THEORETICAL HISTORICAL PHONOLOGY: A UNIFIED ACCOUNT OF CONSONANT LENITION AND VOWEL REDUCTION IN ENGLISH WITHIN THE FRAMEWORK OF ELEMENT AND OPTIMALITY THEORY

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Abstract

This thesis is intended to provide a unified and coherent theoretical analysis of phonological weakening processes of vowels and consonants in English within the framework of Optimality Theory (Prince and Smolensky 1993). The analysis of weakening phenomena may vary according to the theory you adopt and the language you choose, but in this thesis, vowel reduction and consonant lenition in English will be explored in a constraint-based approach. In addition, most importantly, I seek to show which generalisations can equally be applied to both consonant lenition and vowel reduction in terms of a phonological theory.

The key questions to be investigated in this thesis are as follows.

1) How do we represent phonological weakening phenomena in terms of segmental features or elements?
2) How can these representational elements be integrated into the constraint ranking and evaluation mechanisms in Optimality Theory?

3) Do the historical data such as the initial fricative voicing and vowel reduction in Old and Middle English give us any insight in this regard?

There seems to be a similarity between consonant lenition and vowel reduction in terms of their phonological behaviour. For instance, both consonant lenition and vowel reduction can be treated as loss of some element or reduction of complexity in Element Theory (e.g. Harris 1994). This is an interesting point of my PhD project because this kind of representational approach to weakening phenomena has rarely been applied in Optimality Theoretic analysis. Therefore, what is intended to do in this thesis is that melodic representation will be used for modelling weakening phenomena within the framework of Optimality Theory.

In this regard, I suggest a combined theoretic account of weakening phenomena involving the combination of two approaches namely Element Theory and Optimality Theory, which differentiates this account from previous analyses. I argue that the constraint *COMPLEX[Element], where 'element' refers to one of the primitives of Element Theory, plays a central role in analysing phonological weakening processes in this thesis. In addition, it will be shown throughout the thesis that these processes can be accounted for within the constraint interaction between positional faithfulness constraints such as IDENT[Element] and the integrated constraint *COMPLEX[Element] which I propose in this thesis.

Declaration

The material contained within this thesis has not previously been submitted for a degree at Newcastle University or any other university.

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List of abbreviations

The following abbreviations are used in the text and gloss

GEN: Generator

EVAL: Evaluator

OE: Old English

ME: Middle English

ModE: Modern English

PE: Present-day English

OT: Optimality Theory

ET: Element Theory

GP: Government Phonology

LP: Lexical Phonology

CPH: Critical Period Hypothesis

dim: diminutive

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Chapter 1. Introduction

1.1 Goals

This thesis is intended to provide a unified and coherent theoretical analysis of phonological weakening processes of vowels and consonants in English within the framework of Optimality Theory (Prince and Smolensky 1993, henceforth OT). The analysis of weakening phenomena may vary according to the theory you adopt and the language you choose, but in this thesis, vowel reduction and consonant lenition in the history of English will be explored in a constraint-based approach. In addition, most importantly, I seek to show which generalisations can equally be applied to both consonant lenition and vowel reduction in terms of a phonological theory.

Each of these phenomena (i.e. vowel reduction and consonant lenition) has been a common topic in the field of phonology and phonetics over the decades. However, few people have attempted to unify consonant lenition and vowel reduction even though many people seem to agree that they have something in common in many points (e.g. Hyman 1975 and Bauer 2008). Therefore, in this thesis, a phonologically unified account of vowel reduction and consonant lenition is investigated with special attention to the history of English.

The key questions to be examined in this thesis are as follows.

1) How do we unify two different weakening phenomena within a single theoretical framework?

2) To what extent can the question in (1) be modelled in Optimality Theory?

3) In relation to the question 2) above, how can we best represent phonological weakening phenomena in terms of subsegmental features or elements?

4) How can these representational components be integrated into the constraint ranking and evaluation mechanisms in OT?

5) Finally, do the historical data such as initial fricative voicing and vowel reduction in Old and Middle English give us any insight in this regard?

Given the questions posed above, there seems to be a similarity between consonant lenition and vowel reduction in terms of their subsegmental structure and behaviour , especially when representational approaches such as Government Phonology (e.g. Kaye, Lowenstamm and Vergnaud 1990, Harris 1994, and Harris and Lindsey 1995) and Element Theory (Backley 2011) employed as an analytic method. In an element-based theoretical model, both consonant lenition and vowel reduction can be dealt with by the notion of loss of element or reduction of complexity.[1] This is an important starting point of this thesis because this kind of representational approach to weakening phenomena has rarely been applied within an Optimality Theoretic analysis. Therefore, what is intended in this thesis is that the melodic elements characterised by ET are converted into a form of constraints in OT, thereby the mechanism dealing with weakening phenomena in ET is absorbed into the constraint set within the OT in specific ways.

In this regard, I suggest a combined theoretic account of weakening phenomena involving the combination of two approaches namely Element Theory (e.g. Harris 1994 and Backley 2011) and OT (Prince and Smolensky 1993), which differentiates this account from previous analyses. I argue that the *COMPLEX[element] constraint family, where 'element'

[1] Details of these theoretical concepts such as 'loss of element' and 'reduction of complexity' are fully given in the next chapter.

refers to one of the primitives of Element Theory (henceforth, ET), plays a central role in analysing phonological weakening processes in this thesis. In addition, it will be shown throughout the thesis that both consonant lenition and vowel reduction can be accounted for within the constraint interaction between positional faithfulness constraints such as IDENT[element] and the integrated constraint *COMPLEX[element] which I propose. The specifics of this mechanism will be explored in detail later in this thesis.

As for question (5) above, two typical examples of weakening phenomena in the history of English will be investigated as a case study of this PhD topic. Firstly, the voicing of initial fricatives in the southern dialect of Old English (henceforth, OE) fits in with the object of this PhD project because this phenomenon particularly involves the process of 'voicing' where this process is considered as one of the points on lenition trajectories in phonology (e.g. Lass 1984: 178). Secondly, vowel reduction in OE can also contributes to our understanding of how phonological weakening processes are treated in language change since vowels are transformed themselves in various ways, for instance quantitatively and qualitatively.

There is support from Middle English examples such as ***u****if* / ***f****if* 'five' (see Fisiak 1984: 5) which is regarded as spelling evidence for the initial fricative voicing in the southern OE. For more details of it, the orthographic forms such as ***u****ader* / ***f****ader* 'father' and ***z****enne* / ***s****ynne* 'sin' (Campbell 1959), where the first of each pair show the evidence of the affected dialect and the second of each pair the forms of the unaffected one, indicate that certain varieties of English had clearly undergone the process of the initial fricative voicing. Examples such as these corroborate my claim in this thesis, given that they show a change of the whole set of

fricatives (e.g. f, θ, s, ʃ > v, ð, z, ʒ) in one dialect of English and since this is an important point for lenition theory to unify different types of changes.

In the same way, unstressed vowels are considered to support and reinforce a unified solution between consonant lenition and vowel reduction in that a phonological behaviour of unstressed vowels is similar to that of consonant lenition. This is fully explored in later chapters below.

1.2 The Phenomena under Investigation

1.2.1 *Consonant lenition*

In general, lenition is a very common phenomenon in phonology and phonetics. Therefore, the study of this phonological (and phonetic) process has been done by many researchers and consequently contributed to the development of phonological and phonetic theories in many ways. The term 'lenition' has been applied to a number of different processes, including 'Voicing', 'Spirantization', 'Debuccalization', 'Approximantization, and 'Flapping'. Each of these changes is described in (1) below.

(1) Types of lenition processes (Kirchner 1998: 1)

- Voicing: a change in laryngeal feature from voiceless to voiced, e.g., [p] > [b]

- Spirantisation: a stop segment becoming a fricative, e.g., [p] > [f]

- Debuccalization: an oral segment becoming a glottal, e.g., [x] > [h]

- Flapping: a stop becoming a flap, e.g., [t] > [ɾ]

- Approximantization: a continuant segment becoming an approximant,

e.g., [r] > [ɹ], [ß] > [β̞], [ð] > [ð̞], [ɣ] > [ɯ]

The phonological processes listed in (1) above are typically regarded as lenition. One of the main tasks to linguists who have dealt with this phenomenon is to combine these types of changes into a phonologically unitary account since it has been agreed that lenition phenomena listed above have something in common with their phonological patterns in many ways. In this sense, it is well-known in the phonological literature that the question such as 'What is the definition of lenition?' has frequently been asked and answered in synchronic and diachronic phonology over the decades.[2]

There have been a number of previous studies which have dealt with lenition phenomena in the phonological literature. For instance, these include phonologists such as Lass & Anderson (1975), Foley (1977), Escure (1977), Bauer (1988, 2008), Harris (1990, 1994), Kirchner (2001), Lavoie (2001), Cser (2003), Honeybone (2001, 2008) and many others. The analyses of lenition phenomenon which has been done so far will be reviewed in the next chapter, and so the focus of this section is to consider the current definition of lenition in the literature.

