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Table of contents

List of figures

List of tables

List of abbreviations

CNP	Classical Natural Phonology
ECCE	Evolution of Consonant clusters in English
HMS	Hypothesis of Mutual Support
ME	Middle English
MOA	Manner of articulation
NAD	Net Auditory Distance
OE	Old English
OSDP	Optimal Sonority Distancing Principle
PDE	Present-Day Standard English
UAAVE	Urban African American Vernacular English
POA	Place of articulation
PPCEME	Penn-Helsinki Parsed Corpus of Early Modern English
PPCME2	Penn-Helsinki Parsed Corpus of Middle English, second edition
SMH	Strong Morphonotactic Hypothesis

1. Introduction

The Middle English (ME) period was a time of great linguistic change, both in terms of phonology and morphology. The systematic reduction of weak vowel sounds in word-final syllables resulted in many new word-final consonants clusters. These consonant clusters could be generated through the loss of a final schwa (apocope), where a medial cluster moved to the edge of a word, as for instance in *strengþe* > *strength*, the reduction of a final syllable's nucleus (syncope), as in *runneþ* > *runth*, or through a combination of both, as in *comeþe* > *comth*. Both dental fricatives and consonant clusters are universally dispreferred and many consonant clusters ending in /θ/ have been reduced.

To understand the evolution of word-final TH[1], morphological changes have to be considered as well: many consonant clusters consist partly of a derivational or inflectional suffix. In derivation, the suffix *-þe* formed nominalizations (e.g. *length*, *warmth*), ordinal numbers and fractions (e.g. *tenth, fifth*), in inflection, the suffix *-eþ* represented several verbal categories. Although the derivational suffixes are still found in Present-Day Standard English (PDE), their productivity as morphological rules is questionable. The inflectional suffixes disappeared in accordance with a general development during the ME period towards an isolating language type. That is, there was a general loss of inflectional endings, with only a few of them surviving into PDE. One of those survivors is the 3rd sg. present indicative suffix *-s* (as in *she makes*), which is of particular interest, both because it is the only personal verb ending to survive and because it replaced *-eth* during the ME period.

This thesis will examine the dynamics of these historical developments within the framework of Natural Linguistics and attempt to find explanations by means of various linguistic models. The development of word-final TH is closely linked both to morphological factors and phonological changes: schwa-loss not only created consonant clusters (which are 'unnatural' in terms of universal phonotactic preferences), but also impacted morphologically complex words, reducing suffixes and making the words they formed less natural in many respects. Therefore, the issue needs to be addressed in terms of phonological and morphological naturalness, as well as at the intersection of both phonology and morphology, namely in morphonology. To analyze the naturalness of word-final TH, this thesis will therefore first discuss the morphological naturalness of both the inflectional and the derivational suffixes

[1] TH will be used throughout as a cover label for the dental fricatives /ð/ and /θ/, their graphemic representations *<þ>, <ð>, <th>*, as well as the various suffixes containing. Where necessary, distinction between them will of course be made.

(section 3.1), then the phonological naturalness of TH (section 3.2.1) as well as the naturalness of consonant clusters (section 3.2.2), under consideration of various models concerned with consonant cluster preferences (section 3.3), and finally within the field of morphonotactics (section 3.4).

Lastly, I will also try to provide empirical evidence supporting models and theories which provide explanations for the historical development of word-final TH, namely the Net Auditory Distance Principle (Dziubalska-Kołaczyk 2014) and hypotheses within the field of morphonotactics (Dressler & Dziubalska-Kołaczyk 2006). To empirically test the hypotheses derived from these models, I will primarily use data which I analyzed for the ECCE database (Evolution of Consonant clusters in English) (Ritt et al. 2017) Before analyzing the naturalness of word-final TH in theory (chapter 3) and empirically (chapter 4), however, I will outline the history of Middle English morphology (2.2) and describe the linguistic framework (2.3) of this thesis, presenting various theories of naturalness.

2. Preliminaries

2.1. Why word-final TH is of particular interest

During the Middle English period, the English language saw great changes in terms of phonology and morphology. As the following section will show, sound changes during the Old English period and the systematic loss of schwa in word-final syllables during the Middle English period caused the inflectional system to be heavily reduced and a great number of new word-final consonant clusters to be formed. Many of these new consonant clusters ended in a dental fricative ([θ] and [ð]), a sound which is commonly perceived as phonologically marked or unnatural (see section 3.2.1). This sound was present in lexical stems, derivations and inflections. It appeared in derivational suffixes of ordinals (e.g. *tenth*) and nominalizations (e.g. *length*), and in inflectional suffixes of several verbal categories. In Present Day English, the suffix only survives in ordinals and some nominalizations (e.g. *strength*, *warmth*, *breadth*).

The drastic decline of the inflectional *-(e)th* suffixes can only be partly ascribed to a general loss of inflections, as it was often replaced or ousted by other suffixes, and some of these are still present in the English language (e.g. 3rd person singular present indicative *-s*) (see section 2.2.2). The nominalization suffix is no longer regarded as productive and has been superseded by other nominalization suffixes such as *-ness* or *-ity* (see section 2.2.3.). The

loss or decline of *-th*[2] suffixes appears to be caused by phonological changes which rendered them phonologically as well as morphologically less natural: through the loss of schwa, new unnatural consonant clusters were formed and through both schwa loss and previous sound changes, suffixes which had different functions became homonymous as well as phonologically less recognizable, which led to their levelling. In other words, the loss of word-final TH is characterized by a complex diachronic interaction of phonological and morphological naturalness. This thesis is an attempt to shed some light on these interactions in terms of universal as well as system-dependent naturalness of phonology, morphology and morphonotactics and to suggest explanations for the decline of word-final TH. In order to obtain better insight into the development of the sound in word-final position, I will first describe the morphological changes which took place during the Middle English period and relate them to the present.

2.2. Middle English morphology: phonological and morphological evolution

2.2.1. Morphological levelling and schwa loss

Like many other Indo-European languages, English used to have a rich inflectional system, marking case, number, and gender in nominal, pronominal and adjectival declensions and person, number, tense and mood in verbs (cf. Faiß 1992). However, sound changes taking place during the late Old English period and the Middle English period greatly affected the morphology of English, causing the levelling of many inflectional endings. What remains in Present-Day Standard English (PDE) are plural and genitive markers in nouns, 3rd person, preterite, present participle and past participle endings in verbs, comparative and superlative markers in adjectives, a heavily reduced pronoun system, as well as a mostly obscure subjunctive mood (cf. Faiß 1992). A major factor for the morphological levelling in English is often assumed to be the change to root stress in Germanic languages, which caused the weakening of final unstressed syllables and the loss of the independent prosodic status of suffixes, first in inflectional formants and then in derivational formants (Minkova 1991: 135). Syntactic changes such as the fixation of word order and syntactic functions being fulfilled by prepositions (e.g. '*for*-genitive', '*to*-dative') went hand in hand with the levelling of inflections and consequently, English shifted from a rather synthetic language type to a more analytical one (Faiß 1992: 9). The shift to a more word-based morphology happened faster

[2] *-th* will be used throughout as a cover label for suffixes containing the dental fricative and includes all orthographic variants and pronunciations, i.e. *-(e)þ(e), -(e)ð(e), -(e)th(e).*

and to a greater extent in English (and Afrikaans) than in other Germanic languages, which Kastovsky (1992: 411-412) suggests may be connected to language contact with the Celtic population.

Along with these factors, several phonological changes led to the loss of inflections in English: during the late Old English period, final vowels were neutralized, and /m/ in the ending *-um* was changed to /n/; during the ME period, the inflectional suffix *-(e)n* disappeared and schwa was gradually lost in final position (Fisiak 1968: 76). The neutralization of word-final unstressed vowels resulted in a great number of morphemes from various grammatical paradigms being represented by the same phoneme /ə/[3], thus making those morphemes formally as well as functionally less distinctive (Minkova 1991: 136-137). This 'morphemic identity' and the fact that most of these schwa-morphemes could also alternate with a zero morpheme was accompanied by analogical levelling of further word-final schwa morphemes within a paradigm (Minkova 1991: 139). Other language-specific factors to be considered in the loss of schwa-morphemes are the phonological environment (segmental, syllabic and prosodic), the aforementioned syntactic developments, as well as extra-linguistic factors such as language contact (Minkova 1991: 136-138). Attempting a hierarchy of factors for each word class, Minkova (1991: 149-150) views the loss of formal distinctiveness of morphemes as the most important factor for the loss of schwa-morphemes in the major word classes (nouns, verbs, adjectives, adverbs and pronouns), emphasizing that the impulse for these changes was phonological, namely the shift in stress.

With schwa-morphemes losing their grammatical functions (due to functional indistinctiveness), the loss spread to other, non-morphemic schwas, thus becoming a phonological change affecting inflections, derivations and lexical stems alike (Minkova 1991: 2). The loss of final weak vowels occurred between 1100 and 1400, starting in the North (where it was well developed by 1250), spreading south to the Midlands and (reluctantly) to the South of England (1250-1350), being fully completed by 1400 throughout the country (Minkova 1991: 30). While word-final schwa seems to have been lost quite regularly due to a systematic sound change, the same cannot be said for (inflectional) non-final schwa, as for instance in the plural marker of nouns (*handes* > *hands*) : According to Dobson (1968: 879), it is a special result of syncope, a common process which causes non-final weak vowels to be deleted. Schwa-loss in final syllables was prevalent in the inflections of stems with two or more syllables and of monosyllabic stems forming part of a phrasal group with similar stress

[3] Cf. Minkova (1991: 88) for a discussion of the phonological status of schwa loss.

patterns (e.g. *mannes wit* would have a similar stress pattern to *medicine*) but less common with disyllabic stems (Dobson 1968: 880). By the 15th century, inflectional forms both with and without the vowel co-existed in the language, with the latter eventually prevailing over the former through analogical generalization (Dobson 1968: 880). However, there seem to have been other forces at work than merely phonological ones, since Dobson (1968: 880) also states that the syncopated variants of the plural and genitive markers of nouns were more common than the unsyncopated ones by 1500, but that others, such as the past tense marker *-(e)d* or the 3rd person singular inflection *-(e)th* persisted well into the 17th century in their unsyncopated forms. According to Dobson (1968: 880-881), syncope was more likely in nouns, both due to their different stress patterns and their stronger unity within phrasal groups, which explains why the process happened earlier in nouns than in verbs or adjectives. The fact that some verbal inflections syncopated much later than others, however, casts doubt on the assumption that it was a purely phonological process and draws attention to the interaction of phonology and morphology, i.e. morphonology.

While schwa-loss explains why part of the English inflectional system was simplified (i.e. where a suffix consisted of a single weak vowel), it does not necessarily account for the large-scale morphological levelling taking place during the ME period. Syntactic changes such as the fixation of word order and the use of prepositions certainly facilitated or compensated for the loss of inflections, but it is unlikely that they directly caused it. Neither is it likely that more complex endings were simply deleted in analogy to schwa-inflections especially since quite a few inflections have survived, as for instance *-s* in plural nouns or in 3rd person singular present. However, the loss of non-final schwa as well as the phonological loss of final schwas might have played a more substantial role for the development of *-(e)th*. It resulted in significant phonotactic changes: In derivation, deletion of final schwa made the suffix lose its syllable nucleus, thereby moving word-medial consonant clusters into a word-final coda position (e.g. *strengthe* > *strength*). Likewise, the loss of non-final schwa would mean that inflectional endings lose their syllable status and word-final codas made heavier by merging the remaining consonant them with preceding consonants or consonant clusters (e.g. *cometh* >*comth)*. However, as I will discuss in the following section and for the remainder of the thesis, it is a widely held opinion that the vowel in dental inflections rarely syncopated. The disadvantages that such phonotactic changes would bring, are therefore still highly relevant for the explanation of the suffixes' development, as it was lost or changed despite retaining its vowel. As chapter 3 will show, the loss of schwa and various changes within morphology caused phenomena which are not generally preferred in languages, morphosemantic opacity

and non-iconicity, suffixes which were inadequate for the English language and untypical for its linguistic type, and consonant clusters. Before analyzing which of these phenomena are likely to have influenced the ultimate loss or change of dental suffixes, I will provide an overview of inflectional and derivational suffixes containing a dental fricative during the Middle English period and outline their subsequent development.

2.2.2. *-th* in inflection

During the ME period, *-th* could be found in verbal suffixes of all three main dialects (North, Midlands, South) and across eight different verbal categories (cf. Fisiak 1968: 92):

a) 3rd sg. present indicative

b) plural present indicative

c) 2nd pl imperative

d) 1st and 3rd sg. preterite indicative

e) 2nd sg. preterite indicative

f) pl preterite indicative

g) pl preterite subjunctive

h) past participle

The forms verbal *-th* could take were *-th*, *-eth* and *-ieth*, and in all of the above, those were just some of several allomorphs (including zero) in use at any one point of the ME period in any one dialect. In the preterite forms, *-(e)th* was a tense marker and commonly followed by another suffix marking the person (with the exception of northern 1st and 3rd indicative; Fisiak 1968: 92). However, the prevalent ME preterite and past participle suffix was *-(e)d*, and during Early Modern English, it developed into a complementary distribution of [id], [d] and [t] (Faiß 1992: 43-44).

3rd person sg. *-(e)th*

The 3rd person singular present indicative is a much-studied suffix and various variables such as phonology, geographical region, social setting, text-type and frequency have been said to correlate with its change to *-(e)s* (cf. e.g.; Kytö 1993; Ogura & Wang 1996; Nevalainen & Raumolin-Brunberg 2000b). The change can be observed to have spread south from the North, with the South and London resisting the longest (Faiß 1992: 51-52). Furthermore, in

accordance with the general tendency of linguistic change being headed by women (cf. Labov 2001, Eckert & McConnell-Ginet 2003), *-(e)s* was initially predominantly used by women (Gries & Hilpert 2010: 294). According to Nevalainen and Raumolin-Brunberg (2003: 144), the change was also adopted earlier by speakers of the middle classes, with the lower classes eventually becoming the most frequent users in the late sixteenth century. In terms of text type, *-(e)s* can be found most frequently in informal genres such as private letters (Kytö 1993:132).

The origin of Modern English 3rd person *-(e)s* is assumed to have been a change in the Old English period: in the 10th century, *-(e)th* was replaced with *-(e)s* (pronounced [z], [ɪz] and [s]) in plural and then in 3rd person singular present of the Northumbrian dialect (Faiß 1989: 219). This change has been much discussed; and many different sources for it have been suggested, such as a sound change, analogical extension from the second person singular (directly or via the second plural), or the availability of subject pronouns (Stein 1986: 637-638). The Northumbrian change from *-(e)th* to *-(e)s* is unlikely to be phonological, especially since no tendency to replace /θ/[4] with /z/ cannot be observed in other positions (for instance after a consonant, as in *length*) or in similar phonological contexts in lexical forms and derivational suffixes (Dobson 1968: 948). The most likely explanation, according to the Corpus of Narrative Etymology (Lass et al. 2013: NSE), is that it was the influence of Scandinavian features, where the 2nd and 3rd singular of the present indicative were represented by the same suffix. However, this claim is not supported by any further evidence, and Miller (2002: 355) points out problems with this and other Scandinavian explanations, as for instance the fact that the suffix only spread to the 3rd sg. after it had spread to the 2nd and 3rd plural.

3rd person present indicative *-(e)s* gradually spread to the South via the Midlands, being widely used in the East by the 14th century (Faiß 1989: 219-220). The south of the country (and London in particular) was more resistant, however, with the suffix only conquering London during the Early Modern English (EModE) period, around the middle of the 17th century (Faiß 1992: 51-52). Examining evidence from contemporary southern[5] orthoepists, Dobson (1968: 883-884) suggests that in the period between the 16th and 18th century, *-eth* was replaced with *-s* rather than *-es*, and during their coexistence, *-s* seems to have been regarded as a shorter (more colloquial) variant of *-eth*. Furthermore, it appears that the vowel in *-(e)th* was usually only deleted in words whose stems ended in vowels (such as *doeth* > *doth*), and only the

[4] As [ð] and [θ] were allophones at the beginning of the ME period, and since the PDE *-th* suffixes are voiceless, the dental fricative in ME suffixes will be represented by /θ/ throughout this thesis.
[5] Nevalainen and Raumolin-Brunberg (2000b: 237) point out that these orthoepists were either from London or had been living there for a long time, therefore primarily commenting on Southern Middle English.

phonetician Hart has recorded both *-eth* and *-th* in other words (Dobson 1968: 884). Other and especially later occurrences of *-(e)th* without a vowel are mostly attributed to colloquial speech (Faiß 1989: 222).

The evidence given above suggests that the change from fricative to sibilant went hand in hand with syncope; at least in the South, unsyncopated *-eth* was apparently immediately replaced with syncopated *-s*[6]. In a closer examination, Nevalainen and Raumolin-Brunberg (2000b: 244) posit that rivalry between these two suffixes was not so much dependent on the final consonant but rather on the presence or absence of the preceding vowel. They come to this conclusion through a study of orthographic evidence of 3rd person singular and plural suffixes obtained from the Corpus of Early English (CEEC) demonstrating that the sibilant suffix only took hold in London when it coincided with vowel loss (Nevalainen & Raumolin-Brunberg 2000b: 243-245).

Figure 1: Proportion of *-(e)s* in 3rd person singular indicative in London, the North, and East Anglia, 1460-1680 (Nevalainen & Raumolin-Brunberg 2000b: 243).

Figure 1 (Nevalainen & Raumolin-Brunberg 2000b: 243) shows the percentage of *-(e)s* in 3rd person singular indicative in London, the North, and East Anglia. The figure shows that by the end of the 15th century, *-(e)s* was used both in the North and London to a considerable extent but that it failed to persist. According to Nevalainen and Raumolin-Brunberg (2000b:

[6] When *-s* is represented here without a potential vowel, it is to distinguish it from an unsyncopated *-eth* in a simplified matter and is not intended to dismiss the allomorph *-es* (pronounced /-ɪz/) which appears after stem sibilants. Equally, representation of *-eth* without parentheses of variability or doubt serve to make a point without consideration of occasional syncope.

240, 244), *-(e)s* was primarily used by London merchants and unsyncopated variants of the suffix (both sibilant and dental) were in the majority until 1600 in the London area. They also suggest that schwa disappeared from the verbal suffixes later than from the nominal suffixes (cf. also Dobson 1968: 884), and that syncopated *-th* was rather rare (Nevalainen & Raumolin-Brunberg 2000b: 242). As can be observed in Figure 1, the usage of 3rd person singular *-(e)s* grows in all three dialects during the late 16th and throughout the 17th century at various speeds, with London displaying a particularly large increase between 1580 and 1619. During this period, the change from *-(e)th* to *-(e)s* in the London area appears to coincide with the loss of schwa in this suffix (Nevalainen & Raumolin-Brunberg 2000b: 244). Later in the EModE period, 3rd person *-(e)th* was mainly used in literary contexts, either for metric reasons (due to its status as an independent syllable) or to give it an air of formality (Faiß 1989: 220).

Several studies of the 3rd p. sg. suffix in Middle and/or Early Modern English have tried to identify which words changed to the sibilant variant earlier and/or faster, considering both phonological environment and word frequency (e.g. Ogura & Wang 1996; Gries & Hilpert 2010; Nevalainen & Raumolin-Brunberg 2000b). There is consensus on the fact that words with stems ending in sibilants as well as the function words *have* and *do* were among the last to fully adopt the *-s* suffix (Ogura & Wang 1996: 121-122; Gries & Hilpert 2010: 310-311; Nevalainen & Raumolin-Brunberg 2000b: 244). Among words ending in non-sibilants sounds, frequency seems to have played a crucial role; according to Ogura and Wang (1996: 121-122) the most frequent words (with *do, have* and *say* at the top) were the first to begin to change but were then overtaken by less frequent verbs; a phenomenon which the authors call the "snowball effect", where more and more verbs changed as the development progressed, and verbs which changed later also changed faster than earlier ones. The implications of these findings will be discussed in in section 3.1.3.2.

Plural *-(e)th*

According to Faiß (1989: 225), plural *-(e)th* was gradually replaced with *-(e)n* in the Midlands, where it was common by the middle of the 13th century; a change that may be ascribed to a newfound homophony with the 3rd p. sg., as the OE plural present suffix had been *-(a)þ* up until the 10th century and thus still been different from 3rd person singular *-(e)th.* The choice of *-(e)n* is said to be an extension from one or several other verb forms displaying this suffix (cf. Faiß 1989: 225, Bryan 1921, see section 3.1.3). The new suffix seems to have been fully established in large parts of the Midlands by the end of the 12th century (McIntosh 1989: 121). In the South of England, *-(e)th* persisted as the common present plural indicative suffix during

the Middle English period and was still in use in the 16th century (Faiß 1989: 225). In the North, the development took a different path; the plural indicative was *-(e)s*, its precise origin being as disputed as 3rd sg. *-(e)s* (Godfrey and Tagliamonte 1999: 90). From at least the 14th century on, the Northern present indicative followed the Northern Present-Tense Rule (NPTR):

1) Northern paradigm (Mcintosh 1983: 238):

(i)	subject not a personal pronoun in contact with verb
3sg.	*-es*
l, 2, 3 pl.	*-es*
(ii)	personal pronoun subject in contact with verb
3sg.	*-es*
l, 2, 3 pl.	*-e, - Ø*; in the south of the N area, often *-en*

The plurals were expressed through *-e*, zero (in the southern parts also *-en*) wherever the subject was a personal pronoun in contact with the verb, and *-es* elsewhere; 3rd sg. was also *-es*, regardless of pronouns (McIntosh 1983: 237-238). Due to dialect contact, a new mixed paradigm emerged in the late ME period, which followed a similar pattern (McIntosh 1983: 238).

2) Mixed paradigm (Mcintosh 1983: 238):

(i) subject not a personal pronoun in contact with verb

3sg.	*-eth*
l, 2, 3 pl.	*-eth*

(ii) personal pronoun subject in contact with verb

3sg.	*-eth*
l, 2, 3 pl.	*-en, (-e, -Ø)*

In this mixed paradigm, the pattern remains but with other variants: *-en* (as well as *-e* and zero) occurred in the plurals with pronoun contact and *-eth* in other plurals and all 3rd singular (McIntosh 1983: 236-238). With the emergence of an Early Modern English standard, however, the dialectal variants *-(e)s*, *-(e)n* and *-(e)th* eventually gave way to the then dominating zero suffix variant (Schendl 1996: 144).

Similarly to the present plural indicative, the imperative plural had developed from Old English *-(a)þ* to early ME *-(e)th* in the Midlands and London[7], resulting in a homophony with the present plural until the latter yielded to *-(e)n* in the middle of the 13th century (Faiß 1989: 230). Both imperative plural *-(e)th* and its northern equivalent *-(e)s* alternated with zero during

[7] In the North, the change was from *-(a)s* to *-(e)s* (Faiß 1989: 230).

the late 13th and the 14th century and ultimately, imperative plural *-(e)th* was lost by the middle of the 15th century (Faiß 1989: 230-231). In Northumbrian and Scottish, both present plural and imperative plural *-(e)s* persisted into the 16th century and still occur dialectally (as *-s*) (Faiß 1989: 225).

The history of inflectional *-(e)th* outlined here raises some interesting questions: Why was the dental suffix generally reluctant to syncopate? Why was it replaced by other suffixes, such as *-(e)s* at all? It is of particular interest that the change of the fricative suffix to a sibilant suffix in 3rd sg. seems to have happened hand in hand with syncope and that *-(e)s* was not fully adopted as long as schwa deletion had not yet been in effect. If, as Nevalainen and Raumolin-Brunberg (2000b: 244) suggest, the choice of variants was dependent on the vowel rather than the consonant, why was the syncopated variant *-th* not chosen? Certainly, both *-eth* and *-s* appear to have been used more frequently than *-th*, but it may also have been possible to adopt the process of syncope alone, rather than opting for a variant that has a different consonant. While the answers to some of these questions probably lie in sociolinguistics, the present thesis may shed some light on this matter in terms of naturalness within morphology, phonology, as well as morphonology. Before moving on, I will discuss the historical development of *-th* suffixes in derivation and their status in terms of productivity both in Present Day and Middle English in the following section.

2.2.3. *-th* as a derivational suffix

-th can also be found in the history of English word-formation, representing two different derivations: a suffix forming ordinals and fractions (as in *four+th > fourth*) and a nominalization suffix, which is usually de-adjectival (as in *warm+th > warmth*) or deverbal, (as in *beren+th > birth*).[8] The ordinal[9] suffix commonly took the forms *-ða, -ta, -oða,* and *-eða* in Old English and *-the, -te* and *-ethe* in Middle English (Klein 1971: s.v. *-th*). Masculine and feminine *-th* nominalizations were formed with two different suffixes in Old English, through *-aþ* or *-oþ* and *-þ(o)* or *-þ(u),* respectively (Mitchell & Robinson: 2001: 59). In Middle English, both types were formed with the suffix *-þe* (Zbierska-Sawala: 1993: 29).

[8] De-nominal derivations exist as well: For instance, w*ealth* is derived from the ME noun *weal* 'well-being' (related to the adverb *well;* cf. Klein 1971: s.v. *wealth*, *weal*), *theft* was derived from *thief* in OE (*þēof > þēofð*) and ME *saelth* 'happiness' seems to be derived from *sael* 'happiness, good fortune' (cf. Holthausen 1974: *theft, saelth*). Other cases such as *month* (related to moon) or ME *frumthe* 'the beginning of the World, Creation' (likely related to ME *frume* 'beginning, start') seem less obvious and may not have been (or perceived to be) formed with the nominalization suffix (cf. McSparran et al. 2000-2018: s.v. *month, frume, frumth*).

[9] The term 'ordinal' will include fractions from here on.

According to Dalton-Puffer's (1996: 88) findings, nominalizing *-th* derived more adjectives than verbs, especially considering token frequency.

In order to assess the suffixes' historical development, I will consider their productivity. Deciding whether a process can be considered productive depends heavily on one's understanding of productivity and on one's approach to measuring it. I will mainly rely on Bauer's (2003) and Anderson's (1985) definitions of productivity here. Bauer (2003: 83) defines a fully productive process as one that "applies to every relevant base, defined in terms of a number of specific restrictions of types […]", pointing out that no process is ever without restrictions. Anderson (1985: 17-20) names two main criteria for determining the productivity of a morphological process: (a) its applicability to forms of its input range (i.e. whether suffixes may or may not attach to bases which clearly share some semantic or functional category), and (b) its applicability to new forms (borrowed or completely new).

The input range of ordinal *-th* may be defined as 'all cardinal numbers except *one*, *two* and *three'* (their ordinals being formed by the suppletions *first*, *second* and *third*). The suffix can be considered either productive or unproductive, depending on whether one views it as affixing to an infinite number of bases or a limited set of words (Bauer 2001: 148). That is, the potential number of words formed through this process depends on whether one regards *fourth* and all its combinations (24th, 34th, 44th, etc.) as separate instances of suffixation or not (Bauer 2001: 148; Anderson 1985: 17). Informal formations such as *umpteenth* or *gazillionth* would certainly suggest that the suffix is still productive, as it shows its applicability to new forms.

Bauer (2003: 86) laments the difficulty of measuring productivity, either through the means of lexicographic documentation of new words or by assessing the relative number of words formed through a process found in corpora. Introducing a method of identifying new words in a corpus (based on 'deleted estimation' and independent of token frequency), Nishimoto (2004) identifies *-ness* as being among the most productive derivational suffixes of Present-Day Standard English, while nominalization *-th* is considered unproductive. Indeed, nominalizing *-th* is widely considered to be unproductive and its formations lexicalized in PDE (cf. Bauer 1983: 49). Marchand (1969: 349) enumerates a few words that were coined in Modern English, most of which are no longer (or hardly) in use in PDE: still frequently used in current speech are the spatial de-adjectival nouns *breadth* (influenced by *length*) and *width* (parallel to *widness*, modelled on *length* and *breadth*), both formed by analogy rather than through a productive suffixation process (cf. Klein 1971: s.v. *breadth, width*). Other

analogical formations are the deverbal noun *growth* (after *health* and *wealth*), the (now mostly informal) *coolth* (after *warmth*), and *illth* ('ill-being', after *wealth* as 'well-being') (Marchand 1969: 349). Many of these words were coined by individuals: *illth* was coined by John Ruskin, *greenth* and *gloomth* by Walpole and *lowth* by Bacon (Marchand 1969: 349). The word *spilth*, now considered archaic, was first used by Shakespeare, which suggests that he coined it (Simpson and Weiner 1989: s.v. *spilth*). According to Bauer (2001: 98), "isolated instances of coining from individuals do not in themselves necessarily indicate productivity", as these coinages also need to be frequent in the speech community. Since the past and current usage of these words coined by literary authors is doubtful according to Marchand (1969: 349), we may assume that these words are not the result of a productive process.

Opinions on the productivity of *-th* in the Middle English period differ: Dalton-Puffer (1996: 87) suggests that it is "extremely unlikely that *-th* produced any new words in Middle English". By contrast, in a study of the 'AB dialect'[10] of Early Middle English, Zbierska-Sawala (1993: 30) states that the suffix (here written as *-ðe*) seems to have been productive, basing this conclusion on two (rather weak) examples: *uncuððe* ('strange land'), due to its co-existence with the simplex *uncuð* ('unknown') and *nearowðe* ('constraint', from *nearow* 'narrow') which is not attested earlier but is related to the OE form *nirwðe* (Zbierska-Sawala 1993: 30). Compared to *-ness*, a competing nominalization suffix available at the time, one can at least say that *-th* was not very productive in a quantitative sense: In a study based on the *Helsinki Corpus of English Texts*, Dalton-Puffer (1996: 74-75) found that while deverbal *-ung* and (mostly) de-adjectival *-ness* are the most frequent abstract noun suffixes in Middle English, both in terms of type frequency (496 and 220, respectively) and token frequency (1840 and 1332, respectively), *-th* is of 'considerable' frequency only in terms of tokens, ranking 5th for tokens (445), but is merely 11th for types (31). Since both *-ness* and *-ung* ostensibly derive the same bases and fulfil the same functions as *-th*, the suffix may at least be considered much less productive than its rivals. This may be due to some further, more specific restrictions, which will be discussed in section 3.1.3. For the moment, it is sufficient to note that Bauer (2003: 74), while maintaining that *-th* was still productive in the 16th century, concedes that there seem to be strong restrictions on which bases it derived. Furthermore, the suffix does not seem to have operated on non-native bases, thus not fulfilling (part of) the criterion (b) either (Bauer 2001: 69).

[10] The AB language or dialect, is a local written standard from the early ME period, based on two manuscripts: Corpus Cristi College 402 and Bodley 34.

Arguably, ME nominalization *-th* could at least be considered to have been a 'passive' process, that is, it did not function "as a living part of the language", determining the make-up of new word-forms, but only permitted the speaker to recognize the compositionality of existing words (Anderson 1985: 20). In Modern English, words containing the suffix are considered to be lexicalized but still analyzable to some extent (Bauer 1983: 49): While the morphological make-up is fully transparent in some words (e.g. *warmth*, *growth*) and arguably still analyzable in others (e.g. *strength*, *width*), there are also a number of words where the suffixation is less evident from a modern perspective, for instance in words such as *birth* (derived from OE *beran*, 'to bear, bring forth') or *filth* (related to OE *ful*, 'foul, rotten') (cf. Bauer 2003: 73).[11]

2.2.4. Summary and implications

Word-final TH was lost in inflectional suffixes and as a derivational process during the Middle English period. The historical development of the *-th* suffixes in English seems to suggest that dental suffixes are/were not generally preferred for some reason. However, the disappearance of word-final TH is neither complete nor uniform, as it still survives in lexical and derivational morphemes and has been replaced by various sounds in inflectional morphemes. A process that seems to have influenced the loss of final TH is schwa loss, since it resulted in morphological levelling and phonotactic changes (such as loss of transparency and new consonant clusters). In derivation, consonant clusters formed through the widespread phonological loss of word-final schwa (e.g. ME *lengthe* > PDE *length*). The resultant consonant clusters are partly still present today, but many were lost over time, either by altering the consonant cluster (e.g. ME *thefth* > PDE *theft*) or because the word went out of use (e.g. ME *ermthe* 'poverty'). In inflection, the development of *-th* was influenced by a rather more irregular loss of non-final schwa. Syncope in inflectional *-th* is attested rarely, commonly happening only in certain segmental (after vowels) and social contexts (informal). Conversely, the inflectional suffix *-s*, which replaced 3rd person *-eth* over time, was commonly syncopated. It appears, then, that schwa-deletion did not normally occur before word-final TH. The reasons for the aversion against such a deletion and perhaps also the preference for

[11] The reason for partial or complete non-transparency in many lexemes can largely be ascribed to a vowel change in the root that has been derived, for instance in PDE *broad*>*breadth* or *wide*>*width*. Many of these vowel alternations can be traced back to 'i-mutation' or 'i-umlaut': if followed by an /i/ in the next syllable, back vowels are fronted and low front vowels are raised, and the /i/ usually disappears (Mitchell and Robinson 2001: 28). In Proto-Germanic, the *-th* suffix was *iþo, thus altering roots which had back and low front vowels (e.g. Proto-Germanic **langiða* > OE *lengðu* > ME *lengthe* > PDE *length*) (Mitchell and Robinson 2001: 159; Klein 1971: 417).

other variants may be found in morphological naturalness, phonetic properties of the sound, universal phonological preferences as well as in the interaction of phonotactics and morphotactics. These areas will be explored in more detail in chapter 3.

