated in section 1.4, whereas these voiceless sounds do contain |H| (cf. (14) and (15)). Voiceless nasals usually occur in languages which also have aspirated consonants and also display similar behaviour. Phonetically, there are also reasons to regard these sounds as fricatives, as they have high frequency noise (cf. Ohala & Ohala 1993). Maybe this means that aspirated sonorants, which have fricative-like characteristics, are phonologically actually

fricatives (Botma 2011: 177-178), and are thus not sonorants at all. A similar case could be made for voiceless laterals as well. Backley (2011: 183) notes that voiceless laterals should be considered as obstruents because they have |H| in their elemental structure. He further states that the terms voiceless lateral and lateral fricative are used interchangeably, but that this does not pose a problem as there are no languages with a phonological contrast between those sounds. Backley (2011) does not mention voiceless rhotics, but if other voiceless sonorants have |H|, then it is quite probable that rhotics might too. Since these voiceless sonorants pair with both voiceless stops and voiceless fricatives, it may even be the case that this H-element is headed in voiceless sonorants. The voiceless sonorants are revisited in section 4.1.

### 3.3 Sibilant fricatives

Strident or sibilant fricatives (henceforth called sibilants) are very frequent in languages of the world and often display different phonological behaviour than non-sibilant fricatives.[17] Kim et al. (2015: 184-188) investigated stridency and gave an articulatory, a perceptual and an acoustic definition of sibilants. They are shown in (21) (the perceptual definition is interpreted from the context).

(21) Articulatory: Strident consonants are produced by directing a rapid airstream against the incisors. Non-strident sounds are produced without this obstacle.

Perceptual: Strident consonants can be distinguished from non-strident sounds by listeners because of inherent spectral cues.

Acoustic: Strident consonants are characterized by a strong noise component over a broad range of higher frequencies. Non-strident sounds lack this high-frequency component.

Kim et al. (2015: 188, 191) note that some writers assume that some features like [strident] are best defined in acoustic or auditory terms. This is compatible with ET, as the acoustical pattern of elements is the most important cue, because of its availability to both the speaker and the listener. They also note that it has traditionally been used as an enhancing feature, meaning that a contrast between /s/ and /t/ is a more robust one than a contrast between /θ/ and /t/. This robustness is also observed by Goad (2011: 898), who notes that sibilants are perceptually salient even in non-optimal contexts, such as in sC-clusters.

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[17] As already noted in section 1.1, while sibilant fricatives are frequent, sibilant affricates, which are treated as stops by ET, occur not as frequently as plain stops.

The following fricatives are regarded as sibilants: the (denti-)alveolars [s z], the retroflexes [ʂ ʐ], the palatals [ʃ ʒ] and the alveolopalatals [ɕ ʑ], which are all coronal. The only other coronal fricatives are the (inter)dentals [θ ð], which are rare cross-linguistically and acoustically not as salient as sibilant coronal fricatives (cf. Kim et al. 2015). In ET, coronals have either an |A|-element, an |I|-element, or both, but crucially they lack |U|. This means that they always have a different place element than the labial fricatives [ɸ β f v] and the dorsal fricatives [ç ʝ x ɣ χ ʁ]. Although the palatal stops are considered to be coronal, there is controversy regarding the palatal fricatives [ç ʝ] (Hall 2011: 267). Hall (1997: 15-21) argues that palatal fricatives phonologically pattern as non-coronal. Backley (2011: 101-104) argues that not only palatal fricatives, but also palatal stops are more aptly described as palatovelars or front velars, since they sometimes pattern with velars, whereas palatals do not. In German for instance, there is a complementary distribution where [ç] is preceded by |I|-vowels, whereas [x] and [χ] are preceded by other vowels (cf. Wiese 1996: 209-218 for a detailed analysis). Kim et al. (2015: 182) state that the palatal fricative [ç] is universally regarded as non-strident. Given the fact that it also patterns with velars, this makes sense, as it then also has |U| in its elemental structure, whereas sibilants never have |U| in their structure, because they are coronal. It is important to note that sibilants do form a natural class, as can for instance be seen in English plural formation, where there is an intervening vowel after sibilants (e.g. *kisses* [kʰɪsɨz] or *dishes* [dɪʃɨz]), but not after other sounds, including non-sibilant fricatives (e.g. *cats* [kʰæts], *gills* [gɪlz], *mouths* [maʊðz] or *caves* [kʰeɪvz]).

An issue that might arise, is why sibilant fricatives are special, whereas coronal is assumed to be the least marked place of articulation by many scholars, which means that these sounds are more prone to processes as deletion, assimilation and neutralization, as noted by Hall (2011: 285). He also concludes that the unmarked status of coronals only refers to the stops and nasals and that it is unclear whether coronals at other manners, such as fricatives, also have a special status, because processes such as place neutralization to coronal generally have stops or nasals as output, but not fricatives. However, given the fact that sibilant fricatives do sometimes behave differently phonologically, it seems that they might have a special status, although not in the same way as coronals at other manners. How should sibilants then be distinguished from non-sibilants?

One attempt to distinguish sibilants from non-sibilants has been undertaken by Smith (2000: 248-251), who proposes that non-sibilant fricatives should be regarded as stops modified by a fricative aspect, because they have the same (or fewer) places of articulation as stops. In his view, non-sibilants are more complex than sibilants, but the observation that these sounds are both less frequent than sibilants and possibly not always obstruents but rather sonorants (cf. chapter 6), rather contradicts such a claim.

Let us see how an ET approach would fare here. First, the use of headedness for fricatives is examined as possibility to describe the differences. This has been explored already by Harris & Lindsey (1995: 33), who use the element [h] for noise or aperiodic energy. Because of a greater noisiness strident fricatives should be headed and non-strident fricatives should have non-headed [h].[18] It should also be noted that it has been pointed out (e.g. Casserly 2012: 59) that in many Germanic languages [s] seems to 'share' its laryngeal feature with another consonant, suggesting that only [s] has the same laryngeal feature , i.e. |H|. This seems feasible, but it seems very difficult to make such as distinction in the recent frameworks of ET. A big problem would be that voiceless non-sibilant fricatives and voiced non-sibilant fricatives would need another phonological contrast in such an analysis, as headedness is now used to contrast voiced and voiceless fricatives in H-languages. An accompanying issue, which seems even more problematic, is that sibilant fricatives generally also pair with (voiceless) non-sibilant fricatives in phonological processes targeting fricatives. Furthermore, there may even be variation within sibilants, as in English only /s/ can be the sibilant in sC-clusters, whereas in plural formation all sibilants behave uniformly. The use of an extra manner element does not seem feasible at all, since sibilants mainly seem to have a strong high noise component, which is already captured by |H|. It need not be problematic in languages with only voiceless fricatives, but on structural grounds this does not seem to be very likely.

Another idea that could be called upon, is the use of an additional element or different elements in the elemental structure. Árnason (2014: 112, 125) proposes that sibilants have a dense spectral profile compared to non-sibilants, which can be captured by a mixture of resonance elements in Icelandic, which only has /s/, and Faroese, which has /s ʂ ʃ/ (|I A| for /s/, |I A| for /ʂ/ and |I A| for /ʃ/). In this sense sibilants would be more marked, because they have a greater complexity compared to non-sibilants. A similar proposal to add melodic material to sibilants is put forward by Baroni (2014: 16). He makes use of a smaller framework of only four elements, but nonetheless proposes that the sibilants, unlike other fricatives and stops, are made up of two melodic elements which are similar to the elements used here. These claims are interesting, but it is unclear why this would not work with other fricatives with multiple resonance elements. Maybe the combination of both |I| and |A| provides a perceivable acoustic cue, because both elements have high formants (F1 for |I| and F2 for |A|), whereas |U| has low energy in the first three formants. Non-sibilant fricatives with two resonance elements are rather infrequent (cf. Maddieson 1984) if the labiodental fricatives contain just |U| in languages that do not contrast labial and bilabial fricatives. Nevertheless, these suggestions are worth investigating and they are therefore explored in more detail in chapter 5.

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[18] They also included the labiodental [f] and the uvular [χ] as sibilant fricatives, but even if those sounds would be disregarded as being non-sibilant sounds, their analysis remains the same.

# Part II: Phonological processes

# 4. The phonological behaviour of |H̲|

It has been observed by several scholars (e.g. Iverson & Salmons 1995; Ringen 1999) that voiceless stops in Germanic languages are not always aspirated in onsets, because of a preceding voiceless segment. Iverson & Salmons (1995) note that there is no aspiration of plosives when they are preceded by an /s/ in English. This may have to do with the fact that the feature [spread glottis] is either shared between the /s/ and the plosive or the plosive and the aspiration, but not with both, rendering English /sp/ and /p$^h$/ grammatical, but */sp$^h$/ ungrammatical. This principle is called Avery & Idsardi's Law by Hermans & van Oostendorp (2011: 169-173), following a proposal made in Avery & Idsardi (2001). A similar proposal which states that [spread glottis] must be linked to more than one consonant, was put forward by Ringen (1999: 140) as Multi link or Multiple Link[sg] for Icelandic, since there is either aspiration of a stop or devoicing of a sonorant before a stop, but not both (cf. section 4.1). Van Oostendorp (2007: 90) rephrased Multilink to denote that [spread glottis] has to be linked to two positions. This is formalized and rewritten in terms of elements in (22). Following van Oostendorp, I refer to this as Multilink.

(22) Multilink: |H̲| must occupy two positions in the segmental structure

This is an interesting interpretation, but it is not entirely clear why /sp/ is allowed and */sp$^h$/ is not allowed in English, since both clusters consist of two positions. The different representations in English could be made by a distinction in headedness in ET, but in Icelandic a stop would not be specified for |H| if it is not aspirated (cf. (3)). I review (22) in 4.1 below, in Icelandic and Faroese. Because the data in Icelandic and Faroese are somewhat complicated, I first outline the distribution of obstruents and voiceless sonorants to make the following analyses clearer. Assimilation processes involving voiceless obstruents are discussed in 4.2. I return to sibilant-stop clusters in chapter 5.

## 4.1 Icelandic and Faroese

### 4.1.1 A brief overview of Icelandic and Faroese

The distribution of obstruents in Icelandic and Faroese is by and large the same, so I focus on Icelandic in this section; Faroese examples are supplied when there is a distributional difference between the languages. The rhymal adjunct position is reviewed in more detail in the upcoming sections. Árnason (2011: 162) proposes that aspirated stops, voiceless fricatives and voiceless sonorants contain |H|[19],

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[19] In the elemental notation of Árnason (2011) voiceless consonants have |H|, whereas |h| is used for frication. Nevertheless, the analysis for the spreading remains the same.

which is absent in unaspirated stops, voiced fricatives and sonorants. In Icelandic, these categories of sounds have a parallel distribution initially, as can be seen in (23) (cf. Árnason 2011: 162). Furthermore, it should be noted that both languages have initial stress.

(23) No |H|                          |H|

  *dala* /taːla/ 'valley'              *tala* /tʰaːla/ 'to talk'

  *vara* /vaːra/ 'to warn'             *fara* /faːra/ 'to go'

  *nota* /nɔːta/ 'to use'              *hnota* /n̥ɔːta/ 'nut'

  *rota* /rɔːta/ 'to knock out'        *hrota* /r̥ɔːta/ 'snoring'

  *laða* /laːða/ 'to entice'           *hlaða* /l̥aːða/ 'to load'

Faroese has a similar distribution, except for the fact that voiceless sonorants do not occur word-initially. These sounds have either lost their voicelessness or a stop has developed in front of the sonorant as can be seen in (24) (cf. Árnason 2011: 124).

(24) Icelandic                        Faroese

  *hrópa* [r̥ouːpa] 'to shout'          *rópa* [rɔuːpa] 'to shout'

  *hneppa* [n̥ɛhpa] 'to button'         *kneppa* [kʰnɛʰpa] 'to button'

Both languages have 'hard' and 'soft' varieties which show differences in non-initial positions and which correspond with northern and southern dialects in Icelandic. Whereas aspiration can be found in non-initial onsets in the 'hard' varieties in Icelandic, it is only found initially in the 'soft' varieties, which instead have voiceless stops before a vowel, word-finally, i.e. as onset of an empty-headed syllable, and before /j v r/ as can be seen in (25) (Botma 2001: 24).

| (25) example | hard varieties | soft varieties | translation |
|---|---|---|---|
| *dýpi* | [tɪːpʰɪ] | [tɪːpɪ] | 'depth' |
| *sök* | [søːkʰ] | [søːk] | 'fault' |
| *nepja* | [nɛːpʰja] | [nɛːpja] | 'cold weather' |
| *vökva* | [vøːkʰva] | [vøːkva] | 'to water' |
| *depra* | [tɛːpʰra] | [tɛːpra] | 'sadness' |

The Faroese data are more complicated, but here it appears that 'hard' varieties generally have preaspiration in medial position and voiceless stops in the 'soft' varieties (Árnason 2011: 119-120). This shows a similar picture to the distribution in Icelandic.

In the 'soft' varieties there are voiced fricatives in Icelandic in medial position, which, as stated earlier, might rather be viewed as approximants. Voiceless fricatives, like aspirated stops, are not allowed in medial position, although there are some exceptions, which I return to in chapter 6. This can be seen in (26) (cf. Árnason 2011: 167). Faroese has virtually no intervocalic fricatives, since these developed into glides.[20] ET assumes that they can be analysed similarly, as both approximants and glides lack manner elements. I return to their phonological status in chapter 6.

(26) <u>voiced 'fricatives' or approximants</u>

    *sofa* [soɔːva] 'to sleep', but *[soɔːfa] is ill-formed

    *taða* [tʰaːða] 'hay', but *[tʰaːθa] is ill-formed

    *saga* [saːɣa] 'story', but *[saːxa] is ill-formed[21]

### 4.1.2 Sonorant devoicing

In most languages it is difficult to establish whether sonorant devoicing has taken place, as voiceless sonorants are generally not separate phonemes (cf. section 3.2). Icelandic and Faroese however, have separate phonemes for voiced and voiceless sonorants, which can be used to distinguish words and thus form minimal pairs (cf. (23)). In Icelandic, there is devoicing of a sonorant preceding a voiceless stop in the 'soft' varieties instead of aspiration of that voiceless stop (cf. (25)). In addition to this, Thráinsson (1994: 151) states that /r/ is devoiced before /s/, but unfortunately he only provides one example of this. This is also assumed by Árnason (2011: 166), but it is not mentioned explicitly in his analyses about sonorant devoicing. Examples of sonorant devoicing are given in (27), with sonorant devoicing before /s/ in (27a) and sonorant devoicing before a stop in (27b).

| (27) | <u>devoicing</u> | | <u>no devoicing</u> |
|------|------------------|---|---------------------|
| a. | *far* [far̥s] 'fare (gen.)' | | *far* [faːr] 'fare (nom.)' |
| b. | *fúlt* [ful̥t] 'sour (neut.)' | | *fúl* [fuːl] 'sour (fem.)' |
| | *fimt* [fɪm̥t] 'nimble (neut.)' | | *fim* [fɪːm] 'nimble (fem.)' |
| | *fínt* [fɪn̥t] 'fine (neut.)' | | *fín* [fɪːn] 'fine (fem.)' |

In Faroese, devoicing occurs in more environments, since it happens in both hard and soft varieties and also consistently before /s/ (Árnason 2011: 120), although there can be alternations, as

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[20] The U-glide can vary phonetically between [w], [ʊ] and [v].
[21] It should be noted that [x] also does not occur initially, except in dialectal forms which can also have a labialized [x] such as *hvalur* [xaːlvr̥]/ [xʷaːlvr̥] (Árnason 2011: 107).

in the word *dansa* [tantsa] / [taṇsa] 'to dance', where an intrusive stop seems to block devoicing.[22] Furthermore, this devoicing appears to be regular when the sounds /g m n ŋ l r v/ precede a voiceless stop, an /s/ and marginally an /f/ as Barnes & Weyhe (1994: 194) observe. Árnason (2011: 120) mentions a point noted by Weyhe (p.c.) that there is a dialectal difference in Faroese, in that some varieties do not have voiceless sonorants before /s/, just like in the 'hard' varieties of Icelandic, as can be seen in (28).