The types of lenition processes are illustrated in (1) above. However, the definition of lenition can vary from authors to authors. For instance, Lass (1984) adds the affrication of stops to the list of lenition. In Lass(1984), 'lenition' (and 'fortition) is defined as segmental movement in terms of two strength scales such as 'openness' and 'sonority'. Therefore, he

[2] Yet there have been different answers given the different sorts of 'lenition'.

argues that 'affrication' (and 'aspiration' as well) should be treated as lenition process since it "involve opening of stricture in the release phase of a stop (Lass 1984: 178)". In addition, Odden (2005: 239) claims that lenition is mostly linked to voicing contexts, so this phenomenon typically occurs in intersonorant positions according to his explanations. On the other hand, others refer to consonant strength[3] (e.g., Hyman 1975, Foley 1977, Escure 1977 and Lass 1984) when they define lenition.

The term 'Lenition' has often been thought of as being in some way analogous to 'weakening'. For example, it has been stated in many phonological textbooks such as Carr (1993: 24), Kenstowicz (1994: 35), and Gussmann (2002: 137) that lenition and weakening are synonymous. In addition, some historical textbooks and dictionaries also count these two words as the same concept, for example, as in Hock (1991), Trask (1996), and Campbell (1998). For example, Campbell's *Historical linguistics: an Introduction* mentions

> Lenition (weakening): Lenition is a reasonably loose notion applied to a variety of kinds of changes in which the resulting sound after the change is conceived of as somehow weaker in articulation than the original sound. Lenitions thus typically include changes of stops or affricates to fricatives, of two consonants to one, of full consonants to glides (*j* or *w*), sometimes of voiceless consonants to voiced in various environments, and so on…..

[3] As for consonant strength, lenition is often concatenated with the notion that a consonant has some kind of degree for strength, which shows a relative relation. The most commonly cited definition in regard to consonant strength is Vennemann's personal communication as reported in Hyman (1975) "A segment X is said to be weaker than a segment Y if Y goes through an X stage on its way to zero." This well-known definition is based on diachronic studies and very much linked to the concept of consonant strength, which involves a change from stronger segment to weaker one. In other words, lenition traces a trajectory which represents how consonants are hierarchical in terms of its segmental strength, which gives an essential idea to this definition.

Campbell (1984: 44)

In this way, even though research on the topic of lenition as partly shown above has had a quite long history, a number of phonologists and phoneticians are still pursuing the unifying the definition itself of consonant lenition, however. In other words, this topic is an ongoing issue in contemporary linguistics and still worth investigating in detail, particularly as even the definition of lenition is variable.

1.2.2 *Vowel reduction*

Vowel reduction is also a very common topic like consonant lenition in the phonological literature. This phenomenon is frequently referred not only as a subject for contemporary linguistics, but also one of the most essential recurring issues in diachronic phonology. For instance, to put it simply, the alternation between [e] in a stressed syllable and [ə] in an unstressed syllable of 'expl*a*in' and 'expl*a*nation' is an example of vowel reduction in Present-day English, where the full vowel alternates with a reduced vowel. For a little bit more detail, pairs such as 'pho<u>to</u>graphic, pho*to*graphy' and 'diplo<u>ma</u>tic, diplo*ma*cy' which show a full vowel in the stressed syllable (an underlined syllable) and a reduced vowel in the unstressed syllable (an italicized syllable) have been shown as an example of vowel reduction in phonology textbooks (e.g. Giegerich 1992). Many linguists dealing with diachronic studies are also interested in vowel reduction phenomena. For instance, it has been examined in many Old English handbooks such as Hogg (1992), Lass (1994), and Luick (1921-1940) that vowel reduction is one of the core elements in the field of historical

phonology since it has a long and complex history in terms of language change. This sort of characteristics is emphasized by the following examples shown in (2) below.

(2) McMahon (1994: 15) [4]

a. Apocope: Middle English [na:mə] > Modern English *name* [neɪm]
b. Syncope: OE *munecas* > ModE *monks*
c. Haplology: OE *Engla-lond* > ModE *England*

Examples and processes indicated in (2) are associated with vowel deletion via reduction processes. Some authors tend to include deletion as a subcategory of vowel reduction or weakening while others insist that they are completely separate processes. This is, however, not the topic of this current study, so I see it aside for the future research at this moment. Returning to the data shown in (2) above, it can be argued that these historical data can shed some light on the development of languages. More details of previous studies and the importance of vowel reduction will be given in the next chapter.

Vowel reduction is also the term in phonetics that refers to various changes in the acoustic quality of vowels. Namely, a phonetic vowel reduction often involves a centralisation of the vowel, which means that in languages in which vowels reduce any vowels in unstressed position tends to be reduced to [ə]. This schwa is regarded as the weakest vowel in general, and [ə] is normally situated in the centre of a vowel inventory chart. To put it differently, a definition of a phonetic vowel reduction as a centralisation can also be

[4] Apocope: the loss of one or more sounds from the end of a word; syncope: the loss of one or more sounds from the interior of a word; haplology: the elimination of a syllable when two consecutive identical or similar syllables occur.

described as a reduction in the amount of movement of the tongue in producing the vowel in terms of articulatory gestures. In connection with this, there are a number of studies which investigatet the phonetically-based analysis of vowel reduction. For instance, Flemming (2005) claims that a durational difference is a crucial factor in reduction, especially in fast speech. To wit, vowels are reduced due to physical limitations of the articulatory organs, for instance, the tongue cannot move to a prototypical position fast or completely enough to produce a full-quality vowel in unstressed syllables.

On the contrary, vowel reduction often refers to a reduction of the number of distinct vowels in a phonological inventory. In other words, from the phonological point of view, there are two distinct vowel inventories depending on their positions (i.e. stressed / unstressed positions). On the basis of this position, some theoretical analyses of vowel reduction have recently been examined. For instance, Crosswhite (2001) argues that there are two classes of vowel reduction cross-linguistically. They are prominence-reduction and contrast-enhancing reduction, and both cause the size of vowel inventories to be reduced in unstressed positions.[5] For example, contrast-enhancing reduction is found in a language like Algueres Catalan. In this language, mid vowel /e/ and /o/ reduced to /a/ and /u/ respectively (Crosswhite 2001:202). This type of reduction increases vowel contrastivity. On the other hand, Bulgarian shows an example of prominence reduction. In this language, /e/ reduces to /i/, /o/ to /u/, and /a/ to /ə/

[5] In Crosswhite (2004), one type of constraint is based on the idea of prominence, and is implemented using prominence reduction constraint. With respect to prominence-reducing vowel reduction, unstressed /a/ is disfavoured, being a highly sonorous vowel. The other is based on the idea of contrast, and is implemented using licensing constraints; specifically, licensing constraints focusing on avoiding unstressed noncorner vowels. In this sort of vowel reduction, unstressed /a/ is favoured, since /a/ is one of the three corner vowels /i, a, u/. More details of these constraints are discussd in the Chapter 2 and 4.

respectively (see footnote 5 below). In this case, it is observed that the ease of articulation is increased.

1.2.2.1 *The definition of vowel reduction: centralisation, neutralisation, and vowel reduction*

Many linguistic studies have tried to define what vowel reduction is over the last couple of decades. For example, there are several terms such as 'vowel reduction', 'neutralisation', and 'centralization', all of which have been used to refer to this weakening phenomenon. Which term is selected for use really depends on the researcher's theoretical assumptions. In fact, some argue that vowel reduction is the neutralization of vowel contrasts in unstressed syllables (e.g., Crosswhite 2001 and Flemming 2005). On the contrary, other researchers claim that vowel reduction can be treated as an independent process of centralization towards a neutral vowel 'schwa' in some languages (e.g., Lindblom 1963 and many others). Even though their descriptions and explanations for vowel reduction differ, they nonetheless have a certain commonality with each other. For instance, as mentioned above, the neutralization of vowels means a loss of vowel contrast in a particular vowel inventory, especially in an unstressed vowel inventory. Namely, neutralized vowels change their qualitative characteristic, and they are consequently drawn into a centralized area, 'schwa'. Therefore, the neutralization of unstressed vowels can also be defined as the centralization of vowels in some ways. This might be adequate for English in that any full vowels in unstressed syllables tend to be reduced to schwa in this language.[6] Miller (1972)'s

[6] However, there is a contrast in reduced vowels in some dialects of English such as [ə] in 'Rosa's' and [ɪ] in 'roses'. According to Flemming & Johnson (2007), some dialects of English show two reduced vowels such as schwa [ə] and barred-i [ɨ]. Both are regarded as centralised vowels, but are separated by the feature of height.

proposal supports this idea. According to her analysis within the framework of Natural Phonology (e.g. Stampe 1969), the neutralization of vowels shows "a kind of centripetal force in the vowel system". In other words, she treats schwa as the most neutral and unmarked vowel. Miller uses a set of features to represent vowels in her analysis such as [round], [palatal], [high], and [low], and the quality of [ə] is described with [-] specification for all features, for instance, [-round], [-palatal], [-high], and [-low]. In this way, vowels on unstressed syllables become more and more schwa-like one, and this is regarded as an output of vowel reduction.

However, the same picture does not always emerge when other languages are considered, especially languages which show non schwa-based vowel reduction. For instance, the Bulgarian unstressed vowels do not centralise. In fact, unstressed vowels in this language can best be described as the raising of vowels (e.g., /e/, /o/, and /a/ are reduced to /i/, /u/, and /ə/ respectively; Crosswhite 2001:203). On the other hand, in Belarusian, /o/ and /e/ are neutralised to /a/ in unstressed syllables (Crosswhite 2004: 199). According to Crosswhite (2001/2004), Bulgarian vowel reduction can be described as prominence-reducing reduction, and the reduction pattern of Belarusian as contrast-enhancing reduction since prominent-reducing reduction eliminates more sonorous vowels in unstressed positions, whereas contrast-enhancing reduction takes place when non-corner vowels are avoided in unstressed positions. This is puzzling because these languages show the opposite result of reduction process. In fact, in Bulgarian, /a/ is reduced to /ə/ due to the avoidance of high sonorous vowel in unstressed position. On the other hand, /a/ appears in unstressed position in Belarusian because /a/ is non-corner vowel.