2.3. Linguistic framework: theories of naturalness

This thesis examines diachronic change within the framework of Natural Linguistics, a theory which explains aspects of language as the result of natural reactions to extra-linguistic influences. Contrary to more traditional linguistic theories, it concerns itself with tendencies (preferences) rather than constraints and considers aspects of naturalness based on extra-linguistic sources. Originating in (classical) Natural Phonology (cf. Stampe 1969; 1979; Donegan and Stampe 1979), (modern) Natural Phonology has been placed in a functional and semiotic framework by Dressler (cf. 1984; 2002) and extended from phonology to other areas of linguistics (cf. Dressler 1985; 2009) to provide a more unified explanation of language. As it is the groundwork for Natural Linguistics, I will briefly describe the basic concepts of Classical Natural Phonology and its differences to Dressler's modern, integrative model in the following sections. As a preference theory, Natural Linguistics also shares some similarities with Natural Generative Phonology (cf. Vennemann 1972; Hooper 1976) and Vennemann's theory of preferences (cf. Vennemann: 1983), which is also concerned with extra-linguistic bases of preferences. While this thesis mainly remains within the framework of Natural Linguistics, I will also briefly discuss Vennemann's "preference laws" when considering phonological naturalness in order to highlight the superiority of naturalness theories and Natural Linguistics.

2.3.1. Classical Natural Phonology

Natural Phonology, as founded by Stampe (cf. 1969) and developed and illustrated further by Donegan and Stampe (cf. Stampe 1979, Donegan and Stampe 1979), is a naturalness theory. That is, "it presents language […] as a natural reflection of the needs, capacities, and world of its users" and seeks to show that language is a result of nature (Donegan and Stampe 1979: 127). It is also an explanatory theory, explaining phonological structure, language acquisition and language change through the notion of phonetically motivated phonological processes, suggesting that both ontogenetic development and phylogenetic evolution of the sound patterns of a language are "governed by forces implicit in human vocalization and perception" (Donegan and Stampe 1979: 126-127). Processes, the concept at the core of the model, are

seen as natural responses to limitations in articulation and perception (Donegan and Stampe 2009: 6).

There are two types of processes responding to these limitations or difficulties: lenitions (i.e. assimilatory processes), which enhance the fluency of speech, and fortitions (i.e. dissimilatory processes), which enhance the clarity of intended sounds and "the divisions of the prosodic score" (Donegan and Stampe 2009). Typical assimilatory processes are weakening, shortening, deletion, assimilation, and centralization; typical dissimilatory processes are strengthening, lengthening, insertion, diphthongization (Dressler 1984: 30). According to Donegan and Stampe (2009: 14), fortitions do not necessarily enhance contrast, they rather "exaggerate or enhance a phonetic property" and may serve articulation, perception or both. Lenitions, on the other hand, purely serve articulatory ease, by decreasing articulatory distance and are typically sensitive to phonological context and/or prosody (Donegan and Stampe 1979: 142). Fortitions are mostly insensitive to context and apply mostly in formal or attentive speech; lenitions are usually context-sensitive and apply in casual and inattentive situations (Donegan and Stampe 1979: 142-143). Furthermore, phonetic difficulties are more or less tolerated depending on the speech style (e.g. attentive, inattentive, highly emotional, etc.) that is being used, making phonological processes optional in certain situations (Donegan and Stampe 1979: 139-140).

In Generative Phonology (GP), natural responses to phonetic difficulties are regarded as 'post-lexical rule applications', their nature not being differentiated from the one of 'lexical rules' (Donegan and Stampe 2009: 6). In Natural Phonology, these concepts are referred to as processes and rules, respectively. As opposed to rules (i.e. 'lexical rules' in GP), which have to be learned through linguistic observation and depend on morphology, processes (i.e. post-lexical rules in GP) are seen as innate and universal (Donegan and Stampe 2009: 5-6). What is learned during first language acquisition are not the processes themselves but rather their inhibitions: according to the theory, a language's phonology is shaped by linguistic experience through the revision and suppression of these universal innate phonological processes (Donegan and Stampe 2009: 6-7, Stampe 1979: vii). That is, when acquiring their L1 phonology, children constantly revise their innate phonological system, preserving only the processes that fit the (mature) pronunciation of said language (Stampe 1979: x-xi). These "acquired inhibitions" shape the phoneme inventory as well as the phonetic realizations that are conventional in the language (Donegan and Stampe 2009: 7). In other words, the processes that remain after the speaker has achieved 'adult' pronunciation define the speaker's phonology, determining pronunciation and perception, even in second languages and loan

words (Donegan and Stampe 1979: 127-129). Furthermore, processes even operate on slips of the tongue, speech errors and language games, something which does not typically apply to rules (Donegan and Stampe 2009: 10).

With the idea of suppressed or limited universal processes, Natural Phonology offers insight into various phonological phenomena that generative and structuralist theories fail to explain adequately (Donegan and Stampe 1979: 132). For example, Donegan and Stampe (1979: 132) observe that speakers who do not usually devoice final obstruents (because their native language does not have any final obstruents) will still apply the process onto foreign loan words. Natural Phonology accounts for this phenomenon with the notion of natural processes and their suppression: since the speakers were not able to apply that process to their specific native language, the process did not get suppressed and is therefore still present in their phonological system (Donegan and Stampe 1979: 132). Furthermore, according to Donegan and Stampe (2009: 10) processes "apply in real time and are sensitive to speech rate and other real-world circumstances", as for instance drunkenness or fatigue, which might induce the speaker to relax their inhibitions on optional processes (typically lenitions) (Donegan and Stampe 2009: 10). Generative and structuralist theories fail to explain such variation adequately (disregarding actual speech and keeping to "artificial phonetic representations" (Donegan and Stampe 1979: 131). However, in Natural Phonology, phonetics is considered to be part of phonology and phonetic representations regarded as mental constructs, that is, they are pre-planned with regards to articulatory effort (Donegan and Stampe 2009: 19-20).

The output form which a speaker aims at is therefore a phonetic representation and not the phonological representation or intention it is derived from (Donegan and Stampe 2009: 20). Natural processes create mental substitutions for phonological representations which pose a phonetic difficulty of one kind or the other, altering the phonetic property which presents a problem (Donegan and Stampe 1979: 137). In order to remain perceptually similar to the original representation, the substitution of a sound usually differs only in one feature (Donegan and Stampe 1979: 137). This may for instance be observed in dialectal substitutions such as /fɪŋk/ instead of /θɪŋk/, where only the place of articulation was changed. Changes where more than one property was altered must be assumed to have happened in two steps, since "distinct processes have distinct causalities" and cannot be collapsed into a single process (Donegan and Stampe 1979: 137).

2.3.2. Natural Phonology as part of Natural Linguistics

Since its inception, linguists have tried to integrate Natural Phonology into a model of Natural Linguistics that includes morphology, syntax and text linguistics (cf. Dressler 2009). In order to find a bridge between these areas of Natural Linguistics, Dressler (1984; cf. 2002; cf. 2009) provides an overarching functionalist and semiotic framework (based on Peirce 1965) which offers new insights into Natural Phonology. Since Natural Linguistics acknowledges the role of non-linguistic bases of naturalness (such as cognitive, psychological, and socio-pragmatic bases) within Natural Morphology, Natural Syntax and Natural Text Linguistics, it is consequently also assumed to be present in Natural Phonology (Dressler 2009: 34). For instance, rhythmicity is not only found in prosody but in any (non-)linguistic motor activity and the preference for binary contrasts (both paradigmatic and syntagmatic) found in phonology is based in neurology and semiotics (Dressler 2009: 34-35). While 'Classical' Natural Phonology (CNP) acknowledges that rhythmicity is also found in music and nature, and even though processes are responses to physiological, acoustic, neurological and mechanic limitations, the extra-linguistic basis of phonology is never fully acknowledged (Dziubalska-Kołaczyk 2002b). Classical Natural Phonology explains phonology with reference to the functions of pronounceability and perceptibility, but only with Dressler's take on Natural Phonology is functionalism truly integrated into the explanation and prediction of language (cf. Dressler 2002).

2.3.2.1. Functional Processes

Processes either serve the function of articulatory ease or the one of perceptual clarity, that is they are "two often conflicting needs of speaker and hearer respectively" (Dressler 1984: 33). The interplay and the contradiction of those two functions is therefore not only based in phonetics and rhythmicity but also in the socio-pragmatic opposition of speaker-friendliness and hearer-friendliness (Dressler 2009: 35). Dressler (1984: 30) further distinguishes between pre-lexical processes and post-lexical processes, the former being responsible for the sound inventory and phonotactics, the latter being responsible for the phonetic outputs derived from these phonemes. However, as this is a functional distinction, this does not mean that all processes belong to either one type or the other. Rather, a process can both be applied pre-lexically and post-lexically (Dressler 1984: 30). He further argues that if phonemes are regarded as 'sound intentions', their primary goal must be to serve the function of communication through perceptibility rather than pronounceability, and that pre-lexical

processes will therefore predominantly be dissimilatory (Dressler 1984: 33). Furthermore, assimilatory processes are more likely to be post-lexical processes, since both process types primarily serve articulation (Dressler 1984: 33).

2.3.2.2. Processes as signs

In Natural Linguistics, processes are seen as signs (in the sense of Peircean semiotics; Peirce 1965). According to Dressler (1984: 35-37), they

a) should have distinguishable signantia: i.e. pre-lexical processes create phonemes of maximal distinction and phonological space;

b) are most natural when iconic: signatum (the process input) and signans (the process output) are similar or analogical;

c) should be reliable, transparent and biunique (i.e. one form is represented by one function and vice versa): deletion and fusion processes are rare (in formal speech) since they create non-unique signantia (i.e. outputs).

The semiotic basis of Natural Phonology can also be observed in the distinction between fortitions and lenitions, which corresponds to the semiotic principle of figure and ground, which states that "figures tend to be foregrounded, grounds to be further backgrounded" (Dressler 2009: 34). That is, relatively strong structures tend to be strengthened further and relatively weak structures tend to be weakened further (Dressler 2009: 34). This phenomenon is explained as an exclusively phonological 'rich-get-richer principle' (cf. Donegan 1987).

2.3.2.3. Process Innateness

Another important difference between 'classical' Natural Phonology and 'Modern' Natural Phonology models is their view on the innateness of phonological processes. Both theories draw evidence from (first) language acquisition, claiming that a child revises its phonological system with increasing linguistic experience by suppressing phonological processes. Stampe (1969), describing CNP, claims that these processes are part of a completely innate system that is already in place before there are any linguistic experiences. Dressler (2009: 38-39), on the other hand, suggests that some of these process types only become available by non-linguistic and linguistic maturation, relating Natural Phonology to physiology, psychology and neurology, and joining naturalness theory with a constructivist model that sees processes as self-organizing. The model supposes "an interplay of genetic preprogramming and of

selecting and evaluating post-natal information" (Dressler 2009: 39). Therefore, rather than speaking of innate phonological processes, Dressler's Natural Phonology concerns itself with "universally likely reactions to phonetic (and other phonology-related) difficulties" (Dressler 2009: 38). The strong view on innateness found in CNP was subsequently modified, or at least "expressed more cautiously" (Dressler 2009: 38) by Donegan (1985). She states that processes may well be learned by children but that it is a learning by experience rather than through (cognitive) maturation, like other aspects of language (Donegan 1985: 26, note 5). When Donegan and Stampe (2009: 6) later speak of innateness, they mean it in the sense that processes are determined by the limitations in production and perception that are universal to all (healthy) humans, rather than in the sense of a universal grammar or a language-innocent state.

2.3.2.4. Processes and Language Change

According to Donegan and Stampe (2009: 6) phonological processes are "the basis of systemic variation and change". That is, the failure of a child to inhibit certain natural processes not present in its language may result in a phonetic change (Donegan and Stampe 1979: 131). This change may not have any consequences except for the individual who has made the change, but it is possible that it is the origin of a historical change. With the example of monophthongization in Viennese German, Dressler (1997: 114) suggests that such lenition changes may originate in adult-child interaction, where spontaneous lenitions by children are not corrected by adults in situations or contexts in which the lenitions were not perceived well, and the change subsequently spread to more dispreferred contexts, such as formal speech, stressed positions, less frequent words, etc. Furthermore, children generalize one of various variants until they learn the socially accepted complementary distribution, which may favour the adoption and spread of the change (Dressler 1997: 114). However, change primarily seems to spread in adolescents and adults, for instance as a social or dialectal marker (Dressler 1997: 114).

Donegan and Stampe (1979: 131) ascribe adult changes to variations arising from the application of natural processes in certain speech styles. Typically, a diachronic change will involve an assimilatory process, which arose in casual speech, spread to increasingly formal speech styles and subsequently became obligatory (Dressler 1984: 34). Its defining properties are a) the lenition processes and their application hierarchy (including their generalized application in informal speech), b) the aspects of the linguistic situation and the psychological

factors for which phonological casualness is favoured, and c) the spread of the generalization of application to more formal speech (Dressler 1997: 113). While changes from below are usually quite slow in spreading as social rise is usually slow and of small scale (Dressler 1997: 115), Viennese monophthongization spread quite rapidly, due to the social rise of the lower classes and the demarcation from the standard language of post WW2 Germany.

Of course, sound changes may also involve dissimilatory processes: Dressler (1984: 34) argues that child-directed speech usually involves more dissimilatory processes than other adult speech and that if language learning plays a role in diachronic change, dissimilatory processes can effect a language change as well. However, he concedes that dissimilatory processes rarely become post-lexical, or that they are soon "morphologized into rules" or lost (Dressler 1984: 34). That is, dissimilatory changes more commonly happen pre-lexically, due to perceptual reanalysis: either synchronic fortition processes are generalized or the hearer has not mastered the phonological norms yet (being a child or a non-native speaker) (Dressler 1997: 118).

2.3.3. Natural Linguistics as a preference theory

Dziubalska-Kołaczyk (2002b: 104) names three main characteristics of Natural Linguistics: First, the functionalist and semiotic nature of explanations and predictions. Form can be predicted from function but only to some extent, due to goal conflicts and plurifunctionality (Dressler 1984: 31). Semiotics serves as a metatheory in Natural Linguistics to explain phenomena from various areas of linguistics, treating language as "a system of verbal signs" (Dressler 1984: 32). Second, the use of preferences (universal as well as language-specific) rather than rules or laws, which allows for a more gradual view on naturalness (with a continuum from more preferred to less preferred) as opposed to the binary oppositions of permissible and forbidden forms (Dziubalska-Kołaczyk 2002b: 104). Natural Linguistics is considered a preference theory, referring to concepts such as universal markedness or naturalness. Dziubalska-Kołaczyk (2002b: 116-117) maintains that as Classical Natural Phonology is an explanatory theory, it may also be viewed as a preference theory yet only Natural Linguistics explicitly uses the idea of markedness and preferences. Third, the importance of external evidence, i.e. performance data (Dziubalska-Kołaczyk 2002b: 104). Despite stressing the importance of external evidence, Natural Linguistics maintains that "all types of evidence are important", thus avoiding the any priority commonly given by linguists to either internal or external evidence (Dressler 1987a: 12). Different sources of both internal

and external evidence will be discussed below when considering the naturalness of dental fricatives (section 3.2.1), consonant clusters (section 3.2.2) and *-th* suffixes (section 3.1.).

2.3.3.1. Preferences, markedness, naturalness

The term 'markedness' has been applied to various linguistic phenomena in the past (cf. Andersen 1989) and is usually associated with notions such as naturalness, normalcy, preference and complexity. In a "very rough taxonomy of preference theories", Dressler (1987a: 9) classifies Markedness Theory as being a linguistic preference theory which is "biologically and sociocommunicationally interpreted". In Natural Phonology, on the level of universals, markedness is seen as the opposite of phonological naturalness (Dressler 1989: 111). That is, the more marked an option, the less natural it is and the more likely it is to be subjected to universal processes. On a language-specific level, markedness is concerned with "dispreferred vs. preferred phonological options of language types" (Dressler 1989: 111). 'Marked' is therefore largely used synonymously with 'dispreferred' and 'unnatural' and contrasted with 'preferred' and 'natural' in the literature of Natural Linguistics. These labels, however, may lead to misinterpretation of the concepts they signify. Dressler (1989: 111) names two of the most common misconceptions of the term 'naturalness': first, that 'natural' is synonymous with "intuitively plausible" and second, that it can be equated with a high frequency of cross-linguistic occurrence. While it may be true that 'natural' or 'preferred' structures are more frequent cross-linguistically, one cannot readily assume that every widespread structure is automatically 'natural'. Rather, parameters for naturalness need to be "deduced from the extralinguistic bases of phonology", with cross-linguistic frequency used only as evidence or counter-evidence for these parameters (Dressler 1989: 111).

2.3.3.2. Preference theories

According to Vennemann (1983: 10), general linguistic theories which formulate universals can only indicate what is possible or impossible but not specify what is usual or unusual in the languages of the world. In order to describe what is usual (or natural) and what is unusual (or marked), one needs 'theories of linguistic preference', which rank-order elements of possible languages "on a scale of preference relative to a specified parameter" (Vennemann 1983: 11). Such theories, however, are still of a descriptive nature and unable to explain linguistic preferences (Vennemann 1983: 13). Referencing the common method in linguistics to draw parallels to theories of neighbouring domains, Vennemann (1983: 9, 13) concludes

that in order to arrive at deductive explanations one must also consider non-linguistic theories, such as "phonetic theories, theories of learning, semiotic theories, theories of communication etc.". As Figure 2 (Vennemann 1983: 14) shows, non-linguistic theories provide a strong explanation for linguistic preferences by deduction. Linguistic preference theories, in turn, provide a weak explanation for language-specific properties by identifying preferences, 'elucidating' rather than deducing these properties (Vennemann 1983: 13-14).

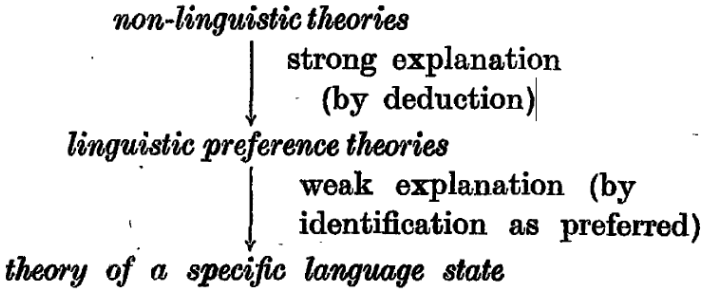


Figure 2: Chain of explanation between theories of specific language states and non-linguistic theories (Vennemann 1983: 14)

As a preference theory, Natural Linguistics proposes a "hierarchic, deductive system within which linguistic preferences occupy a general second rank, below higher principles and above the specific linguistic consequences of preferences" (Dressler 1999: 390). These higher principles, i.e. the non-linguistic bases of naturalness, can be 1) of a neurological/ psychological nature, for instance restrictions on processing, memory, information storage and retrieval, etc.; or 2) of a socio-communicational/socio-psychological nature; for instance, the struggle between hearer-friendliness and speaker-friendliness (see section 2.3.2.1), and the two types of bases may also interact according to Dressler (1987a: 11-12).

higher principles	*Non-linguistic (cognitive, phonetic, psychological, sociological etc.)*
|	|
preferences	*linguistic*
preference parameters	*functional and semiotic*
|	|
consequences of preferences	*linguistic*

Figure 3: The explanatory system of Natural Linguistics (adapted from Dziubalska-Kołaczyk 2001: 73)

Figure 3 shows an adaptation of Dziubalska-Kołaczyk's (2001: 73) visualization of the explanatory system in Natural Linguistics. Dziubalska-Kołaczyk (2001: 73) illustrates the system with a phonological example, namely the universal preference of CV structures: Higher, non-linguistic principles, such as the least effort principle or the principle of cognitive economy explain why "having only open syllables is preferred to not having only open syllables" (Vennemann 1983: 12) on the preference parameters of pronounceability and perceptibility, and the consequence of this preference is the absence of consonant clusters in a language (Dziubalska-Kołaczyk 2001: 73). As section 3.2.2 will show, this preference for CV can also be observed in the evolution of languages, where certain consonant clusters are often repaired in order to move towards a CV structure again.

By suggesting a graded scale of preferences, ranking elements as more or less preferred than others, Vennemann (1988: 2) attempts to explain language change, later formulating the "Diachronic Maxim" with reference to preference laws:

> Linguistic change on a given parameter does not affect a language structure as long as there exist structures in the language system that are less preferred in terms of the relevant preference law.

The implication of this hypothesis is that "the worst structures" (Vennemann 1988: 2), i.e. the most marked elements of a language are the first to be affected by change. In order to identify those 'worst' structures, one needs to define parameters that make them more marked or less natural. Section 3.2 will be looking at phonetic and phonotactic aspects which make *-th* suffixes less natural and therefore more likely to be reduced.

2.3.4. Natural Morphology

Naturalness has not only been examined within the field of Phonology, but also for morphology, syntax and text linguistics. While the basis for naturalness in phonology can largely be ascribed to articulatory and perceptual phonetics, bases for other fields of linguistics are less evident and early attempts at describing naturalness or markedness seem rather tentative. For instance, Mayerthaler (1981: 2) enumerates some characteristics of natural

morphological processes or structures "bis auf Widerruf" ('until revoked'): prevalence, early acquisition, and resistance against or being a frequent result of language change. However, these characteristics do not constitute bases for naturalness but rather represent its evidence (see chapter 3), and Dressler et al. (1987) have further suggested principles which are deduced from extra-linguistic bases for naturalness (see 2.3.3):

a) system-congruity, i.e. the degree to which something conforms to patterns that are normal in a system;
b) class stability, e.g. inflectional paradigms following dominant paradigm structure conditions;
c) uniformity and transparency (biuniqueness);
d) constructional iconicity/diagrammaticity, i.e. an analogy between signans and signatum.

These principles will be discussed more closely when analyzing the naturalness of *-th* in section 3.1 below. However, as it is likely that the development or loss of the various *-th* suffixes cannot be explained by phonological or morphological naturalness alone, the following section will discuss their interaction: morphonology.

2.3.5. Morphonology

Natural Linguistics is an all-integrative model, also examining the interaction of different areas of linguistics (e.g. morphonology, sociophonology, morphopragmatics). Of these, morphonology, that is the link between phonology and morphology, and specifically its sub-area morphonotactics are of special interest for this thesis. Morphonology consists of three major areas of research: 1) the phonological structure of morphemes, 2) sound modifications in morphemes due to morphological combination, and 3) 'sound alternation series' ('Lautwechselreihen') fulfilling a morphological function (Trubetzkoy 1967: 269-270).

Morphonotactics, that is the area investigating phonotactic aspects of morphology, places itself within the first of these areas of research. The interaction of morphotactics with phonotactics and their influence on the development of word-final TH will be discussed in more detail in section 3.4 below. The second and third area of morphonology are what may be referred to as morphophonemics, which examines phonemic changes in derivation and inflection (Dressler 1985: 2). This excludes purely phonological alternations (e.g. plural devoicing) and allomorphic alternations (e.g. umlaut, suppletion). However, the distinction between those types of processes or rules is not always clear, not least because there are "gradual synchronic and diachronic transitions from phonological rules or processes (PRs) via

morphonological rules (MPRs) to allomorphic rules (AMRs)" (Dressler & Dziubalska-Kołaczyk 2006: 70). While Natural phonology strictly separates morphonological rules and phonological processes, Dressler (1985: 30) regards their distinction as more gradual, speaking of "prototypical morphonological rules (MPRs) with "fuzzy boundaries to phonological rules (PRs) and allomorphic morphological rules (AMRs)". He proposes a set of criteria which determine the degree to which a phenomenon can prototypically be classified as one or the other (cf. Dressler 1985: 57-59).

In their interaction, linguistic subsystems may come into a naturalness conflict: for instance, as observed in the history of English, a natural process such as weakening in word-final unstressed syllables may result in very indistinctive word-final inflectional suffixes, i.e. in rather unnatural morphology and consequently inflectional suffixes may be lost completely. This is in line with the common observation in Natural Morphology (as well as amongst Neogrammarians) that "when phonology and morphology interact in diachrony, the former is typically active, the latter reactive" (Dressler et al. 2010: 64). Similarly, the natural lenition process of schwa-loss in English resulted in many unnatural word-final consonant clusters. In the case of consonant clusters ending in /θ/, morphology seems to have reacted by replacing the verbal *-th* suffixes with various (phonologically) preferable variants. Furthermore, certain consonant clusters, which had previously only occurred within a morpheme, then also occurred across morpheme boundaries (or vice versa), and such (mor)phonotactic ambiguity may have caused further repair mechanisms.

It seems likely that both phonological and morphological aspect of naturalness as well as their interaction (i.e. morphonology) played a role in the development of word-final TH in English. In the following chapter, the morphological naturalness of the various *-th* suffixes (section 3.1) and the phonological naturalness of dental fricatives (section 3.2.1) as well as consonant clusters (3.2.2 and 3.3) will be examined more closely, before the implications of morphonotactic ambiguity will be considered in section 3.4.

3. Theoretical analysis: Naturalness of word-final TH

The development of word-final TH during the Middle English period was influenced by its degree of naturalness in various domains: As it was part of several inflectional and derivational suffixes, which have either disappeared or become unproductive, it seems likely that morphological naturalness has played a significant role in their loss. Furthermore, the fact

that 3rd person *-eth* appears to have largely resisted the natural lenition process of schwa-deletion suggests that at least some consonant clusters ending in /θ/ are relatively marked or unnatural. This chapter will closely examine naturalness within morphology, phonetics, phonology an morphonology, attempting to find theoretical explanations for relative markedness or preferences, and supporting them with external and internal evidence (see section 2.3.3). According to Dressler (1987a: 13), such evidence of naturalness provides both a heuristic basis and a testing ground for hypotheses. External evidence for naturalness or markedness is paramount in Natural Linguistics; it covers "all imaginable facets of linguistic behavior", i.e. of performance (Dziubalska-Kołaczyk 2002b: 104). According to Dressler 1987a: 13-14), it may be found in

a) phylogenetic evolution: linguistic entities produced or processed by something that came late in evolution will be relatively more marked;
b) ontogenetic maturation: later linguistic developments are more marked than earlier ones;
c) perception tests: less marked elements are perceived more easily;
d) error linguistics: more marked structures trigger more mistakes;
e) speech disorders: more marked entities are affected/lost before less marked ones;
f) child directed speech: adults favour less marked structures when talking to a child;
g) language acquisition: less marked structures are acquired before more marked ones.

Despite the general impression that external evidence receives special recognition in Natural Linguistics, internal evidence is seen as equally important. Dressler (1987a: 14) lists the following sources of internal evidence:

a) cross-linguistic frequency: the less marked, the more frequent
b) language change: from more marked to less marked
c) change chronology: more marked elements change before less marked ones
d) frequency: less marked entities are more frequent in type as well as token
e) pidgins and creoles: reduction of marked structures in pidgin, first recurrence of unmarked structures in creoles
f) analogy: less marked elements survive better during analogical change
g) neutralization: less marked structures survive better
h) morphology: zero encoded structures are usually less marked
i) phonology: phonological markedness tends to entail morphonological markedness
j) binomial pairs: the first part of a binomial pair tends to be less marked than the other

In this chapter, several of these sources of evidence of naturalness will be considered within various linguistic sub-systems in order to determine the naturalness of /θ/ as a word-final sound and as a suffix. A common hypothesis in (non-generative) phonology is that rules are applied before phonetically motivated processes (cf. Donegan and Stampe 1979: 156), which is also in line with the semiotic view that morphemes (and morphological rules) have priority over phonemes and phonological processes (cf. Dressler 1984b: 36-38). It thus seems reasonable to consider morphological aspects of naturalness/markedness (section 3.1) before discussing phonetic and phonotactic (3.2) and morphotactic preferences (3.4).

3.1. Morphological naturalness

3.1.1. Introduction

As shown in section 2.2.1 on morphological levelling as well as in section 2.2.2 on inflection, phonological changes seem to be at the root of the levelling of English inflection in general. However, not all inflections were lost; they are still present in noun plural, noun genitive, 3rd person, preterite, present participle, past participle, comparative and superlative suffixes (cf. Faiß 1992). Inflectional *-(e)th* was replaced or ousted by various suffixes (*-Z*[12], *-(e)n*, *-D(-)*[13]) or even deleted completely. This seems to have depended largely on what alternative suffixes were already available in the system at the time: as described in section 2.2.2, the change from *-(e)th* to *-(e)s* in the Northumbrian has been attributed to various phonological, syntactical and analogical reasons. The change from plural present *-(e)th* to *-(e)n* in the Midlands and London seems to have happened by extension from other verb forms (cf. Faiß 1989: 225; Bryan 1921, see section 3.1.3). In the case of the preterite and past participle suffix, *-(e)th* was replaced by a more common suffix, *-(e)d.* While the choice of substitution or variant varies between inflectional categories (and indeed dialects), the fact that *-(e)th* was substituted or lost suggests that it was more marked than the alternatives just mentioned, as "[l]anguages tend to change from what is more marked to what is less marked" (Dressler 1987a: 14).

While *-th* disappeared from inflection, it survived into PDE in derivation, namely in ordinals and nominalizations. As discussed in section 2.2.3 above, the PDE list of (possible) *-th* nominalizations is known and finite (cf. Bauer 2003: 73) and many ME forms became obsolete through a change in suffix (e.g. *fulth* 'fulness', Lexico.com 2019: s.v. *fulth*), replacement by a synonym (e.g. *ermthe* 'poverty', McSparran et al. 2000-2018: s.v. *ermthe*) or through disuse

[12] With the allomorphs *-z*, *-ɪz*, and *-s*
[13] With the allomorphs *-ed(-)*, *-d(-)* and *-t(-)*

(e.g. *frumthe* 'the beginning of the World', McSparran et al. 2000-2018: s.v. *frumthe*). While many of these forms are still analyzable, the rule is generally considered to be unproductive (cf. Bauer 1983, Nishimoto 2004). In ordinals, on the other hand, *-th* can still be regarded as productive (see section 2.2.3 above). According to Dressler (1987b: 108), "more natural WFRs [word formation rules] should be more productive than less natural WFRs". Similarly, Bauer (2001: 98) mentions naturalness as one of the factors which influence the productivity (and ultimately the survival) of a morphological rule. This chapter will therefore thoroughly examine the development of the various *-th* suffixes through aspects of morphological naturalness, namely universal, system-independent naturalness and relational naturalness. Universal, system-independent markedness in morphology can be determined within a semiotic framework through the notions of constructional iconicity/diagrammaticity, biuniqueness, and transparency (all based on human perception) (cf. Dressler et al. 1987). Relational naturalness comprises typological adequacy and system-adequacy (or system-dependent naturalness), which consists of the concepts of system congruity and class stability (cf. Dressler 1987). In each section, I will present the theory along with an analysis of the suffixes' naturalness. Where it is sensible, the inflectional suffixes will be analyzed separately from the derivational ones (i.e. in section 3.1.3.2 on system-adequacy).

3.1.2. Universal naturalness

Semiotic Framework

As described in section 2.3.2, Dressler (1984; cf. 2002; cf. 2009) places Natural Linguistics in a semiotic framework based on Peircean semiotics (cf. Peirce 1965). Within this framework, language is regarded as "a system of verbal signs" (Dressler 1984: 32) and semiotic principles such as iconicity, transparency and uniformity are applied to morphology in order to determine naturalness or markedness. A sign is "something [=signans] which stands to somebody [=interpreter] for something [=signatum] in some respect or capacity [=interpretant]" (Peirce 2014 [1940]: 99; additions by Dressler 1987a: 15). Thus, a sign has four aspects: The interpreter, who is the sign's user, the signatum, which is "what is expressed in the sign", the signans, i.e. what "expresses the signatum", and the interpretant, that is, a sign's outcome or effect, another sign created in the interpreter's mind (Dressler 1987a: 15). The result of this is a chain of signs, with words being primary signs, whose signantia are morphemes and morphological rules (MRs) (secondary signs), who in turn have phonemes and phonological rules (PRs) (tertiary signs) as their signantia (Dressler 1987a: 15-16). Peirce

(2014 [1940]: 99) divides signs into three trichotomies; i.e. triadic relations between different types of signs. The first trichotomy is concerned with the sign in relation to itself (whether it "is a mere quality, […] an actual existent, or […] a general law" (Peirce 2014 [1940]: 99). According to Dressler (1987a: 16), the third of these signs is the most relevant of the three to Natural Morphology, as an MR is a law which is a sign (a 'legisign'), connecting signatum (an MR's input) and signans (an MR's output). Three more signs are important for Natural morphology, *icon*, *index* and *symbol*, which are divided according to the relation of the sign to its object and form the second trichotomy (Peirce 2014 [1940]: 101-102).

All words are symbols; i.e. conventional signs which rely on rules and their interpretants (Peirce 2014 [1940]: 104, 112). Words such as demonstrative and personal pronouns are indices; that is, they are truly connected to the object and do not depend on the interpretant (Peirce 2014 [1940]: 102, 104). The most natural signs are icons; here, the relation between signans and signatum is one of analogy or similarity (Dressler 1987a: 17). The most iconic images are onomatopoetic words, the least iconic signs are metaphors (Dressler 1987a: 17). The type of icon that is most important for Natural Morphology, however, are diagrams (Dressler 1987a: 17). Diagrams "represent the relations […] of the parts of one thing by analogous relations in their own parts" (Peirce 2014 [1940]: 105). Dressler (1987a: 17) compares this to a technical diagram of a car, where arrows and lines all represent similar relations and aspects of an actual car. A diagrammatic relation between signans and signatum in morphology therefore refers to constructional iconicity, that is, a diagrammatic similarity between the semantic and the formal composition of a word or string of words Dressler 1987b: 102).