(28) devoicing in Faroese          no devoicing in some Faroese varieties

    *hálsur* [haḷsʊɹ] 'neck'          [hɔls]

    *klamsa* [kʰlaṃsa] 'to smack'          [klamsa]

    *dansa* [tantsa]/[taṇsa] 'to dance'          [tansa]

    *havs* [hafs] 'sea (gen.)'          [haʊs]

It should be noted that all these instances of devoicing are regressive. Árnason (2011) does not mention onset clusters of obstruents followed by voiceless sonorants anywhere.[23] The devoicing of final sonorants in Icelandic seems to be a different phenomenon, as all voiced consonants are devoiced before a pause. It does not happen consistently, however (Árnason 2011: 237).

A separate analysis for sonorant devoicing for fricatives has to my knowledge not been undertaken. It is briefly mentioned by Casserly (2012: 59), who notes that devoicing of sonorants before /s/ in Faroese might be the result of the spreading of a feature like [spread], although the voiceless fricatives would require a different feature than aspirated stops, because they are phonetically distinct. Nevertheless, it is the same process phonologically, as |H| spreads regressively to a preceding segment, which in turn devoices it.

It is challenging to come up with a uniform analysis for sonorant devoicing, as the data are not consistent, since the amount of devoicing often depends on the dialect. Furthermore, /r/ seems to devoice in more environments than other sonorants in Icelandic, since it devoices before both stops and fricatives. In addition, devoicing takes place just before sibilants (and stops) in Faroese, although Barnes & Weyhe (1994: 194) note that it also marginally happens before /f/, but unfortunately they do not give examples. Golston & Kehrein (204: 17) mention that voiceless fricatives pattern as [spread] in Faroese, but also in Icelandic, because of sonorant devoicing, which indicates that one specification

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[22] This is not entirely clear to me however, as Árnason (2011: 297) also gives a possible intrusion in *ansa ettir* 'to take care of, look after' as [aṇtsa], with both an intrusive stop and a voiceless nasal.

[23] Historically however, the initial voiceless sonorants in Icelandic arose from a combination of an initial glottal fricative followed by a sonorant, as can still be seen from the spelling in (23) and (24), which suggests that a progressive spread of voicelessness has been and has become phonological at some point in the history of these languages before the fricative disappeared.

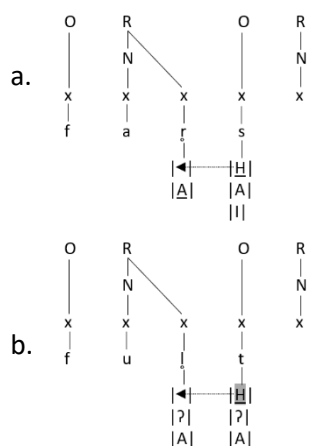for all voiceless fricatives might the right categorization after all. If this is the case, it would mean that devoicing as in (27) and (28) can be explained uniformly. I give two representative examples in Faroese in (29) below: devoicing of *havs* [hafs] 'sea (gen.)' and *dansa* [taṇsa] 'to dance'.

(29) representations of Faroese devoicing

```
        O   R          O   R
            N              N
            |\             |
    a.  x   x   x      x   x
        |   |   |      |   |
        h   a   f      s
                    |◄───┤H|
                    |U|  |A|
                         |I|

        O   R          O   R
            N              N
            |\             |
    b.  x   x   x      x   x
        |   |   |      |   |
        t   a   ṇ      s   a
                    |◄──┤H|
                    |A|  |A|
                    |L|  |I|
                    |?|
```
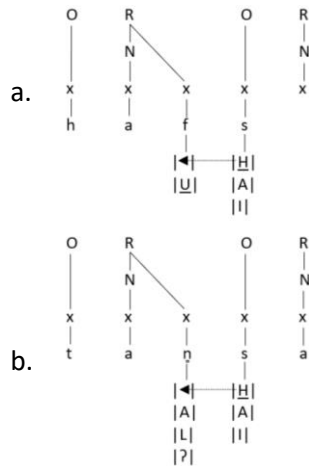
Although there is quite a bit of variation in sonorant devoicing in Icelandic and Faroese, it seems the most economical to assume that voiceless segments, including the voiceless sonorants, contain |H|. Not only does this explain why sonorants devoice, but it also gives a reason for the limited distributional occurrence of voiceless sonorants, especially in Faroese, since they arise by regressive spreading of |H|.[24] Multilink is more problematical for stops however. Since the stop is no longer aspirated, it loses its |H|.[25] This is exemplified in (30) with the devoicing of Icelandic *far* [faṛs] 'fare (gen.)' and *fúlt* [fuḷt] 'sour (neut.)', but this also holds for stops in Faroese.

(30) representations of Icelandic devoicing

```
        O   R          O   R
            N              N
            |\             |
    a.  x   x   x      x   x
        |   |   |      |   |
        f   a   ṛ      s
                    |◄┄┄┤H|
                    |A|  |A|
                         |I|

        O   R          O   R
            N              N
            |\             |
    b.  x   x   x      x   x
        |   |   |      |   |
        f   u   ḷ      t
                    |◄┄┤H̶|
                    |?|  |?|
                    |A|  |A|
```

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[24] Cf. footnote 23 for the reason why initial sonorants have become voiceless. Ohala & Ohala (1993: 233) note that they know of no mainstream approach in phonology which can make a [+sonorant] sound [-sonorant] by adding [-voice]. This is no problem in ET, as a sonorant is not established as formal category. In ET, the only common denominator of a sonorant is the lack of |H| (cf. footnote 4) and by spread of |H| to this sonorant, it becomes voiceless. Since it acquired |H| however, it can no longer be seen as sonorant. It seems that, given the analyses in this section, such a sonorant is best regarded as fricative.

[25] The loss of an element is indicated by shading the element (cf. Backley 2011).

### 4.1.3 Preaspiration

There are other indications for Multilink (cf. (22)) in Icelandic and Faroese. One of these is preaspiration, which is a parallel process to sonorant devoicing (Golston & Kehrein 2004: 17). Although preaspiration is uncommon in languages of the world, it occurs frequently in Scandinavian languages, such as Faroese and Icelandic. Preaspiration does not occur word-initially in these languages. There is preaspiration of stop-sonorant clusters, but not of fricative-sonorant clusters. Preaspiration of geminate stops is a more contentious issue; the main view is that a geminate aspirated stop is realized as preaspirated as a result of fission (e.g. /p$^h$/ -> [hp]). Other ideas, such as an insertion of [h] or devoicing of the vowel seem less likely, for instance because two rules are needed for the former suggestion (insertion of [h] and shortening of the geminate stop) and because there are no good arguments for devoicing of the vowel (cf. Thráinsson 1978 for a discussion). In all Icelandic varieties preaspirated stops occur in medial position in the case of geminate fortis stops or with clusters of aspirated stops followed by /l n m/.[26] Some examples are given in (31) (cf. Árnason 2011: 221).

(31) <u>with preaspiration</u>     <u>without preaspiration</u>

  h*attur* [hahtʏ̥r] 'hat'     h*addur* [hatːʏ̥r] 'hair'

  *epla* [ɛhpla] 'apple (gen. pl.)'   *efla* [ɛpla] 'to strengthen'

  *sakna* [sahkna] 'to miss'    *sagna* [sakna] 'story (gen. pl.)'

There is some difference in the status of preaspiration between Icelandic and Faroese. In Icelandic, preaspiration is seen as a full segment, for instance because of stress patterns, as a stressed syllable never contains a short vowel (e.g. *hatar* [haːtar̥] 'hates' is grammatical, but *[hatar̥] is not). Similarly, preaspiration never occurs with a long vowel (e.g. *[haːhtar̥] is also ungrammatical) (Árnason 2011: 230-231). In Faroese, preaspiration is syllabified with the accompanying stop and thus seen as a feature of the stop. Faroese is therefore omitted from the upcoming comparison.

  Árnason (2011: 225) mentions that preaspiration in Icelandic cannot occur without a stop being present, as can be seen in (32) (adapted from Árnason 2011: 225), although he does mention that preaspiration can occur before other segments in Finnish.

(32) Variant forms of morphologically complex forms related to *vatn* [vahtn] 'water'

  *vatns* [vahtns]/[vasː] 'water (gen.sg.)', but *[vahs] is ill-formed

  *vatnslaus* [vahtnsløys]/[vasløys] 'without water, waterless', but *[vahsløys] is ill-formed

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[26] This also occurs in word-final position, which is also seen as medial position here, as the final consonant is seen as the onset of an empty-headed syllable.

If the aspiration has become independent from its original geminate aspirated stop, a similar analysis can be made for the sonorant devoicing, but it would run into similar problems as (31). The geminated stop and the stop followed by /l n m/ could be described as an identical context if these sonorants pattern with stops and thus contain |ʔ|. This was formulated by Gussmann (1999: 178-179) as the dislodge H principle, which can be seen in (33).

(33) Dislodge H principle: dislodge H onto the preceding rhymal complement if combined with doubly attached ʔ

This is a very feasible suggestion, but it needs some adaptation to the current framework of ET. |ʔ| is linked to segments and not to x-positions, just like |H| is part of individual segments rather than the syllabic structure. This is exemplified in (34) for þakka [θahka] 'to thank' and sakna [sahkna] 'to miss'.

(34) representations of Icelandic preaspiration[27]
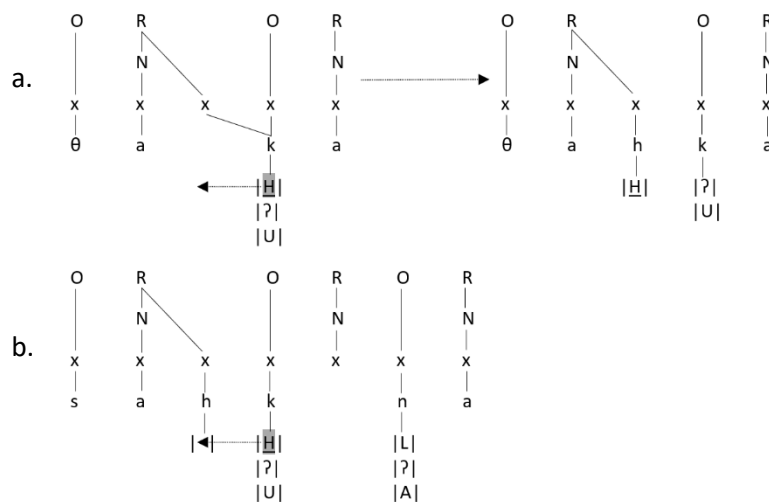


If this context is to be paralleled to sonorant devoicing (cf. (30b)), it seems that a single |ʔ| is already enough to dislodge |H| to the rhymal adjunct. However, there is no preaspiration when an intervocalic fortis consonant is followed by [j v r], which are branching onsets. This once more suggests that |ʔ| is part of individual segments and not of the entire onset. Nevertheless, it still indicates that |H| and |ʔ| appear to be undesirable together (Gussmann 1999: 179; Botma 2001; Czarnecki 2013: 69). This does not rule out co-occurrence all together, since Árnason (2011: 113, 227) notes that voiceless laterals contain both. He tentatively suggests that voiceless laterals are fricatives. Since voiceless nasals have already been described as fricatives (cf. also Ohala & Ohala 1993 for phonetic evidence), It makes sense to extend the categorization of voiceless nasals to voiceless laterals too.[28]

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[27] Gussmann (1999) claims that consonants in sequences like /kn/ are in fact two separate onsets with an intermediate silent nucleus and with |ʔ| linked to both onsets, which he calls an interonset. Since a nasal contains the same amount of elements as stops, it seems reasonable to assume it is the first member of a separate onset.
[28] Árnason (2011: 112, 126) does not include a stop element in the elemental representation of (voiceless) nasals, but since (voiceless) nasals pattern like (voiceless) laterals, these sounds should contain a stop element too.

More importantly however, it seems that |H̲| is also spread to the rhymal adjunct, but is not deleted from the onset when sonorant devoicing takes place in front of a fricative. The spreading scenario in (34) looks very reminiscent of sonorant devoicing in (29) and (30) and it also provides some evidence that the glottal fricative [h] patterns as a voiceless fricative. A somewhat modified rule to (33) could be summarized as the H-prominence principle in (35), which is complemented by the Delink |H̲| principle in (36).

(35) H-prominence principle: |H̲| prefers to be in the rhymal adjunct of a stressed syllable; it spreads from an onset to this rhymal adjunct if that adjunct does not already contain |H̲|

(36) Delink |H̲| principle: delink |H̲| from the onset if all segments of the onset have |ʔ|

These principles also hold for preaspiration as a result of fission in geminates (cf. (34a)), in which case the onset loses its |H̲|. One implication of these principles is that the rhymal adjunct of a stressed syllable becomes a strong position, since |H̲| only occurs in strong positions, i.e. the onset of stressed syllables, but also the rhymal adjunct of stressed syllables. This prominence of |H̲| is readdressed in section 5.1.

### 4.1.4   Other related processes

Another process with similar conditions to sonorant devoicing and preaspiration is spirantization of stops before other stops and /s/ in the rhymal adjunct position. This occurs in Icelandic only, as Faroese still has stops in rhymal position (e.g. *vaksa* [vaksa] 'to grow'). This spirantization causes alternating forms, which can be seen in (37) (cf. Árnason 2011: 226).

(37) <u>no spirantization in onsets</u>          <u>spirantization in the rhymal adjunct</u>

    *djúpur* [tjuːpʏ̥r] 'deep'          *dýpka* [tifka] 'to make deeper'

    *skip* [scɪːp] 'ship'          *skips* [scɪːps]/[scɪfs] 'ship (gen.)'

    *ryk* [rɪːk] 'dust'          *ryksuga* [rɪːksʏɣa]/ [rɪxsʏɣa] 'vacuum cleaner'

This spirantization is sometimes not fully carried out before /s/. This also means that the stop is not in the rhymal adjunct, which is indicated by the long vowel in [scɪːps] and [rɪːksʏɣa]. The result of this spirantization is a sequence of a voiceless fricative in the rhymal adjunct and a voiceless obstruent in the onset. This sequence is structurally identical to preaspiration, which also has a voiceless (glottal) fricative in the rhymal adjunct followed by a stop in the onset and to sonorant devoicing, which also has a voiceless 'fricative' followed by a stop (and perhaps /s/ if /r/ precedes) in the onset (cf. also Botma 2001 and Botma & Grijzenhout 2018). This parallel can be seen in (38) (cf. Árnason 2011: 226).