In line with this comparison between neutralisation and centralisation, there is another issue that should be pointed out here. That is a question about what the difference are between phonetic vowel reduction and phonological vowel reduction. Finding the answer to this question may give us a better understanding of the various definitions of vowel reduction. According to Crosswhite (2001), what is referred to as vowel reduction is divided into two notions: vowel reduction and vowel undershoot. Vowel reduction implies a categorisation of vowel system depending on its position in a language. In other words, it is sensitive to phonological factors such as stress and vowel length. On the other hand, vowel undershoot[7] refers to articulatory phenomena and is a process that is affected by phonetic factors such as speech tempo.[8] Vowel undershoot is in line with a centralisation of a vowel in traditional ways. With an increase in speech tempo, vowels are become centralised like [ə] in certain contexts. This kind of phonetic centralisation can be seen in many languages such as Sri Lankan Portuguese creole (Crosswhite 2004: 215). To sum up, vowel reduction is traditionally seen as a sort of phonological phenomenon where a vowel contrast in unstressed position is reduced in terms of the number of vowel inventory in a language. On the contrary, vowel undershoot is mentioned when vowels are phonetically weakened and fail to reach the target sound in terms of articulatory gestures. For example, as shown above in this section, unstressed vowels in Bulgarian are raised instead of becoming centralised, and this causes

[7] Vowel undershoot is interpreted as an effect where the articulatory gesture fails to reach the target due to the following contrary gesture (de Jong 2004).

[8] Crosswhite (2004: 216) claims that prominence-reducing vowel reduction resembles 'vowel undershoot' in phonetic phenomenon. 'Vowel undershoot' is simply defined as incomplete sound production for the targeted object. Therefore, when it happens in unstressed syllables, it is usually referred to as 'vowel reduction'.

neutralisation of vowel contrasts in certain environments such as unstressed positions.[9] In fact, Many languages also show the same vowel neutralisation, and it is considered as a phonological vowel reduction. However, it really depends on which language is being considered. For instance, some languages (e.g., English) show that any full vowels in unstressed positions are reduced to schwa altogether. Therefore, the crucial point regarding the comparison between vowel undershoot (phonetic perspective) and vowel reduction (phonological perspective) is whether or not a phonemic change occurs in a particular position (i.e., unstressed syllables).

1.3 A Short History of the Issue

The research question addressed in this thesis is not a new proposal at all in the literature. Although there have been various examinations of this issue (Hyman 1975, Harris 1994, and Bauer 1998, for instance) since modern theoretical analyses in phonology (e.g. Chomsky and Halle 1968) appeared, it has nevertheless not been discussed in detail. As a result, previous attempts to unify weakening processes of vowels and consonants have not been presented in a theoretically plausible way. Thus, with the aim of improving our understanding of the connection, selected former approaches are critically reviewed first in the following and then a specific alternative is discussed later in this section.

First of all, Hyman (1975) suggests that certain strength values can be given to both consonants and vowels in order to show how they are weakened. For consonant weakening phenomena, he gives an example of consonant change in the intervocalic position.

[9] For example, vowels such as /e, a, o/ in Bulgarian are neutralised to /i, ə, u/ respectively in unstressed syllables.

(3) The intervocalic consonant change (Hyman 1975: 164)

tappu > tapu > tabu > taβu > tawu > tau > to:

In this example, some consonants are changed (weakened) intervocalically; e.g., /pp/ > /p/ (degemination), /p/ > /b/ (voicing), /b/ > /β/ (spirantisation), /β/ > /w/ (sonorisation), and /w/ > Ø (deletion). Hyman then proposes to define weakening on the basis of the historical change illustrated above (in footnote 3) - a segment X is said to be weaker than a segment Y if Y goes through an X stage on its way to zero (Hyman 1975: 165). Finally, strength scales such as Foley[10] (1970: 90) and Vennemann (1972: 6) are referred to not only to support the definition suggested just above, but also to define strong and weak segments in Hyman (1975). One of these is demonstrated in (4) below.

(4) Vennemann's consonant strength scale (1972: 6)

1	2	3	4	5	6	7	8	strength
---------->								
y	r	l	m	f	s	p	t	
v			n	b		k		
				d				
				g				

[10] Foley (1977: 144) argues that phonological strength reflects the unequal relation among phonological elements. It does not refer to the phonetic strength of the phonetic manifestation of the phonological element, but rather simply to their abstract relation.

In (4), it has been assumed that segments (i.e. consonants in this context) can be distinguished by some sort of strength and weakness. It is well-known that many phonologists (e.g. Foley 1977, Escure 1977, and Lass 1994) have attempted to define this strength scale of consonant in terms of phonological theories. This strength scale is inevitably connected with phonetic factors in that the notion of strength is likely to be accounted for by ease of articulation or articulatory effort. Therefore, in Vennemann's scale, /t/ is the strongest segment because this sound requires more energy to produce than others. In this way, Kirchner (2004) argues that the change /t/ to /f/, for instance, can be referred to reduction of constriction degree or duration.

The consonant strength scale is language-specific and thus it is not the focus whether or not Vennemann's proposal of the consonant scale is correct in this section. What really matters here is that relative strength values between consonants play an important role in explaining how consonants are weakened. For example, the stronger segments are, the more likely it is that they are stable against weakening processes.

Now, let us turn to vowels. Hyman also suggests that a weakening of vowels can be described just as consonants are. For instance, vowels in unstressed positions are reduced to schwa in most dialects of English, for example, *about* [əˈbaʊt]. What is more, from the diachronic point of view, final unstressed vowels in the history of English and French, although they are still written, were also reduced to schwa and subsequently deleted (e.g. *name* [neɪm] in English and *petite* [pətít] 'little' in French: the final '-e' from both languages were pronounced with [ə] in the past, but these are mute now). Therefore, the fact that vowels become schwa on unstressed positions is regarded as an intermediate step on the way to zero, and this looks quite similar to Hyman's definition of consonant weakening just described

above. In line with this thinking, Hyman refers to a certain strength scale to vowels on the basis of the observation that some vowels are more sensitive to weakening processes in some languages. For example, Hyman (1975: 170) refers to Hooper (1973: 170)'s strength scale for Spanish vowel.

(5) Hooper's vowel strength scale of Spanish (1973: 170)

e o i u a

---------->

1 2 3 4 5

In this way, Hyman claims that the same mechanism which is described as so-called 'strength scale' can be applied to consonant and vowel when they are weakened.

There is a second approach to consider, indicating the possibility that both consonant lenition and vowel reduction can be accounted for from a single phonetic perspective. Bauer (2008) suggests that the concept of 'articulatory underachievement'[11] allows for a single solution to the two different phenomena under consideration here, namely vowel reduction and consonant lenition. For instance, Bauer argues that both intervocalic voicing and final devoicing can be treated as weakening processes because they fail to retain a certain level of an articulatory gesture in their positions. In other words, intervocalic voicing takes place due to the failure to get the voiceless gesture in relevant environments, and final devoicing is caused by not keeping the voicing gesture in final position. In this way, these two processes

[11] This definition of 'articulatory underachievement' is described as 'the failure to reach a phonetically specified target (Bauer 2008: 611)'.

are treated phonetically as a single phenomenon with the concept of 'articulatory underachievement' in this approach.

As for the unification between consonant lenition and vowel reduction, Bauer extends this definition of 'articulatory underachievement' to weakening processes of vowels. For example, Bauer considers schwa as the weakest value since it requires the least energy to generate (Bauer 2008: 613), and he then defines vowel reduction as the failure to fully articulate vowels. Consequently, if vowels in unstressed positions show a schwa-like articulation, this phenomenon can be interpreted as 'articulatory underachievement'. However, this analysis has a limitation on its application to languages. As Bauer admits, this type of analysis can only fit in with the languages that show the 'reduction-to-schwa' pattern, such as that found in English.

Apart from those approaches shown above, some theoretical possibilities in terms of unifying vowel reduction and consonant lenition can also be imagined among a number of different existing theoretical frameworks. For instance, some phonetically-based approaches can deal with various aspects of this topic. Within this theoretical tradition, both consonant lenition and vowel reduction can be treated as weakening phenomena in that both are analysed by some kind of 'energy' decreasing process when articulated (e.g. Kirchner 2001, 2004). In other words, these two phonological weakening phenomena may have something in common in terms of the suprasegmental level. It can be argued that vowel reduction occurs only in unstressed positions, and consonant lenition also has a relatively close relation to unstressed syllables. For instance, flapping and glottalisation (e.g. /t, d/ > [ʔ] or [ɾ] intervocalicallly) occurs only when the segment is on the onset of unstressed syllables, but not vice versa (e.g. *better* ['bɛʔə] and ['bɛɾə] *vs. deter* *[dɪ'ʔɛ:] and *[dɪ'ɾɛ:]).