Constructional iconicity

For inflection, constructional iconicity or diagrammaticity can be observed in the relations between the features of semantic categories and of morphological categories: categories such as subject, animate, indicative, nominative/accusative are semantically more marked (i.e. cognitively more complex) than other syntactic functions, inanimate, non-indicative, or other syntactic cases, respectively (Mayerthaler 1987: 41, cf. Mayerthaler 1981: 14-15 for an exhaustive list). Consequently, in a diagrammatic relation between form and meaning, the cognitively less complex category should be represented by a less complex morphology, which can be observed in the tendency to use zero-encoding for such "natural language categories" (Mayerthaler 1987: 48). For instance, in ME, the present tense was unmarked

while the past tense was marked with a *-D* suffix (cf. Fisiak 1968). If a semantically more complex (i.e. more marked) category is expressed with less morphology than its semantically less complex (i.e. natural) counterpart, then it is "countericonic" (Mayerthaler 1987: 48-49). Evidence of the naturalness of iconicity can be found in language acquisition: children process more iconic word-formation rules more easily than less iconic ones (Dressler 1987b: 109).

In terms of constructional iconicity, it is surprising that a 3rd person singular present indicative suffix survived at all, being semantically more natural than the 3rd person plural present indicative or than the 3rd person singular subjunctive, both of which have zero-encoding in English today. Of course, one might look at it from another point of view and ask how those semantically more marked categories came to receive zero encoding. Furthermore, this principle does not explain why other (non-zero) variants were preferable to *-(e)th*, since all of them represent an additional morphological feature. Nevertheless, the dispreference of such a non-iconic suffix may be observed in the tendency of some PDE dialects and sociolects to use zero-encoding in 3rd person as well (cf. Trudgill 2002: 93-95).

Whereas in inflection constructional iconicity is concerned with the markedness of categories and their morphological encoding, in word-formation, it is concerned with the "diagrammatic analogy between semantic and morphotactic compositionality (or transparency)" (Dressler 1987b: 102). For instance, in the word *reader*, the semantic composition (A+B), consisting of the meanings *read* (A) and *agent* (B), is represented by the morphotactic composition (a+b), consisting of the morphemes *read* (a) and *-er* (b) (Dressler 1987b: 102). A derivation is considered iconic if the addition in semantic meaning is paralleled by a formal addition (e.g. *read+er*), metaphoric if the addition is represented by modification only (e.g. *sing* > *song*) and non-iconic in the case of conversion (e.g. *to cut* > *a cut*) (Dressler 2005: 269).

Morphotactic and morphosemantic transparency

The morphological motivation of a word is the more diagrammatic the more morphotactically transparent it is (Dressler 1987b: 102). Morphotactic transparency is given when the composition of the word is fully perceptible; for instance, an allomorphic alternation as in *five* > *fifth* is opaque to some degree, since there is an alteration in the base (Dressler 2005: 273). Ideally, the morphological boundaries of a word should match its syllable boundaries in order to be fully transparent (Mayerthaler 1987: 49). However, after schwa loss, the derivational suffix *-the* > *-th* lost its status as a separate syllable and became perceptually more difficult to distinguish from its base. For instance, a pre-schwa-loss word such as *warm-the*, with the base

form unaltered, and the syllable boundary still corresponding to the morpheme boundary, is morphotactically fully transparent. A post-schwa-loss word such as *strength*, on the other hand, which not only has a vowel alteration in the base (*strong* > *streng-*) but also has no clear morphotactic boundary between base and derivational suffix, is far opaquer and therefore more marked. Likewise, in a monosyllabic form such as *doth* 'does' the morpheme boundary between the base and the inflectional suffix is much less transparent than in an unsyncopated *doeth*.

1 intrinsic allophonic phonological rules	*?lauerdom*
2 extrinsic allophonic phonological rules, resyllabification	*accep$table, adver$sitee*
3 morphonological rules: without fusion	*caitif : caiti$uete*
4 morphonological rules: with fusion	*dyvyded : dyvysioun, defenden : defence*
5 morphonological rules: vowel alternation	*long : lengthe, arm : ermthe*
6 weak suppletion	*corumpen : corupcion*

Figure 4: Morphotactic transparency in Middle English (Dalton-Puffer 1996: 58)

1	2	3	4	5	6	S&S
271				174		
60 %				40%		

Examples: T1/2 *truthe*
T 5 *lengthe*

Figure 5: Morphotactic transparency of *-th* (Dalton-Puffer 1996: 114).

Compared to rival suffixes, *-th* is also the least transparent: Taking a quantitative approach based on tokens, Dalton-Puffer (1996: 58) ranks the items on a scale of morphotactic transparency, which considers phonological, morphonological and morphological rules as well as weak suppletion (see Figure 4). On this scale, words derived with *-th* can either be found at threshold 1/2 at the more transparent end of the scale which is concerned with allophonic rules, or on the less transparent end, at threshold 5, which involves vowel alternations (Dalton-Puffer 1996: 114).[14] As can be seen in Figure 5, the division between the two thresholds shows that the majority (60%) of *-th* derived tokens are on threshold 1/2, a

[14] It should be noted that these morphonological alternations are by no means consistent for each lexeme; Dalton-Puffer (1996: 114) notes that a base may be left unaltered in some instances while being altered in other instances.

trend which can also be seen in terms of types (albeit to a lesser extent) (Dalton-Puffer 1996: 114). In comparison, alternative nominalization suffixes such as de-adjectival *-ness* or deverbal *-ung* (later *-ing*) do not alter the stem and are separate syllables remaining distinct from their base and are therefore much more natural in terms of diagrammaticity than *-th*. Furthermore, according to Dressler (2005: 276), the optimal shape of a grammatical morpheme appears to be one syllable, something which applies to most of the English derivational suffixes, but not *-th.*

On the other hand, a suffix which has no syllable status is closer to the stem, which may be seen as good indexicality, as "an index is a sign where the signans directly refers to the signatum" (Dressler 2005: 270). The importance of directness refers to both a closeness in rule application as well as on a syntactic level (Dressler 2003: 465). Thus, an affix which is immediately attached to its base is preferred over an affix that is more distant from it (e.g. due to the presence of an infix) (Dressler 2005: 270). That is, a signans can point to the signatum better if it is closer to it, with stem-change representing an even closer connection (Dressler 1987b: 110-111). When considering complexity-based suffix-ordering, Hay and Plag (2004) found that suffixes which could be parsed (i.e. separated from the base) more easily, would also attach more freely to other suffixes. In terms of suffix ordering, then, *-th* can also be considered being closer to the stem, as it cannot attach to other suffixes, further away from the stem (cf. Hay & Plag 2004: 581-583). A vowelless *-th* is therefore more natural according to the parameter of indexicality than *-eth*, *-the* (with the vowel intact) or an alternative suffix such as *-ness*, which is clearly separated from the base by a syllable boundary.

The semiotic preference for transparency within morphology not only manifests itself on the parameter of morphotactic transparency but also on the one of morphosemantic transparency (Dressler 2005: 271). While morphotactic transparency pertains to the perception of morphemes, morphosemantic transparency is concerned with the compositionality of meaning. Inflectional meanings are usually fully compositional; however, according to Dressler (2005: 271), no word-formation can ever be fully transparent, as its meaning cannot be derived from its parts alone. The relative morphosemantic opacity of derivations is attributed to a biuniqueness conflict, where the biuniqueness of the whole word (lexical biuniqueness) is prioritized over the biuniqueness of its parts (morpheme biuniqueness), due to words being more important than morphemes in semiotics (Dressler 2005: 277-278). Thus, all accepted derived words are stored in the lexicon, and only newly formed derivations ('occasionalisms') are not (Dressler 1987b: 114). Such neologisms commonly only fulfill one of the potential meanings of a derivation (or compound), which is why one should differentiate

between “lexicalised word meaning” and “transparent word formation meaning” (Dressler 2005: 271). Furthermore, the lexicalization of derivations increases over time on a path of ‘univerbation’; that is, syntactic phrases become compounds, which become derivational words, which become simple words (Dressler 1987b: 115). Therefore, the more a word is stored (lexicalized), the more semantically opaque it becomes, which is usually reflected in an increase of morphotactic opacity (Dressler 1987b: 115). Evidence for the naturalness of transparency can be found in language acquisition and speech pathology: aphasics tend to preserve transparent rules much better, often using them to replace opaque ones (Dressler 1987b: 109). Furthermore, children with English as a first language may apply a more transparent word-formation rule such as *-ness* nominalization and form words such as *angriness* or *stronginess* before they acquire the more lexicalized *anger* and *strength* (Konieczna 2002: 58).

Biuniqueness

According to Mayerthaler (1981: 35), complete transparency is only given if a paradigm exhibits only monofunctional suffixes, an ideal found in the concept of ‘uniform encoding’ or ‘one function – one form’. The uniform encoding of a language ideally means that there is only one form for each meaning (i.e. avoids allomorphy) and only one meaning for each form (i.e. avoiding polyfunctional or polysemous affixes) (Mayerthaler 1987: 49). Based on preferences in perception, production and processing, it is equivalent to the semiotic criterion of biuniqueness (Dressler 1987b: 112). If a sign is biunique, the uniqueness goes both ways; there is a “relational invariance between signatum (A, B) and signans (a, b), i.e. A ≡ a, B ≡ b” (Dressler 1987b: 111). In morphology, uniqueness, or “one-to-many relations” (Dressler 2005: 274), either occurs as allomorphy or as polysemy (or polyfunctionality); if both phenomena occur, the sign is non-unique and therefore highly unnatural (Dressler 1987b: 111). The presence of allomorphy, polyfunctionality and opacity can usually be explained by phonological changes, for instance vowel alternations as in *long*/*length* through i-mutation, the collapse of several affixes through the neutralization of word-final vowels in inflections (see section 2.2.1), or the loss of a syllable nucleus in an unstressed position through schwa-loss.

The ideal of (bi)uniqueness is limited in word-formation, as it would need too much cognitive storage (Dressler 1987b: 112). In the case of derivational *-th*, non-uniqueness can be found both in the suffix and many of its bases. For instance, in derivations such as *long* > *leng+th*,

young > *you+th*, the meaning A is represented by several forms (e.g. *long, leng-*) due to allomorphy. Furthermore, the same function B (abstract noun formation) can also be denoted by several other forms than *-th*, such as *-ness* and *-ity* (cf. Dressler 2005: 274). Moreover, the form b (*-th*) can represent several meanings or fulfill several functions: the form *-th* was (and still is) also used for forming ordinals as well as fractions. Arguably, the suffix would have become even more polyfunctional in contexts where syncope of schwa took place, i.e. where inflectional *-eth* and derivational *-the* were represented with the same form *-th*. While it is doubtful that verbal *-eth* ever syncopated on a large scale (see section 2.2.2), even occasional syncope in informal contexts and the strong association of the consonant with both inflectional and derivational *-(e)th* may have had an influence on perceived non-biuniqueness. Polyfunctionality of this degree is not found in other nominalization suffixes such as *-ity* or *-ness*, which makes them more natural in terms of (bi)uniqueness than *-th*.

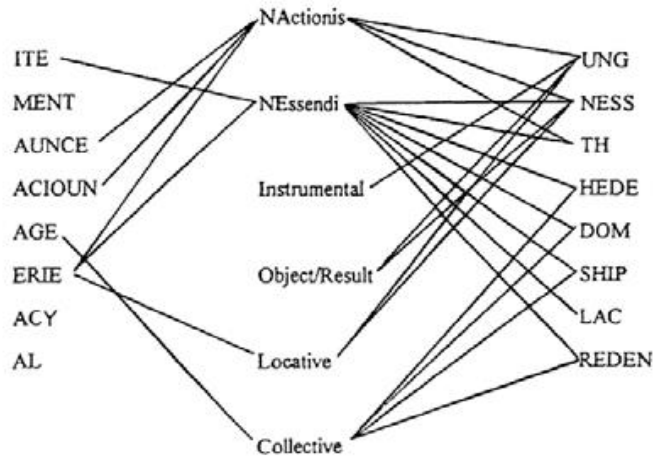


Figure 6: Form-function mapping of abstract noun suffixes in ME1 (Dalton-Puffer 1996: 124)

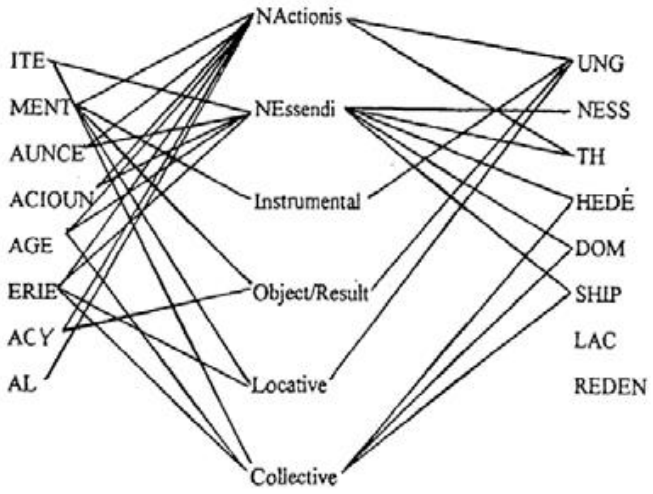


Figure 7: Form-function mapping of abstract noun suffixes in ME3 (Dalton-Puffer 1996: 124)

However, the situation of abstract noun suffixes is not as simple on a deeper level. Figure 6 and Figure 7 (Dalton-Puffer 1996: 124) show the complex relationships among abstract noun suffixes at the beginning and at the end of the Middle English period. Clearly, the status of abstract noun suffixes was by no means biunique; one suffix could represent several semantic categories, which could in turn be represented by several suffixes. For instance, *-th* created both nouns denoting a state or quality (nomina essendi, usually formed from adjectives), or nouns signifying an action or the result of an action (nomina actionis, usually derived from verbs) (cf. Zbierska-Sawala 1993: 30). As Figure 6 and Figure 7 show, these same categories may also be expressed through multiple other suffixes, such *as -ness* or *-ung*. Thus, even if one disregards the functions and meanings which the form *-th* fulfils in inflection and when it is attached to numbers, it is still highly non-unique within the bounds of abstract noun formation. It is not, however, less natural than most of the other abstract noun suffixes in this respect: during the entire ME period, only *-al* and *-lac* never fulfilled more than one semantic function.

It is possible to look at polyfunctionality at an even deeper level, in terms of the combinations of semantic categories a suffix represents. While such combinations are considered unique for each suffix by Marchand (1969: 227-228), Dalton-Puffer (1996: 125) identifies no less than 4 Germanic suffixes which fulfilled the same set of functions: *-hede; -dom; -ship; -reden*; a state which led to a specialization of meaning of the three former and the disappearance of the latter. While *-th* did not have any rivals with the exact same combination, there were a great number of suffixes which covered both categories it represented: *-acioun, -aunce, -erie, -age,* and *-lac* (Dalton-Puffer 1996: 125). Thus, in terms of semantic functions, *-th* was clearly in competition with many other suffixes; even more so once Norman influences introduced new suffixes into the system (cf. Dalton-Puffer 1996: 122). The increasing polyfunctionality of Romance suffixes that can be seen in Figure 7 is certainly not natural in terms of biuniqueness, and Dalton-Puffer (1996: 123) links this to the general increase of complex French loans during that period. The general decrease in number of functions among Germanic suffixes, however, may well be a natural development towards biuniqueness. The issue of competition among noun suffixes as well as the relevance of language type and lexical strata will be dealt with in more detail in the following section.

As mentioned above, lexical biuniqueness has priority over morpheme biuniqueness (Dressler 2005: 277-278). Biuniqueness therefore tends to avoid synonymy, which is why, in PDE, a productive WFR such as *-ness* affixation may be blocked from creating words such as *longness* or *strongness*, because the words *length* and *strength* already express those meanings

(Dressler 1987b: 112-113). However, Dressler (1987: 113) concedes that this "synonymy constraint" is not very strong, and *strongness, longness, wideness, broadness, warmness* have been recorded in dictionaries to some extent; either with a separate entry or as an addendum to their base word (cf. Lexico.com 2019: s.v. *strongness*, *longness*, *wideness*, *broadness, warmness*; Merriam-Webster.com 2019: s.v. *strongness*, *long*, *wide*, *broad*, *warm*). A possible explanation for creations such as *strongness* may be found in system-adequacy, where dominating processes may oust competing suffixes (see section 3.1.3.2). Nevertheless, while such neologisms may well be formed by individuals, they are usually blocked from being fully institutionalized unless they differ in semantic nuance or if they are used in different contexts (cf. Bauer 2003: 80-82). For instance, while *slowness* and *foulness* are direct nominalizations of *slow* and *foul*, with the meaning 'the state/quality of being A', *sloth* and *filth* have more specific, lexicalized meanings such as 'dirt' or 'reluctance to work', respectively (cf. Lexico.com 2019: s.v. *sloth, filth*). The fact that none of the other neologisms mentioned above have been institutionalized so far may be due to the high degree of lexicalization of words formed with *-th*.

While the derivational *-th* suffix has been heavily reduced and lexicalized in nominalizations, it persists in ordinals and fractions. As has been argued above in section 2.2.3, ordinals can both be regarded as productive and unproductive, depending on one's definition. Aside from sharing the same form with nominalization and inflectional suffixes, *-th* derives numbers in order to form both ordinals and fractions, thus fulfilling two distinct functions. This polyfunctionality and the lack of a clear syllable boundary increase the relative markedness of the ordinal and fractional suffixes on the parameter of (bi)uniqueness. However, as there are no competing WFRs to replace the *-th* suffix in either of these functions and having a zero-marker would defy iconicity, it persists in ordinals and fractions. Nevertheless, the suffix may get lost sporadically in production due to phonological processes (see section 3.2).

According to Mayerthaler (1981: 35), no natural language fully reaches uniform encoding in all paradigms, although some agglutinating languages such as Turkic manage this to some extent. In its weak interpretation, uniform encoding means the avoidance of allomorphy rather than truly being biunique Mayerthaler (1981: 34). The inflectional *-th* suffix was both allomorphic and polyfunctional in the Middle English period: *-(e)th* represented several verbal categories and was usually one of several variants in each category (see section 2.2.2 above). The shapes of inflectional suffixes could become even more similar with the derivational ones through schwa loss (from *-eth* to *-th*), in some cases even creating full homonyms such as *birð* (ME 3rd p. sg. verb) and *birth* (deverbal noun): However, as already mentioned in section 2.2.,

most word forms seem to have retained the vowel of the dental suffix, thus still differing from the derivational ones. Orthoepic evidence suggests that in Early Modern English, *-(e)th* was rarely syncopated, possibly only in informal social situations and certain phonological environments (e.g. after vowels, as in *doth*, *hath*) (cf. Dobson 1968: 883-884). This will be examined more closely in the empirical section (chapter 4). If the vowel of the verbal suffixes was indeed generally retained, polyfunctionality does not help explain the various suffixes' loss, change or fossilizations. It does, however, help explain why the vowel was so reluctant to syncopate; the retention of the vowel would have avoided further polyfunctionality between the derivational and the inflectional *-(e)th* suffixes. It may also explain why it was the only present indicative verbal ending to survive morphological levelling: since it retained transparency by keeping morphological and phonological boundaries intact, it was less marked in terms of (bi)uniqueness than the categories where the vowel was lost.

The subsequent change to the *-s* morpheme during the late ME period and the Early Modern English period, however, seems to be less natural according to these semiotic principles: Since 3rd person singular *-eth* seems to have been directly replaced by or alternating with a vowelless *-s* (cf. Dobson 1968: 883-884), rather than having syncope as an intermediate step, the change went from a less marked to a more marked morpheme, as morpheme and syllable boundary no longer coincided. Furthermore, *-s* was highly polyfunctional, in the Northern verbal paradigms as well as in other word classes, and therefore more marked than *-eth*, which was only present in 3rd person sg. by the time it was fully replaced (see section 2.2.2). Similarly, Midland *-en*, which replaced *-eth* in plural forms, was polyfunctional, representing several plural morphemes in present, preterite, indicative and subjunctive as well as infinitive and past participle (cf. Fisiak 1868: 92). A less marked variant ousting *-eth* is *-D*, which replaced *-eth* to represent preterite and past participle and which was less polyfunctional, already more common (see section 2.2.2) and as reluctant to syncopate as *-eth* (cf. Dobson 1968: 880-881).

Further universal preferences

Other universal preferences presented by Dressler (2005) are figure-ground sharpening, binarity and optimal shape. Figure-ground sharpening (cf. Scherer 1984) is the preference for a distinction between a more important element, i.e. the figure, and a less important element, i.e. the background (Dressler 2005: 274). It is therefore preferred if this contrast between figure and ground is revealed in a morphosemantic and morphotactic hierarchy between head (figure) and non-head (ground) (Dressler 2005: 275). For this reason, the transparency of the

non-head is less significant than the transparency of the head (Dressler 2005: 274). Words derived with the noun suffix as well as words formed with verbal *-th* only fulfil this preference to a certain degree. Whether the suffix contains no or a weak vowel, it is dependent and less conspicuous than the stem, which, in turn, is independent and contains a full vowel. The transparency of the suffix is supposed to be less important (hence the greater likelihood of vowel loss); however, both in *-th* nominalization (including ordinals) and the 3rd person sg. ind. verb inflection, stems may contain vowel alternations, making them less transparent.

Binarity refers to the semiotic preference for binary relations between elements, which in morphology means that one affix is attached to one base (Dressler 2005: 276). Circumfixes, where two affixes are added at the same time, as for instance in German *ge-wünsch-t* (< *wünschen,* 'to wish'), are therefore less preferred than words which only attach one affix at a time such as English *wish-ed* (< *wish*) (cf. Bauer 2003: 28, my examples). Structures which are apparently composed of three elements can often be split up into two binary relations (Dressler 2005: 276). For example, the word *unthankful* consists of two binary relations; the prefix *un-* is attached to the base *thankful*, which in turn is a combination of a base *thank* and a suffix *-ful*. Due to this preference for binarity, the optimal shape of a lexical word is one disyllabic foot with only one derivational or inflectional affix, which in turn is monosyllabic (Dressler 2005: 276). While no extensive analysis has been done on the syllabic composition of nominalizations with *-th* or verbs that take *-(e)th* in the third person, Ritt (1994: 122) notes that around two thirds of Middle English words were monosyllabic, a number which had been increasing since the Old English period. This, and their loss of syllable status would indicate that the suffixes which had lost their nuclear vowel were unnatural in terms of binarity.

To conclude, the dynamics of *-th* suffixes during the Middle English period can only partly be explained in terms of system-independent markedness. Initially allomorphic and polyfunctional within the verbal paradigm, the verbal suffix *-(e)th* was dispreferred in terms of uniformity and transparency, making it more likely to be subjected to change. Nevertheless, apart from *-D*, its surrender to various other variants cannot be explained based on these semiotic principles. Furthermore, the suffix defied constructional iconicity, surviving in the 3rd person singular (later as *-s*), while semantically more complex categories became morphologically less complex. This, however, may be explained under the assumption that *-eth* did not regularly syncopate and was therefore morphologically more transparent than other inflections disappearing at the time. Transparency might also explain why *-eth* resisted the change to *-s* for such a long time but not why it was changed to *-s* at all. Presumably, the pressure to conform with the rest of the paradigm and to evolve towards zero encoding may

have had an influence, with vowelless *-s* being an acceptable intermediate step. This assumption may be supported by the fact that the 3rd present singular has been lost in PDE varieties (cf. Trudgill 2002: 93-95; Hughes & Trudgill 1987: 10-11; Wolfram 2008: 522). The question of why *-s* is preferable to *-th*, however, cannot be sufficiently explained through universal naturalness.

In the case of *-th* derivations, system-independent markedness can account for the fossilization of the nominalization WFR and the lexicalization of its products. The source of this markedness can be found in various phonological processes: i-mutation, a process that was already obsolete in the Middle English period (cf. Mitchell and Robinson 2001: 28; 159), created allomorphy in stems of words (e.g. *long* > *length*), making words opaque; syncope (word-internal sound loss) and apocope (word-final sound loss) created homonymy/ polyfunctionality between distinct suffixes (found in de-adjectival and deverbal nominalizations, ordinals and fractions, as well, occasionally, in various verbal endings), also deteriorating their transparency. Ordinals and fractions can be considered morphologically marked for the same reasons (although allomorphy in the stem plays only a minor part). However, since there are no alternative WFRs to these *-th* suffixes (as opposed to nominalizations, which can also be derived through suffixes such as *-ness* or *-ity*), ordinals and fractions are still derived with a morphologically marked suffix *-th*.

This section has shown that language may evolve contrary to system-independent naturalness parameters and that these parameters can conflict with each other, as is the case with diagrammaticity and indexicality (cf. Dressler 1987b: 111). For instance, while the nominalization *-th* is more indexical due to being closer to the stem, it is less transparent and therefore less diagrammatic. Which of these parameters are given more weight must therefore be determined by more than system-independent naturalness, i.e. some force which overrules it, as the following chapter will explore.

3.1.3. Relational naturalness

The previous section on universal naturalness showed that factors beyond system-independent naturalness must be at play when it comes to the naturalness of the inflectional and derivational dental suffixes. The answer to this and to the development of both inflectional and derivational *-th* may therefore be found in relational naturalness, more specifically in typological adequacy and system-adequacy. Typological naturalness "relates different universal naturalness parameters and various language components to each other" (Dressler

2005: 279) system-dependent naturalness is relational in terms of "language-specific means and operations of a single component", such as morphology (Dressler 2005: 279). According to Dressler (2005: 281), the interaction between these types of naturalness may be seen as hierarchical, as a system of filters:

> Typological adequacy […] may be understood as a filter and elaboration on universal naturalness/markedness […], and language-specific system adequacy […] as a filter and elaboration on typological adequacy. Each lower-level filter can specify and even overturn preferences of the preceding higher-order level […].

In other words, the morphological naturalness of a structure is not only determined by universal, system-independent parameters of naturalness, but also by the system itself and the language type it belongs to. That is, what appears to be unnatural on a universal level, may be caused by changes that are happening in accordance with the language's typological properties or trends within the system.

3.1.3.1. Typological Adequacy

Based on Skalička's (1979) work on language typology, Dressler (1987b: 118; 2005: 278) proposes a model of language typology within Natural Morphology. Skalička (1979: 23) notes that every language displays characteristics of various language types and a language is said to be of a certain type depending on their proportional display of characteristics of said type. According to Skalička (1979: 341), no language belongs exclusively to one type, as this is often impossible, improbable and useless. Dressler (2005: 278) describes this typology as "ideal language types which are approached by natural languages to a greater or smaller degree and which consist of properties which favour one another". Within Natural Morphology, language types are seen as "consistent *responses to naturalness conflicts* [original emphasis]" (Dressler 2005: 278), where certain naturalness on some parameters are favoured at the expense of naturalness on other parameters (Dressler 2005: 278).

In order to discuss the typological development of the English language and the typological adequacy of the dental suffixes, a short overview of the major language types involved is necessary. Each of Skalička's (1979) types will first be described in terms of their most prominent and typical features and then related to the naturalness parameters presented in the previous chapter. This will be followed by an analysis of *-th* in terms of typological adequacy.

Agglutinating type

The agglutinating type is characterized by a high use of inflectional suffixes and is most prominent in Altaic languages (Turkic, Mongolian and Tungusic languages), Finno-Ugric languages as well as in some Indo-European languages (Skalička 1979: 36). Skalička (1979: 36-45) presents the following characteristics of the agglutinating type:

1a) Syntactic functions (e.g. grammatical case endings vs. prepositions, possession) and grammatical categories of verbs (e.g. number, tense, mood, reflexivity, negation, etc.) are often expressed through suffixes rather than separate words. Categories such as case and number for nouns are symbolized through separate suffixes rather than being both expressed in one.
1b) There are neither suffixes for the nominative case, nor are there usually personal subject pronouns.
1c) There are few "true" prepositions or postpositions; they may function like nouns and even take possessive suffixes, or their functions are expressed through case endings.
1d) There are no grammatical genders.
1e) There is no agreement („Kongruenz") of attributive adjectives with the noun (i.e. number, case, possessive, etc. are only communicated once, as part of the noun).
1f) Conjugation is uniform (i.e. personal endings are the same for all verbs).
1g) Derivation is highly productive and may take inflected forms as its base.
1h) Roots may be monosyllabic and may become part of the following syllable; inflectional endings often contain a consonant
1i) Allophonic/allomorphic alternations are rare but there is often vowel harmony.
1j) Sentences can be constructed in various ways.
1k) Infinite verb forms are prevalent, subordinate clauses are rare.

Many of the properties above are considered natural within the semiotic framework for natural morphology outlined in section 3.1.2. The existence of separate forms for categories such as case and number (a) and the rarity of allomorphic alternations (i) mean a high degree of biuniqueness. The nominative's lower semantic markedness (cf. Mayerthaler 1987: 41) is paralleled in its unmarked morphology (b), and the addition of meaning through derivation is diagrammatically mirrored in the addition of suffixes (g), making the type constructionally iconic. The high use of suffixation (a ,c, g), both in inflection and derivation, also ensures morphotactic transparency. Yet, these advantages are not without cost. Due to little polyfunctionality and an abundance of affixes, word forms are long, which in turn results in signantia (the outermost suffixes) being further away from their signatum (the stem) and

therefore being less indexical (Dressler 1987b: 120). A lack of redundancy (a, d) also means that phonological reduction (in order to facilitate speech) and perceptual processing become harder (Dressler 1987b: 120). However, perceptual processing within this language type is often aided by the use of vowel harmony, so that words are more obviously presented as a unit (Dressler 1987b: 120).

Inflectional/ Fusional type

The inflectional type is characterized by the use of one form to convey several meanings and can be found in several Indo-European languages and in the Bantu languages of Southern Africa (Skalička 1979: 45). Its characteristics are as follows (Skalička 1979: 45-54):

2a) Suffixes may convey several meanings at a time: case and number in nouns; person, number, and sometimes even gender, as well as tense and mode in verbs; and gender, number and case in adjectives. Possession is expressed through a separate word.
2b) There is a suffix for the nominative case. Some personal pronouns are omitted in favour of suffixes (esp. subject pronouns), some must be expressed through separate words.
2c) Prepositions are more frequent than in the agglutinating type but rarer than in the isolating type.
2d) There are grammatical genders.
2e) There is an agreement („Kongruenz") of attributive adjectives with the noun in gender, number and case and of numbers linked to the plural. nouns and adjectives have different declensions.
2f) There are several different types of conjugation, i.e. various verb classes with different endings. There are several declension types.
2g) Word-formation is agglutinating: i.e. derivation is highly productive.
2h) Allomorphy ("Synonymie") and homonymy are frequent. Suffixes operate on the stem and create alternations.
2i) Subordinate clauses are frequent; nominal sentences are rare.

Many of the characteristics listed above are the opposite of those found in the previous type: where the agglutinating type tends to use several separate suffixes (a); categories and suffixes that exist in fusional languages are not expressed in agglutinating languages (b, d), the inflectional/fusional type conflates several categories into one form. Furthermore, meanings that are symbolized through suffixes in agglutinating languages expressed through separate words in fusional languages (a, b, c). While agglutinating languages give grammatical

information once, fusional languages are more redundant (e). In agglutinating languages, both allomorphy and homonymy are rare (h); in fusional languages, on the other hand, the same meaning may be expressed through various forms (f, h) and homonymy is frequent. However, the word-formation of inflecting languages is akin to the one of agglutinating languages (g).

In terms of morphological naturalness, the inflectional type gives priority to semiotic principles that are neglected in the agglutinating type and vice-versa. Due to phonological and morphophonological rules creating stem-variation, there is less morphotactic transparency (h). There is little biuniqueness due to allomorphy, synonymy and homonymy (h) and less constructional iconicity in its inflection (b). On the other hand, indexicality is high: word forms are shorter (a), which results in a closeness between signans and signatum; there is more redundancy in the form of agreement of words (e); and word and morpheme classes are signalled by morphological rules (f).

Isolating type

The isolating type does not use affixes for declension or conjugation and can be found in Western European languages (such as English or French and partly German), and in some Polynesian languages (Skalička 1979: 21-23). Skalička (1979: 21-36) names the following characteristics for the isolating type:

3a) Syntactic functions are mostly expressed through separate words rather than through suffixes, e.g. possession, grammatical categories of verbs (number, gender, tense, mood, reflexivity, negation, etc.), adjective comparison, noun and adjective cases.
3b) There is an abundance of pronouns to express various cases.
3c) There is an abundance of prepositions.
3d) There are no grammatical genders.
3e) Adjectives and adverbs are indistinguishable in form; numbers linked to nouns are unchangeable.
3f) Compounds and derivation are avoided; new meanings are formed through borrowing, semantic shift or conversion, or as multi-word expressions.
3g) There is neither allomorphy (“Synonymie”) nor homonymy when expressing case, person or number.
3h) Words tend to be monosyllabic.
3i) Sentences (main clauses) have a noun or pronoun followed by the verb.

As Dressler (1987b: 121) focuses on word-formation within Natural Morphology, and as isolating languages have little to no morphology, he has little to say about them. However, one may still attempt to relate the characteristics of the isolating type to the semiotic principles presented in section 3.1.2. As there is neither allomorphy nor homonymy in terms of grammatical information (g), the type can be considered to be high in biuniqueness. However, the word-formation of isolating languages utilizes conversion (zero-derivation) (f), which create a great number of synonyms and lessens biuniqueness on a lexical level. Furthermore, Dressler (2005: 269) states that conversions may seem non-iconic, as they are non-diagrammatic (semantic additions are not mirrored by any morphological additions). He draws attention to the works of Crocco Galeas (1990, 2003), who suggests that conversions are morphological metaphors, as their differences are signalled through syntactic context. Other processes of word-formation such as borrowing or semantic shifts (f) may also be considered non-iconic, as the former does not allow for any morphological interpretation and the latter does display any diagrammatic relationship between form and meaning. The absence of any grammatical endings (a) means that constructional iconicity does not hold true in inflection either; as mentioned in section 3.1.2, some semantic categories are more marked than others, which cannot be reflected in morphology if no category is expressed morphologically at all. The isolating type is indexical insofar that an autonomous signans is processed better than a suffix (Dressler 1987b: 110). However, good indexicality is also given when signans and signatum are close (both semantically and morphologically) (Dressler 1987b: 110).