(38) <u>preaspiration</u>                              <u>spirantization</u>

   *keppa* [cʰɛhpa] 'to complete'          *keppti* [cɛftɪ] 'completed'

   *hnekkja* [n̥ɛhca] 'to breaḱ'             *hnekkti* [n̥ɛxtɪ] 'broke'

The representation of *keppti* is given below in (39).

(39) representation of Icelandic spirantization
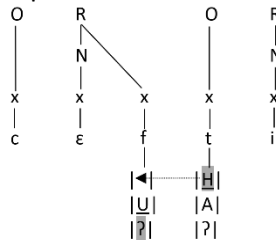


This analysis is again reminiscent of the one in sonorant devoicing and preaspiration. Furthermore, the stop element in the rhymal adjunct is suppressed as well, again suggesting an undesirability of |H| and |ʔ| to co-occur in the same segment.

   sC-clusters also have the same representation as the clusters in spirantization processes. Although the analysis in this section is similar for initial clusters, there are additional things to be said about these clusters and therefore initial sC-clusters are discussed in more detail in section 5.1. For now, it suffices to say that both Icelandic and Faroese have internal sC-clusters as well. I give the representation of Icelandic *hestur* [hestʏr̥] 'horse' in (40), which has a similar representation to Faroese *hestur* [hestʊɹ] 'horse'.

(40) representation of (medial) sC-clusters, exemplified by *hestur*
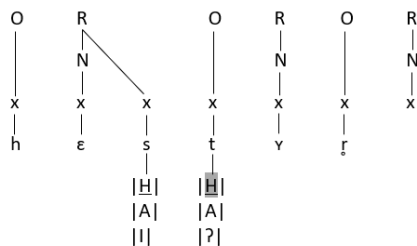


Although there is no spread of |H| here, since an sC-cluster is not a phonological process, the structure of such rhymal-onset clusters is the same as the structure of a medial sonorant-obstruent cluster, a preaspirated stop and a fricative-obstruent cluster.

   For all processes above, there seems to be no case of Multilink (cf. (22)), except for the case when two fricatives form a rhyme-onset cluster, which may then rather be a coincidence. Furthermore, all processes have in common that in all cases the outcome is a fricative in the rhymal position, since voiceless sonorants are also regarded as fricatives. This suggests that the analyses for sonorant devoicing, preaspiration and spirantization towards a spreading of |H| conform the H-prominence

principle (cf. (35)), whereas no spread is necessary for (medial) sC-clusters, since that rhyme already contains |H̲|. It should be noted that this is a not a universal principle, but that it is language-specific; for instance, it is absent in the northern varieties of Icelandic (e.g. *vanta* [vantʰa] 'to need' instead of southern [vant̯a]). I return to this principle in section 5.1. The fact that a regressive spread does not take place with other fricatives is due to the fact that other voiceless fricatives are not allowed in internal onsets (cf. section 4.1.1). Thus, a specification for |H̲| for all fricatives, based on the fact that all sounds in rhyme-onset adjuncts are fricatives, seems very feasible to me.

## 4.2  Obstruent assimilation in H-languages

Another process that involves a spread of |H̲| is described as spread glottis assimilation by Riad (2014: 102), although other terms, such as obstruent assimilation, voice assimilation or devoicing have also been used to describe this process. While the focus in the previous section was put mainly on regressive spreading, there is also progressive spreading of |H̲|. Below I focus on assimilatory processes in English, Swedish and Norwegian. Not all Germanic languages have these kinds of processes, however. In German, the first element of an obstruent cluster is always voiceless, even is the second member is voiced. Dutch has regressive voicing in obstruent-stop clusters, but progressive devoicing in fricative-obstruent clusters. I return to these issues in chapter 7.

English assimilation can be seen in processes as past tense marking and plural formation. I focus on plural formation here, as the plural suffix is a fricative, but the pattern of laryngeal assimilation is essentially the same (cf. Backley 2011: 138). There are three variations of the plural suffix, as can be seen in (41).

(41) a. *cows* [kʰaʊz], *gills* [gɪlz], *mouths* [maʊðz], *caves* [kʰeɪvz], *leaves* [liːvz]

b. *cats* [kʰæts], *safes* [seɪfs]

c. *kisses* [kʰɪsɨz], *dishes* [dɪʃɨz], *mazes* [meɪzɨz]

The default of the plural suffix is a /z/, as can be seen in (41a). (41b) shows that the suffix is /s/ instead if the final sound of the singular is voiceless. If the last sound of the singular is a sibilant, a neutral vowel is inserted between the final consonant and the suffix, as can be seen in (41c), which means that the suffix does not end up voiceless. Therefore, it is clear that the suffix is underlyingly a /z/, since it would turn up as /s/ in (41c) otherwise. This means that |H̲| spreads in (41b) from the final consonant

of the singular to the plural suffix, which in turn means that the |H| of the suffix gets headed because of this spread. Also, the |H̲| in plosives in the singular gets unheaded.[29]

There are also some words with fricative-fricative clusters in which both fricatives are voiced, which can also be seen in some examples in (41a). Iverson & Salmons (1999: 15-16) argue that this is not a synchronic phonological process, but rather a lexical reflex of historical segmental weakening, which is suggested by the spelling and by lexical variation in modern English. However, these fricative-fricative pairs in (41a) are remnants of a voicing process in Old English, in which the voiceless fricatives [f θ s] were voiced to [v ð z] respectively between two vowels (van Gelderen 2006: 51-52). It did not affect medial [x], as that sound had already disappeared from that position (Hogg 1992: 282). Voiced and voiceless fricatives were in complementary distribution in Old English; voiceless fricatives, which were long, only occurred after short vowels (and in non-medial positions), whereas voiced fricatives only occurred after long vowels (Sledd 1958: 253). While this notion has often not been made explicit in the literature, it has been noted that voicing does not take place if the preceding vowel is unstressed (Hogg 1992: 282). The spelling does not show a difference in voicing in fricatives, but consonantal length is indicated by a double consonant and length is marked in (some) vowels, indicated by a macron. Some examples are shown in (42) (Hogg 1992: 282, 288).

(42) Voiced fricative: *hlāfas* 'loaves', *cweðan* 'to say', *rīsan* 'to rise'

   Voiceless fricative: *befaran* 'go round', *asendan* 'send forth', *sċeþþan* 'to injure'

This distribution between vowel length and voicing of fricatives is interesting and also applies to modern-day Dutch and German. I return to this in more detail in chapter 7.

In Swedish, stops either contain [voice] or [spread glottis] (Riad 2014). Riad (2014: 70) mentions that there are indications in assimilatory behaviour which could provide evidence for these features in fricatives too. Some examples are given with verbs, their preterit and their past participle in (43), with a voiced stop in (43a), a voiceless stop in (43b) and an /s/ in (43c) (cf. Riad 2014: 103 & Brown 2016: 417; Riad describes the second form as past participles, whereas Brown calls these supines).

(43) Assimilation of [spread glottis] from/to stops and /s/

   a. *väga* 'to weigh'  /väg-de/  *vä*[gd]*e* (preterit)  agreement

      /väg-t/  *vä*[ʰkt] ~ *vä*[kt] (supine)  regressive assimilation

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[29] Backley (2011: 138, 141) does not make the final stops unheaded. It should be noted that headedness of voiceless stops seems somewhat inconsistent in his analysis, as this final stop remains headed, whereas the medial voiceless stop in a word like *stupid* is unheaded. In Backley's terms the medial [p] gets weakened here to an unheaded stop, because it is foot-internal. It is unclear to me why the same would not apply to the stop in words like *cats* in his analysis. This final stop is also foot-internal, since it is the onset of an empty-headed syllable.

| | | | | |
|---|---|---|---|---|
| b. *köpa* 'to buy'[30] | /köp-de/ | *kö*[ʰp:t]*e* ~ *kö*[p:t]*e* (preterit) | progressive assimilation |
| | /köp-t/ | *kö*[ʰp:t] ~ *kö*[p:t] (supine) | agreement |
| c. *läsa* 'to read' | /läs-de/ | *lä*[st]*e* (preterit) | progressive assimilation |
| | /läs-t/ | *lä*[st] (supine) | agreement |

While the /s/ devoices an obstruent when it precedes it, it does happen across the board. Helgason & Ringen (2007) compared the second clusters of the type (43ab) and compared these to clusters which ended in /s/ in a phonetic study. While the former assimilate quite constantly, the latter remains rather distinct, e.g. *bröts* 'broke (pass.)' /brøt-s/ [brø:ts] and *bröds* 'bread (gen.)' /brød-s/ [brø:ds] are identical. There is no real assimilation inside morphemes, so that the first consonant of an obstruent cluster in a word like *blidka* 'to appease' [blɪd:ka]~[blɪd̥:ka] does not devoice to a voiceless segment (Helgason & Ringen 2007; Riad 2014: 105), although it may be phonetically devoiced. These differences in assimilatory behaviour are an argument as to why Swedish obstruents are either specified for [voice] or [spread glottis], although there is no assimilation of [voice] (Riad 2014: 102, 106). A possible reason for the even more ambiguous behaviour of /s/ might be that Swedish does not have a voiced sibilant. The difference between stops and fricatives indicates that for [spread glottis] progressive assimilation seems slightly more pervasive than regressive assimilation in non-initial clusters. Voiced fricatives pattern even more ambivalently than sibilants. I return to this in chapter 6.

Norwegian is more consistent in its assimilation processes than both English and Swedish. Postvocalically, obstruents are either voiceless or voiced in obstruent clusters, as in e.g. *bygd* [bygd] 'rural community' and *laks* [lɑks] 'salmon'. Further, /f/ only occurs with /t/ as in *saft* [sɑft] 'juice', whereas /ʋ/ only occurs with /d/ as in *hevd* [hɛʋd] 'acquired right'. Such assimilation can also be seen in sonorant devoicing. While the devoicing is partial in liquids, /j/ and /ʋ/ are fully devoiced. However, devoicing is not consistently marked by Kristofferson (2000), which obscures a clear analysis.[31] Norwegian has only voiceless fricatives (cf. (2)), yet there are indications that fricatives are sometimes voiced (Kristoffersen 2000: 74-75). Like Swedish fricatives, I return to this in chapter 6.

At any rate, assimilations provide another clue for the fact that |H̲| is active in the phonology of (most) Germanic languages. Although I view it (and the phonological processes in 4.1) as spreading of |H̲| (and subsequent delinking or at least delinking of its headedness), rather than Multilink (cf. (22)), the analyses of Iverson & Salmons (1995) and Ringen (1999) remain similar, but are now more in line with the current framework of ET, which assumes that |H̲| is not present in Germanic voiceless stops.

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[30] The [⁽ʰ⁾p] is long in the transcriptions of Riad (2014: 103), because the vowel is short, and the rhyme needs two positions. In words with long vowels, the transcription is short (e.g. lö[ʰpt]e ~ lö[pt]e 'to run (pret.)').

[31] As it is also difficult to determine whether sonorant devoicing is phonetic or phonological, it is not analysed further. See also section 3.2 for remarks on sonorant devoicing (in Norwegian).

# 5.  The salience of sibilants

In this chapter I examine sibilants in Germanic languages. First, I investigate initial sC-clusters and why only sibilants can occur in certain positions of the word. Thereafter, I look at metathesis processes regarding sibilants and review if the observations made about initial sC-clusters also provide insights here.

## 5.1   Initial sC-clusters

Initial sC-clusters are interesting clusters phonologically, because they do not always constitute well-formed onsets, since there is no rise in sonority if the element following the sibilant is an obstruent or a fricative (Goad 2011: 902), i.e. the second member of the onset does not contain less elements (cf. the English word *stop*). The H-prominence principle in (35) also needs to be reconsidered here, as the sibilant is not in the rhymal adjunct of a stressed syllable, nor do sibilants in L-languages contain |H̲|. Furthermore, sibilants (usually /s/) can precede two consonants, which means that a/sCC/-sequence cannot be an onset, as an onset is maximally binary branching (cf. section 2.3). Some examples of clusters with three consonants are *strain* and *spleen* in English, *strand* 'beach' and *splinter* 'id.' in Dutch, *strand* 'beach' and *skvätta* 'to splatter' in Swedish and *spjaldur* 'board, plaque' and *skriva* 'to write' in Faroese. Because sibilants pre-occur initial consonant clusters, they cannot be part of the onset.

Another argument why these sC-clusters cannot be onsets can be seen in the phonotactics of British English in the syllabification of initial CjV sequences in (44) (cf. Harris 1994: 61-62).

(44) a. words starting with Cju: *cute*, *tune*, *lucid*

b. words starting with Clu (*Clju): *blue*, *clue*, *tune*

c. words starting with sCju: *stew*, *skew*, (*slew*[32])

In English, onsets are limited to two x-positions, as can be observed from (44a). Therefore, the /j/ is unable to fill the onset position in (44b), as both positions are already filled. This is not the case in (44c), as the /j/ can appear in these words, which once again suggests that /s/ cannot be part of the onset. This is based on the assumption that the /j/ is part of an onset and not of a diphthong /juː/ as is sometimes assumed (cf. Deterding 2004 for a discussion), although /j/ cannot be part of the nucleus, as the nuclear position is already filled with a long [uː]. In addition, the other diphthongs in British English are structurally different, since they are either raising diphthongs ([eɪ], [aɪ], [ɔɪ], [əʊ], [aʊ]) or

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[32] The combination /slj-/ is rare in English. It can still be pronounced as /slj-/ by some speakers according to Kaye (1992: 303).

centring diphthongs ([ɪə], [eə], [ʊə]), so analysing /juː/ as diphthong seems unattractive in this regard too.

A question that is more difficult to answer, is where the /s/ does belong. From previous works (e.g. van der Hulst 1984; Kaye 1992; van de Weijer 1996), Goad (2011) offers several possibilities. One option is that sC-clusters form a complex segment (van de Weijer 1996). There is no conclusive evidence here, but data from Dutch and English show a difference in distribution in sC-clusters versus singletons. An sC-cluster can follow only follow a vowel, whereas other consonants can follow other consonants as well, which is exemplified by *wesp* 'wasp' and *welp* 'lion cub' in Dutch, but no \**welsp*, and by *wasp* and *warp* in English, but no \**warsp* (van der Hulst 1984). The other proposals by Goad (2011: 902-903) can roughly be divided by a position outside of the subsyllabic constituents (e.g. van der Hulst 1984; Botma & Ewen 2009) and the rhymal adjunct of an empty-headed syllable (e.g. Kaye 1992). Although Harris (1994: 62) leaves the question of initial sC-clusters open for debate, he assumes that they are rhyme-onset clusters in medial position. I extend this view to include initial sC-clusters as well, following Kaye (1992) and Goad (2012). The structure is of an initial sC-cluster is given in (45).