As shown above, there have been some attempts to deal with the unification of consonant lenition and vowel reduction in both phonological and phonetic literature. However, most of them have not dealt with this issue in detail. In other words, previous approaches have suggested that the analysis of consonant weakening phenomenon might simply be extended to that of vowels, yet there may be some unforeseen shortcomings on this issue. Therefore, to refine such works, I seek to provide a unified phonological analysis of consonant lenition and vowel reduction in a different way. In line with this thinking, one aspect of Element Theory (Kaye, Lowenstamm and Vergnaud 1985, Harris 1994, Harris & Lindsey 1995 and Backley 2011) can give a hint of unifying weakening phenomena. That is to say, a subsegmental representation of both consonants and vowels composed of phonological primitives, which are seen as 'element' in this approach. In addition, the phonological behaviour of these elements looks quite similar in terms of representational structures of both types of segment. Therefore, I argue that consonant lenition and vowel reduction can be examined by a single mechanism of the loss of elements on subsegmental representation. However, this theoretical solution is not as simple as it looks: in order to see how this works on subsegmental level, the concept of 'complexity' needs to be understood first. The details of this element-based model will be illustrated in the next chapter.

1.4 Historical Phonology and Optimality Theory

Several theoretical insights in OT can shed new light on long-standing controversial issues in historical phonology. In historical phonology, some OT studies have attempted to solve traditional and controversial issues: Bermudez-Otero 1998, McCully 1999 for OE stress, Minkova 1997 for ME stress, Bermudez-Otero 1999 for quantity changes in Germanic,

Kiparsky 1998 for Sievers' Law in Gothic, among others. These existing OT analyses regarding diachronic phonology are often innovative and have shown insightful solutions for previous unsolved problems of language change and variation. In addition, this new movement of theoretical historical linguistics arguably provides us with a valid characterisation of historical sound change and further effectual investigation.

The question 'how can language change be modelled?' is the central substantial question among historical OT researchers. In fact, each stage of a language has its own specific constraint hierarchy which may change from one period to another. Therefore, a ranking of constraints is an essential mechanism in order to account for the characterization of language change within Optimality theoretic approach. By allowing this, OT contributes to a discussion concerning the fundamental question in the field of theoretical historical phonology.

It can be argued that OT, in various ways, plays an insightful role in characterising language change by means of different settings of constraint ranking. However, some concerns regarding OT framework arise when the question of whether or not OT really explains certain language changes is considered. The answer to the question is probably yes and no. In fact, it is generally assumed that OT offers a theoretical tool for organising the grammar of language by means of (violable) constraint ranking on the one hand. However, what is missing in OT analyses is that a representation of segmental structures needs to be considered in order to understand language change more deeply. Why do we need to consider subsegmental structure of a language in order to understand language change better?

A language is composed of some particular units such as segmental and suprasegmental elements. Segments are conventionally divided into two types such as vowels and consonants;

suprasegmental elements include stress, tone, and many other prosodic elements. Given the fact that language contains these linguistic units, a representational approach in phonology needs to be explored in order to understand what happens during language change. In this regard, this thesis is intended to unify two different theoretical approaches, namely OT and theory of representation. In this thesis, Element Theory is brought into take charge of the representation part of the issue when consonant lenition and vowel reduction are dealt with in later chapters. This sort of unified approach to phonological processes is necessary in order to obtain an appropriate solution for these questions such as 'what phonological processes really mean' and 'how can they be modelled within phonological framework'.

1.5 Thesis Structure

The thesis is structured as follows. In chapter 2, previous approaches regarding consonant lenition and vowel reduction will be reviewed while various definitions of them are discussed in this chapter. In 2.1, for instance, there is a discussion of the argument put forward by Kirchner (2004) that lenition can be characterised as a reduction of articulatory effort which speakers produce in order to make sounds. He provides OT-based analysis of lenition processes and the effort minimisation constraint called 'LAZY' is developed in his model. Furthermore, the framework of Element Theory (e.g., Government Phonology) is illustrated. In this theoretical model, lenition phenomenon can be analysed by the loss of element. A general definition of vowel reduction is also presented. Vowel reduction can be defined as 'neutralisation' or 'centralisation' depending on different theoretical frameworks. As discussed above, Crosswhite (2001) claims that vowel reduction can be identified as a neutralisation of vowel contrasts in unstressed syllables. On the other hand, Lindblom (1998)

insists that vowel reduction is an independent process of centralisation towards a neutral vowel ‘schwa’ in some languages.

In addition, chapter 2 also investigates a unification of consonant lenition and vowel reduction by applying two different theoretical approaches such as ET and OT. For example, phonological structures in Element Theory are discussed in 2.3. ‘Element’ in this framework is represented and the concepts of ‘complexity’ and ‘loss of element’ are also explored in detail. Lastly, section 2.4 shows a constraint *COMPLEX[Element] and its crucial role in analysing relevant data.

Case studies regarding weakening phenomena in English are presented in chapters 3 and 4. In chapter 3, the voicing of initial fricatives in southern OE is examined. This phenomenon has been well known to English phonologists and philologists, but has not been explored by them in detail. For preliminary work, the consonant system in OE is exemplified in 3.2. In 3.3, initial fricative voicing in southern OE is illustrated with relevant data and previous analyses. This phenomenon has been dealt with within two different views. For example, the voicing of initial fricatives in southern OE can be treated as an independent innovation taking place in English (e.g. Jespersen 1891). However, Fisiak (1984) argues that this is the Germanic innovation which is brought into England before the OE period. In 3.4, a combined theoretical account of initial fricative voicing is proposed in detail.

Chapter 4 investigates vowel reduction in OE and ME. In 4.2, a number of relevant data from OE and ME are examined. Furthermore, various factors regarding reduction such as stress, syllable types, interaction between vowel and consonant, and phonetic elements are fully discussed in 4.3. For instance, Burzio (2007) stresses that the interface between a vowel and the following coda consonant can be a decisive factor in defining reduction of vowels. In

4.4, previous analyses of vowel reduction are dealt with. There are three different arguments concerning vowel reduction phenomenon: phonetically-based models of reduction, system-changing models of reduction, and traditional approaches to reduction. Subsequently, an alternative analysis is developed.

Chapter 5 returns to one of the fundamental issues raised in chapter 1. In this chapter, the question of 'What is Theoretical Historical Phonology?' is dealt with, while some fundamental issue how theory and historical data can mutually be interacted is also handled in this chapter. In regard to that, a question of 'the locus of phonological change' is deeply examined since this topic necessarily gives us a hint of the former inquiry. Finally, some residual problems regarding unification between consonant lenition and vowel reduction are revealed and partially modified.

Chapter 6 offers a summary and conclusion.

Chapter 2. Theoretical Framework of the study

In this chapter, the core idea of the framework that will be carried out in the thesis is introduced. Before the theoretical framework is presented, however, previous analyses of consonant lenition and vowel reduction are reviewed first in order to help to understand why this current approach is proposed.

2.1 Previous Approaches to Consonant Lenition

The fact that lenition has been analysed in many different ways makes the job of reviewing previous accounts of lenition rather difficult. For instance, each phonological framework seems to deal with this process differently. First of all, the notion of sonority scale (e.g., stops > fricatives > nasals > liquids > glides > vowels (Cser 2003)) has been used for the analysis of lenition phenomena. Furthermore, in Government Phonology (e.g., Harris 1990), lenition is treated as the loss of subsegmental material.[12] On the other hand, Kirchner (1998) argued that lenition can be explained by the reranking of 'LAZY' and faithfulness constraints within the framework of Optimality Theory.[13]

Another difficulty in reviewing previous studies for lenition is that it can be divided into two major categories, phonetic lenition and phonological lenition. The phonetically-

[12] In Harris' model, a segment has one or more elements and some of them are represented here; 'noise' which can be represented by 'h', 'occlusion' by '?', and 'coronality' by 'R'. In segmental representations with these elements, lenition is defined as any processes which show a reduction of the number of elements that a segment holds. More details will be discussed in the next section.

[13] 'LAZY' represents an effort minimization constraint. More details will be presented later in this chapter.

based accounts for lenition are typically made with reference to articulatory or acoustic factors. For instance, the ease of articulation and perception are the most dominant factors when treating lenition process. On the contrary, more abstract notions have been suggested when lenition is considered in phonology. For example, phonological relationships such as the sonority scale and lenition trajectories can be treated as more abstract and phonological conceptions (More detailed explanations for both approaches will be given in the next subsection.). Hence, it is hard to compare these accounts in that they are basically from different grounds and based on different assumptions. However, putting those points aside, it is still worth reviewing previous analyses of lenition in order to set up a useful background for this research.

The last issue of consequence in the lenition literature is how the way of defining it should be discussed. According to Honeybone (2008), there are two ways of doing this. One is to treat lenition as a set of types of phonological processes, and the other approach is to see it as a set of changes together with their environmental effect.[14] Both ways of defining lenition have been done by many authors, and they are illustrated below.

2.1.1 *Sonority hierarchy and lenition trajectory*

It is common that lenition processes can easily be linked with sonority scales or a consonant strength hierarchy (e.g., Foley 1977, Escure 1977, Cser 2003 and many others). For instance, one of the most cited hierarchies which show a certain degree of consonant

[14] In relation to that, some phonological processes have been controversial among linguists when they try to unify some types of changes as a lenition. For instance, Harris (2009) argues that final obstruent devoicing is seen as a weakening. On the contrary, Iverson & Salmons (2007) claim the opposite by characterising final devoicing in German as fortition. However, this is not a crucial point of the thesis, so will not go into details here.