The changing language type of ME

As mentioned at the beginning of this section, languages are usually not identified as belonging to a specific type but rather by the degree to which they display certain typological properties, only 'approaching' a certain type (Dressler 2005: 278). According to Dressler (2005: 278), the typological ideal of Old English was the inflecting-fusional type, which favours binarity, optimal shape, figure-ground sharpening and indexicality. English typologically changed from being a more synthetic (i.e. inflectional) language, where grammatical functions are expressed through morphology, to being an analytic and configurational one, where grammatical and syntactic functions are expressed through the use of prepositions and word order (Kastovsky 1992: 411). Dressler (1987b: 121) states that a language can be approaching two language types at the same time. The morphology of Modern English is approaching various typological ideals, depending on its submodules: Its

inflectional system indicates a striving towards the isolating type, which also becomes apparent in the preponderance of conversions and a preference for monosyllabic bases (Dressler 2005: 278). In other words, the English inflectional system underwent a typological change from being essentially inflecting (OE) to being largely isolating (PDE). As to derivational affixes, the approached type depends on their stratum: while Germanic derivations approach the agglutinating type, Latinate ones are rather inflecting-fusional (Dressler 2005: 278-279).

According to Dressler (2003: 467), there are two ways in which a morphological change can be considered type-adequate:

i change does not modify typological properties – this is a typologically conservative change;

ii change correlates with other changes which implement an overall typological change of the respective language – this is a typologically innovative change.

For the historical development of *-th* suffixes, both inflectional and derivational, the typological changes happening in the English language have several implications. As English inflection became more isolating, the disappearance of inflectional suffixes (as for instance present plural *-th*) is very much type-adequate. Conversely, the survival of the 3rd present sg. ending into PDE verbal inflection shows a resistance against the overall typological change towards a lack of inflection, which is therefore not type-adequate. However, synchronic variation (and its possible indication of further changes) should be considered, as the 3rd present singular is zero in varieties such as the East Anglian dialect (cf. Trudgill 2002: 93-95; Hughes & Trudgill 1987: 10-11), or UAAVE (Urban African-American Vernacular English) (cf. Wolfram 2008: 522), and therefore type-adequate for those dialects. For derivation, the typological ideal of English depends on its stratum: native, Germanic derivations approach the agglutinating type and non-native, Latinate (Latin and French) derivations are of the inflecting type (Dressler 2005: 278-279). As Germanic suffixes, both nominalization *-th* and ordinal-forming *-th* should display characteristics of the agglutinating type, such as biuniqueness (no allomorphic alternations), constructional iconicity (addition of meaning paralleled by addition of form), and morphotactic transparency (cf. Dressler 1987b: 120). As has been outlined above in 3.1.2, derivational *-th* does not adhere to all of these principles, being neither biunique nor fully transparent. The disappearance of *-th* as a word-formation rule is therefore also type-adequate, as it was not (especially in its vowelless form) conforming to the emerging agglutinating language type. The survival of the ordinal suffix, on the other

hand, is not type-adequate. The fact that there was no type-adequate alternative to choose from may be an indication to its survival.

While Dressler's analysis is based on Skalička's (1979) typology, Kastovsky (2006: 156) presents a different typology, specific to the morphology of languages. Since most typologies are focused on inflection, Kastovsky (2006: 156) proposes parameters which include derivation and its intersections with inflection. This typology may therefore shed some more light on the development of derivational *-th* (Kastovsky (2006: 156):

1 the morphological status of the input to the morphological processes (word, stem, or root);
2 the existence and status of morphological levels/strata (native vs. non-native);
3 the status and function of morphophonemic alternations;
4 the position of affixes.

The morphological status of the input (1) refers to the nature of the base that derivation and inflection operate on (Kastovsky 2006: 157). That is, if the base may appear as a free form, the morphology is word-based; if the base is a lexeme without inflectional but potentially with stem-formatives or derivational affixes, the morphology is stem-based, and if the base is an "abstract lexical [entity]" without any of the aforementioned elements attached, the morphology is root-based (Kastovsky 2006: 157). As root and stem are essentially the same in Modern English, Kastovsky (2006: 157) distinguishes between word-based and stem-based morphology for this language. Lexical strata (2), a result of language contact and borrowing, are levels of words which have different properties depending on their origins (Kastovsky 2006: 158). Furthermore, languages (or their sub-modules) may have variable or invariable morphemes, depending on the presence or absence of morphophonemic alternations (3), which can be conditioned phonologically or morphologically, and which produce allophonic, phonemic, or allomorphic alternations (Kastovsky 2006: 159). The position of affixes (4) is of little relevance in the present thesis, as it is only concerned with suffixes.

Modern English morphology can be assigned to different morphological base-types depending both on whether it is inflectional or derivational and on whether its origin is native or non-native (Kastovsky 2006: 158). Inflection is largely word-based, with some stem-based exceptions loaned from Latin and Greek, as for instance *stratum -> strata* (Kastovsky 2006: 158). Native word-formation is word-based, while non-native word-formation may be either word-based or stem-based (Kastovsky 2006: 158-159). Similarly, the status of morphophonemic alternations differs according to submodule and stratum: Regular inflection and native word-formation are base-form-invariant (e.g. *make – makes, write – writ+er, writ+ing,),* irregular inflection has morphophonological and allomorphic alternations of

affixes (e.g. *send – sent*) and bases (e.g. *goose – geese)* and non-native word-formation has segmental and suprasegmental alternations (e.g. *eléctric – electríc+ity*) (Kastovsky 2006: 158-160, my examples).

The present state of English as typologically mixed and the fact that there are different typological tendencies according to strata would indicate that language contact, especially Norman influences during the Middle English period, played a major role in shaping its typology. However, the language was already typologically heterogeneous during the Old English period, both in inflection and derivation (Kastovsky 1994: 18). Indo-European morphology was root-based and characterized by ablaut, but the Germanic stress shift made ablaut alternations hard to predict, resulting in a morphological reanalysis and a shift to stem-based morphology (Kastovsky 2006: 163-164). That is, originally phonologically conditioned ablaut alternations were morphologized during the Old English period and re-interpreted as stem-based rather than root-based and consequently, English was permeated with stem-variation and irregular alternation patterns (Kastovsky 1992: 419). Verbs were stem-based until, at the end of the OE period, the loss of the infinitive ending (starting in the North) created uninflected base-forms, i.e. word-based inflection (Kastovsky 1994: 23-24). Nouns and adjectives had both stem-based and word-based paradigms, with the former being the prevalent base-type (Kastovsky 1994: 23). The weakening and loss of unstressed syllables and the subsequent loss of morphological contrasts lead to word-based morphology in OE and ME (Kastovsky 2006: 163-164). As a Germanic suffix that operates on stems, *-th* did no longer fit in with the word-based morphology of the native stratum.

This shift in typology towards word-based morphology and stem invariance progressed much faster in English than in other Germanic languages, despite them possessing almost identical typologies (Kastovsky 1992: 414). While he admits that external factors such as language contact might have accelerated the process, Kastovsky (1992: 414-415) maintains that it is primarily the interaction of morphology and phonology that lead to this typological shift in English. At the end of the Old English period, the abundance of lexicalized allomorphs demanded the simplification of an unpredictable morphological system to one that favoured word-based morphology and stem-invariance (Kastovsky 1992: 426). Subsequent contact with French considerably changed the derivational morphology of Middle and Early Modern English: extensive borrowing introduced new derivational processes into the language (see Dalton-Puffer 1996), reintroducing stem-based derivation into the non-native vocabulary as well as stem-variation due to different stress patterns (Kastovsky 2006: 172-173).

According to Kastovsky (2006: 172), word-based morphology "seems to favour a system without alternations" and alternating stems were replaced or lost, leaving only a few 'irregular' cases, both in inflection and in derivation. Due to i-mutation (caused both by linking vowels and stem-formatives, see Kastovsky 1994: 234), many words derived with *-th* displayed vowel-variation in the stem. As the language's (native) morphology shifted towards stem-invariance, the rules behind these alternations became opaquer and unpredictable. It is therefore not surprising that rivalling, more regular and predictable MRs such as *-ness*, *-ing*, or conversion should have replaced *-th* to form abstract nouns. Of course, words such as *length* or *strength* have survived, but this is due to lexicalization rather than due to a productive WF process. As the WFR for ordinals does not involve stem-variation, its survival is type-adequate in the frame of Kastovsky's (2006) typology.

To conclude, while typological adequacy seems to serve as an explanation for the disappearance of *-th* as a nominalization suffix, it only partly explains the survival of the ordinal suffix and cannot account for the prolonged existence of 3rd person *-(e)th*, nor for its change to *-s*. The WFR for nominalization became fossilized, no longer being adequate according to both Skalička's (1979) and Kastovsky's (2006) typologies. The ordinal suffix is adequate in the sense of Kastovsky (2006) but untypical for the agglutinating type as described by Skalička's (1979). It has been argued that the formation of ordinals is no longer productive (see 2.2.3), however, as no adequate alternatives exist, it has survived into PDE nonetheless. The 3rd person present ending persists in Standard PDE despite becoming type-inadequate as English inflection became isolating. Furthermore, the change from *-(e)th* to *-s* can neither be fully explained with universal naturalness nor with type adequacy. Another of Dressler's (2005: 281) filters must therefore be applied and the suffix be examined in terms of system-dependent naturalness.

3.1.3.2. System-adequacy

At the lowest level of Dressler's (2005: 281) filter model is language-specific system-adequacy, which is able to determine or contradict preferences on a higher level such as universal naturalness or typological adequacy. What seems unnatural on a universal or typological level may therefore be explained through language-specific naturalness, i.e. system-adequacy (or system congruity). In contrast, Wurzel (1987: 69-70) considers the relationship between system congruity and system-independent naturalness to be one of conflicts rather than filters; however, he agrees that system-congruity is usually a stronger

force than system-independent naturalness. First Wurzel's (1984, 1987) model of system-dependent naturalness in inflection will serve as a basis for analyzing the naturalness of the inflectional *-th* suffixes in the context of their historical development. Then, in section 3.1.3.2.2, the concepts pertaining to inflection will be adapted for the discussion of the derivational suffixes.

3.1.3.2.1. Inflection

According to Wurzel (1987: 92), the naturalness of inflectional morphology is determined by two principles on a system-dependent level: system congruity and class stability. System-congruity prefers inflectional systems which display typological uniformity and systematicity of structure (Wurzel 1987: 69-70). This typological uniformity can be observed on the basis of certain superordinate properties (Wurzel 1987: 63):

(a) Occurrence of categorical systems and categories […]
(b) Occurrence of base form inflection or stem inflection […]
(c) Separate or combined symbolization of categories […]
(d) Number and manner of formal distinctions in the paradigm […]
(e) Occurrence of marker types related to the categorial system involved […]
(f) Presence or absence of inflectional classes […]

That is, in a perfectly uniform system, there are (a) distinct and systematic categories (e.g. various case categories, various number categories, etc.), which (c) have separate symbolizations without conflation of categories (i.e. one form per function) and (d) are formally distinct within a paradigm (i.e. one function per form); (b) affixes are attached to either word bases or stems; (e) the type of marker is conforming to the system (e.g. suffixation only, no umlauts or article inflections); and (f) there are no inflectional classes (e.g. strong vs. weak verbs, various plural suffixes in nouns) (Wurzel 1987: 63).

A completely uniform system with regards to these structural properties is relatively rare; most inflectional systems are non-uniform (Wurzel 1984: 82). However, if a system is non-uniform, it will strive to become more uniform by changing the structural features which deviate from the system-defining features, i.e. the structural features which dominate a word class in terms of the aforementioned parameters. In non-uniform systems, the dominant features are the ones that are quantitatively dominant compared to competing structures (Wurzel 1987: 64). That is, the relationship between competing structures can be seen

- in the relative number and size of inflectional classes in which a structural property is realized (that is, the relative number of paradigms in which a structural property occurs)

- in the extent to which the structural property is realized in these cases (that is, the relative number of forms in which the structural property occurs)

(Wurzel 1987: 64).

The relative system-congruity of specific morphological occurrences is then defined by the degree to which they conform to the system-defining features, i.e. the dominant structural properties (Wurzel 1987: 65). The inflectional system of a language is determined by its system-defining features, which may remain unchanged even as morphological changes take place in that system (Wurzel 1987: 65). They are considered "generalizations of the morphological forms and rules" of a language, acting as a norm in uniform systems, and establishing preferences in a non-uniform system (Wurzel 1987: 65). Individual structural features which are not system-congruous (i.e. they deviate from the norm or are dispreferred) therefore tend to be changed in order to correspond with a language's system-defining morphological properties (Wurzel 1987: 65).

In order to demonstrate these natural morphological changes, I will provide examples for each of the properties (a) to (f) presented above.

(a) In Old High German (OHG), some noun classes had five cases (nominative, genitive, dative, accusative and instrumental), but as the dominant paradigm was to have only four cases (all but the latter), the instrumental was lost (Wurzel 1984: 82; 84). That is, the categorical system to have five cases disappeared in favour of the dominant four-case-system.

(b) New High German (NHG) is characterized by word-based inflection (e.g. *Hund - Hunde*) but there are a number of nouns which are stem-inflected, e.g. *Radius – Radien* (Wurzel 1984: 82). However, word-based alternatives for the latter exist, e.g. *Radius* as *Radiusse*, which shows a tendency to adapt these 'outliers' to the existing preference for word-based inflection (Wurzel 1984: 84).

(c) In Middle High German (MHG), the tense category was mostly symbolized separately from the person/number category, through a dental suffix for weak verb classes and through ablaut for strong verb classes (Wurzel 1987: 66). However, as there were different types of ablaut for different persons, the ablaut markers effectively also signified person/number, and as some personal endings were different for present and preterite, they also mark tense (Wurzel 1987: 66-67). This incongruence in the system resulted in the restriction of ablaut to tense only and the unification of present and preterite endings (Wurzel 1987: 67). That is, the system-defining property was to

symbolize the categories person/number and tense separately, which is why the combined symbolization disappeared.

(d) Old High German originally had three different types of feminine singular noun declensions, depending on the number of different case endings (Wurzel 1987: 67). Thus, a declension where 1) nominative and accusative are formally the same and genitive and dative have the same ending (i.e. N. = A. =/= G. = D.) is distinguished from declensions where 2) the nominative is the only case different from the others (i.e. N =/= G. = D. = A.) and from declensions where (3) the dative is the odd one out (i.e. N = G. = A. =/= D.) (Wurzel 1984: 83). In the course of OHG development, the third type was changed to the first (Wurzel 1984: 85). In other words, the only type that did not formally distinguish between nominative and genitive was eliminated because the dominant system (present in the other two types) was to have a distinction between these two cases.

(e) In Middle High German, markers could take the form of a suffix or an umlaut and could both be used to mark case as well as number (Wurzel 1984: 83). However, there was only one inflectional class that used umlaut as a case marker, namely feminine i-stems (Wurzel 1987: 68). Umlaut as a case marker was consequently lost, resulting in umlaut being used exclusively to mark number (Wurzel 1984: 85). That is, as umlaut was only used to mark case in a single inflectional class, the use of umlaut as a case marker was system-incongruous and therefore eliminated.

(f) Languages such as Latin, German or English display an array of inflectional classes, while agglutinating languages such as Turkish have a uniform system (see 3.1.3.1. Typological Adequacy). It appears that languages cannot be non-uniform on this parameter; either inflectional classes exist in a language, or they do not (Wurzel 1984: 83).

The system-congruity of ME *-eth*

The parameters and their examples presented above offer some insight into the development of inflectional *-th* during the Middle English period. As outlined in section 2.2.2, in the Midlands, plural *-(e)th* was gradually replaced with *-e(n)* in analogy to other forms, before disappearing entirely by the Early Modern English period (cf. Faiß 1989: 225; Schendl 1996: 144). As mentioned in the introduction of chapter 3, in analogical change, more marked structures survive less well than less marked ones (cf. Dressler 1987a: 14), which points

towards the fact that *-(e)th* was a relatively marked structure. Bryan (1921: 463) names several common assumptions about the origin of *-(e)n* in present plural indicative: (a) that it is a transfer from present plural subjunctive or (b) that it was adopted as a general plural suffix in analogy to the present plural subjunctive and/or to the past plural indicative and subjunctive. However, Bryan (1921: 463-465) goes on to probe these explanations: while the use of subjunctive and indicative is not always easily distinguishable and often confused by writers in Old English, they were not used interchangeably, since the distinction between the moods remains in the singular forms and the tendency would be to replace the subjunctive with the indicative form. The second explanation, namely that in becoming similar due to weakened vowels, the endings *-(e)n* went on to be perceived as a general plural suffix, appears plausible at first but is dispelled with the argument that there is no direct evidence to support this claim (Bryan 1921: 466-467). Instead, Bryan (1921: 467-469) suggests that the source of the suffix were preterite-present verbs (i.e. preterite in form but present in function) as well as some forms of the substantive verb (i.e. 'to be'), such as *sindon*, *beþon* and *earon*, since they are functionally closer to plural present indicative than the other suggested sources. He argues that many of the most frequently used preterite-present verbs were used as normal verbs rather than auxiliaries and that they would likely have been perceived as having the same function, presenting Old and Middle English evidence of transfer between normal and preterite-present verbs happening in both directions and thus supporting this claim (Bryan 1921: 467-469). As further evidence, Bryan (1921: 470-471) cites the case of substantive verbs, which received an additional present plural *-(e)n* suffix in analogy with the preterite-present, thus furthering the extension of the ending to the normal verbs.

This change to *-(e)n* can thus be explained in terms of system-dependent naturalness. During the Middle English period, there were two different types of plural inflection: either preterite indicative, preterite subjunctive and present subjunctive had the same ending (i.e. pres. ind. =/= pret. ind = pret. subj. = pres. subj.) in normal verbs, or all plurals had the same ending, (i.e. pres. ind. = pret. ind = pret. subj. = pres. subj.) in preterite-present and substantive verbs. In other words, for a great number of instances, the indicative and the subjunctive for plurals were the same, namely in the present of substantive and preterite present verbs as well as in the preterite of all verbs. It seems, then, that the model 'all indicative and subjunctive plurals display the same ending' was system-defining and that the non-conforming model containing *-eth* was eventually integrated into it. Although this change happened in the Midlands, it not occurred neither in the North (where it became *-es*) nor in the South (where *-eth* remained in place until replaced by *-s*). Bryan (1921: 472-473) explains this by pointing to differences

between these dialects: In the North, there seems to have been a tendency to generalize all indicative personal endings to *-(e)s*, whereas in the South, the substantive verb was less characterized by *-(e)n* (*sind* rather than *sindon*, *beoþ* rather than *beon*). In terms of system-dependent naturalness, this means that in the North, the dominant system was to have the same ending *-(e)s* for (almost) all indicative forms, while in the South, a formal distinction between indicative and subjunctive in present plurals seems to have tipped the scales for the structural model 'subjunctive is different from indicative', thus having different endings for either mood.

The stability of ME *-eth*

Another type of system-dependent naturalness is the stability of inflectional classes, which is concerned with dominant paradigm structure conditions (Wurzel 1987: 76-78). Morphological properties depend on extramorphological properties such as phonology or semantic-syntactic properties, and inflectional classes are categorized differently according to these properties (Wurzel 1987: 76-78). Words which display the same extramorphological properties implicatively follow the same paradigms patterns, i.e. paradigm structure conditions (Wurzel 1984:117-118). For instance, if a verb ends in a certain sound (i.e. it has a certain extramorphological property), it will have a certain pattern of personal endings, as in Russian nouns that end in /a/ (e.g. *sobaka* 'dog'), which take /i/ in gen. sg. (*sobaki*), /e/ in dat. sg. (*sobake*) etc. (Wurzel 1987:76). In cases such as German *Kalb* 'calf', the pattern cannot be deduced from extra-morphological properties alone and depends on morphological properties: if the plural is formed with /er/, then there is also an umlaut (Wurzel 1987:77). The pattern can also depend on both types of properties, for instance in the German noun *Hund* 'dog', which has /es/ in the genitive sg. if it is masculine and forms its plural with /e/ (Wurzel 1984: 118).

It is common for most inflectional classes that words with the same extramorphological properties belong to different complementary word classes (Wurzel 1987: 78). For instance, German nouns which display the phonological property of ending in a short vowel (except /e/), such as *Kino* 'cinema', *Fresko*, *Cello* and *Schema*, all belong to four different complementary classes which form their plural differently; with *-s* (*Kinos*), *-en* (*Fresken*), *-i* (*Celli*), and *-ta* (*Schemata*) (Wurzel 1987: 78). The class which to which most words belong to is commonly perceived as the most normal, i.e. the most natural within that language (Wurzel 1987: 80). This is also evidenced in some the areas outlined in the introduction to this chapter: diachronically, words change to more normal classes; neologisms and nonce words

receive the most normal implicative pattern; and error linguistics, language disorders and language acquisition all more commonly display changes from what is less normal to what is more normal rather than the reverse (Wurzel 1984: 72-73).

The imperative plural stayed *-(e)th* in the Midlands and London, until it disappeared in the Middle of the 15th century (Faiß 1989: 230-231). Reasons of system-dependent naturalness for not changing to *-(e)n* in the Midlands, as had the plural of the other moods, may be that the imperative mood was perceived as different enough in its extramorphological properties from the other moods not to change with them to *-(e)n.* In the North, where the imperative plural was *-(e)s* to begin with, it probably contributed to the generalization of *-(e)s* in all indicative endings (with the model 'all non-subjunctive endings are *-(e)s*'). During the late 13th and the 14th century, the imperative plural (both Northumbrian *-(e)s* and Midland *-(e)th*) alternated with zero (Faiß 1989: 230). It is conceivable that this loss was influenced by the fact that the imperative singular, *-e*, was lost between the 13th and the 15th century, i.e. that system-dependent naturalness enforced the model 'all imperatives are zero'. System-dependent naturalness can also explain the generalization to the *-D-* allophones in preterite suffixes: *-(e)th* was only used for specific lexemes (e.g. *cuþe* 'could') and the other variants were more frequent both across and within paradigms (cf. Fisiak 1968: 92-93).

The normalcy or naturalness of inflectional classes can also be expressed in terms of class stability: Classes where all or most words with the same extramorphological properties also follow the dominant paradigm structure conditions are called stable; that is, the dominant class either has no or less used complementary classes (Wurzel 1987:80). Classes where words with the same extramorphological properties do not follow the dominant implicative pattern are called unstable; that is, unstable classes have a more dominant/more stable complementary class to which their words transfer in the situations mentioned above (diachrony, acquisition etc.) (Wurzel 1987: 80). If there is no dominant paradigm structure condition, i.e. the complementary classes are used equally, then the classes are called stability-indifferent and can transfer between complementary classes in both directions (Wurzel 1987: 81). For instance, of the above-mentioned classes of nouns, the one forming its plural with *-s* is a stable class, while the others, which have *-en, -i* or *-ta* as plural endings, are unstable, all displaying transfer to the stable class in some form: the plural of *Fresko* can both be *Fresken* or *Freskos* in current usage, likewise in the cases of *Cello* (pl. *Celli* or *Cellos*) and of *Schema* (pl. *Schemata* or *Schemas*) (Wurzel 1984: 138). Wurzel (1984: 138-139) identifies the latter two plural classes (*-i* and *-ta*) as even more unstable, as none of their words also belong to the *-s* or *-n* plurals. As these examples show, classes do not transfer from unstable to stable as a

whole, but word by word and gradually (Wurzel 1987: 81). However, words do not always change their whole paradigm pattern to fit a dominant class; sometimes only individual markers (i.e. formal symbolizations of a grammatical category) spread from stable classes to unstable classes, as for instance the Swedish genitive singular marker *-s*, which spread from four original classes to the other classes and even into the genitive plural of all classes (Wurzel 1987: 82-83).

In the case of 3rd person singular present indicative, the change from *-(e)th* to *-(e)s* cannot as easily be explained by system-dependent naturalness. A proposed explanation for the original change in the North during the Old English period is early Scandinavian influence, where extending the consonant of 2nd to 3rd person sg. was common (cf. Lass et al. 2013: NSE). However, as mentioned in section 2.2.2, Miller (2002: 355) points out that the suffix seems to have first spread to the 2nd and 3rd plural and then the 3rd singular. As Wurzel (1987) does not discuss how to regard system-dependent naturalness when it involves another language system, it is difficult to say if such an extension from one grammatical person to another may be regarded as being a change towards system congruity.

As the origin of the *-(e)s* suffix is by no means certain, system-dependent naturalness may only account for its spread once it had entered the language and for its eventual acceptance as the only 3rd person singular ending. Initially, the most frequent suffix (i.e. the dominant paradigm) was an unsyncopated *-eth*, but through contact and migration, the suffix *-(e)s* spread until it became the dominant, most frequent suffix during the first half of the 17th century (cf. Gries & Hilpert 2010: 309-310). According to Nevalainen and Raumolin-Brunberg (2000a: 313), the zero variant was "a real (though rare) alterative" throughout the 15th, 16th and 17th century, meaning that it occurred across various texts but never with a high frequency. Nevalainen and Raumolin-Brunberg (2000b: 244) also suggest that the change to the sibilant suffix was primarily dependent on the presence or absence of the preceding vowel and that the consonants the suffixes contained were less important. This is supported by the fact that *-(e)s* was only fully implemented in London when it included vowel loss (Nevalainen & Raumolin-Brunberg 2000b: 243-245). Thus, the suffix seems to have been system-adequate (in accordance with a general loss of schwa in inflectional suffixes) in that it did not commonly contain a vowel, i.e. it did not have syllable status. It seems that, for want of zero as a viable competitor, *-s* was deemed more system-adequate than *-eth*.

According to several studies (e.g. Ogura & Wang 1996; Gries & Hilpert 2010; (Nevalainen & Raumolin-Brunberg 2000b) verbs with a stem ending in a sibilant adopted the *-(e)s* suffix later

than verbs ending in other sounds. Considering system-dependent morphological naturalness, one might therefore say that the verbs which had the same extramorphological property of having a stem-final sibilant were following a different paradigm than those which had a different stem-final sound. Similarly, high frequency grammatical verbs (*do, have*) were more resistant to the change than lexical ones, being the last to adopt the new suffix: initially, *-(e)th* was preferred both in lexical and in grammatical verbs; however, during the first half of the seventeenth century, where there is a noticeable trend towards using *-(e)s* in lexical verbs, *-(e)th* is still overwhelmingly attached to grammatical verbs, only beginning to yield to *-(e)s* in the second half of the century (Gries & Hilpert 2010: 311). This is hardly surprising, considering that frequency plays a conservative role in morphological change (Bybee 2001: 12) (cf. the "snowball effect" described by Ogura & Wang 1996). From the standpoint of system-dependent naturalness, one could say that lexical and functional verbs were complementary classes, with lexical verbs dominating (in terms of type frequency) with the suffix *-(e)s*. The dominating class finally integrated the weaker class (which was holding on to *-(e)th*).

Any subsequent changes of verbal suffixes to zero may be explained through system-adequacy as well: With the inflectional system evolving towards the isolating language type, the entire verbal paradigm was losing inflections. The survival of the 3rd person sg. suffix is not system-adequate, but as Ferguson (1996: 179) remarks, this is due to standardization: "It is an instance of an unnatural, marked construction becoming accepted as a sign of the standard language as opposed to various nonstandard dialectal variants". Developments in non-standard varieties seem to support this claim; for instance, the non-adequate suffix is regularly lost in Devon English and UAAVE (cf. Godfrey and Tagliamonte 1999). Furthermore, Benveniste (1966: 225-236) notes that the third person behaves differently in a variety of languages. This may also indicate that this semantic category (3rd person sg.) is more marked than suggested by Mayerthaler (1987: 41).

To conclude, the replacement of *-(e)th* with various morphological alternatives (including zero) may be explained through system-adequacy to some extent; these alternatives could be spreading from other, functionally close categories (Midland *-(e)n*), from all other verbal endings (Northern plural *-(e)s*, zero), or be due to existing dominances (preterite *-D-*). The origin of *-(e)s* in the North, however, cannot be explained to satisfaction, especially since another linguistic system (i.e. a Scandinavian language) may have been involved. Its subsequent expansion can mostly be explained in terms of reluctances; that is, system-adequacy can explain why certain extra-morphological properties stalled the full adoption of

the new suffix *-(e)s*, but not how it became dominant. While it has been suggested that the consonant was less relevant for ultimate acceptance than the fact that the new suffix did not contain a vowel, system-adequacy has not been a satisfactory explanation for why vowel loss seems to have been easier for the sibilant suffix than for the dental one, nor why the 3rd person sg. survived that long at all. However, system-adequacy can explain why non-standard varieties have been developing towards zero for the 3rd sg.; something which seems to have been hindered elsewhere due to standardization.

3.1.3.2.2. Derivation

Wurzel (1984: 174-175) summarizes his conclusions on the structure and development of inflectional morphology into five determining universal principles:

(I) das Prinzip der typologischen Einheitlichkeit und Systematik morphologischer Systeme;
(II) das Prinzip des implikativen Aufbaus morphologischer Strukturen;
(III) das Prinzip der strikten Kopplung morphologischer Klassen an außermorphologische Eigenschaften (außermorphologische Klassen);
(IV) das Prinzip der formalen Widerspiegelung ‚inhaltlicher' Identitäten und Distinktionen;
(V) das Prinzip der formalen Widerspiegelung ‚inhaltlicher' Markierungsverhältnisse.

When drawing parallels to derivation, Wurzel (1984: 174-189) points out the limits of the inflectional model, conceding that the principles presented are only relevant to very specific types of word-formation, e.g. involving umlaut (Principle II) or ones that are 'flexionsähnlich' (Principle III). It seems that the main aspect driving change in derivation remains within the realm of universal naturalness, which have been dealt with in section 3.1.2 as morphotactic transparency and diagrammaticity/constructional iconicity (Principles IV and V, respectively), and of typology (Principle I), which has been presented in the previous section and will be discussed further in terms of system-adequacy.

According to Wurzel (1984: 159-161), productivity is the surface result of the adequacy and stability of markers and inflectional classes. Where two or more structural features or complementary word classes are in competition, it is relative quantity that decides which is system-defining (Wurzel 1987: 64). Dressler (2005: 279), however, suggests that adequacy corresponds to dominance, the most significant aspect of which is productivity. Certainly, the two concepts often overlap, in that the productivity of a process influences the overall quantity of words formed through it. However, an abundance of formations may not necessarily point

to the productivity of a process, as these may have long been established and remained in the language's lexicon. Therefore, both frequency and productivity will be considered in this section, the former to determine which suffixes were or became dominant during a time of morphological and lexical change, the latter as a present-day surface indicator of what remains or eventually became dominant.

To discuss the system-adequacy of derivational suffixes, the lexical stratification of the system must be considered. A large influence on changes to the morphology of English was the Norman invasion, which introduced many new structures into the language (cf. Dalton-Puffer 1996). Dressler (2005: 279) therefore suggests that in Present-Day Standard English, a stratification between Latinate and Non-Latinate words, both in the lexicon and in word-formation, is system-defining in English. While some researchers have made the distinction of native vs. non-native (cf. Kastovsky 2006) or foreign vs. native (cf. Marchand 1969) for English derivation, others concentrate on the stratification of Romance vs. Germanic (Dalton-Puffer 1996) or Latinate vs. Non-Latinate (Dressler 2005). As this section is mainly concerned with 'native' noun suffixes of Germanic origin in competition with each other and with suffixes newly introduced into the language through contact with French following the Norman invasion, any of those terminological distinctions will serve to describe the stratification that seems to exist in Middle English derivation. However, it should be noted that the concept of a stratification is not intended to imply an inherent ability of speakers to recognize the linguistic origin of words, nor that suffixes can unfailingly be split up into strata according to their phonological make-up (cf. Bauer et al. 2015: 583-615 for a detailed discussion). Rather, in the present thesis, stratification will be considered a set of general tendencies, largely corresponding to linguistic origins but not completely free from exceptions. Furthermore, while Bauer et al. (2015: 615) conclude that contemporary English derivation shows little stratification and that phonology plays a role in recognition to some extent, it will be assumed that in Middle English, especially in its earlier stages, stratification was still more perceptible than it is today.

Dressler (2005: 279-280) presents a set of criteria to determine the level of productivity of a structure, depending on the type of base a suffix can take and on competition between suffixes. In PDE, while Latinate suffixes prefer to derive Latinate bases, native suffixes tend to attach to both Latinate and Non-Latinate bases (Plag 2003: 84-85). Data analyzed by Bauer et al. (2015: 587-588) shows that of the PDE non-native abstract noun suffixes, only *-age* is attested to attach to non-native affixes more than just occasionally. Productive PDE native suffixes, on the other hand, are shown to attach to both native and non-native bases (Bauer et al. (2015:

584). Non-native or Latinate suffixes may therefore be considered less productive than native ones, since the latter do not have this morphological restriction. The fact that native suffixes are indifferent to this stratification indicates for Dressler (2005: 279) that Non-Latinate suffixes are dominant and therefore more system-adequate than Latinate ones. Marchand (1969: 210-211) explains this discrepancy by pointing to the fact that while adoption of foreign words into a language's lexicon and applying native word-formation processes to them seems relatively simple, adopting foreign affixes involves structural changes in the native language and therefore happens (if at all) considerably later and to a lesser extent. Indeed, Dalton-Puffer (1996: 220) suggests that Romance suffixes were never productive and that any new formations were formed through analogy rather than through a productive word-formation rule adopted into English.[15]

If Non-Latinate suffixes are dominant, then *-th* could be considered system-adequate for being Germanic. However, given this stratification, or at least tendencies resembling stratification, it is reasonable to consider the adequacy of a suffix within its stratum. As Norman French and Early Middle English were typologically different, it was system-adequate for suffixes of the former to attach to stems and to create stem-variation, while for the latter, it was system-adequate to take words as bases and to have stem-invariance (see section 3.1.3.1, Kastovsky 2006: 163-164, 172-173). As a suffix that operates on stems and often creates stem-variation, *-th* is therefore not system-adequate in this respect. It is, noteworthy, however, that Dalton-Puffer (1996: 114) found that *-th* could derive the same base with and without stem-variation, without any preferences for either within a text or dialect. This fact is interesting with respect to two aspects of the suffix' status during the ME period. First, it indicates that words containing the suffix had not yet fully been lexicalized, still being readily perceived as a word-formation rule. Second, it suggests that there were attempts to form more 'regular' nominalizations with the suffix, meaning that formations which historically contain phonological alternations were formed appropriately to the type of derivation dominant within the native stratum, which was word-based and stem-invariant. As mentioned above, Germanic suffixes may derive all bases regardless of stratum; however, Dalton-Puffer (1996: 87) found no instances where *-th* derived non-native bases and Bauer (2001: 69) states that the suffix has "overwhelmingly been used on native bases". This may either indicate that the suffix was not system-adequate or that the process was already unproductive by the time a large quantity of non-native vocabulary was incorporated into the language's lexicon.