(45) The structure of an initial sC-cluster
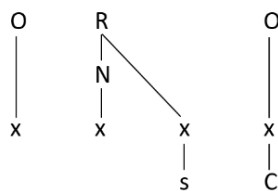


It should be noted that this distribution is language-specific (cf. Botma & Ewen 2009), which can for instance be seen in languages with no codas. Goad (2012: 366-367) mentions Acoma, a Keres language in New Mexico, which has initial and medial sibilant-stop sequences, but no codas. This language still has a laryngeal contrast following sC-sequences (e.g. [ʂkʰúuju] 'giant' and [m̓áaʃtʰu] 'silver fox'). However, English can also have aspiration in sC-clusters in morphologically complex words such as *distaste* [dɪstʰeɪst] (although this need not be the case, as can be seen from other words like *mistake* [mɪsteɪk]). In these cases, /s/ occupies the onset position followed by an empty rhyme, so that |H̲| does not occur in both the rhymal adjunct and the following onset and thus both segments can be specified for |H̲|. This is exemplified in (46). Multilink (cf. (22)) is not applicable here either.

(46) Another structure of an initial sC-cluster in Acoma
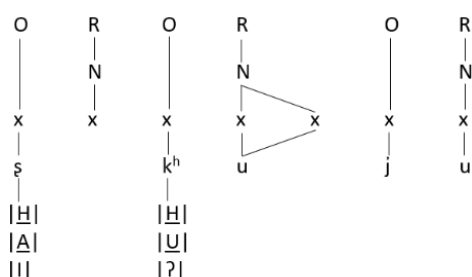
A similar representation also seems feasible for words with s+fricative in English, since there is a laryngeal contrast after [s], as in [*sf*]*ere* and [*sv*]*elte*, although it should be noted that this combination only occurs in loan words (Goad 2012: 347). A similar analysis might also hold for other languages with rare initial sequences of s+fricative. A case in point is Swedish, which has a few words with [sf] (e.g. *sfär 'sphere'*), which is distinct from [sv] (e.g. *svär* 'to swear (imp.)') (Riad 2014: 56, 282-283).

It is more difficult to ascertain whether /sC/ is always a rhyme-onset sequence when the second member is a sonorant and contains fewer elements. Since these clusters pattern ambiguously and to various degrees in different languages (Goad 2011: 919-920), they are largely left out of the present analysis. This ambiguity also holds for other sibilants, such as /ʂ/ in Swedish. In Swedish, /ʂC/ is not allowed in initial clusters, although there are some marginal initial clusters with this structure. The initial clusters are /ʂl/ (e.g. *schlager* 'song hit'), /ʂv/ (e.g. *Schweiz* 'Switzerland', /ʂn/ (e.g. *schnitzel* 'id.') and /ʂm/ (e.g. *Schmidt*, a personal name). It should be noted that the sibilant here is often adjusted to [s], perhaps because it is not integrated in the phonology, but even then it remains to be seen what the syllabic status of the s-sonorant clusters is (Riad 2014: 281, 285). Another case in point is Norwegian, in which /s/ becomes [ʂ] before a lateral, which changes a word like *slå* /slo/ 'hit' into [ʂɭoː], although there is variation depending on the environment and the register. In any case, it is seen as assimilation of /s/ to /l/ (Kristofferson 2000: 102-105; cf. also Jahr 1985), which is an assimilation of |A| in the present analysis. Nevertheless, it is difficult to determine here too whether /ʂ/ is an onset or a rhymal adjunct and thus whether /ʂ/ has two resonance elements or one. Word-internally both occur, although [ʂ] seems less likely in the second environment (Kristofferson 2000: 103), but there is no conclusive evidence here either.

By adopting the view that initial sC-clusters are rhyme-onset sequences in many languages, at least when the consonant following the sibilant is an obstruent, medial sC-clusters can be represented in the same way as initial clusters, although the preceding nucleus is silent in the latter case. Evidence for the view of initial rhyme-onset clusters comes from Romance languages. Here, the initial nucleus need not be silent, as Spanish *estadio* 'stadium' shows an audible nucleus as compared to the Italian *stadio* 'stadium' (and also to Germanic equivalents) (Harris 1994: 62). In medial position, rhyme-onset clusters can also adequately explain the fact that the sibilant in sC-clusters in languages like Dutch and English is part of the rhyme, since a stressed syllable needs to consist of two segments (cf. Booij 1993: 26 for Dutch). Some data are given below in (47) (cf. Goad 2011: 907-908, 913; a point indicates the syllable boundary).

(47) VC rhyme: English *pester* [pɛs.tə(r)], Dutch *Oslo* [ɔs.loː] 'id.', *pasta* [pɑs.taː] 'id.'

VVC rhyme: English *Easter* [iːs.tə(r)], *oister* [ɔjs.tə(r)], Dutch *meester* [meːs.tər] 'master'

The English examples with a VVC rhyme are comparable to words like *shoulder*, *mountain* and *council* and show that the last member of such a rhyme must be a coronal (Harris 1994). Goad (2011: 907, 919) states that a medial 'coda' is problematic in words like *extra* [ɛkstrə] and *bolster* [bowlstər], since the rhymal position is already filled. While this is potentially challenging for a 'coda' analysis, she additionally mentions several VCC rhymes: *antler* [æntlər], *vintner* [vɪntnər] and *junction* [dʒʌŋ(k)ʃən], which are also problematic if the rhymal adjunct can only consist of one segment. These are not discussed by Harris (1994). Goad (2011: 906) states that in the latter case the onset must be coronal preceded by a stop and a homorganic nasal, which is similar to the VVC rhymes, where codas and the onset stops must be coronal. Nevertheless, it shows that sounds other than sibilants are also problematic to explain medial consonant sequences. A solution to this would be to assume an extra syllable. The first obstruent or /l/ here should be in the onset followed by /s/ in the rhymal adjunct in the first case and followed by an empty nucleus in the VCC rhymes (cf. Goad 2012: 361).

sC-clusters also have melodic representations. First, I examine languages which use /s/ in sC-clusters. I compare three types of languages here: English, which makes use of both |H̲| and |H| in the phonology, Icelandic, which uses only |H̲| in the phonology, and Dutch, which is traditionally seen as L-language (Backley 2011: 151). Dutch is considered in more detail in chapter 7 and for now I assume that voiceless fricatives in Dutch are specified as |H|, i.e. as fricatives in a voicing language. The melodic structure of Icelandic *springa* [sprɪŋka] 'to blow up', English *sprinkle* [spɹɪŋk(ə)l][33] and Dutch *sprenkelen* [sprɛŋkələ] 'to sprinkle' are given in (48).[34] The stress in all three words falls on the first audible nucleus.

(48) Structure of initial sC-clusters in Icelandic, English and Dutch



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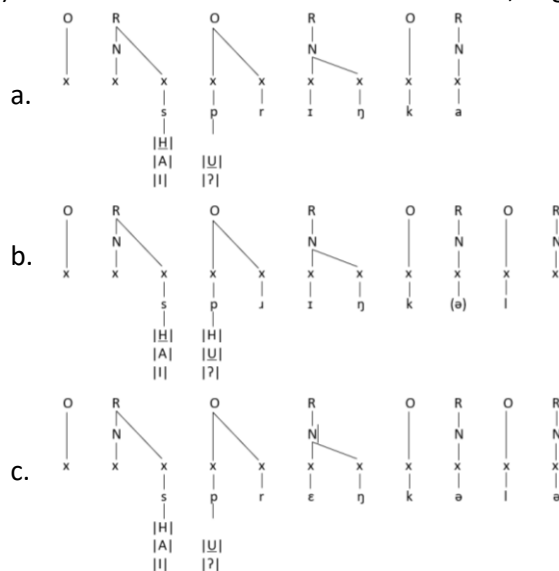
[33] Note that the lateral could also be syllabified in the rhyme (cf. Harris 1994: 192, 258).
[34] The patterning of /ŋ/ is unlike that of other consonants in many languages. It has also been noted that it is in complementary distribution with /h/ (cf. Wiese 1996: 15 for German; König 1994: 536 for English), since it only occurs after a short vowel and not in onsets, whereas /h/ can never occur in the rhymal adjunct, but only in onsets. In the examples in (48) it is therefore syllabified in the nucleus, cf. also (53) for /ŋ/ in Faroese.

The lack of aspiration in Icelandic and English in the first stop is due to the fact that |H̲| already occurs in the preceding rhyme, although it could survive as unheaded in the onset, such as in English. If the language does not have |H̲| in its phonology, i.e. in voicing languages, sibilants contain just |H|. Nevertheless, sibilants in sC-clusters in all languages in (48) have the same complexity, i.e. they contain three elements.

Only sibilants can occur in the initial rhyme of sC-clusters, because these are perceptually very salient (cf. Goad 2011: 898). These sounds are so salient that they are even allowed in a non-optimal context, i.e. in the rhymal adjuncts of empty-headed syllables. This salience is best described by multiple resonance elements, which provide multiple acoustic cues along with a high-frequency noise. I adopt the view that this complexity is due to having both resonance elements |A| and |I| in the melodic structure beside the noise element |H̲| in H-languages or |H| in L-languages (partly following Árnason 2011 & Baroni 2014, cf. also section 3.3). I refer to this as the sibilant salience principle, which can be seen in (49).

> (49) Sibilant salience principle: a sibilant that can occur in the rhymal adjunct of an empty-headed syllable contains the manner element |H̲| or |H| and two resonance elements |I| and |A|

Not all voiceless sibilants can occur in this initial rhymal position, such as [ʃ] and [z] in English. Therefore, these sibilants should only contain one resonance element. While /s/ is the most common sibilant to occur in initial rhymal position in most languages, other sibilants can also occupy this position in other languages. German is a language which uses [ʃ] in word-initial clusters instead of [s]. In post-vocalic position however, the sibilant often is [s] and [ʃ] is extremely rare in this position if it occurs here at all (Brockhaus 1999). This difference is represented differently in the syllabic structure of *Spruch* [ʃpʁʊx] 'saying' and *Gast* [gast] 'guest' by and is given in (50) below (cf. Brockhaus 1999: 185).

> (50) Syllabic structure of /ʃC/- and /sC/-clusters in German
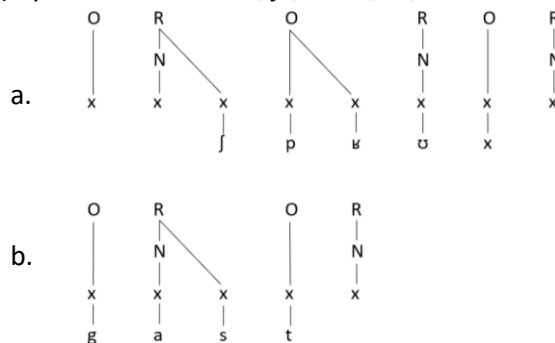


The difference in structure suggests that [ʃ] contains two resonance elements, since it occurs in initial rhymal position, while [s] only contains one resonance element. Brockhaus (1999: 186-188) also mentions several hybrid systems in dialects for sC-clusters: in one system the first element is always

[s], except before [ʁ], and in another system the first element is always [ʃ], except before [v]. In his analysis [ʁ] and [v] do not have a stop element, so therefore they are less complex than the sibilant, which should then be the first element of a branching onset in German. At any rate, it seems feasible to me that for the dialectal forms only [ʃʁ] is a branching onset in the first case and [sv] in the latter case and that the other sibilant in both dialects contains two resonance elements.

The analysis for salient sibilants in German gets more complicated by several initial sC-clusters which have [s] as first member of the cluster, such as *Stil* [stiːl] 'style' and *Sphäre* [sfɛːʁə] 'sphere', which are called marked (Wiese 1996: 266) or rare (Hall 1992: 69). According to Wiese (1996: 267), these are largely loans and therefore not fully adapted to the German phonological system. More problematic are the initial clusters of a sibilant and a velar stop, as this sibilant in these clusters is always [s], such as *Skat* [skaːt] 'id.', *Skrupel* [skʁuːpəl] 'scruple' and *Sklave* [sklaːvə] 'slave' (Hall 1992: 68-69). Brockhaus (1999: 207) notes that this could be viewed as historical accident, since /sk/-sequences turned into the segment /ʃ/ in the transition from Old High German to Middle High German.[35] These two instances seem marked structures, which suggests that their melodic structure should contain more elements. However, in this rhymal position where more resonance elements make a sound more perceptible, since there is no initial audible nucleus, it seems that a marked structure in this position actually contains only one resonance element and thus less elements.

While it is difficult to determine whether sC-clusters form a branching onset when the second element is a sonorant, other fricative-sonorant clusters, like stop-sonorant clusters, are regarded as branching onsets. Goad & Rose (2004: 13) include /ʃr/ as a possible cluster in English in words like *shrew* [ʃɹuː] and *shrink* [ʃɹɪŋk], whereas */sr/ is ungrammatical. Since /ʃ/ does not occur initially preceding other stops nor consonant clusters, it seems feasible that /ʃr/ is an onset cluster, rather than a rhyme-onset cluster. Therefore, English [ʃ] contains only one resonance element, just like German [s]. Conversely, English [s] contains two resonance elements, just like German [ʃ].

To summarize this section, it has been observed that sC-clusters generally do not form branching onsets, although some sequences of sibilant-sonorant might. It was argued that these sequences are actually often rhyme-onset sequences. This is not universal however, as sC-clusters could also be interpreted as onset-onset sequences, as in Acoma, which explains why the second element can be aspirated and why both sounds contain |H|, which would otherwise be unexpected. Even in a language such as English an sC-cluster need not be a rhymal-onset cluster as can be seen from loan words or morphologically complex words. Initial sC-sequences have no audible nucleus preceding this sequence, so in order to be perceptible, the first element should be very salient. ET expresses this salience by

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[35] In the history of Dutch /sk/-sequences also developed to /sx/ in initial position and to /s/ in other positions.

stating that this element should be a sibilant with a lot of high noise energy and multiple resonance cues. This sibilant is mostly [s], but in other languages it can be another sibilant, such as in German or in Acoma. The possibility of salience could also hold for clusters where an initial sibilant in an onset is followed by an empty nucleus, like in Acoma, or in morphologically complex words and loan words in English. It appears that the H-prominence principle in (35) still holds, but it should be extended to include initial rhymes and to denote that |H| instead of |H̲| is prominent in L-languages.

## 5.2 Metathesis

Metathesis concerns the reordering of segments, which often occurs irregularly. There are a range of metathesis processes, which are often divided between local and distant metathesis (for a cross-linguistic overview, see e.g. Blevins & Garett 2004; Buckley 2011). I focus on local metathesis here, as sibilants quite often change positions with an adjacent stop (Buckley 2011: 1380-1382). I discuss Faroese, which is remarkable because it shows a regular process of metathesis. Then I contrast this to Old English, French and irregular metathesis in present-day Dutch.