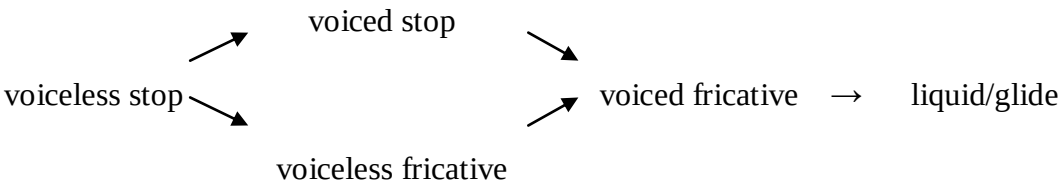
strength is from Escure (1977). Among her several hierarchies, the hierarchy (B) "Hierarchy of major-class and manner feature" is most pertinent to my topic is illustrated in (6) below.

(6) Hierarchy of major-class and manner feature (Escure 1977:60)

Weaker	1	2	3	4	5	6	Stronger
Ø	glides	Liquids	Nasals	voiced fricatives	voiced stops / voiceless fricatives	voiceless stops	

This hierarchy shows the possible path of the weakening process from right to left, finally reaching zero (deletion). More interestingly, Escure's hierarchy shown in (6) has some unusual characteristics. If we see a change 6 to 5, it is seen that voiceless stops have two pathways when they are weakened: voiced stops and voiceless fricatives. This unique change of voiceless stops is well represented in Davenport & Hannahs (2010: 153). They suggest that lenition processes can be progressed by the modification of the manner of articulation, and the following paths shown in (7) account for the typical direction of lenition processes.

(7) Lenition paths (Davenport & Hannahs 2010: 153)



Following this weakening pathway indicated in (7) above, lenition phenomena can be divided into two forms such as increasing sonority process and expansion in the oral tract.

However, Escure (1977) does not show how voiceless stops can be reduced to both voiced stops and voiceless fricatives respectively. Instead, what she really states in her paper is only to show the directionality of a weakened consonant. Therefore, Escure demonstrates how voiceless stop weakens to voiced stop, then reducs to glide via voiced fricative, and finally to delete, i.e. become a zero (e.g., English word 'draw': [dragan] > [draɣan] > [drawen] > [drɔ:]). Another drawback of this analysis would be the members between 4 and 1 of this hierarchy. It seems to be problematic because voiced fricatives do not naturally change to nasals or liquids.

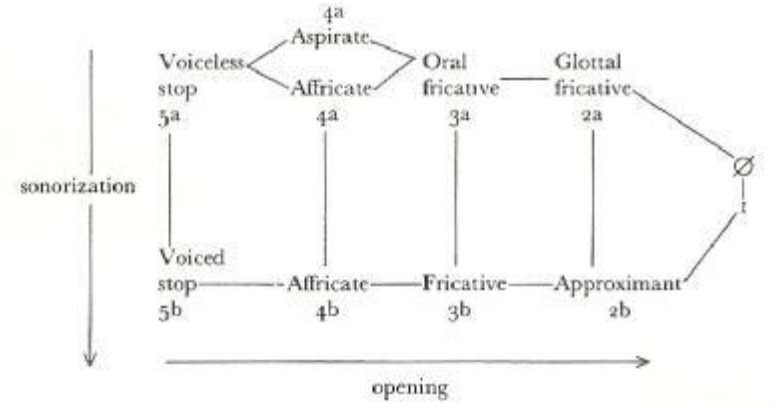
According to Escure (1977), weakening or lenition can be defined as a systematic reduction process of consonants, depending on their position in the word. She offers a set of environments which are likely to present weakening. Weak positions are arranged in order of weakness, which means that the weakest position is word final, the next one intervocalic, and the initial position is much less weak than other ones.

Escure found that a transformational-generative framework has some theoretic limitations on treating weakening processes. A generative approach is specified by a set of phonological mechanisms such as rule addition, rule loss and rule reordering, but she points out that this kind of rule-ordering system cannot characterize lenition with a certain degree of an explanatory value. For instance, in a generative grammar, the change /p/ > /b/ can be described as the addition of a voicing rule, and /b/ > /ß/ the addition of a spirantization rule. However, Escure points out that a transformational-generative framework has some drawbacks when dealing with those instances. In fact, a rule-based approach does not show

the systematic pattern of weakening processes. A derivational (rule-based) theory has a difficulty in dealing with the patterns of weakening since peculiar cases are always needed to explain the directionality of this type of change, for instance, a voiceless stop to become a voiced one before it may spirantize when the change like /p/ > /b/ > /ß/ > ø is considered. After all, what she wants to suggest is that the hierarchical approach represents the crucial phonological relationships which account for the systematic stages, the directionality and the scope of consonantal weakening.

Lass (1984) proposes a somewhat complicated version of the lenition trajectory. It is shown in (8) below.

(8) Lass (1984)'s trajectory for lenition



This trajectory has two dimensions: sonorization which indicates a change of voicing and opening a change in manner of articulation. This kind of weakening mechanism is not new even though the way of illustrating it might be unusual. What is interesting from Lass's explanation is the fact that aspiration (5a to 4a) and affrication (5b to 4b) are included in his lenition trajectory. This makes things complicated because other authors do not see those processes as a type of lenition. According to Lass, lenition or weakening is historically

defined as change both in stricture and glottal state and he also insists that this can be applied to synchronic phonology. Therefore, weakening can be described as the opening of stricture on one hand and the voicing process on the other hand when segments are articulated. In this way, Lass argues that strength scales and lenition trajectories which have previously been proposed should be changed by adding two steps such as affrication and aspiration as forms of lenition, because those processes involve 'opening of stricture in the release phase of a stop' (Lass 1984: 178).

2.1.2 *Loss of subsegmental elements*

Harris (1990, 1994)'s work on lenition is discussed here because it can be seen as a more comprehensive analysis than other previous ones for lenition phenomena. In other words, his works on lenition show not only descriptions of lenition very clearly, but it also gives a specific theoretical analysis for this phonological process. Harris' work is built on the basis of the framework of Government Phonology (Kaye, Lowenstamm & Vergnaud 1985, henceforth GP). All features are privative in GP, so the mechanism of the loss of some features or elements is utilized when dealing with lenition phenomena. For example, spirantization can be expressed as the loss of the element '?' which represents an 'occlusion'. To see this more carefully, one example of his model is presented in (9).

(9) Lenition as loss of element (Harris 1990: 124)

t → s → h → ø

x x x (x)

| | |

h h h

| |

R R

|

?

In this model, each element contains its own distinctive feature value. For example, the {h} represents ‘noise’, and {R} ‘coronality’ and finally {?} ‘occlusion’. A stop /t/ contains all three elements and, as represented above in (9), and a lenition route is expressed by reducing an element one by one. In other words, several lenition processes such as spirantization (t > s), debuccalization (s > h), and deletion (h > ø) are presented by applying the mechanism called an element loss. In this way, the phonological strength on this model is characterized as the number of elements that a segment holds.

2.1.3 *Effort minimisation: phonetically-motivated approaches*

In this section, some previous approaches to lenition which are based on not only the phonetic grounding, but also physiological mechanisms are discussed. There have been some attempts which have tried to find a precise notion of so-called ‘reduction in articulatory effort’, because this notion is the most compelling idea on the ground of this kind. According to previous literatures with reference to this idea, there have been many expressions which attempt to define it, such as ‘relaxation in effort’, ‘laziness’, ‘a principle of least effort’, and ‘a law of economy’. These concepts have been used for the phonetic explanation of lenition for a long time. Among them, it is worth mentioning some recent proposals which are related to this trend.

Kirchner (1998) argues that lenition can be defined as a reduction of articulatory effort which speakers intend to produce in order to make their sounds. His approach is based on the phonetic and physiological evidence, and an articulatory effort is regarded as the amount of 'adenosine triphosphate' that muscles have to consume in order to perform any kinds of articulations. Kirchner (1998: 37) claims that "information regarding the amount that is consumed in any articulation is fed-back to the nervous system to the extent that speakers can develop knowledge of the amount of ATP (adenosine triphosphate) which any articulation requires." With this basic premise of his argument, Kirchner proposes the theoretical analysis of a lenition phenomenon within the framework of Optimality Theory (Prince and Smolensky 1993). In his model, OT executes a crucial role to evaluate the ATP consumption which speakers need when they pronounce sentences. The effort minimization constraint which is called 'LAZY' is developed in this model, and the LAZY constraint actively interacts with the faithfulness constraints in order to capture an ideal result for lenition processes. It is demonstrated here with a tableau below.

(10) Spirantisation within OT (Kirchner 2004)

a.

/d/	LAZY	PRES(cont)[15]
d	**!	
☞ ð	*	*

b.

/d/	PRES(cont)	LAZY
☞ d		**
ð	*!	*

[15] The constraint 'PRES(cont) means the preservation of a feature [-continuant] in this case

As for these constraint interactions, the tableau in (10)a shows that spirantization occurs because [ð] is selected as an optimal form. The candidate '[d]' in tableau (a) is worse form than [ð] under the constraint 'LAZY' since a stop is interpreted as more effortful than continuants. On the contrary, the ranking of two constraints are switched in tableau (b), and a stop [d] is chosen in this constraints interaction. In this way, the main argument of this model is that lenition patterns are treated in terms of conflicts between the effort minimization constraint, 'LAZY', on the one hand, and so-called 'lenition-blocking constraints' on the other hand.