[15] A notable exception to this is the suffix *-able* (see Dalton-Puffer 1996, Marchand 1969).

suffix	tokens	types
UNG	1840	496
NESS	1332	220
ACIOUN	599	156
AUNCE	520	87
ITE	434	74
ERIE	239	55
HEDE	229	45
MENT	379	41
AGE	237	36
SHIP	219	33
TH	445	31
DOM	240	23
LAC	67	12
ACY	9	5
REDEN	5	3
AL	6	2

Figure 8: Abstract noun suffixes in type frequency order (Dalton-Puffer 1996: 75)

suffix	tokens	types
UNG	1840	496
NESS	1332	220
ACIOUN	599	156
AUNCE	520	87
TH	445	31
ITE	434	74
MENT	379	41
DOM	240	23
ERIE	239	55
AGE	237	36
HEDE	229	45
SHIP	219	33
LAC	67	12
ACY	9	5
AL	6	2
REDEN	5	3

Figure 9: Abstract noun suffixes in order of token frequency (Dalton-Puffer 1996: 74)

When considering the system-inadequacy of *-th,* it is necessary to compare it to the suffixes competing with it, more specifically the dominant ones. *-th* was in competition with many other suffixes forming abstract nouns, in both major semantic functions, namely creating nomina essendi and nomina actionis (cf. Zbierska-Sawala 1993: 29-30). As shown in 3.1.2, both semantic categories were also encoded through a variety of other suffixes, especially

once the French suffixes were established.[16] Dalton-Puffer (1996: 74-75) identifies *-ung/-ing*[17] and *-ness* as the two most frequent nominalization suffixes of Middle English and both for types (Figure 8) as well as tokens (see Figure 9). While *-th* is in 5th place for the number of tokens, it is considerably further down the list in terms of type frequency, which points to the existence of a small number of high frequency words formed through the suffix (Dalton-Puffer 1996: 74). High token frequency makes structures more resistant to morphological or analogical change (Bybee 2001: 11), which may explain why the suffix has survived in small number of nominalizations. The dominant and therefore system-defining suffixes for each of these categories were *-ness* and *-ung/-ing*, respectively (cf. Dalton-Puffer 1996: 82; 91).

Diachronic changes where a suffix is substituted by another usually involve a stage of competition between variants of the same word: older derivations formed through a less productive suffix compete with neologisms formed with a more productive suffix (Dressler 2005: 280). This was indeed the case during the Middle English period: Dalton-Puffer (1996: 126) notes that a substantial number of bases occurred with several noun suffixes forming nomina essendi. Figure 10 (Dalton-Puffer 1996: 127) shows her findings. It is clear from this table that among competing de-adjectival nominalizations, *-ness* was the dominant suffix, indicating a high productivity. Its productivity is also attested by the data: Dalton-Puffer (1996: 82) suggests that a relatively small number of shared tokens across time periods indicates that *-ness* was very productive. While she could not find systemic differences in meaning between most competing suffixes, Dalton-Puffer (1996: 128) does mention a few notable exceptions: *hey-the* and *high-nesse, lengthe* vs. *langnesse.* where the derivatives containing the dental suffix refer to spatial dimensions and the ones formed with *-ness* to states. Other competing formations seem to have been used interchangeably, on occasion within the same text (shown in bold in Figure 10, p.63).

[16] The increase and semantic expansion of French suffixes seems to have also gone hand in hand with the specialisation and (in some cases) disappearance of Germanic ones (Dalton-Puffer 1996: 124).
[17] See Dalton-Puffer (1996: 37-39; 90-91) about the distinction from participal *-ing*.

ITY	NESS	HOOD	SHIP	DOM	LAC	REDEN	TH
able	able						
	bright						bright
		brother					brother
caitif	caitif						
chast	chast						
	cleen		**cleen**				
	derk	derk					
	dry	dry					
			dusi		**dusi**		
	even	**even**					
	fair	**fair**			fair		
fals	**fals**	**fals**	fals	**fals**			
		foul					filth
			free	**free**	**free**		
		friendly	friend			friend	
	full	full					
	glad		glad				
	godcund	godcund					
	good				**good**		
			hel				helth
	hethen	hethen	hethen				
	high		high				
	holi			holi			
	kind	kind	kind				
	light		light				
	little	little					
	long						length
	manish	man	man		**mannish**		
	meek		meek				
	mild		mild				
	modi				**modi**		
un(one)	one	one					
	qued	**qued**	qued				
		shiref	ref				
	reu						reuthe
	rightwys			**rightwys**			
scant	**scant**						
			schend		schend		
scars	**scars**						
simple	simple						
sobre	sobre						
	soth	**soth**	soth				
sotil	sotil	sotil					
stable	**stable**						
	still						stilth
unchast	**unchast**						
	wicked	wicked					
	wis			**wis**			
	wod	wod	wod				
	worth		worth				
	wreche	wreche		wreche			
		youth					youth

Figure 10: Multiple de-adjectival derivatives (Dalton-Puffer 1996: 127)

Eventually, where there was no semantic differentiation, such parallel formations decreased as the dominant suffixes were stabilized; *-ness* became dominant for de-adjectival abstract nous and *-ing* for deverbal abstract nouns: Bauer et al. (2015: 246) note that *-ness* derivation appears to be the "default way of forming abstract nouns from non-verbal categories in contemporary English". The high productivity of *-ness* in contemporary English is also attested in Nishimoto 2004 (cf. section 2.2.3). Furthermore, all PDE verbs (except auxiliaries) may be nominalized with *-ing*, a significant number of which is not nominalized with any other suffix or through conversion (Bauer et al. 2015: 202-203). However, when speaking of the dominance of suffixes, zero suffixes should not be forgotten: most native verbs can also

be nominalized through conversion (Bauer et al. 2015: 203). Seeing as conversion seems to be restricted to one stratum, it may be considered less productive than *-ing* (likely due to its close relation to inflection), as it may derive any verb.

To conclude, Middle English derivational *-th* may be considered system-adequate in that it belonged to the dominant stratum but within that stratum, it lacked adequacy: it derived only words from the native lexicon, it often altered the stem (when Germanic derivation had become agglutinating and stem-invariant) and was far less productive and less frequent than other suffixes which encoded the same semantic categories.

3.1.4. Summary and implications

The discussion in section 3.1.2 has shown that universal naturalness cannot fully explain the development of the various *-th* suffixes of English. Many semiotic parameters are in conflict with each other, which is why they must be considered within the approached language types. ME derivation approached two different language types, largely dependent on stratum: Germanic derivations favour the agglutinating type while 'Latinate' derivations approach the inflecting type. As part of an agglutinating type, vowel-less nominalization *-th* (originally inflecting) did not follow all the relevant semiotic principles, such as biuniqueness or transparency, which explains the process' fossilization. Similarly, system-adequacy shows that *-th*, while part of the dominant stratum, was not conforming to the dominant features associated with it (stem invariance, deriving only the native lexicon) and was generally not frequent and productive enough to withstand more dominant competition. Similarly to nominalization *-th*, the ordinal suffix did not adhere to the principles of naturalness relevant to its new language type (i.e. the agglutinating type), but due to the lack of any morphological or syntactic alternatives, it persisted into PDE.

The disappearance of inflectional *-th* suffixes is type-adequate considering that English inflection was developing towards the isolating type. The survival of the 3rd person sg. is not only type-inadequate, it also goes against the concept of constructional iconicity, as it is semantically less complex than other categories which came to be zero-encoded. The change of verbal *-(e)th* to other, non-zero variants cannot be sufficiently explained either. While transparency may explain why *-eth* was reluctant to syncopate, it does not explain why a syncopated *-s* (with *-es* after sibilants) eventually became a viable alternative. System-adequacy can explain the change of *-(e)th* to other variants and zero to some extent, with similar semantic categories as the source and dominant competitors overtaking the suffix in

question. The origin of Northern *-(e)s* is disputed, but system-adequacy may shed a light on the reluctance of *-(e)th* to fully give way to the new alternative due to certain extra-morphological properties. Furthermore, system-adequacy may serve to explain why a usually vowelless *-s* was preferable to *-eth*, as the new suffix would at least conform with the overall dominant paradigm of zero suffixes insofar as it did not have syllable status. Curiously, the zero variant, though attested, was not a viable alternative to -eth in 3rd sg. in what came to be the standard. Its system-adequacy can be observed in non-standard varieties of England and in UAAVE (cf. Godfrey and Tagliamonte 1999), but its failure to dominate elsewhere is ascribed to the conserving effect of prestige and standardization (cf. Ferguson 1996: 179).

The question of why *-(e)s* became a viable alternative for *-(e)th* has still not been answered fully. While it has been suggested that the change was more about the vowel than about the consonant, it is not clear why *-eth* did not lose its vowel until *-s* presented itself as an alternative. Universal naturalness could argue that for the sake of transparency, it was more natural to retain the vowel, but no such retentions occurred in other suffixes during the period of wide-spread syncope. A notable exception may have been the preterite suffix; however, reasons for syncope were first dependent on the etymology of the base and then, by the end of the 14th century, on phonetic context (Minkova 2009: 325).

Furthermore, the persistence of a 3rd p. sg. in the face of a large-scale loss of inflectional endings is highly unnatural both in terms of universal as well as relational naturalness; other suffixes, such as the plural indicatives *-en* (Midlands), *-es* (north) and *-eth* (south) all eventually gave way to zero. It seems that morphological levelling is, to some extent, also dependent on the phonology of the suffix' consonant. Possibly, the dental fricative has some inherent properties that make it less likely to be lost, something that made it necessary for the suffix to undergo an intermediate step of lenition via -(e)n or *-(e)s* before being completely deleted.[18] Perhaps the suffix' reluctance to syncopate, as opposed to others, was also related to properties of the consonant and the resulting phonotactic changes in the shape of word-final consonant clusters.

None of this, however, explains why both plural indicative and plural imperative *-(e)th* were lost in the South and London. A tentative explanation might be that the dynamics of the plural were very different there due to the Northern Present-Tense Rule (see 2.2.2), which prevailed in the North and, in a similar form, in the Midlands. Nevalainen and Raumolin-Brunberg

[18] As mentioned before, the complete loss of the 3rd sg. ending was hindered by standardization but occurs dialectally.

(2000a) stress the role of London and migration to it as a key factor in the diffusion of linguistic change. It is therefore conceivable that the Northern Present-Tense Rule made its way into London in the wake of an emerging Early Modern English standard sealing the plural suffix' fate. As the plural gave way to other variants (including zero) in certain subject contexts while the sg. remained largely the same, plural *-(e)th* was already more unstable, competing with more 'acceptable' variants which could take over dominance. What exactly makes them acceptable, however, remains to be seen in the following sections concerned with phonotactics and morhonotactics.

Clearly, sociolinguistic dynamics play a significant role in the development of the various verbal *-th* suffixes of English, but they are beyond the scope of this thesis. It is also clear, however, that phonetic, phonotactic and morphonotactic factors need to be considered as well. Both the dental suffix' reluctance to syncopate and its near inability to be lost without an intermediate step of consonant change may indeed be related to phonetic-phonological properties of the dental fricative and its interaction with other consonants. I will therefore turn to phonetics and phonology in the next section.

3.2. Phonetic and phonotactic preferences

Wurzel (1987: 69) as well as Dressler et al. (2010: 64) argue that in diachronic change, morphology is typically reacting to phonological changes. As demonstrated in section 2.2.1., phonological changes in Germanic stress placement, the weakening of final syllables and the loss of final schwa entailed widespread morphological levelling of inflectional endings. The loss of word-final TH, being dropped entirely or changing to an alternative suffix, while ostensibly a morphological process, cannot fully be separated from phonology, especially considering the phonotactic differences that seem to have existed between unsyncopated eth and syncopated *-s* in the 3rd sg. Moreover, as mentioned in the introduction to this chapter, phonological markedness tends to entail morphonological markedness, that is, "[i]f the phonological exponent of a category is a phonologically marked segment, then the (morphonologically) encoded category is likely to be marked as well" (Dressler 1987a: 14). It is therefore likely that the phonetic predisposition (section 3.2.1) of the segment in question, as well as any phonotactic (sections 3.2. and 3.3) and morphonotactic (section 3.4) unnaturalness arising from schwa-deletion played a role in the development of the various inflectional suffixes containing /θ/.

3.2.1. Segmental markedness

The markedness of a linguistic element can be observed in its relatively low frequency within a certain language as well as across languages (Dressler 1987a: 14). The most common fricative[19] found in the languages of the world is /s/, i.e. a voiceless alveolar or dental sibilant: it appears in nearly 84% of languages which only have one fricative, in over 90% of languages with two fricatives and in about 83% of all 317 languages surveyed in the *UCLA Phonological Segment Inventory Database* (UPSID) (Maddieson 1984: 44-46). The next most common fricatives are the voiceless fricatives /ʃ/ and /f/, which appear in 146 and 135 languages, respectively, as well as (various versions of) /z/, the most frequent voiced fricative (Maddieson 53-54). Generally, voiced fricatives rarely occur without their voiceless counterparts (23% of the time), and voicing contrast in fricatives hardly ever occurs without voicing contrast in plosives (6.7% of all languages) (Maddieson 1984: 47; 2013c). According to the *World Phonotactics Database* (Donohue et al. 2013), dental fricatives are comparatively rare in the languages of the world, occurring only in 7.3% of all languages which allow fricatives, and in only 3.1% of all languages which have one or two fricatives. The latter group of languages, however, consists mainly of languages from the same region (New Guinea) and only four of 30 languages are from elsewhere (Donohue et al. 2013).

Judging from the geographic distribution of TH sounds, Maddieson (2013a) concludes that "processes that give rise to them are ones that are easily triggered spontaneously". Processes responsible for the origin of TH sounds are, for instance, the fricativization of the phonetically similar plosives [t] and [d], or a loss of sibilance in the sibilant fricatives [s] and [z] (Maddieson 2013a). Conversely, inverse processes can be observed as well; in the history of English, for instance /θ/ has been replaced by /s/ and /z/ in several verbal inflections, by /t/ in words such as *height* or *theft (*cf. Dobson 1968: 954), and /ð/ by /d/ in the words such as *burden, murder* (cf. Dobson 1968: 954-955) and *could*[20] (cf. Faiß 1989: 287). These sounds can also be found in allophonic variation with TH sounds, as for example in Spanish [ð] with [d] (Maddieson 2013a). Such variation can also be observed in English, in specific regional and social dialects, where /θ/ and /ð/ are replaced by /f/ and /v/, respectively (e.g., Cockney /ba:f/ *bath*, /wɪv/ *with*) or with /t/ and /d/, respectively (e.g. Irish /tɪŋk/ *think*, /dæt/ *that*) (cf. Wells 1982: 322-323, 428-430). TH sounds, then, historically have a close and unstable

[19] /h/ is not considered a true fricative here
[20] The additional <l> is an orthographic change in analogy with *would* and *should* (cf. Faiß 1989: 287).

relationship with phonetically similar sounds. The cross-linguistic rarity of TH sounds as well as their frequent loss over time suggest that they are in some way marked or dispreferred.

Another piece of evidence for the markedness of an element mentioned by Dressler (1987a: 13) is late acquisition. In general, fricatives are apparently acquired relatively late, as shown by a cross-linguistic meta-study by Locke (1983: 9-11), where /h/ is the only fricative[21] acquired at the babbling stage. Especially the voiced fricative /ð/ seems to be more difficult to acquire, often being produced 3-4 years later than other sounds by English-speaking children (Ohala 2008:19). Common substitutions for (not yet fully acquired) /θ/ made by English-speaking children are the stop /t/ or another fricative, namely /s/ or /f/ (cf. Dinnsen et al. 2013). These and similar substitutions observed in second language acquisition (cf. Lombardi 2003) not only suggest that /θ/ and /ð/ are difficult to acquire but also seem to confirm the variations and substitutions found in the cross-linguistic history of the sounds.

A reason for the difficulty and the instability of TH sounds as well as the choice of substitutions might be found in articulatory phonetics. The substitutions and variants found in language history and in acquisition are all similar to TH sounds in manner of articulation and/or place of articulation. /t/, /d/, /s/ and /z/ are similar to /θ/ and /ð/ in terms of their place of articulation: they are also coronals, require the same active articulator (the tongue) and can also be realized as a dental or as an alveolar sound (cf. Ladefoged and Maddieson 1996). The most similar substitutions in terms of manner of articulation are /f/, /v/, /s/ and /z/. Therefore /s/ and /z/ are the most similar to /θ/ and /ð/ in terms of articulation. In terms of articulatory effort, fricatives in general, and sibilants in particular, seem to require more precision than other consonants such as stops or nasals (Ladefoged and Maddieson 1996: 137). This would suggest that /t/ and /d/ should be the most preferred substitutions or variants, but TH sounds are being replaced by other fricatives as well. Since manner does not seem to be the only reason these sounds are dispreferred, one needs to take a closer look at place of articulation. In broad terms, only /f/ and /v/ seem to differ from *-th* in articulation, but if one leaves aside the potential allophonic realizations of the coronals and only considers their prototypical places of articulation (alveolar [t], [d], [s] and [s] vs. dental for [θ] and [ð]), then all of the substitutions might be an indication for the dispreference of /θ/ and /ð/ due to their place of articulation. The fact that [θ] and [ð] are the only sounds in the *International Phonetic Alphabet* to be prototypically classified as dentals might suggest that dentals are dispreferred

[21] If one classifies it as such, see Maddieson 1984: 41, Ladefoged & Maddieson 1996: 137

in general. This, however, does still not give any indication on whether some types of substitutions might be more preferred than others.

Acoustic phonetics may shed further light on the sound's markedness and its change to other alternatives. Fricatives can be divided into non-sibilants (/f/, /v/, /θ/, /ð/), which are produced by the articulatory constriction itself, and sibilants (/s/, /z/, /ʃ/, /ʒ/), which are the result of a jet of air striking the edge of the teeth (Ladefoged & Maddieson 1996: 138). Acoustically, non-sibilants are more similar to each other as well: An acoustic study by Tabain and Watson (1996) on the classification of the fricatives [s], [ʃ], [f] and [θ] in Australian English showed that [θ] and [f] were misclassified the most and chiefly confused with each other. Furthermore, in their report on a spectral analysis, Wester et al. (2007: 480) state that both [θ] and [f] are rather weak, staying below 10 kHz and only differing in transitions before and after the consonants, while the energy of [s] is usually concentrated in frequencies above 10 kHz and considerably more intense than the other two, making it far more salient. Rogers (2000: 162) even suggests that [f], [v], [θ] and [ð] are sometimes "so weak that they barely show up [on spectrograms] at all". The considerable difference in acoustic force between [θ] and [f] on the one hand and [s] on the other hand as well as the general weakness of fricatives can be observed in Table 1. It shows a scale of relative phonetic power proposed by Fletcher (1972: 82–86; described in Clements 2009: 166), which relates the power of English sounds to the power of the weakest sound.

Table 1: scale of phonetic power (Fletcher (1972: 82–86; in Clements 2009: 166)

ɔ	680	**u**	310	**ʧ**	42	**k**	13
a	600	**ɪ**	260	**n**	36	**v**	12
ʌ	510	**i**	220	**ʤ**	23	**ð**	11
æ	490	**r**	210	**ʒ**	20	**b**	7
o	470	**l**	100	**z**	16	**d**	7
ʊ	460	**ʃ**	80	**s**	16	**p**	6
e	370	**ŋ**	73	**t**	15	**f**	5
ɛ	350	**m**	52	**g**	12	**θ**	1

As can be seen in Table 1, [θ] and [f] are considered the weakest sounds at the values 1 and 5 respectively and [ʃ] as the most powerful fricative at value 80. According to this scale, [θ] is the most marked sound in the English language when it comes to optimal perception. The

relative ranking of fricatives according to the phonetic power scale is [ʃ] > [ʒ] > [z] > [s] > [v] >[ð] > [f] > [θ], with sibilants being the strongest and non-sibilants the weakest sounds. Surprisingly, [ʃ] and [ʒ], which seem to be the most salient sounds, are not common substitutions for [θ] and [ð], respectively.

As outlined in section 2.3.1, the struggle between optimal perceptibility for the hearer and little articulatory effort for the speaker plays an important role in phonological theory as well as the historical development of languages. With regard to articulation, sibilants seem to require more effort than non-sibilants, fricatives seem to require more effort than most other sounds, and dentals seem to be less preferred than other places of articulation. In perception, sibilants are preferred over non-sibilants, and all fricatives are preferred over [θ]. While the consideration of phonetic factors remains inconclusive with regard to the ranking of the sounds which tend to vary with them, it is clear that [θ] and [ð] are phonetically highly dispreferred. This is reflected in their cross-linguistic rarity, their late acquisition and their general tendency to be replaced by similar sounds. Based on these phonetic observations, one might assume that *-th* suffixes disappeared or changed, at least in part, due to the fact that they contained a highly dispreferred segment. It does not, however, explain why the sound was lost (e.g. *they cometh* > *they come*) or replaced (e.g. *thefth* > *theft, she comth* > *she comes*) in certain positions and environments but retained in others (e.g. *month, think, teeth, scythe, length*). As the following section will show, segmental context as well as language-specific phonotactic preferences have considerably influenced the development of word-final /θ/ and *-th* suffixes in English.

3.2.2. Suprasegmental markedness: Consonant clusters and universal phonotactic preferences

The development of word-final TH is intimately linked to the idea of consonant clusters and their markedness. As has been described in section 2.2.1, the loss of word-final schwa created many new and complex consonant clusters in words derived with nominalization and ordinal *-th*. Syncope also occurred in checked syllables; however, much less regularly than the loss of final schwa. While a syncopated *-s* was common in the plural and the genitive of nouns by 1500; verbal *-(e)th* largely resisted syncope, and therefore consonant clusters, until it was directly replaced by a vowelless *-s* Dobson (1968: 880). Stein (1986: 637-638) concludes that the change to *-s* was likely due to a combination of factors, including a phonotactic preference of *-s* over *-th* in contact with stem consonants. Other instances of suprasegmental markedness

can be observed in the change from *-eth* to *-s*: Gries and Hilpert (2010: 310-311) point to the fact that *-(e)th* was preferred with stem-final sibilants as well as following sibilants. According to Gries and Hilpert (2010: 294), this reluctance of verbs whose stems ended in a sibilant to change to *-s* can be attributed to an avoidance of closely repeating identical sounds (also known as the 'horror aequi' principle, cf. Rohdenburg 2003). It appears, then, that the sibilant was generally preferable to the dental fricative in consonant clusters, seeing as the former easily attached directly to all stems except those ending in sibilants, whereas the latter resisted contact with the stem in most contexts. While the ease with which *-s* attached to stems is noteworthy and could be considered unnatural in terms of suprasegmental markedness, the reluctance of *-eth* to syncopate is very much in line with universal preferences. Conversely, the loss of final schwa in derivation created a great number of complex consonant clusters, which is not universally preferable.

It is widely agreed that there is a universal preference for CV-structures, or more specifically "peaks and valleys of amplitude" (cf. Maddieson 1999). What makes consonant clusters so universally dispreferred, then, seems to be grounded in a lack of such an amplitude contrast. Consonants are commonly perceived best when followed by a vowel; their articulatory release is hindered if followed by another consonant, which influences their perception (Wright 2004: 43-46). The preference for CV-structures is also supported by a cross-linguistic statistical analysis by Maddieson (2013b), who states that CV is the only syllable type found in all languages. However, merely 17.6% of 2,382 languages documented by *World Phonotactics Database* (Donohue et al. 2013) restrict their syllables to the universally preferred CV-structures.

According to Dressler (1987a: 14), cross-linguistic rarity as well as intralinguistic rarity (i.e. low type and token frequency) are indicators of a structure's markedness. Consonant clusters, which deviate from the universal preference for CV sequences, are relatively rare in the languages of the world: A survey revealed that from a representative sample of 30 languages, 70% had no or hardly any (frequency lower than 1%) consonant clusters (Maddieson 1999: 2525). Coda consonant clusters are even rarer than onset consonant clusters: while 42.1% of 2,378 languages recorded by Donohue et al. (2013) allow consonant clusters in syllable onsets, only 20.6% of them allow coda consonant clusters. Figure 11 shows the distribution of maximum coda sizes allowed in the languages documented by Donohue et al. (2013. Clearly, at 1,400, the majority of languages allow a maximum of one consonant, while 489 languages do not allow any consonants and 489 languages allow more than one in the coda. As can be seen from Figure 11, the larger the consonant clusters, the fewer languages allow them: 366

languages allow up to two, 108 up to three, 12 up to four and only three languages permit up to five consonants in a coda. This suggests that the larger the consonant cluster, the more marked it is; this is not surprising considering that larger consonant clusters present an even larger deviation from the preferred CV sequence.

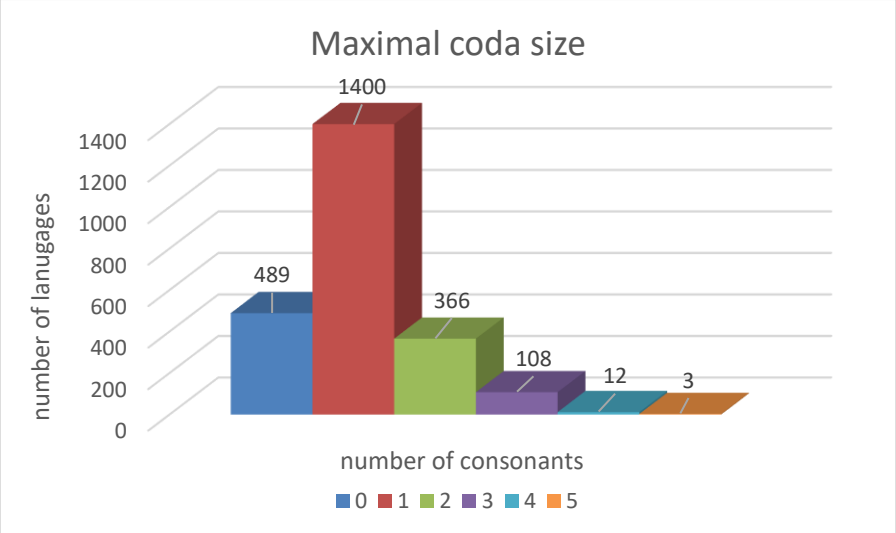


Figure 11: maximal number of consonants in syllable coda across 2,378 recorded languages (adapted from Donohue et al. 2013).

Another indicator for the markedness of a structure is its late acquisition (Dressler 1987a: 14). McLeod et al. (2001) offer a review of the acquisition of consonant clusters which demonstrate that children have trouble producing consonant clusters in early stages of acquisition, usually reducing them, by deleting an element or by coalescing features of elements, or (at a later stage) simplifying them, by using elements which are 'easier' to produce, such as glides. Furthermore, word-final consonant clusters usually occur earlier than word-initial ones (due to grammatical morphemes) and bi-segmental consonant clusters are acquired before tri-segmental ones (McLeod et al. 2001). According to Schreier (2005: 50), consonant clusters are acquired independently of their constituting parts, in the sense that the successful production of individual segments does not necessarily entail that a consonant cluster consisting of those segments can be produced just as easily. However, the acquisition of consonant clusters and their elements do not seem to be entirely independent, in the sense that a consonant cluster cannot be mastered before its constituting segments are acquired: McLeod et al. (2001) demonstrate that consonant clusters which contain fricatives are generally acquired later than consonant clusters which contain stops, which appears to be linked to the late acquisition of fricatives in general. Therefore, consonant clusters containing /θ/ should be acquired later due to /θ/ being acquired later (see the previous section).

Further indicators for the markedness of consonant clusters may be found in diachrony: according to Dressler (1987a: 14), marked structures change before and into less marked structures. Consonant clusters are historically unstable and their modification and adaptation in general and in English is well-documented (cf. Schreier 2005, Dziubalska-Kołaczyk 2005). According to Locke (1983: 162), consonant clusters outnumber single consonants in word-final position in Present Day English monosyllabic words. However, this is mainly due to inflectional suffixation, and only 18% of closed monosyllabic lexical stems end in consonant clusters (Locke 1983: 162). Word-final consonant clusters may contain up to four consonants (including syllabic consonants), allowing for a more varied segmental make-up than initial consonant clusters (Schreier 2005: 126). However, such CCCC consonant clusters are rather rare, only formed through suffixation and regularly reduced, usually through the elision of the consonant cluster's third segment (Cruttenden 2014: 262).

Cruttenden (2014: 262-263) lists the following PDE word-final CC (1) and CCC (2) consonant clusters ending in /θ/:

(1) pθ, tθ, dθ, mθ, nθ, lθ, fθ
(2) ntθ, ŋkθ, ksθ, lfθ

Consonant clusters involving /r/ as the first element are noticeably absent due to the fact that Cruttenden (2014: 262) presents the consonant clusters of what has been termed 'General British'. A survey of Muthmann's *Reverse dictionary* (2002: 128-130) reveals the following consonant clusters ending in /θ/:

(3) pθ, (r)mθ, znθ, fθ, lfθ, ksθ, tθ
(4) dθ, lθ, ŋθ
(5) rθ, nθ

The consonant clusters in (3) only appear in a single word (*depth, warmth, thousandth, fifth, twelfth, sixth* and *eighth*); the consonant clusters in (4) appear in two to five lexical entries (not including compounds); and assuming rhoticity, the consonant clusters in (5) are the only ones which appear in more than 10 words (Muthmann 2002: 128-130). However, it must be considered that while some of these consonant clusters have few lexical entries, many of them appear in ordinal numbers: /znθ/ (*thousandth*), /fθ/ (*fifth*), /lfθ/ (*twelfth*), /ksθ/ (*sixth*), /tθ/ (*eighth*), /dθ/ (*hundredth*), /rθ/ (*fourth*), /nθ/ (*seventh, ninth, tenth, eleventh, -teenth, millionth, trillionth, billionth, umpteenth*) (Muthmann 2002: 128-130). As numbers are infinite, these consonant clusters can therefore be considered highly numerous in terms of possible lexemes,

with /nθ/ clearly in the lead. Clearly, for consonant clusters of ordinals, morphology plays a significant role in their survival, which will be discussed in section 3.4.

Since phonetic variation is considered a source for (natural) sound changes (cf. Blevins 2004: 333), we can perceive synchronic consonant cluster reduction as an indicator of historical instability. As mentioned above in section 2.3.1, assimilation and elision are typical lenition processes common to casual speech, and can be observed in words such as /leŋkθ/ *length*, where the stop may be assimilated to the fricative, yielding /lentθ/, or where the stop after the nasal is deleted, displaying consonant clusters such as /leŋθ/ and /lenθ/ (Wells 2008: s.v. *length* lexico.com 2019: s.v. *length*). But there may also be variation due to fortition processes such as the insertion of a stop in /twelftθ/ *twelfth* /fɪftθ/ *fifth* or /sɪkstθ/ *sixth*, or through fricative stopping in /fɪft/ *fifth* /sɪkst/ *sixth*[22] (Wells 2008: s.v. *twelfth, fifth, sixth;* Merriam-Webster.com 2019: s.v. *twelfth, fifth, sixth*). All regional and social varieties of English display consonant cluster reduction to some extent (cf. Schreier 2005: 198-200). Such repair mechanisms may also be observed diachronically: due to the universal preference for CV structures, certain repair mechanisms such as deletion of a consonant or insertion of a vowel (epenthesis) may alter consonant clusters over time (Schreier 2005: 7). This is exemplified by words such as *height* and *theft*, which originally ended in /θ/ and were altered in a dissimilatory process (Dobson 1968: 954).

Summary and implications

This section has shown that consonant clusters are generally dispreferred due to a universal preference for CV structures. This explains why the consonant clusters formed through schwa-loss in *-th* derivatives are reduced both diachronically and synchronically. It also reveals another reason for verbal *-(e)th* to syncopate, as it would mean an unnatural development towards consonant clusters. By contrast, it cannot account for the fact that a vowelless *-s*, which produced generally dispreferred consonant clusters, was preferable to a fully syllabic *-eth*: a change such as *she speaketh* > *she speaks* means a change from a preferred CVC structure to a dispreferred CC structure. The issue is complicated by the fact that it also involved a change of consonant: Why was it preferable to have *-s* over a hypothetical *-th*? From the historical developments, it seems that (CC)Cs is preferred over (CC)Cəθ which is preferred over (CC)Cθ. While retaining the vowel makes perfect sense in terms of universal

[22] Potentially, *fift* and *sɪkst* could also be the result of an inserted /t/ with the subsequent deletion of /θ/.

phonotactic preferences, the preference of /s/ clusters over a fully syllabic *-eth* suffix is puzzling. It has been pointed out above (section 2.2.2) that, while syncope did not regularly occur in verbal *-(e)th*, it did happen on occasion. Clearly, the imperative to syncopate schwa in checked syllables was strong; a phonological change which could only be resisted due to the high markedness of /θ/ clusters. When a more suitable alternative presented itself in the form of syncopated *-s*, the phonological change could finally gain a foothold.