In Faroese there is a metathesis process of /sk/ to /ks/ if the neuter singular ending /t/ is added to an adjective, which can be seen in (51ab), although there are some instances when metathesis does not occur, as can be seen in (51cd) (cf. Hume & Seo 2004: 38-39).

| (51) | masculine singular | neuter singular | translation | ill-formed |
|---|---|---|---|---|
| a. | baisk-ʊr | baiks-t | 'bitter' | *baisk-t |
| | fransk-ʊr | fraŋ(k)s-t | 'French' | *fransk-t |
| b. | óʃlɛnsk | óʃlɛŋ(k)s-t | 'Icelandic' | *óʃlɛnsk-t |
| c. | falsk-ʊr | fals-t | 'false, spurious' | *falsk-t, *falks-t |
| | nɔʂ-ʊr /nɔrskʊr/ | nɔʂ-t /nɔrst/ | 'Norwegian' | *nɔʂk-t, *nɔkʂ-t |
| d. | fǿːrɪsk | fǿːrɪs-t | 'Faroese' | *fǿːrɪsk-t, *fǿːrɪks-t |
| | rʊ́sːɪsk | rʊ́sːɪs-t | 'Russian' | *rʊ́sːɪsk-t, *rʊ́sːɪks-t |

Metathesis can occur if a vowel or a nasal precedes, but the phonetic realization of the stop is optional in the latter case, as can be seen in (51a). This stop is always coronal, but this is due the fact that there are no labial or velar suffix-initial stops available in the language (Hume & Seo 2004: 37). Furthermore, (51c) shows that the stop is deleted instead, if a liquid precedes the sequence. The /rs/-sequence is realized as [ʂ]. This deletion also takes place in (51d) if the stress does not directly precede the sC-cluster, although there is still metathesis when a nasal precedes the sC-sequence, as can be seen in (51b).

Another environment for this metathesis is the past tense formation in /ti/ when a verb stem ends on /sk/. This can be seen in (52) (cf. Hume & Seo 2004: 36). This is effectively the same environment, except for the fact that the last nucleus is audible in past tense formation, whereas it is not in (51).

(52) <u>verb stem</u>      <u>present singular</u>      <u>past singular</u>      <u>translation</u>
     insk-      instʃ-ɪr[36]      iŋ(k)s-ti      'to wish'

It appears that the sibilant moves to a less optimal position, the rhymal adjunct, while the stop moves to the onset preceding that rhymal adjunct (Hume & Seo 2004: 42). When a nasal precedes the sC-cluster, it becomes a velar nasal and the velar is not always pronounced. Hume & Seo (2004) propose that this is due to coalescence rather than place assimilation and stop deletion, because that involves an assumption of more phonological processes. They perceive the two alternating forms as realizations of two stages of the same process. In one case, the merger is not completely realized, whereas it is in the other case. This seems economical, especially since coalescence already occurs in /rs/-sequences (Hume & Seo 2004: 52).[37] This can be formalized in ET too, as processes are phonetically interpretable at any moment of the derivation (cf. Backley 2011). Some syllabic representations are given in (53).

(53) Syllabic structure of /CSC(V)/-sequences in Faroese

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   O       R        O       R       O       R
           |                |               |
           N                N               N
           |                |               |
   x   x   x   x    x   x   x    x       x
   |   |   |   |    |   |   |    |       |
   b       a   i    k       s    t
   f   r   a   ŋ   (k)       s    t
   i       a   ŋ   (k)       s    t   i
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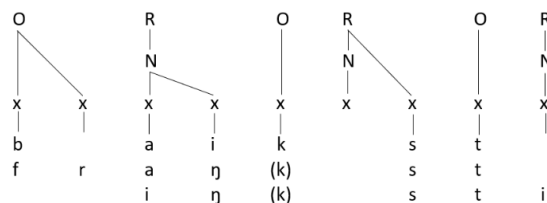
In (51cd) there is a deletion of the stop instead of metathesis. The metathesis fails to take place if a liquid precedes, which is caused by a ban on sequences of a sonorant and another consonant which do not share their place of articulation (Hume & Seo 2004: 50). Hume & Seo (2004: 58) note that the sequence */kʂt/ does not occur in Faroese as the retroflex sibilant never occurs between two stops. It seems to me that this can easily be explained by the sibilant salience principle in (49). According to this principle, only certain sibilants can occur in the rhymal adjunct of an empty-headed syllable, i.e. sibilants with two resonance elements. Since there is no metathesis, but a disappearance of the stop instead, it seems that [ʂ] cannot occur in such a rhymal adjunct. Therefore, it should only contain one resonance element, which is |A|, because it is a retroflex sound (cf. (11)). Metathesis also does not occur in onsets following unstressed rhymes. It seems that these onsets are too weak to allow sequences of consonants with no audible rhymes and the velar stop is deleted instead.

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[36] The velar stop palatalizes to an affricate before a front vowel (Hume & Seo 2004: 57).
[37] It should be noted that there is some variation here, as some speakers pronounce /rs/ for instance as [ɻs] (Árnason 2011: 115-116). However, this could be seen as two realizations of different stages of merger as well.

It seems that metathesis is a process which takes place to put the sibilant in the rhymal position, since it is perceptually salient and to place the velar stop in the onset, because it is less salient. If this metathesis cannot take place, the stop is deleted instead to ensure perceptual salience differently.

The metathesis of clusters with a sibilant and a stop can differ in languages, just like the representation of sC-clusters. Blevins & Garett (2004: 139) compare a historical change of Old English to Late West Saxon, where /sk/ changed into /ks/ and a mirrored change of /ks/ to /sk/ from Standard French to a variety of Colloquial French. Examples are given in (54), with /sk/ word finally in (54a), intervocalically in (54b) and between a vowel and sonorant in (54c), and (55) (taken from Blevins & Garett 2004: 139).

| (54) | Old English | Late West Saxon | translation |
|---|---|---|---|
| a. | frosk | froks | 'frog' |
| | husk | huks | 'insult' |
| | mask | maks | 'meshes' (neut. pl.) |
| | tusk | tuks | 'tooth' |
| b. | aske | akse | 'ash' |
| | aːskian | aːksian | 'to ask' |
| | fiskas | fiksas | 'fishes' |
| | hneskian | hneksian | 'to soften' |
| | toska | toksa | 'frog' |
| | waskan | waksan | 'to wash' |
| c. | horsk ('quick') | horkslic | 'dirty' |
| | muskle | muksle | 'mussel' |
| | θerskan | θerksan | 'to thresh' |
| | θerskold | θerksold | 'threshold' |

| (55) | Standard French | Colloquial | translation & spelling |
|---|---|---|---|
| | fiks | fisk | 'fixed' (fixe) |
| | lyks | lysk | 'luxury' (luxe) |
| | sɛks | sɛsk | 'sex' (sexe) |
| | aks | ask | 'axis' (axe) |
| | feliks | felisk | 'Félix' (Félix) |

Blevins & Garett (2004: 140) suggest that this difference is due to prosody. This can be seen in the location of stress, which is initial in Old English, whereas French has (weak) final stress. It could be that

a sibilant is moved to the adjunct in some languages because of perceptual salience and to the onset in others.[38] The metathesis is not restricted to a sibilant and a velar stop, as other stops can also metathesize with a sibilant. Botma & Ewen (2009: 245) mention /ps/ to /sp/ in Old English *wæfs*, *wæps*, *wæsp* 'wasp' to Modern English *wasp*, while there are still dialectal variants like *waps* and *wops*. Stroop (1981) also mentions the same change of /ps/ to /sp/ in Old Dutch before a schwa in final position, such as *wepse* 'wasp' to Modern Dutch *wesp* 'wasp', while there are still dialectal forms like *weps*. Dialects might even have a broader distribution and metathesize /sp/-clusters also in other positions too, such as the metathesis of *mispel* 'medlar' to *mipsel*. A later change of /sp/ to /ps/ took place in dialects (this actually reversed the consonants to their position in Old Dutch), so that words like *wesp* changed to *weps*. Some more examples of metathesis in dialects can be seen in Southern English in words like *ask* to *aks* or in Southern American English of *wasp* to *waps* (Steriade 2001: 233-234).

Irregular metathesis is often observed in speech errors and in children's speech and is exemplified here with examples from modern Dutch. Thus far, only unidirectional metathesis has been observed, but metathesis can occur bidirectionally in a language depending on the position of an sC-cluster in the word. The tendency of these kinds of metathesis is to reverse the order of /Ts/ to /sT/ initially and the order of /sT/ to /Ts/ word-finally (T denotes any voiceless stop). This can be seen in (56) (cf. van Marle 1981), with initial metathesis in (56a) and final metathesis in (56b).[39]

> (56) a. *psycholoog* 'psychologist' > *spycholoog, psychiater* 'psychiatrist' > *spychiater*, *psychisch* 'psychic' > *spychisch*
>
> b. *wesp* 'wasp' > *weps*, *gesp* 'belt buckle' > *geps*, *rasp* 'grater' > *raps*, *asterisk* 'id.' > *asteriks*

Metathesis of /sT/ to /Ts/ word-initially and of /Ts/ to /sT/ word-finally is not observed. It should be noted that words starting with /Ts/ in Dutch are quite rare. Similarly, words ending with /sp/ and /sk/ are not very numerous, although words ending with both /st/ and /ts/ are quite common. The initial metathesis can be explained based on perceptual salience. Stops disfavour occurring word-initially before a sibilant because they are not salient, whereas sibilants are salient and can precede stops.[40] The preference for /Ts/ word-finally might then be for the same reasons as Late West Saxon in (54), since stress in Dutch is generally initial as well. Stroop (1981: 235) notes that the preference for word-

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[38] This is a tenuous assumption and a substantiation of this claim would require an overview of sibilant-stop and stop-sibilant metathesis in many languages for a more complete analysis. This is outside of the scope of this thesis (and it has also not yet been undertaken to my knowledge).

[39] Botma (p.c.) further points out to me that these kinds of metathesis also occur in the speech of Dutch children, e.g. *Eskimo* 'id.' > *Eksimo*, *husky* 'id.' > *huksy* and *(Bohemian) Rhapsody* > *Rhaspody*.

[40] The lack of salience of initial /Ts/-sequences can also be resolved differently, as can be seen in Swedish. These clusters are often simplified to /s/ instead. Some examples are *psykologi* [psʏkɔlɔgiː] 'psychology' > [sʏkɔlɔgiː] (with a misnomer [pʏskɔlɔgiː]), *tsar* [tsɑːr] 'id.' > [sɑːr] and *xylofon* [ksʏlɔfoːn] 'xylophone' > [sʏlɔfoːn] (Riad 2014: 285).

final /Ts/ became only apparent when Dutch lost word-final schwa, which resulted in paralleled word-final sequences of /Ts/ and /sT/. Apparently, a salient sound is preferred word-finally instead of a stop in the final onset.

While I do not discuss other types of metathesis here, there is one type that deserves a brief mention, as it also has to do with salience. There is a high and widespread frequency of metathesis involving liquids. These sounds are not very salient as they are usually made up of only resonance elements (cf. (7)). Therefore, these are likely to metathesize in a variety of ways[41] (cf. Blevins & Garett 2004: 128, also for references). Sibilants on the other hand, rather metathesize with stops to less optimal positions, because stops are not very salient and thus prefer to be in a stronger position, i.e. an onset. Metathesis of sibilants is still restricted however, as a change of *ask* to *\*kas* in English is unattested, even though it would increasable the perceptibility of all obstruents (Steriade 2001: 235).[42] To sum up, it seems that the salience of sibilants causes these sounds to switch positions with other stops, since sibilants are tolerated in weaker positions. This also means that they are the only sounds that are allowed in the weak rhymal position in initial sC-clusters, because of their salience.

# 6. Voiced 'fricatives' in North Germanic languages

Whereas all Germanic languages have voiceless fricatives (cf. (2)), the status of voiced fricatives is much less clear. Voiced fricatives often pattern as sonorants. Botma & van 't Veer (2013: 49) note that phonetically this is not surprising '(…) as vocal cord vibration leads to lower airstream velocity, making it relatively difficult to produce turbulence.' Therefore, (quite) a number of voiced fricatives might actually rather be described as approximants (Botma & van 't Veer 2013: 49; Botma & Grijzenhout 2018). Similarly, voiced obstruents have been described as sonorant obstruents (Rice 1993). Voiced stops are also included in this category. Botma (2011: 179) however, notes that especially 'sonorant fricatives' are widespread. This is in line with the survey of Maddieson (1984: 48), who observes that several non-sibilant fricatives occur more often than not without a voiceless counterpart. In this chapter, I examine the voiced 'fricatives' in Icelandic and Danish, which pattern mostly as sonorants, and in Norwegian and Swedish, which pattern more ambivalently to see to what extent these observations apply to these languages.

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[41] Some examples are that the English word *precise* is often pronounced as [pərsajs] (and the same is true for this word in Dutch, as *precies* is often pronounced as [pərsis]) and word pairs in which metathesis occurs in one word, but not in the other word (e.g. *third* next to *three* and *nutrition* next to *nurture*) (van Gelderen 2006: 23).
[42] Sibilants can also metathesize with other sounds than stops, but in these cases the range of sounds is not restricted to sibilants, but to a wider variety of sounds (cf. Buckley 2011).

## 6.1 Voiced 'fricatives' patterning as approximants

We already saw in section 4.1 that voiced fricatives in Icelandic (and Faroese) might be better described as approximants or glides. Árnason (2011: 168) mentions that a possible argument to assume that these sounds are fricatives can be found in clitic forms of pronouns. The pronouns have a voiceless fricative [θ], whereas their clitic forms have a voiced fricative [ð], which shows that these sounds alternate in this position. Some examples are given in (57).

(57) Pronouns:    *þeir* [θeiːr̥] 'they'        *þeim* [θeiːm] 'them'        *þar* [θaːr̥] 'their'
        Clitic forms:   (not mentioned)       [-ðeim]                  [-ðar]

However, while I stated in section 4.1 that Icelandic has no medial voiceless fricatives, these do occur in loan words and compounds (e.g. *kaþólskur* [kʰaːθoulskyr̥] 'catholic' and *safarí* [saːfari] 'safari'), which makes assuming a voicing neutralization here less likely. Therefore, I focus on an alternative analysis below.

A good phonological reason for analysing voiced fricatives as approximants can be seen in vowel lengthening, which happens before a stop or /s/ followed by /v j r/. This is shown in (58a). A vowel does not lengthen before a stop or /s/ followed by /l m n/. Some examples of this are given in (58b). When a fricative other than /s/ precedes a /j/, it is not syllabified in the onset, but rather as a rhymal adjunct, given that the preceding vowel is short. This is also the case when /r l m n/ are the first members of a cluster. These clusters are given in (58c). Clusters starting with /r l m n/ followed by /j/ can form complex initial onsets however. This is shown in (58d). Syllable boundaries are indicated in (58abc) (Árnason 2011: 163, 169-170, 221).