There are some criticisms on this analysis. First of all, it seems that the constraint 'LAZY' is problematic. For instance, this effort minimization constraint family has an enormous power when phonological processes are handled. It is not clear how these constraints can get any phonological information from biomechanical activities. Secondly, as Honeybone (2001) argues, the number of constraints is too large. In other words, a number of LAZY constraints are needed to account for lenition phenomena. In addition, lenition-blocking constraints such as general faithfulness constraints and positional faithfulness constraints (e.g., Ident(cont/onset)) are also required at the same time. Therefore, if the theory requires too many supplementary materials, it may lead it to be less convincing.

There is another claim in the literature that is equipped with a phonetic mechanism. Bauer (1988) claims that lenition is interpreted as the failure to reach a phonetically specified target. He rephrases it as an articulatory underachievement. With this definition, many problems which remained unsolved can be answered. Firstly, a definition, articulatory underachievement enables us to offer a unified phonetic notion of lenition. In addition, it can label both voicing and devoicing as lenition process if they occur in appropriate environments.

In other words, it may work well when final devoicing is treated as a weakening process. Finally, this definition may cover vowel weakening processes. For example, Bauer counts vowel shortening as lenition because a shortening can mean that an articulation is not completed. This type of explanation works well for English, but other languages which have different vowel settings need a language-specific notion of lenition.

2.1.4 *Lenition in English*

In this subsection, some types of lenition in English are introduced. However, one question should be asked before we go further on this matter. Is lenition a common phenomenon in English? And, does the studying of lenition in English have any notable implications for the development of phonological theory? I think the answer to both questions would be yes, especially through the history of English. In connection with this point, two well-known phonological phenomena in English will be considered in this section. One is diachronic phenomenon and referred to as 'Southern English Fricative Weakening', and the other is Flapping in English which is a synchronic process found in many different English-speaking areas. The former can be described as a type of fricative voicing in Old and Middle English, and so this case is from the historical development of English. On the other hand, the latter is the lenition process which is currently in progress, and it can be shown in many varieties of English.

2.1.4.1 *Fricative voicing in Old English*

As mentioned before, 'Southern Old English Fricative Weakening' is a quite old case, and the resulting segments were lexicalised into the phonology long time ago. This phenomenon has been called several different names representatively; 'Old English Fricative

voicing' by Lass (1994) and 'Voicing of Initial Fricatives in Middle English' by Fisiak (1984). In addition, Honeybone (2012) calls this phenomenon 'Southern English Fricative Weakening'. According to Fisiak (1984), this weakening process has been evidenced by data from the south of England and parts of the west Midlands.

Now, let us consider some relevant examples below in (11). These data indicate the change as evidenced by the writing system in Middle English period. In fact, this orthographic evidence shows the transition from Old English to Middle English. Unaffected words which are containing <f> and <s> are taken from Mossé (1952), and others are from Luick (1914-1940).

(11) Southern English Fricative Weakening (Mossé 1952 and Luick 1914-1940)

[f]	[v]		[s]	[z]	
fader	*uader*	'father'	*synne*	*zenne*	'sin'
fram	*uram*	'from'	*swerd*	*zuord*	'sword'

This data provide us orthographic evidence for lenition process, comparing <f> and <s> which show unaffected forms and <u> with <z> affected by this change in Middle English. This data shows that word-initial voiceless fricatives in Old English are weakened to voiced ones in a certain dialect of English (e.g., the South of England and some parts of the West midlands). It might give somewhat an unmatched picture to us because lenition occurs domain-initially, although the process itself fits in with lenition trajectory discussed above (for instance, the changes such as f > v and s > z mesh with Lass' lenition trajectory).[16]

[16] This undesirable consequence will be fully accounted for in the Chapter 3 below.

2.1.4.2 *Flapping*

There is one lenition phenomenon which is an ongoing in Present-Day English. Flapping is a synchronic process which has been taking place in many different parts of English-speaking zones, including General American, some Irish, New Zealand and Australian English. Interestingly, only /t/ and /d/ are affected by this phenomenon, and those consonants are weakened to [ɾ] in most cases. Some data are shown below in (12).

(12) Flapping

/t, d/ → /ɾ/

wri<u>t</u>ing	[ˈɹaɪɾɪŋ]	*pe<u>t</u>i<u>t</u>e*	[pʰəˈtʰiːt]
ri<u>d</u>ing	[ˈɹaɪɾɪŋ]	*<u>t</u>ip*	[ˈtʰɪp]
bo<u>tt</u>om	[ˈbɑɾəm]	*<u>d</u>ip*	[ˈdɪp]
par<u>t</u>y	[ˈpʰɑɹɾi]	*li<u>d</u>*	[ˈlid]

Then, how do we say that flapping is a member of lenition family? Firstly, a flap sound resulting from lenition is typically regarded as more sonorous than a stop /t/ and /d/. In addition, as it is shown the relationship between sonority hierarchy and lenition trajectory above, this movement from a voiced/voiceless stop to a flap can be interpreted as lenition process even though this does not exactly match up with Lass' lenition trajectory and Escure's hierarchy. According to Honeybone, we can see it as an alternative path from /t, d/ to approximant, and if it is right, flapping would show the movement from both sonorization and opening in terms of Lass' lenition trajectory.

Another point that we should pay attention is the locus which flapping takes place. It seems that flapping has a positional restriction because it only occurs at medial positions. If we see data in (12) above, flapping is limited to occur in intersonorant environment, specifically in unstressed syllable. Namely, the first *t* in *pe<u>t</u><u>t</u>e* does not undergo weakening because this is the onset of stressed syllable. In addition, flapping occurs in intersonorant environment, not in intervocalic. If we see data such as *par<u>t</u>y*, a stop can be reduced to a flap between vowels and sonorous consonant like /r, l/. Finally, flapping does not occur with word-edge segments (e.g., see examples such as *tip, dip, lid,* and the second *t* in *petite*).

2.2 Previous Analyses of Vowel Reduction

In this section, previous approaches to vowel reduction are reviewed and discussed. Some of these share certain characteristics, but others, on the other hand, show different perspectives. To sketch this in detail, this section is divided into three sub-sections; a rule-based approach, an element-based approach, and a constraint-based approach. These are shown below in order.

2.2.1 *Classical model of vowel reduction*

In the Sound Pattern of English (henceforth, SPE), Chomsky and Halle (1968) claim that vowel is reduced when it is rewritten with features [-stress, -tense]. At this point, these features need a thorough investigation. The first question is to find out the interaction between this feature [-stress] and the vowel reduction in terms of stress assignment. For instance, in the English data, vowels usually bear full stress in monosyllabic words. However, polysyllabic words which have more than one syllable show us a different picture. In such circumstances, only one syllable can bear full stress and the other syllables may contain

lower stress or be unstressed. Therefore, if vowels become unstressed, they are reduced due to the rewrite rule. When unstressed vowels are weakened, they are likely to be schwa vowels which yield a narrowed vowel inventory in the end. According to Giegerich (1992), in unstressed syllables, there is a very restricted range of vowel phonemes. For instance, the most ordinary vowel in such environment is the schwa. In general, schwa is neither high nor low and neither front nor back in terms of phonetic aspect. Therefore, the schwa can be an endpoint of unstressed vowels.

Giegerich (1992) shows a somewhat different picture for vowel reduction. When he deals with vowel reduction, he separates two different environments of vowel reduction: citation form and connected speech. According to Giegerich, in connected speech, schwa can occur in positions in which corresponding citation forms have full vowels; and in such cases the reduction of the vowel can be put down to a loss of stress. A pair of example is given below.

- potato /pəteto/ / potato peeler [pətetə pilə].

Along with this example, he continues to argue that there is a difference between the citation form and connected speech. The former could contain the secondary stress, but, on the other hand, the latter may produce a vowel without the secondary stress that leads to vowel reduction. This case can be supported by two factors; one is the loss of foot in the suprasegmental structure, and the other is the loss of distinctive features in the segmental representation of the vowel. In addition, Giegerich suggests an argument which is similar to Luick's opinion as shown above. He argues that vowels in unstressed syllables could be reduced when the secondary stress is eliminated due to the acceleration of speech tempo. It is because weak (secondary) stresses would be obvious candidates for the dropping of

stresses with rapid speech tempo. Namely, vowels in unstressed syllables are reduced to a schwa and then this reduction causes loss of structures; a foot, segmental features. This is interesting because the vowel reduction process is divided into two viewpoints: the citation forms and connected speech. The focus on this dissertation is however on the vowel itself with respect to vowel reduction. The analysis of connected speech, of course, should be pursued in different works.

2.2.2 *Element-based approaches*

Different versions of elemental approaches such as Kamprath (1991), Anderson (1996), and Harris (1994) have been provided in order to capture the nature of vowel reduction. Even though each phonological representation associated with these different models looks more or less different with its own way, the key theory of element phonology is common to them. In Element Theory, all vowels are basically represented by three elements such as I, U, and A. The phonetic interpretations of these three materials are /i/, /u/, and /a/ respectively. These elements are combined in order to derive different vowel qualities. For the details of it, the basic structure of vowels in this framework is demonstrated in (13).