The history of verbal *-(e)th* seems to indicate that coda consonant clusters ending in /s/ are preferable to those which end in /θ/. Indeed, as exemplified above, consonant clusters containing the dental fricative have been shown to be even more dispreferred, which can be observed in language acquisition, synchronic variation and diachronic changes. Furthermore, the frequency of certain consonant clusters in PDE seems to indicate that some of them are more acceptable than others. Which consonant clusters are more acceptable and survive longer than others may depend on universal phonotactic preferences, with the most marked/dispreferred structures being attacked first (or avoided at all cost). While consonant cluster size appears to play a significant role, other criteria must be in place for consonant clusters of the same size to differ in their degree of (dis)preference. Dziubalska-Kołaczyk (2002a: 113-114) proposes a hierarchy of consonant clusters in terms of 'tolerance', with each consonant cluster fitting one of the following categories: impossible consonant clusters, dispreferred consonant clusters, "which are possible, though dysfunctional in the given position" and preferred consonant clusters, that is, consonant clusters which are "sustained by some force counteracting the overwhelming tendency to reduce towards CV's". Several attempts have been made to account for such a force and for the structure of syllables and consonant clusters, some of which will be examined in the following sections. While sonority seems to play an essential role in most theories, a crucial factor influencing the variety and the size of final consonant clusters in English is also the morphological operation of (consonantal) suffixation, which results in polymorphemic consonant clusters. Their morphemic status and the relationships of consonant clusters to each other influence their phonotactic preferences. The interplay of morphotactics and phonotactics and their disregard of universal preferences will be dealt with in more detail in section 3.4 below.

3.3. Models of phonotactic preferences

Thus far, I have presented the various reasons for *-th* nominalizations to have become unproductive and for the verbal *-th* endings to have been replaced or lost (section 3.1) and

considered phonetic and phonotactic reasons for the suffixes to be dispreferred (section 3.2). Segmental markedness (section 3.2.1) showed that while dental fricatives are dispreferred in many respects, they still commonly appear in Present-Day Standard English in various phonological contexts (in consonant clusters, between vowels, at word and syllable boundaries, etc.). Suprasegmental considerations have demonstrated that consonant clusters are universally dispreferred, and that consonant clusters repair mechanisms have occasionally involved the change of a dental fricative to a stop (/t/), both synchronically, in words such as *theft* (< *thefth*) and diachronically, as in *height* (< *heighth*). As the diachrony of the suffixes have shown, coda consonant clusters ending in /θ/ appear to be less preferred than those ending in /s/, and some /θ/ clusters seem to be more acceptable than others. To account for suprasegmental markedness and these phonotactic changes, I will consider several models of phonotactic preferences. While it is not positioned within Natural Phonology, Vennemann's (1983) theory of preferences shares similar views (see section 2.3 above) and will therefore briefly be considered as well. Many models of phonotactics mainly concern themselves with the syllable, focusing on scales of segmental sonority to arrive at explanations for syllable shapes. However, as the following section will show, neither the syllable nor sonority are necessarily the best (or only) basis for phonological preferences.

3.3.1. Preference laws for syllable structure

Vennemann (1988) formulated a number of universal preference laws concerning syllable structure, which have subsequently been heavily criticized. Claiming that "every change in a language system is a local improvement" (Vennemann 1988:1) and that changes which make the syllable structure 'worse' are not "motivated by syllable structure" (Vennemann 1988:2), Vennemann supports his preference laws with a selection of diachronic examples from various languages. Auer (1994: 58-59), however, lists a number of counter-examples in conflict with some of Vennemann's preference laws. Of course, the counter-argument would then be that Auer's examples are simply motivated by a change on another given parameter which "merely happens also to affect syllable structure" (Vennemann 1988: 2). However, Berg (1990: 569) aptly points out that Vennemann's hypothesis is reiterative: the claim that all diachronic change is improvement is explained through the assertion that only changes which improve the syllable structure are seen as motivated by it. Furthermore, Berg (1990: 570) argues that his linguistic examples are only proof that these types of changes exist, not that there is a statistically significant tendency to comply with these laws. Both critics agree that 'preference

laws' is a misnomer and Berg (1990: 570) concludes that they could have their merit as 'preference tendencies'. The present thesis will therefore regard Vennemann's laws as tendencies and with caution.

A concept at the basis of these laws is 'Universal Consonantal Strength', that is the "degree of deviation from unimpeded (voiced) air flow" (Vennemann 1988: 8). Presenting a parameter which is essentially an inverse sonority scale, Vennemann (1988: 8-9) proposes an order of 'principal correlates' (i.e. representatives) of the speech sounds of a language according to their consonantal strength. Figure 12 shows his order of speech sounds, with the sounds of greatest consonantal strength at the top Vennemann (1988: 9):

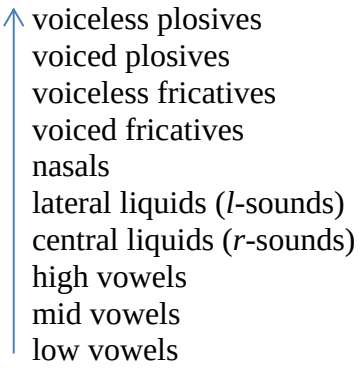


Figure 12: Consonantal strength of principal correlates, slightly adapted from Vennemann (1988: 9)

The preference law of interest for this thesis is the 'Coda Law', that is preferences concerning syllable codas (Vennemann 1988: 21):

> A syllable coda is the more preferred: (a) the smaller the number of speech sounds in the coda, (b) the less the Consonantal Strength of its offset, and (c) the more sharply the Consonantal Strength drops from the offset toward the Consonantal Strength of the preceding syllable nucleus.

Part (a) of the law is in accordance with the general dispreference of consonant clusters described in section 3.2.2 as well as the fact that larger consonant clusters are more dispreferred than smaller ones. Vennemann (1088: 21) further suggests that it "shows its most dramatic effects in word-final syllables", a claim which is not explained any further except with selected examples of word-final consonant cluster reduction (as well as examples where no reduction has taken place). Part (b) seems to support the general notion that final consonant clusters tend to be weaker or subjected to weakening more often than initial consonant clusters but again, this is not substantiated by any extensive examples. Part (c) tries to account for exceptions to rule (b): where a dispreferred consonantally strong coda-final (=offset) consonant is 'redeemed' by its distance in strength to one or more preceding consonants

(Vennemann 1988: 27). Vennemann has very little else to say about the laws or how they interact with each other.

For instance, considering two variants of an ME word, namely *thefth* and *theft*, with regard to the coda law immediately poses problems. According to part (b) of the law, *thefth* would be preferred over theft due to /θ/ having slightly less consonantal strength than /t/. However, the drop in consonantal strength between /t/ and /f/ is minimally sharper than the one between /θ/ and /f/ (as both are on the same level), which would make *theft* the preferred variant according to part (c). If one assumes that the parts of the coda law are also ordered by preference, that is (a) is preferred over (b) and (b) is preferred over (c), then *thefth* would be more preferable since it conforms to part (b) of the law better than *theft* would. Furthermore, a theoretical form where /f/ was weakened to, say, /v/ would display a similar drop in consonantal strength, therefore complying with part (c), without having to increase the strength of the offset, therefore also complying with part (b). Historical evidence, however, shows no such developments: the PDE word is /θeft/, and not /θefθ/ or /θevθ/. Similarly, for the word *fifth*, variants such as /fɪθ/, fɪft/, fɪftθ/ exist in PDE (Merriam-Webster.com 2019: s.v. *fifth*). While /fiθ/ would be preferred according to (a) and /fift/ according to (c), /fiftθ/ is not supported by any of Venneman's laws. While the latter would be claimed to be motivated by something other than the syllable structure, it is not clear why the former two variants co-exist and whether one should be preferred over the other.

Clearly, there is much counter-evidence to Vennemann's quite dogmatic claims about syllabic preferences, and the relations between sub-sections of his laws are anything but clear. In order to make sense of the parts of the law and how they relate to each other, one would need to define some conditions, for instance relative differences in consonantal strength. Such an approach has been made with the Optimal Sonority Distance Principle, found within the framework of the Beats-and-Binding phonology model (cf. Dziubalska-Kołaczyk 2002a: 114-116).

3.3.2. Syllable-less approaches: OSDP and NAD

In order to better explain phonology and phonotacics, Dziubalska-Kołaczyk (1996, 2002a) proposes the Beats-and-Binding phonology model, set within the framework of Natural Linguistics. As many phonological phenomena cannot be properly be accounted for by conventional syllable models, the Beats-and-Binding model offers a syllable-less approach, instead proposing the binding of 'beats' with 'non-beats'. The beat is a "regularly recurring

skeletal prosodic unit of phonological representation, of a size corresponding to that of a segment" (Dziubalska-Kołaczyk 2002a: 86). Beats are realized by sounds that are commonly referred to as syllable nuclei (vowels and syllabic consonants) and are connected to non-beats (consonants) through bindings of differing strengths. Within this model, Dziubalska-Kołaczyk (2002a) identifies a number of phonotactic preferences relating to consonant clusters. Two of the most notable of these are the preference for alternating beats and non-beats in a sequence and the preference for bindings of the form **n→B**, that is a beat bound to the subsequent non-beat, most commonly realized as CV-structures (Dziubalska-Kołaczyk 2002a: 93). In order to account for the survival of consonant clusters despite the general tendency of languages to return to CV-structures, Dziubalska-Kołaczyk (2002a: 114-116) initially proposes the Optimal Sonority Distance Principle, which is subsequently developed into the Net Auditory Distance Principle (cf. Dziubalska-Kołaczyk 2014).

3.3.2.1. Optimal Sonority Distancing Principle

Dziubalska-Kołaczyk's (2002a: 114-116) Optimal Sonority Distance Principle (OSDP) defines optimal sonority relations between segments in a sequence, based on the following sonority scale:

Table 2: Sonority scale adapted from Dziubalska-Kołaczyk (2002a: 114)

vowels	semivowels	liquids	nasals	fricatives	affricates	plosives
0	**1**	**2**	**3**	**4**	**5**	**6**

Each subgroup of sounds is assigned a value relative to their sonority which serves as the basis for sonority distance calculations. According to the OSDP, the sonority distance between pairs of adjacent segments should be optimally balanced, with 'optimality' depending on the size and position of the consonant cluster (Dziubalska-Kołaczyk 2002a: 114). Dziubalska-Kołaczyk (2002a: 117) gives the following condition for preferred bi-segmental word-final consonant clusters:

VC1C2

$$|son\ (V) - son\ (C1)| \leq |son\ (C1) - son\ (C2)| \text{i.e.: } sondis\ (V, C1) \leq sondis\ (C1,C2)$$

The condition reads (Dziubalska-Kołaczyk 2002a: 117):

> In word-final double consonant clusters, the sonority distance (**sondis**) between the two consonants should be greater than or equal to the sonority distance between a vowel and a consonant neighbouring on it.

For instance, in the consonant cluster /lθ/ as in *health* the calculations are as follows:

/Vlθ/

sondis (V, l) : |0-2| = 2

sondis (l, θ) : |2-4| = 2

2 = 2 → sondis (V, l) = sondis (l, θ)

Since the sonority distance between the vowel and /l/ is equal to the distance between /l/ and /θ/, the condition is fulfilled and /lθ/ is considered a preferred consonant cluster. The same would apply for /rθ/, since the /l/ and /r/ are considered to have the same sonority level. Any bi-segmental consonant cluster containing a first element which has a higher value will inevitably be dispreferred: in a consonant cluster such as /nθ/, as in *tenth*, the nasal is more distant from the vowel and even closer to /θ/, yielding the result sondis (V, n) > sondis (n, θ). Consonant clusters where both elements are a fricative, for instance /fθ/ in PDE *fifth* or /xθ/ in ME *height* are dispreferred as well, since there is no sonority distance between the consonants at all. Consonant clusters where /θ/ is preceded by an affricate or a plosive, as for instance /tθ/ in PDE *eighth*, not only violate the Sonority Sequencing Generalization, but also display a greater distance to the vowel than to the fricative:

/Vtθ/

sondis (V, t) : |0-6| = 6

sondis (t, θ) : |6-4| = 2

6 > 2 → sondis (V, t) > sondis (t, θ)

Therefore, no bi-segmental *-th* consonant cluster other than /rθ/ and /lθ/ can be considered preferred according to this principle. For tri-segmental word-final consonants, Dziubalska-Kołaczyk (2002a: 125) gives the following condition:

VC1C2C3

|son (V) – son (C1)| ≤ |son (C1) – son (C2)| > |son (C2) – son (C3)|

i.e.: sondis (V,C1) ≤ sondis (C1,C2) > sondis (C2, C3)

The condition reads (Dziubalska-Kołaczyk 2002a: 125):

> For word-final triple consonant clusters, the distance between the first consonant and the second consonant should be greater than or equal to the distance between this first consonant and the beat, and greater than the distance between the second and the third consonant.

As opposed to consonant clusters where /θ/ is preceded by one consonant, consonant clusters where /θ/ is preceded by two consonants display much more often preferred sonority distances: while /nθ/ and /tθ/ both are dispreferred, their combination to /ntθ/ is not:

sondis (V, n): |0-3| = 3

sondis (n, t): |3-6| = 3

sondis (t, θ) : |6-4| = 2

3 = 3 > 2 → sondis (V, n) = sondis (n, t) > sondis (t, θ)

The consonant cluster /ntθ/ therefore satisfies the sonority distance condition for tri-segmental word-final consonant clusters. This is particularly interesting considering pronunciation variations of the word *thousandth*: Wells (1990: 717) gives /θaʊzᵊnᵗθ/ as the main pronunciation of the word, indicating that both the schwa sound and the stop are optional additions to be ignored by 'foreign learners'. In the case of schwa omission, the /n/ can be considered a consonantal beat (i.e. syllabic consonant) (cf. Dziubalska-Kołaczyk 2002a: 287-289) and thus not part of the consonant cluster. In this case, the insertion of /t/ would result in a dispreferred /tθ/ consonant cluster. If the schwa is considered to be present and therefore the beat or nucleus, then the insertion of /t/ is preferred, since /ntθ/ fulfills the sonority distance condition while /nθ/ does not. Presumably, then, speakers would prefer to either omit both optional sounds /ə/ and /t/ or to pronounce both.

Despite being a long-standing concept to explain syllable structure and consonant clusters, sonority is not without its problems. First of all, there does not seem to be a universal hierarchy of sonority, especially for obstruents (Marecka & Dziubalska-Kołaczyk 2014: 38). Secondly, its phonetic basis (if there is any) is not entirely clear; it has been connected with audibility, acoustic energy, loudness, 'phonetic power' and 'relative resonance' (cf. Clements 2009). Greater sonority does not necessarily correlate with better perception, as can be gleaned from the scale of phonetic power presented above in section 3.2.1, which can be adapted as follows: vowels > ʃ > affricates and nasals > other sibilants > stops and non-sibilants. As can be seen, the relative phonetic force of consonants cannot simply be equated with any sonority scales, since some consonant types intermingle and cannot be separated into distinct categories, as for example stops and non-sibilants. Thirdly, while most scales of sonority usually group and order sounds by their manner of articulation, they do not take into account the contribution of place of articulation to perceptual contrast. Dziubalska-Kołaczyk (2014) therefore proposes the Net Auditory Distance (NAD), a concept based on articulatory parameters and the notion of perceptual distance rather than on sonority.

3.3.2.2. NAD Principle

The preference for CV sequences seems to be rooted in the acoustic contrast between vowels and consonants (beats and non-beats, 'peaks and valleys'), so in order for a consonant cluster to survive and not be reduced to CV, it must display a relatively high auditory contrast. In concrete terms, this means that the auditory contrast (or distance) between the consonants of a consonant cluster must counterbalance the contrast existing between one of the consonants and its adjoining vowel (Dziubalska-Kołaczyk 2014: 8). This optimal balance in auditory contrast was demonstrated and calculated in terms of sonority with the OSDP in the previous section. However, as mentioned above, sonority may not be an ideal basis for determining optimal perceptual contrasts. Dziubalska-Kołaczyk (2014), expanding on the notion of perceptual distances at the basis of the OSDP, introduces instead the concept of Net Auditory Distance (NAD). The Net Auditory Distance Principle by Dziubalska-Kołaczyk (2014: 8) states:

> A consonant cluster is preferred if it satisfies a pattern of distances specified by the universal phonotactic preference relevant for its position in the word.

Although the NAD Principle is concerned with auditory distance, its calculation is based in articulation: distance is measured by looking at how the segments differ in terms of manner of articulation (MOA) and place of articulation (POA) (Dziubalska-Kołaczyk 2014: 8). This is justified by the fact that "auditory impression is the overall product of articulation, mediated by acoustics" and that different articulatory features bring about differences in perception (Dziubalska-Kołaczyk 2014: 8). Figure 13 (p. 83) shows the original distance table proposed by Dziubalska-Kołaczyk (2014: 9), which can be modified according to the criteria and details relevant in a specific language. To measure the distances, the consonants are arranged by place and manner and given certain number values to mark the distance: The six manners of articulation that were deemed relevant are arranged based on commonly accepted sonority criteria and given values from 0 to 4: being the most sonorous, the vowels form the departure point (0), with stops being the most distant from them (4) and affricates and semivowels being given half-distance values (Dziubalska-Kołaczyk 2014: 9). For place of articulation, the consonants are divided into 5 main places based on criteria taken from Ladefoged (2006: 258). The model does not yet include place distinctions for vowels; at present, vowels only serve to measure sonority (or MOA) distance and to identify the position of a consonant cluster in a word.

4	3	2	1	0	
obstruent		sonorant			
stop	fricative	sonorant stop	approximant	V	
affricate			semiV		
p b	ɸ β f v	m ɱ	w	labial	1
t̪ d̪ t d ʈ ɖ	θ ð s̪ z̪ s z ʂ ʐ ʃ ʒ	n̪ n	r l	coronal	2
k g c ɟ	ɕ ʑ x ɣ	ɲ ŋ	j	dorsal	3
				radical	4
ʔ	h			laryngeal (glottal)	5

Figure 13: Distances in MOA and POA, original table (Dziubalska-Kołaczyk 2014: 9)

As with the OSDP, Dziubalska-Kołaczyk (2014: 9-11) lists conditions of preferred distances for consonant clusters of two or three consonants in all positions. For bi- and tri-segmental word-final consonant clusters, Dziubalska-Kołaczyk (2014: 10-11) gives the following conditions:

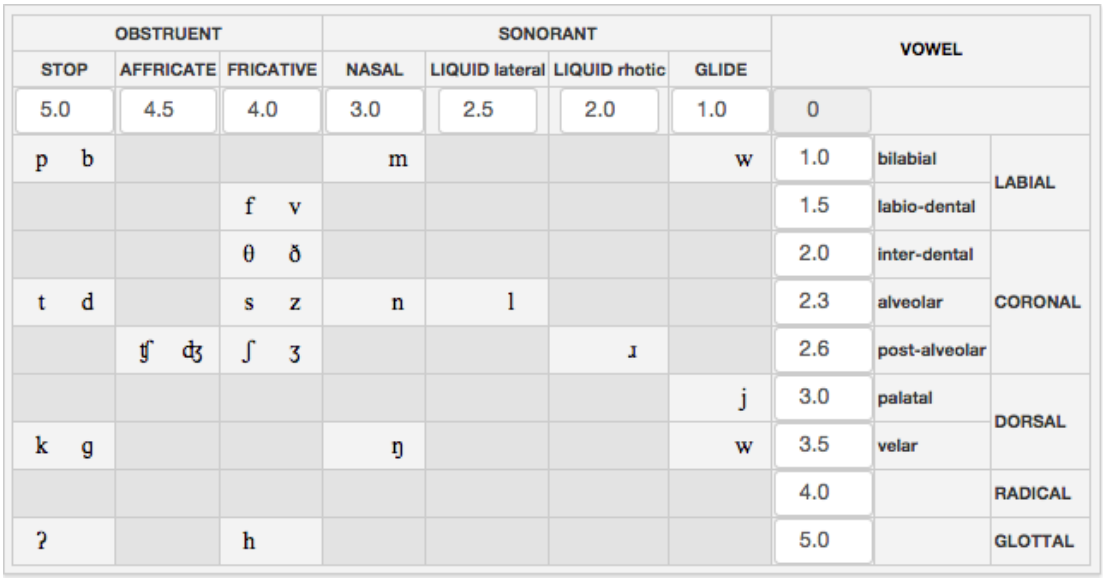
1) VC1C2
   NAD (V,C1) ≤ NAD (C1,C2)

2) VC1C2C3
   NAD (V,C1) ≤ NAD (C1,C2) > NAD (C2,C3)

The conditions are essentially the same as in the OSDP, only that it is concerned with NAD rather than with sonority distance. For the distance between two consonants, their differences in MOA and their difference in POA are added; for the distance between a vowel and its neighbouring consonant, only the difference in MOA (or sonority) value is calculated (Dziubalska-Kołaczyk 2014: 9-10):

3) NAD CC = |(MOA1 - MOA2)| + |(POA1 - POA2|)
4) NAD CV = |(MOA1 - MOA2)|

In order to test the preference conditions on English consonant clusters, a table of distances specific to English consonants is given. Figure 14 shows an updated version of English consonant MOA and POA values.



OBSTRUENT			SONORANT				VOWEL		
STOP	AFFRICATE	FRICATIVE	NASAL	LIQUID lateral	LIQUID rhotic	GLIDE			
5.0	4.5	4.0	3.0	2.5	2.0	1.0	0		
p b			m			w	1.0	bilabial	LABIAL
		f v					1.5	labio-dental	
		θ ð					2.0	inter-dental	CORONAL
t d		s z	n	l			2.3	alveolar	
	ʧ ʤ	ʃ ʒ			ɹ		2.6	post-alveolar	
						j	3.0	palatal	DORSAL
k g			ŋ			w	3.5	velar	
							4.0		RADICAL
ʔ		h					5.0		GLOTTAL

Figure 14: Updated distances in MOA and POA for English (Dziubalska-Kołaczyk et al. 2014, http://wa.amu.edu.pl/nadcalc/).

The preference calculations for a word-final /rθ/ consonant cluster in English would read as follows:

5) Vrθ

NAD (V, r): |0-2| = 2

NAD (r, θ): |2 - 4| + |2.6 - 2| = |2| + |0.6| = 2.6

2 < 2.6 → NAD VC1 < NAD C1C2

Since the distance between the vowel and the neighbouring consonant is smaller than the distance between the two consonants, the preference condition VC1C2: NAD (V, C1) ≤ NAD (C1, C2) is satisfied. Consonant clusters such as /lθ/ or /ntθ/, on the other hand, which were preferred according to the OSDP are dispreferred under the NAD Principle:

6) Vlθ

NAD (V,l): |0-2.5| = 2.5

NAD (l,θ): |2.5 - 4 | + |2.3 - 2| = |1.5| + |0.3| = 1.8

2.5 > 1.8 → NAD VC1 > NAD C1C2

7) Vntθ

NAD (V,n): |0-3 | = 3

NAD (n,t): |3 - 5 | + |2.3 - 2.3| = |2| + |0 | = 2

NAD (t,θ): |5 - 4 | + |2.3 - 2| = |1| + |0.3| = 1.3

3 > 2 > 1.3 → NAD VC1 > NAD C1C2 > NAD C2C3

Neither consonant cluster fulfills the NAD conditions, despite having been considered preferred on the basis of sonority. However, if one accommodates for a sonorant/obstruent distinction, the calculations may be quite different: according to the online NAD calculator (Dziubalska-Kołaczyk et al. 2014, http://wa.amu.edu.pl/nadcalc/), the inclusion of sonority as a criterion classifies both consonant clusters as preferred:

Results:

IPA transcription	CV structure	NAD(VC)	NAD(C1C2)	NAD(C2C3)	NAD(CV)	NAD product	Preferred cluster?
Vlθ	VCC	2.5	2.8	-	-	0.3	Yes
Vntθ	VCCC	3	3	1.3	-	0.85	Yes

Figure 15: NAD calculations of /Vlθ/ and /Vntθ/ in English, including sonority.

As can be seen in Figure 15, if two sounds differ in sonority (i.e. one is an obstruent and the other is a sonorant), a value of 1 is added to the NAD of those sounds. The increased distance between C1 and C2 in both consonant clusters is enough to fulfil their respective preference conditions. While a sonority scale as a basis for preferences is still problematic for the reasons listed above, it seems reasonable to at least include a sonorant/obstruent distinction. Sonority seems to be an important factor in syllable structure and consonant clusters, considering that so many linguists intuitively choose it as a basis for their phonotactic models. Clements (2009: 168) suggests that sonority scales define to what degree a segment displays the "characteristic properties of [+sonorant] sounds", naming "the presence of prominent formant peaks" as the main property of the feature. Since 'peaks and valleys' are preferred in phonology, it seems reasonable to include a sonority distinction in the calculations of consonant cluster preferences.

While the NAD Principle appears to be of a binary nature, where consonant clusters are either preferred or dispreferred, it is possible to rank consonant clusters according to there preferability. Each consonant cluster has a "NAD product", i.e. the margin by which the preference condition for a consonant cluster has or has not been met (Dziubalska-Kołaczyk 2019: 117). For CC consonant clusters, the NAD product is calculated by subtracting the NAD between vowel and adjacent consonant from the NAD between the consonants:

8) Vrθ (including sonority)
   NAD (V,r) = 2

NAD (r,θ): 3.6

NAD product = NAD (C1,C2) – NAD (V,C1) = 3.6 – 2 = 1.6

For CCC consonant clusters, the NAD values are subtracted and then averaged out: the result of NAD (C2,C3) – NAD (C1,C2) and the result of NAD (C1,C2) – NAD (V,C1) are added and divided by two:

7) Vntθ (including sonority)

NAD (V,n) = 3

NAD (n,t) = 3

NAD (t,θ) = 1.3

NAD product = ((NAD (C2,C3) - NAD (C1,C2)) + (NAD (C1,C2) – NAD (V,C1))) = ((1.3-3) + (3-3)) / 2 = ((-1.7) + (0)) / 2 = -1.7/2 = - 0.85

IPA transcription	CV structure	NAD(VC)	NAD(C1C2)	NAD(C2C3)	NAD(CV)	NAD product	Preferred cluster?
Vlθ	VCC	2.5	2.8	-	-	0.3	Yes
Vls	VCC	2.5	2.5	-	-	0	Yes
Vmθ	VCC	3	3	-	-	0	Yes
Vms	VCC	3	3.3	-	-	0.3	Yes
Vnθ	VCC	3	2.3	-	-	-0.7	No
Vns	VCC	3	2	-	-	-1	No
Vpθ	VCC	6	2	-	-	-4	No
Vps	VCC	6	2.3	-	-	-3.7	No
Vldθ	VCCC	2.5	3.5	1.3	-	1.6	Yes
Vlds	VCCC	2.5	3.5	1	-	1.75	Yes
Vmpθ	VCCC	3	3	2	-	0.5	Yes
Vmps	VCCC	3	3	2.3	-	0.35	Yes
Vlnθ	VCCC	2.5	0.5	2.3	-	-1.9	No
Vlns	VCCC	2.5	0.5	2	-	-1.75	No
Vɹmθ	VCCC	2	2.6	3	-	0.1	No
Vɹms	VCCC	2	2.6	3.3	-	-0.05	No

Figure 16: NAD calculations comparing /s/ and /θ/ clusters (using Dziubalska-Kołaczyk et al. 2014)

This NAD product may serve as an indicator of how preferred a consonant cluster is compared to others and therefore shed light on the preferability of /s/ clusters compared to /θ/ clusters. In section 3.2.2, I have suggested that consonant clusters ending in /s/ may be more preferable to consonant clusters ending in /θ/. As was shown in section 3.2.1, the two sounds are very similar in terms of articulation; with both sounds being fricatives and their places of articulation being rather close together, any differences between the two in terms of NAD would be minimal. An analysis comparing all types of consonant clusters would be beyond the scope of this thesis, but even a small sample of consonant clusters may lead to some insights. Figure 16 shows the NAD calculations of a selection of preferred and dispreferred consonant clusters, both bi-segmental and tri-segmental. As the calculations show the selected dental consonant clusters have, sonority included, the same preference status their sibilant counterparts. It comes as no surprise that the sibilant consonant clusters can be relatively more preferred (/Vms/, /Vps/, /Vlds/, /Vlns/) as well as less preferred (/Vls/, /Vns/, /Vmps/, /Vrms/) than the same consonant clusters ending in /θ/, depending on the consonant clusters' overall composition. It is thus plausible that NAD differences between *s*-clusters and *th*-clusters had no significant impact on the choice of *-(e)s* over *-(e)th* as a suffix. A comprehensive corpus study comparing the two may shed some light on the matter, but it is rather unlikely to account for the change from *-(e)th* to *-(e)s.*

According to the NAD Principle, then, the perceptual difference between [θ] and [s] in consonant clusters is rather small. However, in section 3.2.1 the latter was revealed to be acoustically much more perceptible than the former. Furthermore, Baroni (2014: 20) observes that NAD cannot predict any differences in preference for clusters of equal sonority[23], i.e. 'plateau clusters', therefore introducing the notion of salience. According to Baroni (2014: 18), "the more salient a consonant, the more easily it will be perceived correctly […] as the last member of a final plateau cluster". Based on previous acoustic studies, he proposes a salience scale based on manner of articulation, since "manner of articulation contributes to the identification of segments to a much greater extent than place" (Baroni 2014: 18). The scale for obstruents is as follows (adapted from Baroni 2014: 20):

a) Obstruent clusters: fricatives > stops
b) Fricative clusters: sibilants > non-sibilants
c) Stop clusters: dorsal > labial > coronal

[23] Obstruents are assumed to have equal sonority here.

This scale differs from the acoustic scale discussed in section 3.2.1 (see Clements 2009: 166), where [θ] and [ð] are among the weakest sounds in terms of phonetic power, which calls into question whether sounds should be grouped by manner. As Gordon et al. (2002: 169) note, the acoustic weakness of /θ/ is "presumably ascribed to its extremely small front cavity", which suggests that place of articulation matters as well. Indeed, Baroni (2014: 33) observed that salience did not play a large role for obstruent clusters, deducing that either the salience scale for obstruents was incorrect or that other factors are more important. Clearly, acoustic power should be considered as well when discussing the perceptibility and preference of consonants and consonant clusters. Similarly, Baroni (2014: 33) concludes that phonotactic preferences result from an interaction of NAD, salience, predictability as well as articulatory effort.

A further assumption I made in section 3.2.2 was that the number of surviving consonant clusters in PDE may be a result of and thus an indicator for their relative preference. As already mentioned, the following PDE consonant clusters ending in /θ/ can be found in Muthmann's *Reverse dictionary* (2002):

(1) znθ, fθ, lfθ, ksθ, tθ, dθ, rθ, nθ

(2) pθ, (r)mθ, lθ, ŋθ

IPA transcription	CV structure	NAD(VC)	NAD(C1C2)	NAD(C2C3)	NAD(CV)	NAD product	Preferred cluster?
Vznθ	VCCC	5	2	2.3	-	-1.65	No
Vfθ	VCC	5	0.5	-	-	-4.5	No
Vlfθ	VCCC	2.5	3.3	0.5	-	1.8	Yes
Vksθ	VCCC	6	2.2	0.3	-	-0.95	No
Vtθ	VCC	6	1.3	-	-	-4.7	No
Vdθ	VCC	6	1.3	-	-	-4.7	No
Vɹθ	VCC	2	3.6	-	-	1.6	Yes
Vnθ	VCC	3	2.3	-	-	-0.7	No
Vpθ	VCC	6	2	-	-	-4	No
Vmθ	VCC	3	3	-	-	0	Yes
Vɹmθ	VCCC	2	2.6	3	-	0.1	No
Vlθ	VCC	2.5	2.8	-	-	0.3	Yes
Vŋθ	VCC	3	3.5	-	-	0.5	Yes

Figure 17: NAD calculations for TH clusters in PDE (using Dziubalska-Kołaczyk et al. 2014)

While the consonant clusters in (1) are partly or only found in ordinals, the consonant clusters in (2) only appear in very few or a single word. Figure 17 shows the NAD calculations of these consonant clusters, among both categories there are preferred and dispreferred consonant clusters. While no inferences on phonotactic preferences immediately reveal themselves on the basis of this sparse data it may confirm one assumption: that phonotactic preferences cannot fully (if at all) account for the survival of certain consonant clusters into PDE. If this was the case, then the consonant clusters that survive should arguably all be preferred, or at least for the most part, while dispreferred ones should have been subjected to repair mechanisms. Admittedly, such repairs happen synchronically, in casual speech, as for instance in the ordinals *sixth* /sɪkst/ s or *twelfth* /twelf/ (Wells 2008: s.v. *sixth*, *twelfth*). However, it seems that as a whole, the survival of these consonant clusters is largely due to the continued productivity of the suffix. With a much lower productivity, *-th* as a nominalizing suffix seems to have had much less influence on consonant cluster development, as repairs happened in words such as *theft* and *height*, where /θ/ changed to /t/. In any case, it is clear that phonology alone cannot explain why certain consonant clusters survived untouched.

In the chapter on morphological naturalness (3.1), I considered the reasons for the various dental suffixes to have become unproductive (in nominalizations), to have been replaced (3rd sg. ending) or lost (other personal endings), or to have survived (in ordinals). Reasons for their morphological unnaturalness were linked to changes in phonology, in typology and within the system. The following chapter considered further sources of the suffixes' markedness, such as the phonetic properties of dental fricatives (3.2.1) and the markedness of consonant clusters in general (3.2.2) and in terms of their phonological make-up (3.3). While both morphological and phonological naturalness have been able to explain the various dental suffixes' development to some extent, some questions have remained unanswered: Why was the vowelless suffix *-s* preferred over *-eth* for 3rd sg. present indicative, although the former involved consonant clusters and the latter upheld the preferred CV structure? Why did some nominalizations survive and not others? Why were some consonant clusters formed through the derivational *-th* suffixes altered, while others are still intact? Since the answers to these questions could neither be found in morphology or phonology alone, they must be searched for in the interaction of both, as the following section will show.