(58) a. *flysja* [flɪː.sja] 'to peel', *tvisvar* [tʰvɪː.svar̥], *titra* [tʰɪː.tra] 'to vibrate'

     b. *efla* [ɛp.la] 'to strengthen', *sagna* [sak.na] 'story (gen. pl.)'

     c. *tefja* [thɛv.ja] 'to delay', *veðja* [vɛð.ja] 'to bet', *hemja* [hɛm.ja] 'to control', *venja* [vɛn.ja] 'habit', *velja* [vɛl.ja] 'to choose'

     d. *mjólk* [mjouḷk] 'milk', *njóta* [njouːta] 'to enjoy', *ljós* [ljouːs] 'light', *rjómi* [rjouːmɪ] 'cream'

Clusters form a complex onset in (58a), because the vowel of the preceding syllable is long. This indicates that /v j r/ occur as second member of the onset. My ET approach therefore suggests that they must be segmentally weaker than the first member of the onset. This weakness can be attributed due to their lack of manner elements, and therefore they are phonologically approximants or glides. /l n m/ in (58b) cannot occur in the second position of the onset position, because they contain a manner element, i.e. |ʔ| (cf. (34)). Because the fricatives in (58c) cannot form a complex onset with /j/ as second element, it becomes clear that they do not contain manner elements either. Although /lj/, /mj/

and /nj/ can form complex initial onsets in (58d)[43], it seems that |ʔ| in medial position is not strong enough as manner element in the first segment of a cluster. This raises a problem for medial voiceless stops however, since their only manner element is |ʔ| too (in 'soft' varieties). A possible solution would be to make the manner element in stops headed, i.e. |ʔ̲|, although this solution seems rather ad hoc. Nevertheless, if voiced fricatives are actually approximants, their distribution in medial clusters in (58ac) is adequately accounted for, as approximants cannot precede /v j r/ in internal onsets.[44] Analysing voiced fricatives as approximants also explains why these sounds can disappear intervocalically in natural speech in Icelandic (e.g. *dagur* [taːɣr̥] 'a day' instead of [taːɣr̥] and *dagar* [taːr̥] 'day (pl.)' instead of [taːɣar̥]), as Árnason (2011: 108) notes. This would be less likely if the intervocalic sound was a fricative, because fricatives contain an additional |H|-element, making it less prone to deletion. The same reasoning may explain why, in Faroese varieties, initial /j/ hardens to /ʧ/.

For Danish, Basbøll (2005: 147) notes that a feature [voice] is necessary to describe the devoicing in [v], e.g. *svære* [svɛːɐ]~[sv̥ɛːɐ] 'difficult (pl. / def.)', since it remains distinct from [f] (cf. *sfære* [sfɛːɐ] 'sphere'). Nevertheless, the description in Basbøll (2005: 62-63) suggests that /v/ patterns mainly as approximant. /v/ cannot precede consonants other than [ʁ] initially (unlike /f/, which can also precede /l n j/), whereas it can follow non-labial stops and /s/. /r/ and /j/ also mainly pattern as approximants [ʁ] and [j]. [ʁ] can be preceded by all stops, /f/, /v/ and /s/, while [j] can be preceded by all stops and /f/.[45] Both /r/ and /j/ do not have a voiceless counterpart and their distribution is more limited, as they cannot occur as first consonant in a cluster initially (Basbøll 2005: 206). This indicates that the voiced fricatives pattern as sonorants. In non-initial position, /v/ is realized as [u̯], whereas /f/ is not, which suggests that /v/ is an approximant too (Botma & Grijzenhout 2018). Some examples are given in (59).

(59) *trav* [tˢʁau̯] 'trot' (next to *traf* [tˢʁaf] 'met') and *tæver* [tˢɛu̯ɐ] 'bitch (pl.)')

Still, Basbøll (2005: 64) describes /v/ as [v] initially and following non-initial /l/. /j/ is also analysed as [j] in the same positions, whereas /r/ is analysed as [ʁ] initially only. Grønnum (1998: 100) suggests that [v] rather should be transcribed as [ʋ] in the onset (and [ð] and [ʁ] as [ð̞] and [ʁ̞]), since they lack frication. Therefore, I focus on non-initial positions below first. Some examples are given in (60), with /v j r/ following /l/ in (60a) and /v j r/ word-finally (60b).

(60) a. *ulv* [ulˀv] 'wolf', *elg* [ɛlˀj] 'elk'
　　 b. *hav* [hau̯] 'sea', *mig* [mɑi̯] 'me', *bær* [b̥æɐ̯] 'berry'

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[43] Initial /rj/ is difficult to explain, as the first sound is not more complex than the second one.
[44] A similar analysis is reasonable for the fricative contrast in Faroese, although Árnason (2011: 154) points out that this analysis is more complicated here, because of qualitative differences in vowel pairs and dialectal differences.
[45] Note that the sequence /s/+/j/ turned into [ɕ].

However, Basbøll (2005: 238) mentions that /lj/ does not occur finally in monosyllables. If this is the case, it seems attractive to analyse /j/ (and also /v/) in the examples of (60a) as onsets of empty-headed syllables, which would mean that their distribution as for non-final onsets. [u̯ ɪ̯ e̯] in (60b) seem to the vocalic counterparts of /v j r/ respectively. Given their limited distribution as consonants and the fact that final sounds in (60a) are onsets, it seems attractive to analyse the voiced fricatives as glides in onset position and as vowels in nuclear position. Therefore, they lack manner elements and only contain place elements: |U̲| for /v/, |I̲| for /j/ and |A̲| for /r/. The only observation that runs counter against this analysis would be that /v/ can still precede /r/ word-initially, which means that /v/ must be more complex in this position. Given the analysis for the patterning of /v/ otherwise, it seems that the initial sequence /vr/ still requires an adequate explanation (as does /rj/). I also discuss this sequence at some length in the next section.

## 6.2  Voiced 'fricatives' patterning ambivalently

Whereas voiced fricatives pattern quite clearly as sonorants in Icelandic and Danish, their analysis is less clear for Norwegian and Swedish, as the fricatives sometimes pattern as obstruents and sometimes as sonorants. This ambivalent behaviour has also been noted by Vaux & Miller (2011: 682-684) for Russian /v/. They state that this sound seems best explained as a category between obstruents and sonorants. For Norwegian and Swedish, analyses are quite distinct, since Kristoffersen (2000) characterizes voiced fricatives largely as sonorant, whereas Riad (2014) describes both voiced and voiceless as obstruents.

Kristoffersen (2000) describes that /v/ and, to a lesser extent, /j/ mainly pattern as approximants, but notes that they sometimes also pattern as obstruents. Examples are given in (61). Relevant sounds are indicated in bold.

(61) a. *he**v**n* [hɛʊn] 'revenge', *vrø**v**l* [ʊrœʊl̩] 'nonsense', *t**v**err* [tʊær] 'sullen', *d**j**evel* [djeː.ʊl̩] 'devil'

b. *he**v**d* [hɛʊd] 'acquired right', ***v**røvl* [ʊrœʊl̩] 'nonsense', ***v**ri* [vriː] 'to twist', *stø**v**el* [stæʊ.ʊl̩] 'boot', *d**j**evel* [djeː.ʊl̩] 'devil', *ber**g*** [bærj] 'hill', *hel**g*** [hœɽj] 'weekend'

In (61a) /v/ can precede sonorants in the coda and occur as second member of an onset, like sonorants. The isolated case of /vd/, where /v/ is in the coda, is more ambiguous. Since it is the only sound to precede /d/ in this position, along with /g/ (cf. *bygd* [bygd] 'rural community'), it is analysed as an obstruent by Kristoffersen (2000: 57) in (61b). It also patterns as obstruent when it occurs as first member of an onset if /r/ follows and it can even minimally contrast in initial position (e.g. *fri* [friː]

'free' next to *vri* [vriː] 'to twist'). However, /v/ can only precede one consonant, i.e. /r/ (like in Danish), which casts some doubt on its status as obstruent. On the other hand, the only sounds that precede /r/ are obstruents. Furthermore, there is a contrast between non-initial laterals. The /v/ could underlyingly be a sonorant in words like *vrøvl* [ʋrœʊl̩] 'nonsense', whereas it may be an obstruent in words like *støvel* [stæʊ.ʊl̩] 'boot' (Kristoffersen 2000: 39). Nevertheless, if the lateral is syllabic, it could still be that the /v/ is a sonorant, as it is the only sound in the onset, although that would not explain the distributional differences. Kristoffersen (2000: 39) further notes that /v/ cannot occur in a coda before /r/, so that a word like *maur* 'ant' is pronounced as [mæʊ.ʊr̩] and not *[mæʊr]. Perhaps this is due to the fact that /r/ is not allowed in an onset before an empty nucleus, because it has no manner elements, unlike the lateral in *vrøvl*. At any rate, it is difficult to completely disregard any obstruent status for /v/. It might contain |H| in some cases, but the evidence for its status as approximant is less clear than in Danish.

/j/ can also occur as second element of the onset, as can be seen in (61a), which would make it a sonorant. While /j/ cannot precede /r/ in initial clusters, it can occur as second member of a final cluster in (61b). If /j/ would be an approximant here, a vocalic reflex would be expected in the surface representation, which happened in some dialects (e.g. *sørja* 'to mourn' > *sørri*). Kristoffersen (2000: 62) therefore proposes that the /j/ in these cases patterns as an obstruent too, although the evidence for this is more limited. Classifying /j/ as obstruent seems less likely to me for the following reasons. There are no indications that it alternates with the palatal fricative and it cannot precede /r/ in onsets, nor can it precede liquids word-finally, like /v/ can. The fact that /j/ has no vocalic reflex indicates that it is syllabified as onset followed by an empty nucleus than in a nucleus. I return to a similar analysis for /j/ in Swedish below, but from the preceding discussion we may already conclude that /j/ is most straightforwardly explained as sonorant, while /v/ patterns ambivalently.

Swedish displays a similar distribution in the patterning of /v/ and, also to a lesser extent, of /j̊/. Examples are given in (62). Relevant sounds are indicated in bold. Riad (2014: 56-57, 70) also indicates devoicing of these sounds next to a voiceless segment.

> (62) a. *s**v**in* [sʋ̥iːn] 'pig', *k**v**inna* [kʋ̥ɪnːa] 'woman', *d**v**ärg* [dværːj] 'dwarf', *spj**uver* [spj̊ʉːvɛr]
> 'rogue', *pj**äxa* [pj̊ɛkːsa] 'ski-boot'
>
> b. ***v**råk* [vrɑːk] 'buzzard', ***v**rist* [vrɪsːt] 'ankle' and *tor**v*** [tɔrv] 'turf', *kampan**j*** [kampanːj]
> 'campaign', *d**v**är**g*** [dværːj] 'dwarf', *ber**g*** [bæ̥rːj] 'mountain'
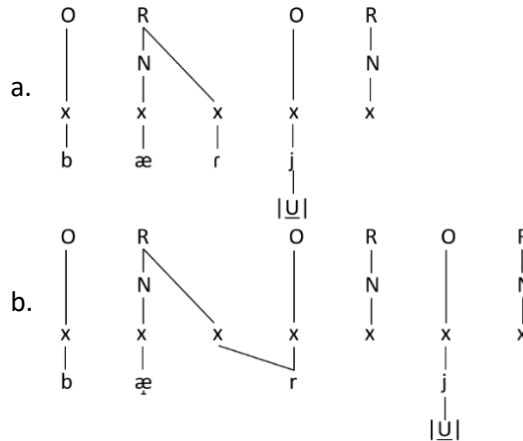
(62a) shows that /v/ and /j̊/ pattern as sonorants, since they can easily occur as second consonant in initial onsets. (62b) shows that /v/ can also occur as first member of an onset preceding liquids and occur following a liquid word-finally, like obstruents. Like /v/, /j̊/ occurs only as second member of a

final cluster. Riad (2014: 56) mentions that devoicing might provide an argument for the feature [voice] in /v/, but since it is difficult to determine the phonological status of devoicing, this evidence cannot easily be regarded as conclusive. Riad (2014: 59) further observes that both the fricative and the approximant /ʝ/ occur in onsets in idiolectal variation, with a general tendency of a fricative realization in onset position of an initial stressed syllable and an approximant realization in other onset positions, but it is more likely that this is a phonetic implementation given this variation, which means that this also cannot be used as phonological argument.

/v/ can precede liquids, but it is primarily /r/ that follows, since /vl/ occurs marginally in borrowings only, e.g. *Vladic* [vlaːdɪtɕ] (Riad 2014: 57). Whereas the labial stops still have a voicing distinction before /ʝ/, this is neutralized when a fricative precedes. Similarly, there is no voicing contrast for fricative-nasal and fricative-lateral sequences in initial position. Riad (2014: 281-282) attributes this to the fact that labiodental fricatives are presumably more marked, but it could also be argued that /v/ in initial position no longer has a fricative articulation. The argument for both sounds as obstruents word-finally is not very persuasive, as almost all consonants can follow a prefinal /r/, and as most consonants can follow prefinal /l/.

Turning now to geminates in (62), it is most likely that they occur both in the rhymal adjunct and the onset. It is less clear how a consonant following this geminate should be syllabified. Syllabifying /ʝ/ as second member of the onset is not too likely, as it is not less complex than the geminate. It could be that the final sound follows the geminate as an onset with an intermediate empty nucleus. These forms never epenthesize though, but epenthesis is limited to a (geminate) obstruent followed by a coronal sonorant anyway (e.g. /bot-n/ [boːtɛn] 'the boat' compared to the Uppland dialectal form [boːtn̩]) (Riad: 2014: 278-279). Nevertheless, syllabifying word-final /ʝ/ as onset allows for the generalization that almost all consonants occur in this position. Furthermore, it explains why [ŋ] is one of the few sounds that is absent from this (final) position. The representation of /j/ in Norwegian and /ʝ/ in Swedish is given in (63), but a similar analysis applies to final /v/. For *torv* 'turf', this would mean that the /r/ would be a coda and that the /v/ would be an onset).

(63) Comparison of Norwegian *berg* [bæɾj] 'hill' and Swedish *berg*[46] [bæːj] 'mountain'

```
        O    R          O    R
        |    |          |    |
        |    N          |    N
   a.   |    |          |    |
        x    x    x     x    x
        |    |    |     |
        b    æ    r     j
                        |
                       |ʊ|

        O    R          O    R      O    R
        |    |          |    |      |    |
        |    N          |    N      |    N
   b.   |    |          |    |      |    |
        x    x    x     x     x     x
        |    |    |     |
        b    æ̣    r     j
                        |
                       |ʊ|
```

Furthermore, it seems that in Swedish, just like in Norwegian, there is no interaction between a voiced and a voiceless palatal fricative. In conclusion, I see no compelling evidence to classify /ʝ/ as voiced fricative in the North Germanic languages.[47] It is more difficult to determine the status of /v/, but it seems to me that it mainly patterns as an sonorant, although it does sometimes pattern as voiced fricative, which makes it difficult to assume that /v/, unlike /ʝ/, never contains |H|.

In this chapter I have shown that voiced fricatives in North Germanic languages often can be characterized as approximants, which means they do not contain the manner element |H|. While their voiceless counterparts are assumed to be present for multiple fricatives, there are only alternations between the labial fricatives, and even there /v/ patterns primarily as sonorant. Voiced fricatives can be straightforwardly analysed as approximants in some cases, such as Icelandic. Danish appears to have approximants only, although the behaviour of /vr/ here is still puzzling. There are even more ambiguous cases, such as Norwegian and Swedish, although this ambivalence in the behaviour of voiced fricatives only appears to hold for /v/ upon closer scrutiny. In all the North Germanic languages that were examined, only non-sibilant voiced fricatives sometimes pattern with obstruents, but this not a fair point of comparison as these languages do not have voiced sibilants. Nevertheless, this chapter supports the analysis of Botma & van 't Veer (2013: 56), who conclude that there are good reasons to analyse many voiced fricatives which do not have voiceless counterparts as approximants. The data considered in this chapter suggest that this analysis can possibly also be extended to languages which have both voiced 'fricatives' and voiceless fricatives.