(13) A basic five-vowel in element-based theory (Harris 1994:97)

Vowels	Representations
i	|I|
e	|A,<u>I</u>|
a	|A|
o	|A,<u>U</u>|
u	|U|

('|' represents 'element' and an underlined element is the head of two.)

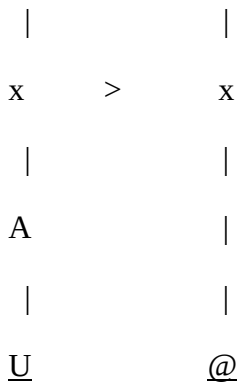
In Harris' representation as shown in (13) above, some unique point should be explained here. In (13), some vowels such as *e* and *o* have two elements; for instance, /e/ holds |A| and |I|, and /o/ holds |A| and |U| respectively. What is interesting here is that one of elements is underlined. In element theory, if a segment has two or more elements, then a dependency relation arises between elements. Therefore, |I| is regarded a head, and |A| as a dependent in /e/. Crosswhite describes it like this - "a vowel that is mostly |I| with a touch of |A| would correspond to /e/, while a vowel that is mostly |U| with a touch of |A| would correspond to /o/ (Crosswhite 2001:189)".

With this basic formation, different vowel qualities are derived by combining and deleting elements in this approach. In addition, reduced vowels are represented by means of an element loss. Now, consider Harris' approach to vowel reduction in terms of element theory. In Harris (1997), he claims that "non-dominant vowels have limited licensing ability, which may have the effect of limiting the articulatory complexity of that vowel's representation" (Here, 'complexity' means that a vowel contains more than one element in its representation.). In line with this argument, Harris assumes that only single-element vowels can appear in unstressed positions, which means that vowels such as /i/, /u/, and /a/ are treated as single-element vowels in terms of the representation shown in (13), and these vowels can only occur in weak positions. What is more, complex-element vowels should be simplified to one or fewer elements when they occur in weak (i.e., unstressed) positions as demonstrated in (14) below.

(14) Vowel reduction in unstressed positions (Harris 1994:113)

o > ə

N N



(In this illustration, ‘N’ represents a nucleus, ‘x’ a phonological timing, and ‘@’ an element which does not involve any phonetic value.)

As shown in (14), a complex-element vowel loses its elements when it appears in weak positions. Consequently, in Harris’s analysis, a reduced vowel only holds a single element |@|.

A similar theoretical treatment to vowel reduction is provided by Anderson (1996). In his paper, Anderson suggests that a vowel reduction can be captured by deleting a certain element. For example, in Bulgarian, the unstressed vowels such as /e/, /o/, and /a/ are changed to /i/, /u/, and /ə/ respectively. In each case, the element [a] is excluded when /e/, /o/, and /a/ is in unstressed positions. For more details, some vowel reduction data in Bulgarian is illustrated below in (15).

(15) The Bulgarian vowel reduction (Anderson 1996:98)

/'ime/	/ime'na/	‘name/names’
['imi]	[imi'na]	
/'selo/	/se'la/	‘village/villages’
['selu]	[si'la]	

/'rabota/ /ra'botnik/ ‘worker/workers’

['rabutə] [rə'botnik]

According to data shown in (15), the Bulgarian vowels are presented by the changes like /e/ to /i/, /o/ to /u/, and /a/ to /ə/ respectively on unstressed positions. In Anderson’s theory, like Harris’ approach, vowels are represented as containing some features. Anderson's representations are shown below in (16).

(16) The vowel system in Bulgarian (Anderson 1996:99)

/i/ - {i} /u/ - {u}

/e/ - {a,i} /o/ - {a,u}

/ə/ - { }

/a/ - {a}

This is the representation of Bulgarian vowel system on the basis of element theory. By comparing (15) with (16) above, vowel reduction in this approach is analyzed by deleting a certain element, {a}. For instance, in comparing /'rabota/ with /ra'botnik/, the vowel in stressed syllable such as the first syllable of /'rabota/ show the element {a}. on the other hand, in the example of /ra'botnik/, stress has been moved to the second syllable, and the /ra/ in the fisrt syllable loses its element {a} and subsequently becomes /ə/. In other words, in Bulgarian, the element {a} is rejected in reduced vowel inventory. By doing so, the right results are captured in this language.

2.2.3 *Constraint-based approaches*

Optimality Theory has become a dominant theoretical framework in phonology since it appeared in 1993 (Prince and Smolensky), and is typically characterized as a constraint-based approach. Therefore, it is reasonable to review some previous analyses in Optimality theory in this section. Two representative analyses of vowel reduction within the framework of Optimality Theory have been claimed in the literature; Positional faithfulness (Beckman 1998) and Positional markedness (de Lacy 2006 and Crosswhite 2001). The constraint's forms that both approaches utilise are quite similar, but the mechanism for analysing vowel reduction is distinguished between the positional-faithfulness and the positional-markedness in some ways. For example, in a positional faithfulness approach, vowel reduction is captured by applying specific positional faithfulness constraints to certain positions such as the word-initial, the onset, the root, and stressed syllables. In other words, a vowel reduction process is aimed at all vowels, but then it is obstructed by activating positional faithfulness constraints in those prominent positions. Beckman uses Western Catalan vowel reduction in order to display how positional faithfulness constraints interact with other markedness and faithfulness constraints.

In Western Catalan, the lax vowels /ɛ,ɔ/ become /e,o/ when unstressed. Basically, this change is seen as vowel reduction in that /ɛ,ɔ/ are more sonorous than /e,o/. This is achieved with three different constraints.

(17) Constraints for vowel reduction (Beckman 1998)

- IDENT-stressed σ-ATR: Do not change [ATR] specifications of stressed vowels

- IDENT-ATR: Do not change [ATR] specifications for any vowels

- NONLO/ATR: Non-low vowels must be [+ATR]

In this language, a feature [±ATR] has a limited distribution and it is captured by the interaction between constraints shown in (17) above. In (18), some tableaux are presented related to this.

(18) Vowel reduction in western Catalan (Beckman 1998:151/152)

a.

/pɛz/ 'weight'	IDENT-stressed σ-ATR	NONLO/ATR	IDENT-ATR
☞ pɛ́s		*	
pés	*!		*

b.

/pɛz-et/ 'weight, dim.'	IDENT-stressed σ-ATR	NONLO/ATR	IDENT-ATR
☞ pezét			*
pɛzét		*!	

In the first tableau, the positional faithfulness constraint (Ident-stressed σ-ATR) outranks a context-free markedness constraint (NonLo/ATR), and this leads to prevent a stressed lax mid vowel from changing to tense mid vowel /e/ (As mentioned above, the change /ɛ/ to /e/ is treated as a vowel reduction in terms of sonority hierarchy.). On the other

hand, in the second tableau, a lax mid vowel becomes tense in an unstressed syllable. In this case, the positional faithfulness constraint has no role to play, and therefore a lax mid vowel /ɛ/ is reduced to /e/ in order to satisfy the NonLo/ATR constraint.

Unlike Beckman's analysis, Crosswhite (2001) examines vowel reduction with the concept of positional markedness constraints. According to her analysis, there are cross-linguistically two different vowel reduction patterns. As introduced in 1.2.2 above, these are "contrast-enhancing reduction" (moderate reduction) and "prominence reduction" (extreme reduction). In short, the former amounts to the avoidance of unstressed non-peripheral vowels while the latter involves the avoidance of high-sonority vowels in unstressed syllables. Contrast-enhancing reduction is found in a language like Algueres Catalan. In this language, mid vowel /e/ and /o/ reduced to /a/ and /u/ respectively. This type of reduction increases a vowel contrastivity. On the other hand, other languages show an example of prominence reduction. In a language such as Bulgarian, /e/ reduces to /i/, /o/ to /u/, and /a/ to /ə/ respectively. This type of reduction is interpreted as increasing an articulatory ease. For a better understanding, some important constraint for each case is represented here.

In order to account for a contrast-enhancing vowel reduction, Crosswhite (2004: 194) adopts some Licensing constraints (Steriade 1994).

(19) Lic-Q/ß: The vowel quality Q is only licensed in context ß

Where Q = any vowel quality or a natural vowel class

ß = any context that enhances the accurate perception of Q

With this formal definition, Crosswhite suggests the particular licensing constraint which is used to analyses a contrast-enhancing vowel reduction.

(20) LIC-Noncorner/stress: Noncorner vowels are licensed only in stressed positions.

According to this constraint, stressed positions are perceptually favourable in that they provide additional vowel duration and loudness. On the contrary, unstressed positions are perceptually unfavourable, because they can induce vowel shortening, and possibly undergo further processes such as deletion. Therefore, mid vowels in unstressed positions which are perceptually weak are disallowed in terms of licensing constraints.

On the other hand, some articulatory-based constraints are introduced when prominence reduction is considered. In a language like Bulgarian, the corner vowel /a/ is reduced to /ə/, which means that it shows the opposite direction for vowel reduction phenomenon in comparison with contrast-enhancing reduction shown above. In response to this problem, prominence-reducing vowel reduction is proposed on the basis of the avoidance of particularly long or marked (salient) vowel qualities in unstressed positions. A basic idea of prominence-reducing vowel reduction is motivated by Prince and Smolensky (1993/2004)'s statement like 'prominence at both the segmental and syllabic levels should co-occur.' It can be restated as follows.

(21) Prominence alignment: prominence and sonority should co-occur, while non-prominence and non-sonority should also co-occur.