3.4. Morphonotactics

Phonotactically dispreferred sequences are often formed through the interaction of phonology and morphology. In the case of English, suffixation and the deletion of schwa in these suffixes resulted in a great number of consonant clusters. This interaction of phonotactics with morphotactics is treated in the field of morphonotactics, as proposed by Dressler and Dziubalska-Kołaczyk (2006). Regarded as a subfield of morphonology (cf. Dressler 1985) and based in the Beats-and-Bindings model of phonology (cf. Dziubalska-Kołaczyk 2002a), it studies the phonotactic aspects of morphemes. Originally only concerned with the phonological structure of single morphemes (cf. Trubetzkoy 1931), morphonotactics has become more concerned with the phonotactics of combinations of morphemes, seeking to account for phenomena that seem to violate the phonotactic preferences found in lexical roots (cf. Dressler & Dziubalska-Kołaczyk's 2006).

For the case of consonant clusters, one needs to look at the morphological make-up of the word a consonant cluster occurs in. Consonant clusters can be phonotactic (or lexical), that is, they are phonologically motivated and occur only within a morpheme, or they are morphonotactic, that is they are morphologically motivated and exist solely across morpheme boundaries (Dressler & Dziubalska-Kołaczyk 2006: 71-73). Furthermore, a consonant cluster may exist both lexically and morphonotactically, which is why Dressler and Dziubalska-Kołaczyk (2006: 73) organize consonant clusters on a "gradual scale of (only or also) morphologically motivated consonant clusters". This scale contains consonant clusters

1. which are always morphologically motivated, i.e. never occur in monomorphemic words […],
2. which are morphologically motivated as a strong default, i.e. which are paralleled by very few exceptions of a morphologically unmotivated nature,
3. which are morphologically motivated as a weak default, i.e. which are paralleled by more exceptions of a morphologically unmotivated nature,
4. whose majority is morphologically motivated,
5. whose minority is morphologically motivated, i.e. which are quite normal phonotactic consonant clusters, which may also have some morphological motivation

(Dressler & Dziubalska-Kołaczyk 2006: 73).

PDE word-final consonant clusters ending in /θ/ are mostly exclusively morphonotactic and often only present in a single word, as for instance /pθ/ in *depth* or /mθ/ in *warmth*. /nth/ represents a strong default, present abundantly in ordinals, but only in a handful of lexical

stems of Greek origin which entered the language via Latin or French, such as *hyacinth*, *labyrinth* and *plinth,* as well as in *month* (related to *moon*) and in *synth,* an informal clipping of *synthesizer* (lexico.com 2019: s.v. *month*, *synth*). /rθ/ may be considered as mainly lexical, since derivations such as *birth* (*bear+th*) or *dearth (dear+th)* are likely no longer recognized as such and *fourth* is the only instance of /rθ/ in a fully analyzable derivation. A similar case is can be observed in /lθ/, whose place on the scale depends on whether the words in which it appears are considered lexicalized or not. In general, (excluding compounds) there seem to be only very few instances of the consonant clusters in words such as *wealth, health, stealth, filth* and *tilth,* all of which are originally derivations but will likely not be recognized as such, especially since the original root is either no longer in use (e.g. *weal+th* < *wele* 'well-being') or has a different pronunciation (e.g. *fil+th* < *foul*). /lth/, then, might be considered purely lexical.

Hypotheses of morphonotactics

The fundamental assumption of morphonotactics is that phonotactically marked structures are tolerated if they facilitate morphological processing (Ritt et al. 2012: 3-4). For instance, the consonant cluster /md/ is not commonly found in lexical roots, but regularly appears in past tense inflections such as /si:m+d/ *seemed* (Dressler & Dziubalska-Kołaczyk 2006: 70). As it is not found in any lexical roots of the language, the consonant cluster /md/ signals morphological complexity, aiding morphological processing. Furthermore, since the elements of the consonant cluster also appear in different combinations in other word forms (e.g. /si:m+z/ *seems*, /hi:l+d/ *healed*), morphonotactic consonant clusters are expected to be more stable historically and to be more varied than lexical ones (Ritt et al. 2012: 3-4). Consequently, consonant clusters created through morphonotactic operations are more likely to be phonotactically dispreferred than purely lexical consonant clusters (Dressler et al. 2010: 51-52).

A further hypothesis stemming from this notion is what is commonly referred to as Dressler and Dziubalska-Kołaczyk's Strong Morphonotactic Hypothesis (SMH): If a consonant cluster appears both lexically and morphonotactically, there is a homophony which hinders morphological processing and to alleviate this ambiguity, a repair process will be applied in either consonant cluster homophone (Ritt et al. 2012: 3-4). For instance, a consonant cluster such as /ld/ is found both in complex forms such as /jel+d/ *yelled* and in simplex forms such

as /ʧaɪld/ *child*, which makes it "hardly apt to co-signal the application of morphological rules" (Dressler & Dziubalska-Kołaczyk 2006: 72). For such cases of structural homophony, either consonant cluster type will be reduced over time; through altering the consonant cluster (e.g. deletion, assimilation) but also by ceasing to use the words in which the homophony occurs (cf. Baumann et al. 2015). While such repairs or changes may occur in either consonant cluster type, lexical consonant clusters are expected to be less stable and more susceptible to change than morphonotactic ones, due to the elements of a morphonotactic consonant cluster appearing in different segmental contexts (Ritt and Kazmierski 2015: 9-10).

A hypothesis complementing the SMH is the Hypothesis of Mutual Support (HMS), which states that "lexical consonant clusters will remain stable as long as there are a sufficient number of complex homophones to support them" (and vice versa) (Baumann et al. 2015: 8). This conclusion is drawn from two well-known insights into first language acquisition: 1) frequent items are acquired earlier and better before rarer ones and 2) words are initially learned by rote, without analyzing their morphological make-up. By the time a productive morphological rule such as the past-tense suffix *-(e)d* is acquired, the child has encountered a specific consonant cluster (e.g. /ld/) so frequently that it might assume the combination to be natural in lexical items as well (Baumann et al. 2015: 8). Consonant cluster preferences, then, are not only dependent universal phonotactic preferences, but also on their system-adequacy: what is considered a 'tolerable' lexical consonant cluster depends on the individual language (Dressler & Dziubalska-Kołaczyk 2006: 71-72).

Morphonotactics and language-specific tolerances for certain consonant clusters may therefore answer the questions that were still open at the end of the previous chapter. The preference of *-s* over *-eth* as a verbal suffix is due to two aspects of system-adequacy: Firstly, there was a tendency to reduce weak vowels in inflectional endings and creating morphologically complex consonant clusters. Secondly, consonant clusters ending in /s/ were more tolerable than consonant clusters ending in /θ/. This is a reasonable assumption considering that during the time *-eth* was resisting syncope, the plural and genitive nouns both already had syncopated variants of the suffixes *-(e)s* (Dobson 1968: 879-881, see section 2.2.1). That is, the abundance of morphonotactic clusters in plural and genitive nouns legitimized the presence of s-clusters formed through verbal inflection.

PDE consonant clusters

Morphonotactics, combined with NAD may also shed light on the development of the clusters which appear in lexical nouns and nominalizations. Unfortunately, these do not represent an ideal basis for an extensive analysis, at least not with the corpus data used for this thesis (see section 4). As the suffix appears to have been largely unproductive during the Middle English period, it is difficult to decide for each instance in a corpus which words where still perceived as derivations and which were already lexicalized. However, it is possible to glean some insight from the words that have survived into PDE, considering their NAD and their morphonotactic make-up and keeping the issue of lexicalization in mind. Table 3: /θ/ cluster types in PDETable 3 shows the consonant clusters which can be found in Cruttenden (2014: 262-263); the words they occur in (compounds excluded) are divided into ordinals, nominalizations (regardless of their degree of lexicalization) and lexical stems.[24] The consonant clusters are ordered according to their presence or absence in ordinals as well as by their preference status according to the NAD Principle, since both are essential for the analysis.

Table 3: /θ/ cluster types in PDE

	cluster	**preferred (NAD)**	**occurrences**		
			ordinals	**nominalization**	**lexical**
a)	znθ	No	thousandth		
	fθ	No	fifth		
	ksθ	No	sixth		
	tθ	No	eighth		
b)	dθ	No	hundredth	breadth, width	
	nθ,	No	seventh, ninth, tenth, eleventh, -teenth, millionth, trillionth,		hyacinth, plinth, labyrinth, *month*

[24] The word *month* has reluctantly been classified as lexical, as the word goes back to proto-Germanic and its dental fricative is neither explicitly associated with the nominalization suffix in (Klein 1971: s.v. *month*) nor does the relation between moon and month seem as obvious in PDE, especially considering their different vowel sounds.

			billionth, umpteenth		
c)	pθ	No		depth	
	rmθ/ mθ	No /Yes		warmth	
d)	rθ	Yes	fourth	berth, birth, mirth	hearth, earth, firth, girth, forth, north, worth
	lθ	Yes		health, wealth, stealth, filth, tilth	
	ŋθ	Yes		strength, length	
	lfθ	Yes	twelfth		

(a) shows the four dispreferred consonant clusters which appear exclusively in ordinals; /znθ/, /fθ/, /ksθ/ and /tθ/. As morphologically complex clusters are historically more stable (cf. Ritt and Kazmierski 2015: 9-10), their survival is to be expected. Grouped together in (b) are the dispreferred clusters which appear in ordinals amongst other words, /dθ/ and /nθ/. The cluster /dθ/ occurs in one ordinal and two derivations, *breadth* and *width*. Both were only added to the lexicon during the Modern English period in analogy to *length* (cf. Marchand 1969: 349), but this shows that the consonant cluster was recognized as morphological in the ordinal and therefore acceptable for further derivation. /nθ/ appears in several ordinals and in three lexical stems. The morphological complexity of the consonant cluster in ordinals not only ensured its stability but also supported its survival in lexical stems (HMS). The only other dispreferred sequences are /pθ/ and /rmθ/ and each is only found in a single word; *depth* and *warmth* (in rhotic dialects), respectively. Presumably, both clusters are still analyzable as morphologically motivated which ensured their survival into present day. Although the survival of dispreferred clusters is the focus of this analysis, it is interesting to note the preferred clusters (d) as well. The preferred cluster with the most lexical entries (in rhotic dialects) is /rθ/. Most of the words that contain the cluster are lexical, with the exception of *fourth* and derivations which have become highly lexicalized: *birth*, *berth* (both based on *beren* 'to bear'), and *mirth* (derived from *merry*) (Harper 2001-2019: s.v. *birth, berth, mirth*). /lθ/ appears only in derivations,

though many of them may also be argued to be lexicalized in PDE, as for instance *filth* (from *foul*). /lfθ/ and /ŋθ/ do not occur in many lexical entries despite being preferred.

The analysis of PDE consonant clusters ending in /θ/ seem to support the NAD Principle as well as the hypotheses of morphonotactics; if a cluster survives, it is either phonotactically preferred or upheld by being morphologically complex in all or at least most instances. However, this is a small sample size and an extensive corpus analysis would be needed to further test the hypotheses. Since the gradual lexicalization of nominalizations presents a difficulty when trying to quantitively analyze the consonant clusters in nouns, I will instead focus on verbal inflection in order to test the NAD principle and the morphonotactic hypotheses on the consonant clusters in question.

4. Empirical analysis: Verbal *-eth* and syncope

> "Schwa loss during the Middle English period is axiomatic in all standard descriptions of the history of English" (Minkova 1991: 36).

The previous chapter examined the development of *-th* suffixes , i.e. verbal present tense *-(e)th* as well as the derivational suffixes *-th(e),* found in nominalizations, ordinals and fractures, based on various linguistic theories and concepts located within Natural Linguistics. While morphological naturalness played a major role, it could not fully explain all developments, such as the fact that the verbal suffix *-eth* never syncopated on a large scale. After considering several phonetic and phonotactic aspects and various models of phonotactic preferences, it transpired that the theories most apt for explaining this were the NAD (Net Auditory Distance) Principle (Dziubalska-Kołaczyk 2014) and the hypotheses formulated within the field of morphonotactics (cf. Dressler & Dziubalska-Kołaczyk 2006, Baumann et al. 2015, Ritt and Kazmierski 2015). However, in order for these explanations to be justified, a quantitative, empirical analysis is necessary. This section will therefore test the NAD Principle and the morphonotactic hypotheses in the form of a corpus study in order to provide further evidence in their favour. This evidence will support the explanations given for the development of the dental suffixes in English in sections 3.3.2.2 and 3.4.

4.1. Approach: Written evidence of ME pronunciation

As there are no sound recordings of Middle English, linguists rely on written manuscripts to determine the pronunciation of the language. A main source for determining the pronunciation of ME is metalinguistic evidence; for instance, for the pronunciation of English between 1500 and 1700, Dobson (1968) uses texts from spelling reformers and phoneticians, school grammars and spelling books, foreign grammars (which draw comparisons to English) and books on shorthand systems, homophone lists and rhyming dictionaries. These sources all have their disadvantages, of course, and may vary in their value, depending not only on the individual texts or authors but also on the text type: spelling reformers were primarily concerned with a detailed representation of pronunciation, phoneticians were more concerned with a general theory rather than with a detailed description of English, school books are dogmatic and lack understanding of phonetics, foreign grammars do not sufficiently cover phonetic knowledge and only marginally discuss pronunciation, shorthand systems only provide insight into careless pronunciations, homophone lists were used to teach common errors which did not necessarily originate in pronunciation and rhyming dictionaries may also contain near-rhymes or 'eye-rhymes'[25] (Dobson 1968).

A popular linguistic source for determining pronunciation is poetry, as many poetic devices involve a similarity between sounds: rhyme, alliteration, foot-configurations, etc. (Lass 1997: 68). Poetry is highly stylized, which can be both an advantage and a disadvantage: according to Lass (1997: 68), such an 'artistic' use of a language is unlikely to harshly violate its norms but also tends to contain archaisms and may reflect a genre or an idiolect rather than the state of the contemporary language. Furthermore, as already mentioned above, rhyming conventions may have been different or more tolerant at the time. Linguistic sources can also be examined in terms of orthography, with spelling variations indicating variation or change in pronunciation. Middle English orthography was not yet standardized and varies greatly between and within texts. While variations between texts from particular regions or social contexts may point to synchronic dialectal or sociolectal differences (e.g. 3rd person *-s* in the North vs 3rd person *-eth* in the Midlands and the South, see section 2.2.2), variations within such a dialect or sociolect, or even within the same text may indicate diachronic changes (cf. Lass 1997: 61-62). Deviation from the norms established in a certain scribal tradition or region may indicate that a writer felt the freedom or necessity to do so or that a writer was not familiar enough with the conventions, and in both cases the orthography is likely to represent

[25] i.e. visual rhymes, based on spelling and similar pronunciation (cf. Lass 1997: 68-70).

pronunciation more closely (Lass 1997: 61-62). According to Lass (1997: 58), orthographic change (if there even is any) is slower than phonological change, usually manifesting itself in minor deviations from previous conventions. It is therefore likely that a change which was already widespread in pronunciation is only hinted at in writing. Of course, not all variation is evidence for pronunciation; some may be purely graphic (e.g. the various graphemes for dental fricatives, <ð>, <þ> in OE) or simply a spelling mistake (Lass 1997: 62).

If deviations from conventional spellings usually indicate a closer representation of pronunciation, the same may be said for orthographic deletion of the vowel in the present indicative suffix *-(e)th*. In cases where an orthographic deviation is manifested as an omission of a segment which is usually present in conventional spelling, it seems highly unlikely that a sound present in pronunciation should deliberately be left out in writing. As it was apparently conventional to retain the vowel grapheme in *-eth* (most commonly written as <e> and assumed to be schwa-like, see section 2.2.1), any unconventional orthographic syncope of a relatively significant number may be assumed to be representing a phonological deletion. Therefore, orthographic syncope in a given corpus of Middle English manuscripts should be able to show tendencies as to which words or segmental contexts are more conducive to schwa-deletion.

4.2. Hypothesis

According to Dobson (1968: 884) and Faiß (1989: 222), inflectional *-eth* was rarely syncopated to *-th*, with *-s* being regarded as its 'contraction'. Nevertheless, there is some metalinguistic evidence of schwa-loss in verbal present indicative inflection, most notably by the spelling reformer Hart (in Dobson 1968: 884), who transcribes the suffix without a vowel in words such as *comþ* or *runþ* and even confirms their monosyllabic pronunciation, at least in ordinary speech. The vowel was therefore deleted at least in some words, as the result of a common lenition process of casual speech (see sections 2.2.1 and 2.3.2). As mentioned above (section 4.1), changes in spelling often reflect changes in pronunciation, which is why any orthographic deletion of schwa within the verbal suffix can be expected to reflect the same deletion in speech.

However, this deletion of the suffix' vowel in casual speech would have resulted in word-final consonant clusters in words which had a stem final consonant, such as *comth* (as opposed to *lieth*, for instance). Consonant clusters ending in /θ/ are universally dispreferred due to the markedness of the sound itself (see section 3.2.1) as well as the general dispreference of

consonant clusters (3.2.2). It is therefore conceivable that the verbs whose suffix often underwent syncope were somehow more tolerable than those which never syncopated. Several models of phonotactic preference suggest that there are consonant clusters which are more tolerable, more preferred than other consonant clusters. Of the models presented in this thesis, the Net Auditory Distance Principle (section 3.3.2.2) seems to be the most accurate and detailed basis of phonotactic explanations in the development of /θ/ clusters. However, as /θ/ is both found at the end of lexical and morphonotactic consonant clusters, the morphonotactics of the consonant cluster need to be considered as well. According to the Hypothesis of Mutual Support (HMS), a dispreferred consonant cluster may be 'legitimized' by also appearing lexically. In other words, if a consonant cluster appears considerably often within a morpheme, it may be considered normal for that language, i.e. system-adequate and therefore also be more accepted across the morpheme boundary.

The empirical analysis of this thesis aims to test two naturalness theories, the NAD Principle and the morphonotactic hypotheses, on a sample of present indicative verbs, as they represent the amplest amount of corpus data for consonant clusters ending in /θ/. For each consonant cluster occurring significantly often in present indicative verbs in the corpus (see 4.3), I will seek to justify their preference in terms of the NAD principle or the morphonotactic hypotheses. Therefore, I have formulated a two-part hypothesis:

Hypothesis:

a) Orthographic syncope in present indicative verbs primarily produces consonant clusters which are preferred according to the NAD Principle.
b) If syncope is found in dispreferred consonant clusters, it is because the consonant cluster is regarded as phonotactically normal in the language due to lexical homophones.

While part (b) specifically examines the Hypothesis of Mutual Support, other aspects of morphonotactics will also be considered, namely that morphonotactic clusters are more tolerable as they signal morphological complexity and that if a consonant cluster occurs both lexically and morphonotactically, this homophony results in phonological repairs for either consonant cluster (Strong Morphonotactic Hypothesis) (Ritt et al. 2012: 4).

4.3. Data and methods

4.3.1. ECCE corpus data

The main data for this thesis were analyzed within the ECCE (Evolution of Consonant clusters in English) project (Ritt et al. 2017), which was in development at the department of English and American Studies in Vienna at the time. The project seeks to create a database of English word-final consonant clusters in Middle and Early Modern English. At its core are two corpora: the Penn-Helsinki Parsed Corpus of Middle English (PPCME2) (Kroch & Taylor 2000), and the Penn-Helsinki Parsed Corpus of Early Modern English (PPCEME) (Kroch et al. 2004). The PPCME2 consists of 56 text samples and amounts to 1.2 million words; the (PPCEME) contains 448 text samples with over 1.7 million words in total (Kroch & Taylor 2000; Kroch et al. 2004). They both come in three versions; text, part-of-speech (POS) tagged and parsed, and they contain information on the time period of the manuscripts. Table 4 shows the time period labels used in the corpora (adapted from Kroch & Taylor 2000; Kroch et al. 2004):

Table 4: Periods in PPCME2 and PPCEME (adapted)

Period label	**Period of text**	
	Composition date	**Manuscript date**
MX1	unknown	1150-1250
M1	1150-1250	1150-1250
M2	1250-1350	1250-1350
M23	1250-1350	1350-1420
M24	1250-1350	1420-1500
M3	1350-1420	1350-1420
M34	1350-1420	1420-1500
MX4	unknown	1420-1500
M4	1420-1500	1420-1500
e1	1500-1569	
e2	1570-1639	
e3	1640-1720	

As can be seen in Table 4, the two corpora cover a period from 1150 to 1720, with approximately 100 years for each period. Periods labelled ‘M’ are classified as Middle English; periods with an ‘e’ belong to the Early Modern English period. The Middle English periods are labelled both according to the manuscript’s date and date of their composition: If a label contains two numbers, the first refers to the period in which it was composed and the second to the date attributed to the manuscript. The letter ‘X’ indicates that the composition date of the text is unknown.

The corpus was searched with the software AntConc (Anthony 2011) for every configuration that may have possibly been pronounced as a (word-final) consonant cluster at some point. That is, since the database was to include pre-schwa-loss data and since schwa-loss is not necessarily reflected in writing, the corpora were also searched for sequences where the loss of a vowel would potentially form a consonant cluster as well. Spelling variations had to be taken into account, since schwa could be represented by any vowel in writing, and <v> could also represent /u/ (and vice versa, including /f/). In the case of TH sounds, the corpora were searched for any possible consonant clusters ending in one of 4 orthographic representations of the dental fricative, namely <þ>, <ð>, <dh> and <th>.[26] The data from these searches were then imported into Microsoft Excel spreadsheets which displayed for each item the (potential) consonant cluster's spelling POS-tagged immediate left and right co-text, the POS tag and the source text (including the time period). Then all items were qualitatively analyzed: items in which the final *th* was preceded by a full vowel (e.g. *death*) or no word-final consonant cluster at all (e.g. the determiner *the*) were excluded and the rest labelled according to the morphological make-up of the consonant cluster[27]:

a) L: the consonant cluster is within the lexical stem
b) I: if the consonant cluster is formed through inflection
c) D: if the consonant cluster is formed through derivation
d) IS: if the consonant cluster is completely within an inflectional suffix
e) DS: if the consonant cluster is completely within a derivational suffix
f) LI, LD, LIS, LDS: the addition of an L suggests the boundary between stem and suffix is opaque, i.e. lexicalized to some extent.

For every word of the original corpora which (potentially) contains a consonant cluster, the current, publicly available ECCE database (v160608) lists its POS, its morphonotactic label, the phonological make-up of its consonants and its precise date.

4.3.2. Data setup

For this thesis, I used the raw dataset of word-final (potential) th-clusters as prepared for analysis for the ECCE project, which includes each item's part of speech, its immediate co-text (including POS tags), the potential consonant cluster's spelling and the source text. After

[26] < þ> and <ð> are represented as <&t> and <&d> in the database.
[27] Within this chapter (4), 'consonant cluster' will also refer to potential consonant clusters, i.e. sequences which would be considered consonant clusters if the vowel was deleted.

determining the morphonotactic label for each item, I made additional analyses relevant for this thesis. This included adding each potential consonant cluster's make-up, identifying the individual phonemes and noting the syllable structure in terms of consonants and vowels. Based on the latter, it was determined whether schwa-loss is reflected in the spelling: word-final orthographic consonant clusters (e.g. *comð*) were tagged as 's' for syncopated, word-final non-clusters (e.g. (*comeð*) as 'u' (for unsyncopated) and any nonfinal (potential) consonant clusters received the tags 'se' (syncopated but word-final schwa), and 'ue' (unsyncopated and word-final schwa). For the first part of the hypothesis, which examines orthographic syncope in relation to NAD preference, the data set consists of present indicative verbs (3rd as well as plural person) whose (potential) consonant clusters were formed through inflection (I). This included only clusters which were or could be word-final through syncope (i.e. those tagged 's' and 'u'). The original set considered both Middle English and Early Modern English texts, written (composition and/or manuscript) between 1150 and 1720. However, an initial analysis revealed that Early Modern English displayed no orthographic syncope at all. Therefore, the set has been restricted to Middle English only in order to gain a more detailed picture.

Due to sound changes happening during the Middle English period, several consonant clusters cannot be considered as such with certainty. During the 12th century (at the latest) [i] and [u] were inserted before the dorsal fricatives [ç] and [χ], respectively, in certain vocalic environments, for instance OE *ehta* > ME *eighte* or OE *broht* > ME *brought* (Faiß 1989: 83). Subsequently, [ɪç] and [ʊχ] were vocalized to [i] and [u] during the ME and EModE periods via intermediate stages of semi-vowels ([j] and [ʒ] >[w], respectively (Dobson 1968: 985). Faiß (1989: 84) states that where the sounds have disappeared in RP, this change was fully realized by the 17th century, but that the beginnings of such a variation with a zero morpheme can already be found in the 14th century. For the analysis of verbal inflections, which spans over all corpus periods of ME and EModE, it cannot, from the present data, be said for certain whether any observed syncope is the result of the consonant cluster no longer being dispreferred (with the first segment being a semi-vowel) or not being a consonant cluster at all. A more detailed analysis of the pronunciation of the fricatives at any given stage in any given word is unfortunately beyond the scope of this thesis, which is why consonant clusters with [χ] and [ç] have to be excluded from the analysis of verbal syncope. For EModE, (by now standardized) spelling should suffice to give an indication of their pronunciation.

Other Middle English fricatives were affected by variation and change as well: there was a widespread change of pre-consonantal [v] to [w] and then to [u], a dialectal and vulgar change

from [f] to [ʍ] and [u] before [t], and a frequent loss of intervocalic [v] (Dobson 1968: 965, 984-985). While neither variation seems to have affected the modern standard pronunciation of verbs, the possibility of synchronic vocalization or loss makes it difficult to discern whether the sound was pronounced as a fricative both in syncopated and unsyncopated context. Therefore, [v] was excluded from the verbal analysis as well. As [v] could be graphemically represented by <v>, <u> and <f>, consonant clusters containing these graphemes had to be disregarded as well, so as not to skew results. In general, consonant clusters which consist of a semi-vowel and /θ/ are not considered consonant clusters and therefore not part of the analysis. Consonant clusters with /ɹ/ remain in the data set, since Dobson (1968: 992) maintains that loss of [ɹ] is rarely recorded before 1700. Similarly, the combination <ng> was transcribed as [ŋg], as the pronunciation [ŋ] was not widely accepted earlier than the 17th century (Faiß 1989: 1996).

In order to comprehend the morphonotactic status of individual consonant clusters, their occurrence elsewhere, within and across morphemes, have to be considered as well. For this, each cluster's morphological make-up had to be ascertained according to the system proposed by the ECCE project (see 4.3.1). Due to dialectal variation in vowel quality and quantity as well as general sound shifts, the extent of a consonant cluster's lexicalization, that is, the degree to which it was still perceived as morphologically motivated, is not easy to ascertain. The ambiguity of the labels LD and LI[28] (see 4.3.1) will therefore be kept in mind for the analysis.

4.3.3. Data analysis

In order to discern whether orthographic syncope correlates with preference in present indicative verbs, all consonant cluster types for present tense verbs which were created through inflection were determined, the aforementioned ambiguous consonant clusters were removed, and the rest was entered into the online NAD calculator (Dziubalska-Kołaczyk et al. 2014) and exported into a spreadsheet (see appendix). For each of these consonant clusters, I calculated the number of tokens in which the presence of a word-final consonant cluster was visible in their orthography (henceforth: syncopated clusters or orthographic clusters) and measured them against the number of tokens which could potentially have existed in speech but were not recorded in writing (henceforth: unsyncopated clusters or potential clusters). Then the data were grouped by preference type (preferred/dispreferred) and the total number

[28] LIS and LDS are irrelevant to this analysis, as there are no /θ/ clusters which occur within a suffix.

of syncopated and unsyncopated tokens were calculated for each type. The same was calculated separately for bi-segmental consonant clusters (CC) and tri-segmental consonant clusters (CCC) in order to see if consonant cluster size had an effect. Larger clusters could unfortunately not be included, as their NAD could not be calculated. The clusters were also ranked by their amount of syncope, i.e. their number of syncopated tokens in proportion to the unsyncopated ones. These individual clusters were checked against their NAD preference and in the case of dispreference, that same cluster was searched for in the rest of the corpus in order to position it on the scale of morphologically motivated consonant clusters and to find out whether morphonotactics can explain its survival.

4.4. Results

Figure 18 shows all instances of orthographic word-final consonant clusters by preference and by cluster type. With 757 occurrences to 213, the great majority (87%) of orthographic consonant clusters are preferred according to the NAD principle (see appendix).

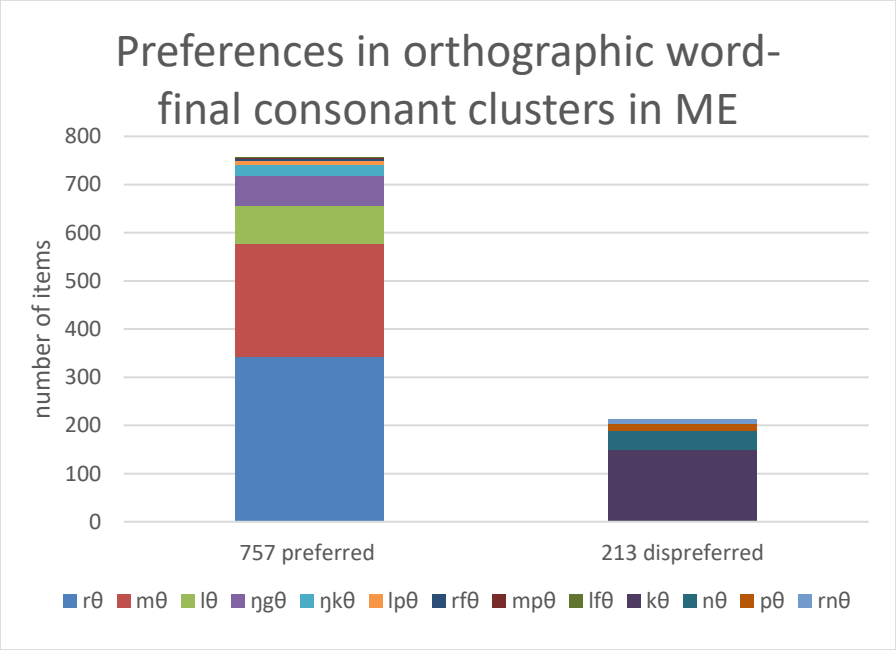


Figure 18 : Preferences in orthographic word-final consonant clusters in ME

In order to gain insights on cluster size, consonant clusters have also been separated by number of segments. Figure 19 shows the normalized distribution of NAD (dis)preference among bi-segmental (CC) consonant clusters and tri-segmental (CCC) consonant clusters, respectively. As can be gathered from Figure 19, tri-segmental consonant clusters are proportionally even more likely to be preferred (91.8%) than bi-segmental consonant clusters (76.3%). To test

whether there is a significant difference depending on consonant clusters size, a chi-squared test has been conducted (see appendix). As the p-value of the calculation was lower than the significance level of α=0.05, the difference between CCC consonant clusters and CC consonant clusters can be considered significant.

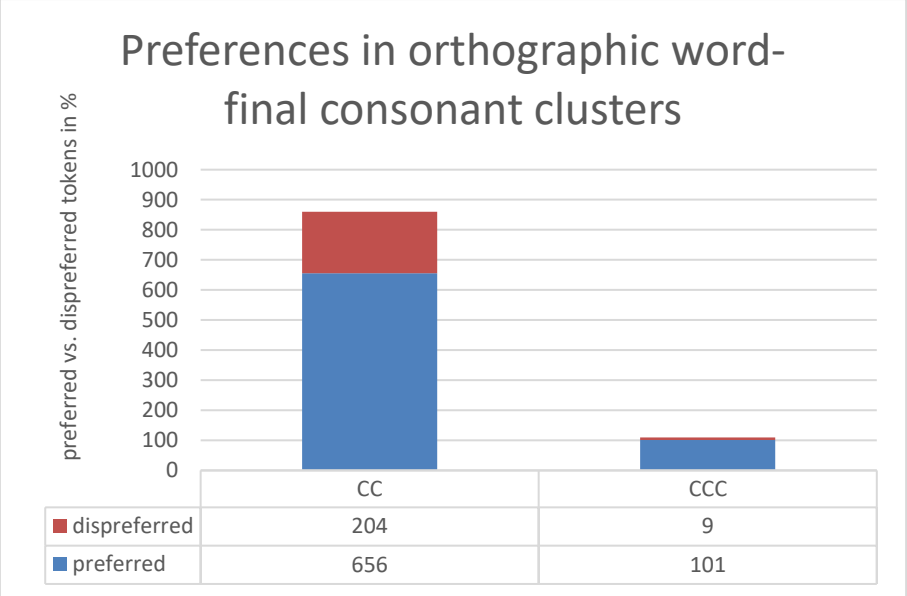


Figure 19: Preferences in orthographic syncope by consonant cluster size

The analysis of individual clusters revealed that with the notable exception of /mθ/, with 63 instances of orthographic syncope out of 377, there were barely any syncopated clusters in the latter half of the ME period (M3 and M4). The data set was therefore restricted to M1 and M2 in order to gain a more detailed image.