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[46] The Dutch cognate b*erg* 'mountain' can be syllabified the same. It can also have an epenthetic vowel ([bɛr(ə)x]), which indicates that /r/ should be an onset, while it also has to be part of the rhyme, because the rhyme needs two x-positions. See also chapter 7 for the behaviour of these sounds which occur in both rhyme and onset. For clarity, it should be noted that epenthesis takes place after /r/ and /l/ followed by a non-coronal consonant (cf. Booij 1995: 127).

[47] This may perhaps also be extended to West Germanic languages. Although German has contrastive voiced and voiceless fricatives, evidence regarding the phonological status of /ʝ/ is divided (cf. Wiese 1996: 235-238).

# 7. The fricative contrast in Dutch and parallels with German

In this chapter I examine the nature of the fricative contrast in Dutch, as it has been described as a Germanic L-language, because it has fully voiced stops, but no aspiration (e.g. Backley 2011: 151). A question which is often unaddressed is whether the voicing contrast that is observed in stops is also present in fricatives. Therefore, I examine Dutch fricatives separately to see if such an analysis can hold for fricatives independently. In addition, I also review whether there are any distributional differences between fricatives and stops. Dutch has six fricatives [f v s z x ɣ] and six stops [p b t d k (g)], although [g] only occurs in loan words and as a voiced variant of /k/ as the result of regressive voicing (Booij 1995: 7). Van Oostendorp (2003: 330) observes that voicing in Dutch obstruents is distinctive in almost all positions of the word, except in final position. De Schutter (1994: 450) mentions that /x/ does not occur in initial position, except for a few loans, so for velar fricatives there is no voicing distinction in this position. Besides, it is often difficult to determine whether a velar fricative is voiced or voiceless in medial position too (cf. Oostendorp 2004: 335).

Differences between the behaviour of fricatives and stops can be seen in assimilation processes. Dutch has two laryngeal assimilation rules, regressive voice assimilation for stops and progressive devoicing assimilation for fricatives. This can be seen in (64) (cf. Booij 1995: 58-59) with regressive voicing in (64a) and progressive devoicing in (64b).

| | | | | |
|---|---|---|---|---|
| (64) a. | *opdruk* | 'imprint' | /pd/ | [bd] |
| | *klapband* | 'flat tire' | /pb/ | [bː] |
| | *stofdoek* | 'duster' | /fd/ | [vd] |
| | *kasboek* | 'cash book' | /sb/ | [zb] |
| | *lachbui* | 'fit of laughter' | /xb/ | [ɣb] |
| b. | *opvallend* | 'remarkable' | /pv/ | [pf] |
| | *zoutzuur* | 'hydrochloric acid' | /tz/ | [ts] |
| | *afval* | 'trash' | /fv/ | [fː] |
| | *wasgoed* | 'laundry' | /sɣ/ | [sx] |
| | *pechvogel* | 'unlucky person' | /xv/ | [xf] |

Such a distribution indicates that Dutch cannot be straightforwardly analysed as a language in which all obstruents are specified for [voice]/|L̲|. Iverson & Salmons (2003) posit that Dutch fricatives are Germanic-like in that they retained [spread glottis], while stops lost their specification for aspiration and instead became specified for voicing, perhaps due to Romance influences (Iverson & Salmons 2003: 20-22). Thus, according to this view, Dutch is a hybrid system, rather than a voicing language and fricatives have become overspecified. In ET terms, this means that they consist of |H̲| or |H L̲|. Instead

of progressive devoicing, there is neutralization of voice (Iverson & Salmons 2003: 15-16; Brown 2016: 401), although the medial distribution outlined in the next section casts some doubt on this observation. Still, it is attractive to disregard progressive devoicing, as fricatives are also voiceless following voiceless stops. Interestingly, German is sometimes also seen as a hybrid system, but with stops contrasting for [spread glottis], while fricatives contrast for [voice] (and [spread glottis]) (cf. Beckman et al. 2009). Beckman et al. (2009) base this on the fact that a fricative retains its underlying voicing specification when followed by a sonorant rather than devoice in coda position (e.g. *gru*[z.l]*ig* 'spooky'). The fact that sonorants may also be syllabic however (e.g. *gru*.[zl̩].lig), perhaps suggests that the fricative rather occurs in an onset followed by an empty nucleus.

An alternative for the laryngeal structure in Dutch is that voicing in Dutch is phonetic, making it an H-language without aspiration (Cyran 2017). Cyran (2017: 490) notes that this is easy to envisage in ET, since elements are defined in terms of gross acoustic patterns. Allen (2016: 205-206) concludes in his survey on Dutch clusters that there is little voicing in regressive voice assimilation (and variety in sonorant devoicing following obstruents), which supports the claim that [voice] is not phonological in Dutch, but phonetic, even in stops. Therefore, an analysis based on the assimilatory behaviour of stops makes it difficult to determine a reliable phonological cue for either [voice]/|L̠| or [spread glottis]/|H̠|. In the upcoming sections, I therefore examine the different phonological patterning of voiced and voiceless fricatives not occurring in clusters in Dutch in order to examine whether a phonological distinction can be established. I also look at parallels with German, as the distributional patterns are similar in both languages. I first analyse the fricative contrast in medial position, as voiced and voiceless fricatives are often preceded by a different set of vowels.

## 7.1 Medial contrasts

Both fricatives occur after a long/tense vowel and a short/lax vowel in medial position. Some examples are given in (65), with intervocalic fricatives before a tense vowel in (65a) and intervocalic fricatives before a lax vowel in (65b). The focus is put on sibilants here, but van Oostendorp (2003: 331) notes that it also holds for other fricatives. For clarity, I marked the vowels for length.

(65) a. *bazel* [baːzəl] 'talk stupidly (1SG.PRES.)'    *Pasen* [paːsə] 'Easter'

   *lezen* [leːzə] 'to read'    *racen* [reːsə] 'to race'

b. *mazzel* [mɑzəl] 'luck'    *passer* [pɑssər] 'compass'

However, a caveat is in order here, as two of these structures are rather marked. Van Oostendorp (2003: 332) mentions only two words, *mazzel* [mɑzəl] 'luck' and *puzzel* [pʏzəl] 'puzzle', which have a

lax vowel followed by a voiced fricative. A third example, *razzia* [rɑzija] 'raid', is mentioned by Booij (1995: 35), who notes that these words are loans and that Dutch has a restriction on short vowels followed by /v/ or /z/. He does not mention [ɣ] for this restriction and van Oostendorp (2003: 335) also states that he ignores the examples with velar fricatives, as there is much uncertainty in these cases.[48] In any case, these three words seem exceptions. Van der Hulst (1985: 63-64) notes these exceptions too, but also mentions that voiced fricatives predominantly follow long vowels, which means that words like *Pasen* [paːsə] 'Easter' en *racen* [reːsə] 'to race' are exceptions too.[49] A similar distribution for a restriction on lax vowels followed by voiced obstruents is observed for German. Jessen (1998: 172) notes that this restriction is stricter for fricatives than stops, and that the words in which this sequence occurs are, with one exception (*Struwwelpeter*, the name of a children's book from 1845), all loan words. Particularly indicative of their marginal, and perhaps disallowed, status is that such a sequence is often replace with either a tense vowel followed by a voiced fricative or a lax vowel followed by a voiceless fricative (Jessen 1998: 172). A German word like *Puzzle* 'id.' is pronounced with [ʊs] rather than with [ʊz]. Similarly, the Dutch word *puzzel* 'puzzle' is often pronounced with [yːz] rather than with [ɣz].
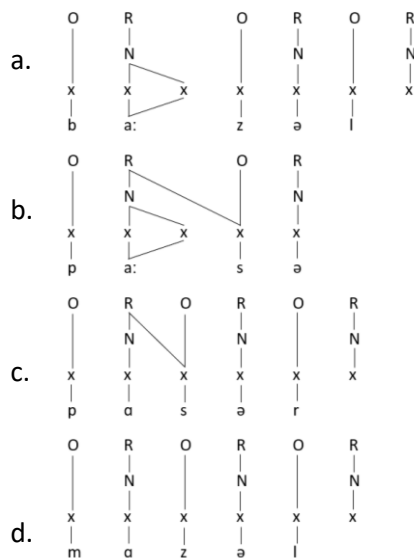
Based on the distributional differences in Dutch, van Oostendorp (2003; 2007) proposes that fricatives are specified for length rather than for voicing. Nevertheless, van Oostendorp (2007: 89) notes two problems with this analysis. The first is final devoicing: fricatives devoice in word-final position just like stops. This suggests to me that voiced fricatives are specified for [voice] after all. I return to this in section 7.3. The second problem is voicing assimilation: [voice] seems to spread from a stop in onset position to the fricative in 'coda' position, although we already saw that it is difficult to establish phonological patterning based on voice assimilation (cf. Allen 2016).

Although a length analysis might be problematic, in view of the problems noted above, it does easily account for the facts in (65). The representations of the vowel-fricatives in (65) are then as in (66), with (66ac) being the regular patterns and (66bd) the exceptional patterns.

---

[48] Botma (p.c.) points out to me that this this restriction possibly also holds for velar fricatives, as Dutch has words like *reiger* [reɪɣər] 'heron' and *egel* [eːɣəl] 'hedgehog', which are pronounced with voiced fricatives, whereas *[reɪxər] and *[eːxəl] are ungrammatical.

[49] Van der Hulst (1985) notes *heuse*, *kiese* and the non-native vocabulary (which includes words such as *racen*) as exceptions. It should be noted this list is not exhaustive, since there are other Dutch words, such as *Pasen* 'Easter', *wafel* 'waffle', *tafel* 'table', *schuifel* 'shuffle (1SG.PRES.)', *luifel* 'canopy', *sjofel* 'shabby', which also have a long vowel followed by a voiceless fricative. Nevertheless, these words are still rare compared to words with a voiced counterpart. Botma (p.c.) further notes that there might be more variety with velar fricatives here, as both voiceless fricatives (e.g. in *kachel* [kɑxəl] 'heater') and voiced fricatives (e.g. in *baggeren* [bɑɣərə] 'to dredge') follow short vowels.

(66) Representations of the contrasts of Dutch vowel-fricative sequences

```
        O    R         O    R     O    R
        |    |         |    |     |    |
        |    N         |    N     |    N
a.      |   /\         |    |     |    |
        x  x  x        x    x     x    x
        |  |           |    |          |
        b  a:          z    ə     l
```

```
        O    R         O    R
        |    |         |    |
        |    N         |    N
b.      |   /\         |    |
        x  x  x        x    x
        |  |           |    |
        p  a:          s    ə
```

```
        O    R    O    R     O    R
        |    |    |    |     |    |
        |    N    |    N     |    N
c.      |    |\   |    |     |    |
        x    x x  x    x     x    x
        |    |    |    |          |
        p    a    s    ə     r
```

```
        O    R    O    R     O    R
        |    |    |    |     |    |
        |    N    |    N     |    N
d.      |    |    |    |     |    |
        x    x    x    x     x    x
        |    |    |    |          |
        m    a    z    ə     l
```

The rhyme in Dutch has to contain at least two x-positions in a stressed syllable (Booij 1995: 26). This is the case in (66a), because the vowel is long and long vowels take two nuclear positions. In (66c) this is also the case, because a voiceless fricative takes two positions. The other two types are less common. This is due to the fact that the rhyme already contains two positions in (66b), which means that there is no need for a voiceless fricative to also occur in the rhyme. Furthermore, it explains why (66d) is marginal; the structure of this type of word is ill-formed, because there a rhyme takes only one x-position.

The /s/ in (66) is regarded as ambisyllabic (e.g. Booij 1995). Voiceless fricatives are required to be ambisyllabic in (66c), as the stressed rhyme would otherwise just have one x-position and stressed syllables needs two x-positions. There is more variation for stops however, as these frequently occur following both short and long vowels (e.g. short vowels in words like *kappen* [kɑpə] 'to cut', *hakken* [hɑkə] 'to chop' and *matten* [mɑtə] 'mat (pl.)' versus long vowels in words like *kapen* [kaːpə] 'to hijack', *haken* [haːkə] 'to crochet' and *maten* [maːtə] 'size (pl.)') and similarly there is more variation for several sonorants too (e.g. short vowels in words like *ballen* [bɑlə] 'ball (pl.)', *mannen* [mɑnə] 'man (pl.)' versus long vowels in words like *balen* [baːlə] 'bale (pl.)' and *manen* [maːnə] 'moon/mane (pl.)'). The existence of ambisyllabicity is controversial and perhaps best described by Hayes (2009), who notes that it exists as some kind of compromise between two contradictory goals, namely that stressed syllables must have a branching rhyme and that all syllables want onsets. These two goals are very similar to Coda Capture and Onset Capture (Harris 1994: 199). Nevertheless, alternatives have been proposed.

Jensen (2000) has argued to disregard ambisyllabicity altogether and proposes that an analysis in terms of a prosodic foot is better suited, since ambisyllabicity generally refers to stress. However, Riad (2014: 52) points out that such an analysis does not always work, for instance in cases when [ŋ]

follows a short vowel in an unstressed syllable in Germanic languages (e.g. in Swedish *vandringen* [vanːdrɪŋɛn] 'the hike', which has initial stress). Caratini (2007) also argues against ambisyllabicity in German and proposes that ambisyllabic segments are geminates instead. This has in fact also been proposed for Dutch by van der Hulst (1985: 61). It is unclear how to divide a rhyme and an onset for ambisyllabic consonants (cf. also Harris 1994: 200), which is why van der Hulst (1985: 61) refers to this as 'improper bracketing'. Swets (2004) follows van der Hulst (1985) and extends the possibility of ambisyllabic consonants to word-final position. I return to this in section 7.3. Caratini (2007) gives five arguments against ambisyllabic segments and instead proposes that these are geminates. Her arguments are given in (67) (Caratini 2007: 53).

(67) - ambisyllabicity has no external motivation (it only explains the problem of vowel length);
- ambisyllabic consonants have the same effects as heterosyllabic clusters on the preceding vowel (they trigger its shortness);
- ambisyllabic consonants are never affected by coda processes (such as final devoicing);
- most of the ambisyllabic consonants come from Middle High German geminates;
- ambisyllabic consonants are generally written as geminates in German.

Caratini (2007: 50) notes that especially the third point is reminiscent of properties that have already been attributed to geminates. These sounds have been proposed to have exceptional properties by Hayes (1984: 321) and are given in (68).

(68) Inalterability: Long segments often resist the application of rules that a-priori would be expected to apply to them;
Integrity: Insofar as they constitute two segments, long segments cannot be split by rules of epenthesis;
Ambiguity: Long segments act in some contexts as if they were two segments, in others as if they were one.

Inalterability is then separately applied to ambisyllabic consonants as a linking constraint (cf. van der Hulst 1985: 62), but this seems ad hoc, just like the first point in (67), i.e. that ambisyllabic consonants are posited only to explain distribution of medial consonants. More generally, the only claim that has to be assumed to regard ambisyllabic consonants as geminates, is that phonological geminates are phonetic geminates in some languages, such as Italian, but not in other languages, such as German and Dutch. If ambisyllabic consonants are phonologically geminates, their representational structure is also different. The examples in (66b) and (66c), but now as geminates, are given in (69a) and (69b) respectively.

(69) Representations of Dutch ambisyllabic consonants as geminates.

```
      O   R              O   R
      |   |              |   |
      |   N              |   N
a.    |   |              |   |
      x   x   x   x      x   x
      |   |              |   |
      p   a:             s   ə

      O   R          O   R      O   R
      |   |          |   |      |   |
      |   N          |   N      |   N
b.    |   |          |   |      |   |
      x   x   x   x  x   x      x
      |   |          |          |
      p   ɑ          s   ə      r
```
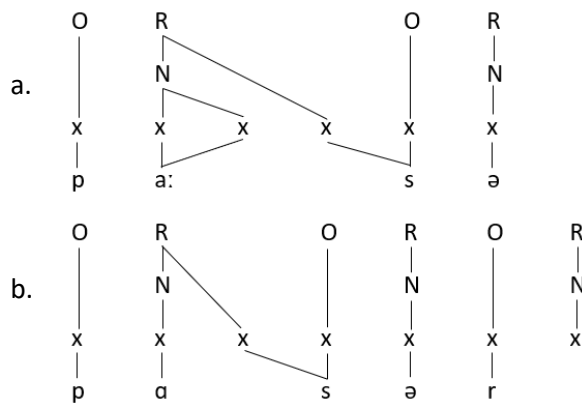
An immediate advantage of this representation is that rhymes and onsets do not have to be regarded as a merged constituent, which means that they no longer form a case of 'improper bracketing'.

Another analysis that posits ambisyllabic consonants as two identical segments, a rhymal adjunct and an onset, can be disregarded because of the Obligatory Counter Principle (OCP). This principle states that adjacent identical units are disfavoured. Harris (1994: 172-173) discusses long monophthongs and states that it is better to represent them as one segment which takes two x-positions rather than two separate segments. This should then also hold for consonants with two x-positions.

To sum up, given the analyses above, I follow van der Hulst (1985) and Swets (2004) in that a representation as geminates is the best suited option for voiceless fricatives. A length-based analysis for fricatives is attractive here. Otherwise, it remains puzzling that while most consonants can co-occur with both short and long vowels, voiced fricatives almost solely co-occur with long vowels, whereas fricatives largely co-occur with short vowels. I now turn to the differences between fricatives in other positions.

## 7.2 Initial contrasts

The data in (70) show that fricatives in Dutch also contrast in initial position (cf. Hermans & van Oostendorp 2011: 168), although initial minimal pairs for fricatives are probably rarer than stops. Perhaps they are rarer than stops in general, but even then the difference in distribution is extensive. For the third pair in (70), it should be mentioned that *chloor* 'chlorine' is a loan, while *gloor* 'glimmer (1SG.PRES.)' occurs, also in other forms of the verb, very infrequently in Dutch.

(70) *zee* 'sea'          *C* '(the letter) C'

    *vee* 'cattle'          *fee* 'fairy, fay'

    *chloor* 'chlorine'          *gloor* 'glimmer (1SG.PRES.)'

Booij (1996: 7-8) notes that the opposition between non-sibilant voiced and voiceless fricatives is being lost initially and to a smaller extent also medially, as the realization of fricatives becomes increasingly voiceless in present-day Dutch. However, this lack of opposition also seems to apply to sibilant fricatives (De Schutter 1995: 448; Allen 2016: 156). There is variety in languages spoken in the Netherlands however. Frisian, spoken in the northern part of the Netherlands, for instance, only allows voiceless fricatives in initial position, whereas a variety of Dutch spoken in Roermond favours voiced fricatives initially (van Oostendorp 2003).

In German, the initial contrast for fricatives seems even more limited than in Dutch. Eisenberg (1994: 354) notes that [ç] and [x] do not occur word-initially. Furthermore, there is doubt whether /j̥/ is a fricative or an approximant (cf. Wiese 1996), /ʒ/ is a marginal phoneme (Wiese 1996) and the uvular fricatives might be derived from the trill (cf. (2)). Moreover, it has been argued that /s/ cannot occur word-initially before a vowel, so words like *sagen* 'to say' are pronounced with a [z]. Exceptions such as *City* 'id.' and *Safe* 'id.', are once again loan words (Wiese 1996: 12; Jessen 1998: 177), although these too are increasingly pronounced with a voiced fricative (Wiese 1996: 12, 176). What remains, is that the only real word-initial opposition is a contrast between labial fricatives, which is indicative of the fact that fricatives are more restricted than stops in German, like in Dutch.

A complete length-based analysis would entail that voiceless fricatives would take up two onset positions initially or maybe even an empty rhyme and an onset. Furthermore, perhaps a word-initial geminate could be analysed similarly to medial geminates, in that phonological geminates are not the same as phonetic geminates. Hermans & van Oostendorp (2011: 173) propose that an initial voiceless fricative has a second position within the syllable and a first position in an initial appendix, because of Avery & Idsardi's law, which is referred to as Multilink here (cf. (22)), but such an analysis is not attractive, especially since I already argued against an appendix for sC-clusters (cf. section 5.1). Van Oostendorp (2003: 332) further notes that it is difficult to aptly describe the change in Dutch from voiced fricatives to voiceless fricatives and claims that in the future of the Dutch language perhaps neither length nor [voice] will be distinctive.

## 7.3  Final contrasts

I now turn to final laryngeal contrasts. In Dutch and German, final obstruents are always voiceless. This is referred to as final devoicing in L-languages, such as Russian, since [voice]/|L| is lost in this position. On the other hand, it is described as final fortition or *Auslautverhärtung* in H-languages like German (e.g. Iverson & Salmons 2011), since the last consonant cannot lose [voice]/|L| and thus still contains |H|. Final consonants here are treated as onsets of empty-headed syllable, so they are final onsets (cf.

section 2.3). Some examples of final devoicing in Dutch are given in (71) (data adapted from Booij 1995: 61), with consonantal alternations on the left side, but not on the right side.

| (71) | Singular | Plural | Translation | Singular | Plural | Translation |
|---|---|---|---|---|---|---|
| | *kloof* [f] | *kloven* [v] | 'to split' | *maf* [f] | *maffen* [f] | 'to sleep' |
| | *raas* [s] | *razen* [z] | 'to rage' | *vis* [s] | *vissen* [s] | 'to fish' |
| | *leg* [x] | *leggen* [ɣ] | 'to lay' | *lach* [x] | *lachen* [x] | 'to laugh' |

A structurally identical pattern is found in German. Examples are given in (72) below (data from Jessen 1999), with consonantal alternations on the left side, but not on the right side.

| (72) a. | Imperative | Subjunctive | Translation | Imperative | Subjunctive | Translation |
|---|---|---|---|---|---|---|
| | *luv* [f] | *luve* [v] | 'to luff' | *ruf* [f] | *rufe* [f] | 'to call' |
| | *blas* [s] | *blase* [z] | 'to blow' | *laß* [s] | *lasse* [s] | 'to let' |
| b. | Singular | Plural | Translation | Singular | Plural | Translation |
| | *Massiv* [f] | *Massive* [v] | 'massif' | *Riff* [f] | *Riffe* [f] | 'reef' |
| | *Los* [s] | *Lose* [z] | 'ticket' | *Roß* [s] | *Rosse* [s] | 'horse' |

Backley (2011: 193) analyses the difference between these two types of final laryngeal neutralization with a different elemental structure. His analysis is based on stop behaviour, but it is reasonable to assume that it can be extended to fricatives, if they behave the same as stops. In L-languages, a voiced segment contains |L̲ H|, which is neutralized to |H| in final position. On the other hand, in H-languages a voiced segment contains neither of the elements, and the difference is attributable to passive voicing in medial position.[50] Although this would hold for stops, it only holds for the fricatives if their structure is the same; also, as shown in section 7.1, it would appear that length is more pervasive in fricatives, which instead suggests that the structure of obstruents is not the same. This can also be seen in the examples in (71) and (72).

A length-based analysis would work well for words like Dutch *maf* 'sleep (1SG.PRES.)' and German *Riff* 'reef'. Since these words contain short vowels, they need to have a consonant in the rhymal adjunct. This consonant then occurs in both the rhymal adjunct and the onset as a final geminate, which has the same representation as a medial geminate. However, it becomes more problematic when the examples with long vowels followed by a voiceless consonant are considered. Swets (2004: 157) suggests for Dutch that a final onset cannot bear a feature [voice], because no sonorant sound follows. This means that the coda must devoice as well, because it cannot contain

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[50] The final laryngeal neutralization in H-languages is still called strengthening however. In section 3.1 it was noted that Vaux & Samuels (2005: 418-419) observe that (final) positions of neutralization often yield aspirates. Perhaps, it is therefore more adequate to mark final obstruents with |H̲| to denote this strengthening.

more elements than the onset. While this may be true for stops, no specific laryngeal specification of fricatives is given in her account, which makes it difficult to deduce any evidence for this. Under a length-based analysis, it could be explained by assuming that all final consonants must be coda-onset pairs, even if the rhyme already has two positions in a long vowel. The final segment would devoice in Dutch under a voice analysis, while in German a medial fricative would be passively voiced. Still, it is strange that a different analysis is required for both languages, while their distribution is the same, not only word-finally, but also medially. It would be more economical to assume that fricatives in both languages have either passive voicing (i.e. only |H|) or that voice is active, so that medial fricatives have |H L|, which is lost word-finally. Further research is needed to provide a solution for this question.

To conclude this chapter, the assimilatory processes in (64) provide an ambiguous image for the laryngeal status of obstruents, which might be due to the fact that this is phonetic rather than phonological. The strongest evidence for a length-based analysis is provided by the medial distribution, which a laryngeal-based analysis would not be easily able to account for. The distribution in initial position, unfortunately, provides no conclusive evidence for either position. The strongest argument against a length-based analysis is the final position, since obstruents pattern together here, suggesting that their laryngeal specification is the same. Since it is unclear which feature spreads in laryngeal assimilation, it might still be possible that fricatives and stops employ different contrasts. Maybe stops have retained their laryngeal voicing characteristics, while fricatives developed a length contrast. It is striking that a length distribution can be established in medial position for both languages. Although there is no conclusive evidence for either a length-based or a laryngeal-based analysis, the data in 7.1 lead me to suggest that length should at least be considered in future research on Germanic fricatives. Lastly, it should also be noted that fricatives have a more districted distribution in medial position and that the contrast in fricatives is also less pervasive in initial position in both languages.

# 8. Conclusion

The starting point of this thesis was that, in line with the 'laryngeal realism' approach, a distinction can be made between H-languages ('aspiration languages') and L-languages ('voicing languages'). My initial hypothesis was that the distinction is present in both stops and fricatives. In Element Theory terms, this means that the obstruents in H-languages are consistently specified for |H̲|, while the obstruents in L-languages are consistently specified for |L̲|. I set out to investigate the behaviour of fricatives, focussing on Icelandic, Faroese, Danish, Norwegian, Swedish, English, Dutch and German. Within the phonological category of fricatives, additional focus is given to sibilant fricatives.

Analyses for fricatives in a 'laryngeal realism' approach have been undertaken based on sonorant devoicing (Beckman & Ringen 2009; Nicolae & Nevins 2016). Unfortunately, it is often difficult to tell whether such devoicing is phonetic or phonological, so phonological arguments cannot easily be deduced from this. Sonorant devoicing in Icelandic and Faroese is an exception to this however, as voiceless sonorants are phonemic in these languages.

The phonological behaviour of |H̲| gives reason to presume a difference in phonological contrast between stops and fricatives. Devoicing of sonorants, preaspiration, spirantization and the representation of medial sC-clusters in Icelandic and/or Faroese all suggest that the first consonant of a medial cluster is a fricative, whereas stops are disfavoured in this position. This also provides some evidence that voiceless sonorants (and the glottal fricative) are, phonologically, obstruents and not sonorants. Further support for |H̲| in fricatives comes from obstruent assimilation in English, Norwegian and Swedish, with /s/ patterning with stops more often than with other fricatives.

Of the fricatives, sibilants take up a special position, as they can also occur word-initially in the rhymal adjunct of empty-headed syllables. This is due to the fact that they are salient enough to be perceived in this position, although I argue that this holds for some sibilants only, i.e. those with the element structure |I A H̲| in H-languages and |I A H| in L-languages. Processes of metathesis provide further support for the relative salience of sibilants. Sibilants can occur in less prominent positions than stops, i.e. (empty-headed) rhymes, whereas stops are restricted to onsets. Within Germanic, Faroese provides the clearest example of this.

While voicing is often assumed to be distinctive in fricatives, the behaviour of voiced fricatives in fact suggests otherwise. Many voiced fricatives in North Germanic instead pattern as approximants, which means that they crucially lack |H|. Furthermore, these fricatives have no voiceless counterpart, except for the voiceless labial fricatives. Interestingly, it is precisely in the labial series that we find ambivalent patterns for fricatives in Swedish and Norwegian, and possibly in Danish. This shows that a

voicing relationship between voiceless and voiced fricatives may only be established when both segments at the same place of articulation are present in the language, but even in these cases the voiced fricative patterns more often than not as a sonorant instead of as a voiced counterpart of a voiceless fricative.

The last chapter of the thesis investigates Dutch fricatives, and compares it to the patterning of fricatives in German. Here the data turns out to be ambivalent. The Dutch stops appear to function as voiced, i.e. they contain |L|, but the main argument that voicing is based on, i.e. regressive voicing, rather appears to be phonetic. Moreover, Dutch and German have a word-medial distribution where voiced fricatives almost solely follow short vowels, whereas voiceless fricatives also largely follow long vowels, which makes it likely that voiceless fricatives are long, i.e. phonological geminates, and voiceless ones short. The contrast in initial position does not yield any convincing evidence for length or a laryngeal specification in fricatives. Word-final position points to either a length- or a laryngeal-based account, but much remains uncertain. Nevertheless, fricatives occur in more restricted environments than stops in medial position. Support for this comes from the observation for German that while all stops contrast in initial position, of the fricatives only /f/ and /v/ do so, and by the fact that the voicing distinction of fricatives is being lost in Dutch.

The data examined in this thesis suggest that the phonological structure of fricatives differs from the structure of stops. Therefore, the hypothesis that the laryngeal specification is the same in both fricatives and stops must be rejected. We already saw that fricatives allow for less contrast than stops in general, as they cannot be voiced aspirated nor voiced glottalized, while stops can. In addition, the data I examined in this thesis show that fricatives, contrary to stops, do not always employ laryngeal contrasts, which is particularly true for [voice]. In North Germanic languages voiced fricatives pattern mainly as approximants, which are not laryngeally specified, because they are sonorants. In other (West Germanic) languages, such as Dutch and German, there are reasons to assume that the relevant contrast in fricatives is based on length, which means that there might not be a laryngeal contrast here altogether. Support for the fact that sibilants are more obstruent-like than sonorants is found in that they always pattern as obstruent, whereas non-sibilant fricatives sometimes also pattern as sonorants, but this only holds if they are voiced. Voiceless fricatives are not less obstruent-like than voiceless sibilants, although they are less salient, which means they cannot occur in the rhymal adjunct of an empty-headed syllable. Further research on other language families could provide more evidence and substantiate the claim that the laryngeal contrast in stops and fricatives is not the same, so that the observations for Germanic here can be extended to hold cross-linguistically as well.

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