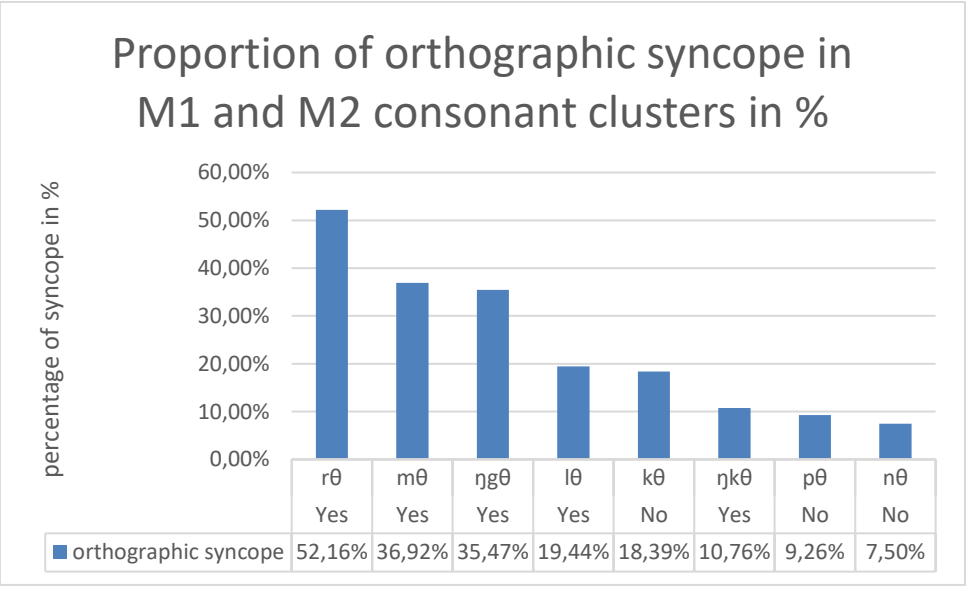
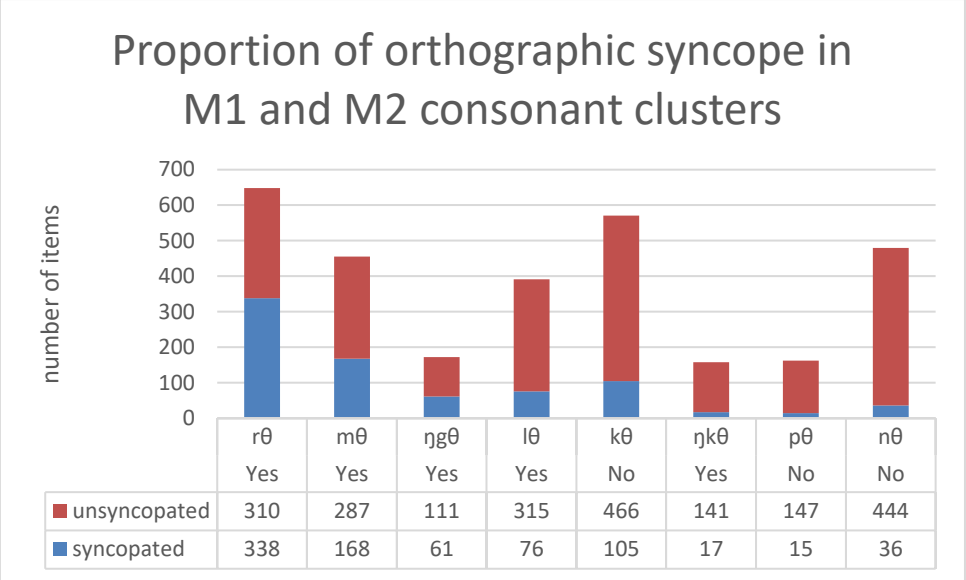


Figure 20: Proportion of orthographic syncope in M1 and M2 consonant clusters in %

Figure 20 shows the number of syncopated consonant clusters compared to the number of unsyncopated clusters, and whether they are preferred according to the NAD principle (yes/no), ordered by percentage of orthographic syncope. Consonant clusters which only display less than 10 instances of syncope have not been considered.



	rθ	mθ	ŋgθ	lθ	kθ	ŋkθ	pθ	nθ
	Yes	Yes	Yes	Yes	No	Yes	No	No
unsyncopated	310	287	111	315	466	141	147	444
syncopated	338	168	61	76	105	17	15	36

Figure 21: Proportion of word-final consonant clusters in M1 and M2

Four of the preferred clusters show the greatest degree of syncope, /rθ/, /mθ/, /ŋgθ/ and /lθ/ at 52.2%, 36.9%, 35.5%, 19.4% respectively. The only other preferred consonant cluster is ŋkθ/ at 10,8%. There are also dispreferred consonant clusters which were syncopated: /kθ/, /pθ/, and /nθ/, at 18.4%, 9.3% and 7.5%. However, the clusters must also be considered in absolute numbers. As Figure 21 shows, the consonant clusters /ŋkθ/ and /pθ/ each have less than 20 instances of orthographic syncope. Among the dispreferred consonant clusters, /kθ/ is syncopated most often, both in terms of total syncopated tokens (105) as well as in relation to the number of unsyncopated tokens of that consonant cluster (18.4%). The consonant cluster /nθ/ is syncopated in 36 out of 444 tokens (7.5%) and therefore shows the least degree of syncope. Nevertheless, as /nθ/ shows the second greatest amount of syncope among dispreferred clusters, it will briefly be considered as well.

4.5 Discussion

4.5.1 Hypothesis: NAD preferences and morphonotactics

Based on preferences of Net Auditory Distance (NAD), the first part of the hypothesis predicts that orthographic syncope should primarily occur in preferred environments. This prediction

is true for the present data: Results showed that the majority (78%) of consonant clusters which were formed through orthographic syncope in verbal inflection are preferred according to the Net Auditory Distance Principle proposed by Dziubalska-Kołaczyk (2014). However, it must be stressed that the data set was not entirely complete; due to uncertainty as to their presence or absence at any given stage, words possibly containing the fricatives [f], [v], [χ], [ç], as well as the semivowels [w] and [j], had to be excluded. There is a significant difference between bi-segmental and tri-segmental consonant clusters: 91.8% of orthographic CCC clusters were preferred, compared to 76.3% orthographic CC clusters. The data for tri-segmental orthographic consonant clusters therefore confirms the first part of the hypothesis and supports the NAD Principle for VCCC sequences. Bi-segmental orthographic clusters found in the data are only partly explained by the NAD Principle, with 23.7% of the VCC sequences being dispreferred.

The second part of the hypothesis predicts that dispreferred consonant clusters which display syncope will be phonotactically normal in the language, i.e. supported by a lexical homophone. In the case of /nθ/, the lexical homophones appear almost exclusively in the word *month* (including *twelve-month*). While one could try to argue that high token frequency of a word may be enough for morphonotactic homophony, it should also be noted that *month* is related to the word *moon (*Klein 1971: s.v. *month*) and may have been perceived as a de-nominal derivation with *-th* during ME. Regardless of whether *month* is considered a (lexicalized) derivation or a lexical homophone in ME, /nθ/ would be classified as morphonotactic by a strong default, with only very few lexical exceptions. The most frequently syncopated dispreferred consonant cluster is /kθ/, a consonant cluster which is exclusively morphonotactic, appearing only in inflection. The prediction that dispreferred consonant clusters which are syncopated in the data set are legitimated by lexical homophones could therefore not be confirmed.

Fortunately, morphonotactics offers further explanations. A fundamental assumption of morphonotactics is that phonotactically marked structures are tolerated if they facilitate morphological processing (Ritt et al. 2012: 3-4). Furthermore, morphonotactic clusters are expected to be historically more stable and more likely to be dispreferred. Of course, many other possible consonant clusters remain largely unsyncopated in the corpus despite being purely morphonotactic. However, it must be considered that /nθ/ and /kθ/ are not only the most frequent dispreferred (potential) clusters in the data set of present tense verbs but also the most frequent (potential) clusters to appear in the entire ME corpus. A higher frequency of words potentially containing the cluster also mean a higher chance of the consonant cluster being

produced in casual speech and a greater likelihood of it being accepted due to its morphonotactic character. Furthermore, the morphonotactic status of /nθ/ may well have been fortified due to its abundance in ordinals, clearly signalling morphological complexity and therefore being more acceptable and likely to syncopate.

However, when discussing the morphonotactics of these consonant clusters one needs to consider whether homophone clusters already existed at the time. Since both derivational and lexical clusters were primarily in a medial position (e.g. *lengthe*, *monthe*) before schwa loss, the question is whether apocope (word-final sound loss) had already taken place in other words (lexical stems, derivations) when verbal syncope is attested in the corpus. Ascertaining this is not without complications; Minkova (1991: 35) notes that there was a "[…] persistence of spelling with final <-e> long after it was uncontroversially deleted from the pronunciation". Indeed, homophone clusters are barely orthographically attested in the corpus for any of the consonant clusters but /rθ/. Approximate dates given for the loss of final schwa are 1100-1250 in the North, 1250-1350 in the Midlands, and 1350-1400 in southern areas (Minkova 1991: 30). While the end dates describe the completion of the change, the start dates do not necessarily imply that the change was in its beginnings then, but rather that this was when it began to spread to a greater extent (Minkova 1991: 30). The syncopated present tense verbs found in the data set are primarily from East Midlands and Kentish texts, with the cluster /nθ/ appearing primarily in Kentish sources. Most sources date from earlier than the designated period (though rarely by more than 10-50 years).

The results of the analysis combined with the commonly assumed development of final schwa invite several interpretations concerning /nθ/:

a) /nθ/ was already spoken but not yet written without schwa in ordinals, nominalizations and lexical stems. As the lexical homophones are rare in terms of type frequency (or might even have been perceived as derivations), the cluster, like /kθ/, can be considered to have been morphonotactic (purely or at least as a strong default), which would support the Morphonotactic Hypothesis that morphonotactic clusters are more likely to survive since they aid morphological processing.
b) The syncope in /nθ/ and other consonant clusters of present tense verb in the corpus took place when apocope was not yet widely realized, in which case many of the clusters must be considered to be without homophones and purely morphonotactic. In this case, the reasons for syncope might be dependent both on NAD and on the frequency of morphonotactic clusters, since the more often a potential cluster occurs,

the more likely it is to be syncopated in casual speech and become accepted. This, too, would support the Morphonotactic Hypothesis.

c) The syncope in /nθ/ and other consonant clusters of present tense verbs in the corpus took place when apocope was not yet widely realized and any orthographic consonant clusters appear in the corpus for other reasons than a combination of NAD preferences and the Morphonotactic Hypothesis.

Ultimately, the present data set is too restricted and the orthographic evidence too insufficient to make any definitive claims. While NAD seems to have predicted syncope for a majority of clusters (with especially accurate results for tri-segmental clusters), there were a number of clusters which were dispreferred. Their readiness to syncopate could not be explained through the Hypothesis of Mutual Support (HMS), but with the general assumption of morphonotactics that consonant clusters which are purely morphonotactic (or at least as a default) are easier to process and therefore more acceptable and historically more stable. Nevertheless, the fact that many clusters had to be excluded due to orthographic and historical ambiguity and that only a few clusters displayed enough orthographic syncope to be considered means that the results are at best an impulse to provoke further thought on the subject rather than offering any supporting evidence for the hypotheses tested.

4.5.2. Further considerations

As stated above (section 4.4.), the data set was restricted to M1 and M2 due to there being virtually only a single orthographic word-final consonant cluster among present indicative verbs in M3 and M4, namely /mθ/. As it was the case with /nθ/ and /kθ/, /mθ/ is a preferred cluster and among the most frequent (potential) consonant clusters of the entire ME period, which explains a higher frequency in orthographic consonant clusters. Upon closer examination, I found that the syncopated clusters appear exclusively in the word *comth*, with all but two instances stemming from a single East Midlands text, the Parson's tale by Geoffrey Chaucer. While a single word and a single source text may be considered insignificant, there are several aspects which identify this as viable evidence: Firstly, as stated above in section 4.1, if something deviates from the norms of a scribal tradition or region, the orthography is likely to represent pronunciation more closely (Lass 1997: 61-62). Secondly, Dobson (1968: 884) points out metalinguistic evidence by Hart, who specifically cites *comth* as an example for words where the verbal suffix was vowelless in ordinary speech. Thirdly, as the most

frequent word containing the potential cluster, *com(e)th* is also more likely to display orthographic syncope.

While it is not surprising that /mθ/, a preferred and overall frequent potential cluster, should occur in syncopated form, it is striking that no other consonant clusters appear in later periods of the corpus. Given that /rθ/ and /lθ/ are also preferred and among the most frequent consonant clusters, it is possible that here too, morphonotactics is the answer. As word-final schwa should, according to (Minkova 1991: 30), already have disappeared from the North and the Eastern Midlands by the beginning of the period in question (M3 and M4), statements about a cluster's morphonotactic status should be more reliable than was the case for M1 and M2. The most frequent potential cluster in the M3 and M4 periods is /rθ/. Since the majority of instances are not morphologically motivated and found in lexical stems, /rθ/ should be considered a normal phonotactic consonant cluster. According to the Strong Morphonotactic Hypothesis, homophony between phonotactic and morphonotactic hinders morphological processing, meaning that repair mechanisms should be applied to either cluster type (phonotactic or morphonotactic) in order to avoid homophony. While there is no syncope to be found in the present indicative verb data of M3 and M4, a substantial number of word-final consonant clusters are found among the lexical /rθ/ clusters, which could suggest that the consonant cluster was blocked from being produced in inflection. Conversely, all potential /lθ/ clusters are morphologically motivated, albeit some of them may be considered to be lexicalized to some extent. As such, the cluster should be easily recognized as morphologically motivated and thus be suitable for syncope in speech. However, it should be remembered that the absence of orthographic syncope in the corpus is evidence for the absence of syncope in speech. In the end, all this analysis can hope to offer are insights gained from instances where syncope has been recorded in orthography. The fact that virtually only a single word within one and the same text is syncopated in the M3 and M4 portions of the corpus is far more likely to indicate spelling conventions present at the time and the way one scribe occasionally liked to write a particular word.

5. Conclusion

> "The story of the verb during Middle English is enormously involved, and nearly impossible to tell coherently" (Lass 1992: 125).

During the Middle English period, word-final TH was lost in inflectional suffixes and as a derivational process, which suggests that they were marked or dispreferred. An important reason for this development is the loss of schwa (through syncope and apocope) in those suffixes. Firstly, as schwa represented several suffixes, its loss resulted in widespread morphological levelling. This levelling correlated with an overall change in inflection towards an isolating language type, which favours separate words over affixes. The loss of various inflectional *-th* suffixes is therefore type-adequate and can be considered a natural development. While many of the intermediate alternatives to *-eth* before deletion can be explained through system-adequacy, the change to -s cannot be sufficiently explained in terms of Natural Morphology. Furthermore, the survival of the 3rd sg. present indicative, first in the shape of *-(e)th*, then in the shape of *-(e)s*, is not type-adequate, defying constructional iconicity. A possible reason for its persistence into PDE has been ascribed to standardization; in fact, many non-standard varieties do not have a 3rd sg. suffix.

Secondly, schwa loss meant that many suffixes lost their syllable nucleus, which resulted in a decrease of transparency. While inflection evolved towards the isolating language type, derivation was essentially split according to its stratum, the Latinate (or non-native) lexicon approached the inflecting-fusional type, which is characterized by allomorphy and homonymy and favours indexicality. The Germanic (or native) stratum, on the other hand, evolved towards the agglutinating type, which is characterized by an abundant use of suffixes and a high degree of biuniqueness. The derivational *-th* suffixes were already present in Old English, when the language was approaching the inflecting-fusional type, creating alternations in the stems they derived. The nominalization suffix as well as the bases it derived were characterized by homonymy and allomorphy, even more so when French eventually introduced similar suffixes. With schwa loss in the ME period, both the ordinal and the nominalization suffix became even more typical of the inflecting type, being close to the stem and high in indexicality. With the Germanic stratum's development towards the agglutinating type, *-th* suffixes were no longer type adequate. Similarly, system-adequacy shows that *-th*, although part of the dominant native stratum, did not have the dominant features associated with it, such as stem invariance and deriving only the native lexicon. Furthermore, it was generally not frequent and productive enough in ME to withstand more dominant competition

and the process ultimately became fossilized. The ordinal suffix did not conform to the principles of naturalness relevant to the agglutinating type either, but as there were no morphological or syntactic alternatives available, it persisted into PDE.

Thirdly, schwa loss created many consonant clusters, both polymorphemic and monomorphemic ones. Consonant clusters are universally dispreferred, as the most natural syllable structure is CV. This preference explains both why consonant clusters become reduced over time and synchronically, and why verbal *-eth* seems to have been reluctant to syncopate. However, it fails to explain why, for the 3rd sg. present indicative, vowelless *-s* was preferred over a fully syllabic *-eth*, as the former created many consonant clusters while the latter retained a more preferred structure of CV sequences. An explanation that was considered was that dental fricatives are segmentally and suprasegmentally marked, while sibilants were preferred. However, while dental fricatives are indeed among the weakest in terms of acoustics and therefore perceptually dispreferred, they are considered to be preferred over sibilants in articulation, as they require less articulatory effort. That is, a change from *-eth* to *-s* not only created dispreferred syllable structures, it also required more articulatory effort on a segmental level. This would suggest that perception plays a more crucial role than articulation when it comes to consonant clusters: if syncope can no longer be avoided, then *-s* is a more viable option than *-th*, as the latter might be even less perceptible in a consonant cluster.

By all indication, then, coda consonant clusters ending in /s/ or /z/ are preferable to those ending in /θ/ or /ð/. Indeed, language acquisition, synchronic variation and diachronic changes have shown consonant clusters containing the dental fricative to be relatively dispreferred. Proposing a hierarchy of consonant clusters in terms of 'tolerance', Dziubalska-Kołaczyk (2002a: 113-114) suggests that there is some 'force counteracting' the preference for a CV structure. I have considered several models of phonotactic preference, most of which put importance on sonority, in order to account for this force, ultimately settling on the NAD Principle (Dziubalska-Kołaczyk 2014). However, the principle is not without its drawbacks (e.g. failing to identify differences in plateau clusters, cf. Baroni 2014) and no significant differences between /θ/ clusters and /s/ clusters could be found which would have explained the preference of the latter over the former, nor were there any definitive explanations for certain consonant clusters to have survived into PDE derivation.

Phonotactically dispreferred sequences are often formed through the interaction of phonology and morphology. Therefore, morphonotactics, the intersection of phonotactics and morphotactics, is a crucial factor in analyzing the survival of certain consonant clusters and

their resistance to universal preferences, such as the CV sequence, or preferences suggested by the NAD Principle. Morphonotactics suggests that phonotactically unnatural structures are tolerated if they facilitate morphological processing (Ritt et al. 2012: 3-4). That is, polymorphemic consonant clusters, due to the compositionality of their parts are more easily recognized as results of morphological operations and therefore more stable historically. The Strong Morphonotactic Hypothesis (SMH) posits that if a consonant cluster appears both lexically and morphonotactically, the resultant homophony hinders morphological processing, prompting repair processes in either consonant cluster homophone (Ritt et al. 2012: 4-6). Its complementing hypothesis, the Hypothesis of Mutual Support (HMS), suggests that the stability of either homophone will ensure the stability of the other, given a large enough number of consonant clusters. A short analysis of PDE consonant clusters ending in /θ/ seemed to support the hypotheses of morphonotactics; if a consonant cluster is not preferred according to the NAD Principle and yet survives, it is upheld by being morphologically complex in most instances.

This effect of rendering dispreferred clusters, normal or tolerable, depends on an individual language; according to the HMS, a high number of a specific consonant cluster in lexical stems will ensure the cluster is more accepted elsewhere, and vice versa. This type of system-adequacy of consonant clusters may therefore explain why -s was preferred over -th; consonant clusters ending in /s/ or /z/ were already abundant in plural and genitive nouns and therefore more tolerable or even normal in Middle English. While the HMS speaks of the mutual support of lexical and morphonotactic consonant clusters, extending this logic to 'morphologically complex clusters support other morphologically complex clusters' does not seem too far-fetched to me. The preference of *-s* over *-(e)th*, then, may be considered to be the result of several factors. Firstly, consonant clusters are universally dispreferred and dental fricatives are relatively marked, which is why verbal *-eth* did not readily syncopate. Secondly, as there was a general tendency for suffixes to lose their weak vowels or even disappear entirely, the 3rd sg. followed suit as soon as a more preferred option presented itself, namely -s. The preference of *-s* over *-th* can be explained through morphonotactics: as morphonotactic consonant clusters ending in a sibilant were already abundantly present in nouns, the same clusters would be considered system-adequate for 3rd sg. too. While none of the models concerning consonant clusters preferences which were considered in section 3.3 showed a significant difference in phonotactic preferences between /s/ clusters and /θ/ clusters, it is conceivable that the low perceptibility of dental fricatives in general may be relevant for the phonotactic preferences of consonant clusters.

In order to justify the explanations involving the NAD Principle and the morphonotactic hypotheses, I tested both empirically through a corpus study, hoping to collect evidence in their favour. For this, I analyzed all ME present tense verbs in the Penn-Helsinki Corpus (Kroch & Taylor 2000) with regard to word-final consonant clusters visible in spelling. My hypothesis was that a) the majority of orthographically recorded consonant clusters would be preferred according to the NAD Principle and that b) dispreferred consonant clusters could be explained with morphonotactics, specifically the HMS. While part a) of the hypothesis was fulfilled, the HMS could not provide sufficient explanation for orthographic syncope. However, the general assumption of morphonotactics that morphonotactic clusters, i.e. clusters with no or little lexical homophones are easier to process and more tolerable provided explanation for syncope in dispreferred clusters.

Unfortunately, due to the exclusion of many ambiguous consonant clusters (due to sound changes and spelling conventions), the final data set was heavily restricted and the number of instances of individual consonant clusters was often rather small. As such, the results of the analysis should rather be regarded as a snapshot of tendencies rather than concrete evidence in support of the NAD Principle in combination with morphonotactics. Chapter 3 has offered many possible answers to the question of why word-final TH developed the way it did, and while not all of them could sufficiently be explained, I hope that both the theoretical and the empirical analysis on the subject may offer the reader some insights and impulses for further research.

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Appendix

Corpus data

Table 5: Documented and potential /θ/ clusters (excl. ambiguous sounds) in ME corpus in token frequency order

cluster	s	se	u	ue	cluster size	preferred?
kθ	149	0	1063	20	CC	No
nθ	40	0	986	17	CC	No
rθ	343	1	695	3	CC	Yes
mθ	234	0	785	12	CC	Yes
lθ	79	9	840	14	CC	Yes
tθ	0	0	532	9	CC	No
dθ	0	0	469	8	CC	No
sθ	0	0	447	4	CC	No
ndθ	0	0	380	3	CCC	Yes
bθ	0	0	351	0	CC	No
pθ	15	2	290	0	CC	No
ŋkθ	24	0	267	1	CCC	Yes
ŋgθ	62	0	218	9	CCC	Yes
ʧθ	0	0	239	6	CC	No
rnθ	9	0	163	0	CCC	No
stθ	0	0	168	2	CCC	No
ldθ	0	0	128	2	CCC	Yes
ksθ	0	0	90	0	CCC	No
rvθ	0	0	72	0	CCC	Yes
ntθ	0	0	68	2	CCC	Yes
lpθ	8	0	50	0	CCC	Yes
rtθ	0	0	50	0	CCC	Yes
mpθ	2	0	42	0	CCC	Yes
rdθ	0	0	43	0	CCC	Yes
rmθ	0	0	43	0	CCC	No
ʃθ	0	0	41	1	CC	No
rsθ	0	0	39	2	CCC	Yes
rpθ	0	0	38	0	CCC	Yes
skθ	0	0	34	2	CCC	No
nsθ	0	0	30	1	CCC	No
rkθ	0	0	29	0	CCC	Yes
ltθ	0	0	27	0	CCC	Yes
nʃθ	0	0	26	0	CCC	No
gθ	0	0	25	0	CC	No
lnθ	0	0	25	0	CCC	No
ʤθ	0	0	23	0	CC	No
nʤθ	0	0	19	0	CCC	No
rʤθ	0	0	10	0	CCC	Yes

rfθ	4	0	5	0	CCC	Yes
rbθ	0	0	8	0	CCC	Yes
lkθ	0	0	6	0	CCC	Yes
lsθ	0	0	6	0	CCC	Yes
mnθ	0	0	6	0	CCC	No
rʧθ	0	0	6	0	CCC	Yes
ftθ	0	0	1	3	CCC	No
ktθ	0	0	4	0	CCC	No
lgθ	0	0	4	0	CCC	Yes
mbθ	0	0	4	0	CCC	Yes
rgθ	0	0	4	0	CCC	Yes
rlθ	0	0	2	0	CCC	No
lfθ	1	0	0	0	CCC	Yes
lvθ	0	0	1	0	CCC	Yes
mtθ	0	0	1	0	CCC	Yes
tsθ	0	0	1	0	CCC	No
mptθ	0	0	9	0	CCCC	-
nskθ	0	0	2	0	CCCC	-

Table 6: Documented and potential /θ/ clusters (excl. ambiguous sounds) in M1+M2 corpus in token frequency order

cluster	s	se	u	ue	cluster size	preferred?
rθ	338	1	310	0	CC	Yes
kθ	105	0	466	0	CC	No
nθ	36	0	444	0	CC	No
mθ	168	0	287	0	CCC	Yes
lθ	76	7	315	0	CC	Yes
bθ	0	0	286	0	CC	No
tθ	0	0	226	0	CC	No
dθ	0	0	184	0	CC	No
ŋgθ	61	0	111	0	CCC	Yes
pθ	15	0	147	0	CC	No
ŋkθ	17	0	141	0	CCC	Yes
sθ	0	0	145	0	CC	No
ndθ	0	0	140	0	CCC	Yes
rnθ	9	0	70	0	CCC	No
stθ	0	0	76	0	CCC	No
ʧθ	0	0	63	0	CCC	No
ldθ	0	0	61	0	CCC	Yes
ksθ	0	0	50	0	CCC	No
rvθ	0	0	41	0	CCC	Yes
mpθ	2	0	33	0	CCC	Yes
lpθ	8	0	23	0	CCC	Yes
rpθ	0	0	27	0	CCC	Yes

rkθ	0	0	22	0	CCC	Yes
rmθ	0	0	22	0	CCC	No
ltθ	0	0	21	0	CCC	Yes
lnθ	0	0	20	0	CCC	No
nsθ	0	0	20	0	CCC	No
gθ	0	0	17	0	CC	No
ʃθ	0	0	17	0	CC	No
ntθ	0	0	17	0	CCC	Yes
skθ	0	0	17	0	CCC	No
nʃθ	0	0	12	0	CCC	No
rsθ	0	0	11	0	CCC	Yes
rdθ	0	0	10	0	CCC	Yes
rtθ	0	0	9	0	CCC	Yes
rfθ	4	0	4	0	CCC	Yes
dʒθ	0	0	6	0	CC	No
lsθ	0	0	5	0	CCC	Yes
ndʒθ	0	0	5	0	CCC	No
lgθ	0	0	4	0	CCC	Yes
mnθ	0	0	3	0	CCC	No
rdʒθ	0	0	3	0	CCC	Yes
ftθ	0	0	0	2	CCC	No
lkθ	0	0	2	0	CCC	Yes
mbθ	0	0	2	0	CCC	Yes
rgθ	0	0	2	0	CCC	Yes
rlθ	0	0	2	0	CCC	No
nskθ	0	0	2	0	CCCC	-
ktθ	0	0	1	0	CCC	No
lfθ	1	0	0	0	CCC	Yes
lvθ	0	0	1	0	CCC	Yes
mtθ	0	0	1	0	CCC	Yes
rbθ	0	0	1	0	CCC	Yes
rʧθ	0	0	0	0	CCC	Yes
tsθ	0	0	0	0	CCC	No
mptθ	0	0	0	0	CCCC	-

Calculations

Table 7: Preferences in orthographic word-final consonant clusters in ME

cluster	preferred	dispreferred
rθ	343	
mθ	234	
lθ	79	
ŋgθ	62	
ŋkθ	24	
lpθ	8	
rfθ	4	
mpθ	2	
lfθ	1	
kθ		149
nθ		40
pθ		15
rnθ		9
total	**757**	**213**

Table 8: Preferences in orthographic word-final consonant clusters in ME by cluster size

cluster size	preferred	dispreferred
CC	656	204
CCC	101	9
total	757	213

Table 9: Proportion of orthographic syncope in M1 and M2 consonant clusters

cluster	s	u	percentage	preferred?
rθ	338	310	52.16%	Yes
mθ	168	287	36.92%	Yes
ŋgθ	61	111	35.47%	Yes
lθ	76	315	19.44%	Yes
kθ	105	466	18.39%	No
ŋkθ	17	141	10.76%	Yes
pθ	15	147	9.26%	No
nθ	36	444	7.50%	No

R-Code

```
> CCvsCCC=matrix(c(656,204,101,9),nrow=2)
> CCvsCCC
     [,1] [,2]
[1,]  656  101
[2,]  204    9
>
```

```
        Pearson's Chi-squared test with Yates' continuity correction

data:  CCvsCCC
X-squared = 12.85, df = 1, p-value = 0.0003375
```

Abstract

The Middle English period was a time great linguistic change, one of which was the loss of schwa in many word-final syllables. This loss entailed both phonotactic and morphological change and influenced the development of the dental fricative (TH) in word-final position. In Middle English (ME), word-final TH occurred both in inflectional endings (e.g. in *they taketh*, *she taketh*) and in derivational suffixes (e.g. in *length, twelfth*). A large part of this thesis is therefore dedicated to the development of these various suffixes containing the dental fricative: In Present-Day Standard English (PDE), the personal endings have been lost (e.g. PDE *they take*) or replaced (e.g. PDE *she takes*). The derivational suffixes are still recognizable (e.g. PDE *warmth)* but no longer productive (at least for nominalizations). This thesis represents an attempt at explaining these developments within the framework of Natural Linguistics. The loss of schwa in word-final syllables influenced the morphological naturalness of the suffixes: they became less natural in many ways, especially with regard to the parameters of universal naturalness relevant to the language type.

Another important aspect of the development of TH suffixes and stem-final dental fricatives is phonological naturalness. The loss of schwa in word-final syllables meant a great number of word-final consonant clusters, which are regarded as universally unnatural. Explanation for the tolerance and survival of certain clusters, have been attempted within several models of phonotactic preferences, as for instance the Net Auditory Distance Principle (NAD Principle), as well as through morphonotactics, which focuses on the morphological complexitiy of consonant clusters. In combination, the NAD Principle and the hypotheses of morphonotactics can explain those aspects of the development of word-final TH which Natural Morphology could not. To support the two theories, I conducted an empirical corpus study analysing written evidence of 3rd person present tense verbs. While both NAD and the hypotheses of morphonotactics could explain the findings, due to the restrictions of the corpus, these results should be regarded as tendencies rather than concrete evidence for the hypotheses tested.

Deutsche Zusammenfassung (Abstract)

Die mittelenglische Periode der englischen Sprache ist von großen Veränderungen in allen Sprachbereichen geprägt. Eine bedeutende Veränderung in dieser Zeit war der Verlust von Schwa in vielen wortfinalen Silben, da sie sowohl phonotaktische als auch morphologische Konsequenzen mit sich zog. So hatte Schwa-Schwund große Einwirkung auf die Entwicklung des dentalen Frikativs (TH) am Wortende, wo er im Mittelenglischen (ME) vor allem in Flexionsendungen (z.B. in ME *they taketh, she taketh*) und in Derivationssuffixen (z.B. in *length, twelfth*) zu finden war. Ein großer Teil ist daher dem Entwicklungsverlauf der verschiedenen Suffixe gewidmet, die den dentalen Frikativ enthielten: Während die persönlichen Flexionsendungen im Heutigen Englisch (HE) verschwunden sind (z.B. HE *they take*) oder durch andere ersetzt wurden (z.B. HE *she takes*), sind die derivativen Suffixe zwar teilweise noch erkennbar (z.B. HE *warmth),* aber zumindest im Falle der Nominalisierungen nicht mehr produktiv. Die vorliegende Arbeit ist der Versuch, diese Entwicklungen im Rahmen von Natürlicher Linguistik zu erklären. Der Verlust von Schwa in wortfinalen Silben hatte Einfluss auf die morphologische Natürlichkeit der Suffixe: sie wurden in vieler Hinsicht unnatürlicher, insbesondere auf den Parametern universeller Natürlichkeit, die im gegebenen Sprachtyp üblich waren.

Ein weiterer wichtiger Aspekt in der Entwicklung der TH Suffixe und der dentalen Frikative am Ende von Wortstämmen ist die Phonologische Natürlichkeit. Durch den Schwund von Schwa in wortfinalen Silben entstand eine große Zahl wortfinaler Konsonantencluster, welche generell als unnatürlich gelten. Erklärungen dafür, welche Konsonantencluster eher toleriert werden und daher überleben, wurden durch Modelle phonotaktischer Präferenzen gesucht, unter anderem durch das Net Auditory Distance Principle (NAD Principle). Weitere Erklärungsversuche finden sich in der Morphonotaktik, wo der morphologischen Komplexität von Konsonantenclustern eine bedeutende Rolle zugeordnet wird. In Kombination können das NAD Principle und die Hypothesen der Morphonotaktik jene Aspekte der Entwicklung von wortfinalem TH erklären, die die Natürliche Morphologie noch offen ließ. Um ihnen mehr Gewicht zu verleihen, wurden beide Theorien empirisch mittels Korpusanalyse getestet. Dafür wurden schriftliche Beweise von Schwa-Verlust in Verben in der 3. Person Präsens analysiert. Obwohl sowohl NAD als auch Hypothesen der Morphonotaktik die Ergebnisse erklären konnten, können diese Resultate (aufgrund vieler notwendiger Einschränkungen des Korpus) nur als Tendenzen und nicht als konkrete Beweise für die getesteten Hypothesen gehandelt werden.