In this way, Crosswhite (2004: 216) indicates some constraint hierarchy on the basis of this.

(22) *Unstressed/a » *Unstressed/ɛ,ɔ » *Unstressed/e,o » *Unstressed/i,u » *Unstressed/ə

As shown above, in Bulgarian, a vowel reduction pattern is described as the change from /e, o, a/ to /i, u, ə/ respectively (e.g., /roˈgat/ ‘horned’ to [ruˈgat], /seˈla/ ‘villages’ to [siˈla], and /graˈdets/ ‘town’ to [grəˈdets]).

However, the problem arises in some languages, as Crosswhite has already stated. In some Russian dialects, the two types of reduction described occur in the same language. This means that these constraints need to be ranked with respect to each other because they target the same vowels which are in unstressed position. The solution that she provides us here is that prominence reduction is limited to extra short syllables which occur in different places in different languages. In contrast, Contrast-enhancing reduction can occur in unstressed syllables with normal duration.

Crosswhite’s definition of vowel reduction is the neutralisation of two (or more) phonemic vowels when unstressed. In line with her definition, she appears to be trying to find the sub-inventory of vowels cross-linguistically when syllables are unstressed. That is, the number of vowels in a vowel inventory is changed systemically. My concern here is that she only considers the vowel quality when she deals with vowel reduction. She argues that vowel reduction can refer to a gradient changes in the quality of unstressed vowels and the deletion of unstressed vowels. However, in order to explain vowel reduction properly, the change of vowel quantity should be analysed in a theoretical way. For example, there is the description of where extra short syllables appear, but there is not enough explanation of how these syllables interact with vowel reduction.

2.2.4 *Vowel reduction in English*

A good source of data encompassing the facts of vowel reduction in English is phonological handbooks or textbooks which deal with phonology synchronically or diachronically. Especially in Old and Middle English handbooks, there are various attempts to define or describe vowel reduction in its content. Some relevant materials are presented below.

2.2.4.1 *Luick (1921-1940)*

Luick (1921-1940) states that the initial reduction of unstressed vowels started in OE and proceeded in ME. Bearing this in mind, there is a straightforward drift in unstressed vowels from OE to ME. According to him, two tendencies are proposed for the motivation of the reduction process. First of all, there is a tendency towards simplification of segmental units (i.e., vowels and consonants) if a phonologically unnatural environment is created in terms of the universal principles. For instance, hiatus is assumed to have been the first environment for vowel changes (e.g., many languages disallow hiatus, avoiding it either by deleting or assimilating the vowel or by adding an extra consonant). In addition, we can see another piece of evidence for simplification in OE. That is, the weak position of the word within the sentence is the environment for vowel reduction and a trisyllabic word is also a typical environment for it. Both relevant data is described (23) below.

(23) Simplification in unstressed environment (Luick 1921-1940)

a. Some function words in OE and ME

OE	ME	
*hwann**e** / hwenn**e***	*when*	‘when’
*ealsw**a***	*als*	‘also’

b. Trisyllabic words

OE	ME	
*hlǽfdig**e***	*lafdi*	‘lady’
*æ lmess**e***	*almes*	‘alms’

(A bold letters are affected vowels by the simplification in unstressed position)

As described above, these data show us how unstressed vowels in auxiliaries, conjunctions, and various non-major class words are reduced and deleted. For example, the final unstressed *e* in OE *hwanne/hwenne* is reduced and eventually deletes becoming *when* in ME. Similarly, ME *als* derived from OE *ealswa* since unstressed (w)*a* in *ealswa* is deleted. In addition, trisyllabic words easily undergo the change at a very early stage. With this data set, Luick suggests that the motivation of vowel reduction is the acceleration of the speech tempo, especially in colloquial speech. In other words, the faster the speech tempo is, the more difficult it is for unstressed vowels keep their phonetic value. He also adds that this fast speech tempo could cause a secondary stress to be suppressed, which leads to the reduction and deletion of the final syllable.

2.2.4.2 *Lass (1994)*

In Lass (1994), a discussion of some weakening processes in the history of English can be found. In OE, vowels in unstressed syllables tend to be reduced; Long vowels > short vowels, short vowels > lost their phonetic characteristics or merged, and final consonants were often lost. He proposes that there are at least three crucial tendencies in weak (unstressed) syllables. First of all, complex nuclei should be simplified. Therefore, long

vowels are shortened and diphthongs are monophthongised to short vowels. Second of all, short vowels are lost with this environment. Finally, the articulation of some vowels is changed. Namely, non-deleted final weak vowels end up at the extreme corners of the vowel inventory such as /i/, /u/ and /a/. After having those three stages, a great range of vowel reduction remains in the structural variety of unstressed syllables.

He also explains some deletion processes in various positions such as apheresis, syncope, and apocope. For example, high vowels /i/ and /u/ are deleted when they were preceded by a single heavy syllable, e.g., **fēti > fēt* 'feet'. In addition, there is some examples of trisyllabic words like **weorodu > weorod* 'troop, army'. High vowels also were subject to syncope in medial positions after a heavy syllable. ex) **yldira > yldra* 'older'. In principle, vowels changes in unstressed syllables must be related to the stress and the vowel (syllable) quantity.

However, there is a significant uncertainty about the relationship between reduction and deletion in OE. This problem is expressed by the following question: how closely is vowel reduction connected to the deletion processes such as apocope, syncope and apheresis?. There are two possibilities. First of all, they may be considered as completely separated phenomena. According to some previous works (e.g., Hogg 1992), the deletion process occurred prior to reduction in terms of the matter of ordering. On the other hand, some people (e.g. Lass 1994) state that the reduction process can be conceived as the intermediate stage of the deletion process. This is actually not the crucial point for this study; however, these two possible hypotheses are worth investigating later in this research.

2.2.4.3 *Hogg (1992)*

Hogg shows us a general picture of vowel reduction in terms of the history of English. In effect, there is one single and apparent trend which applies not only to the OE period but also to the history of English as a whole. This trend is illustrated as follows: sounds tend to be reduced so that, for instance, long vowels become short, short vowels lose their distinctive phonetic properties and merge as a reduced vowel schwa, and the shortened ones are lost. At the time of OE, a merger between vowels appeared in unstressed syllables. For example, front vowels in the unstressed position merged together as /e/. In addition, /i/ and /æ/ are merged as /e/. This /e/, which resulted from the merger, should be discussed with respect to vowel quality. Within this traditional approach, this merged /e/ is defined as a phenomenon where the vowel in the unstressed syllable is shifted toward the mid-central position such as schwa [ə]. Then, why is this merged vowel a schwa? The answer to this question is illustrated next.

First of all, prosodically or morphologically weak positions are targeted for reduction. Unstressed syllables or affixes are the most probable position of this kind. For example, when the vowel is in a stressed syllable like *a*ble, it is pronounced as [eibl]. However, if the same vowel is in an unstressed position like *avail*able, it is realized as the reduced or centralized mid-central vowel like [əveiləbl]. Second, a reduction process usually involves the neutralization of vowel contrasts. In other words, it shortens the size of the vowel systems that exist in strong positions. For example, Anderson (1994) argues that an unstressed position typically displays a system of contrasts no greater than that associated with a stressed position. Most traditional analyses adopt this trend. Therefore, he claimed that vowels in

unstressed syllables in OE tended to be reduced; Long vowels > short vowels, short vowels > lost their phonetic characteristics or merged. This merged vowel thus can be a schwa.

2.3 Theoretical Background

2.3.1 *Basic concepts of OT*

Optimality Theory (e.g. Prince and Smolensky 1993 and McCarthy and Prince 1993) has been proposed as an analytical system of constraint interaction in linguistics, especially in phonology. It has also been observed in phonological literature that OT replaces the derivational rule-based approaches in terms of phonological research. OT has been incredibly influential to linguistic analyses, especially in phonology. As a consequence, rule-based approaches have become less popular, and have been abandoned by some linguists. However, both rule-based and constraint-based approaches are basically a descendants of the generative theoretical framework even though their theoretical differences are conspicuous. Furthermore, it is well-known that each framework has its own weakness with regard to specific phenomena (e.g. conspiracies in rule-based approaches and opacity problem in OT). Therefore, if these two different frameworks can ideally be integrated, some sort of mutual advantages might be expected in the end. The differences between rule-based model and constraint-based theoretical system are first discussed in detail. After taking those characteristics into consideration, a unified theoretical approach will be provided throughout this study.

OT is intended to enable a formal description and search for universal principles across different languages as assumed in its original theoretical framework. However, OT and rule-based theories are essentially different in various ways. According to Kager (1999),

constraints are intrinsically violable and conflicting nature, and languages differ in language-specific constraint rankings. On the contrary, rule-based models assume that constraints are inviolable and principles and parameters can vary cross-linguistically.

In the initial stage of OT, it discards derivations and levels which are important tools in deriving a surface form from an underlying form through derivational mechanism in traditional Generative Phonology. In this regard, the most critical discrepancy between OT and rule-based approach is that there is no intermediate level in OT.[17] Furthermore, in terms of derivational mechanism in the rule-based approach, an underlying form feeds a surface form in a step by step order during the course of derivation. Namely, the output form of each rule becomes the input to the next step, and the surface form is achieved in the last step. On the other hand, in terms of OT analysis, *GEN* (Generator) and *EVAL* (Evaluator) play an essential role in choosing an output form. For instance, *Gen* creates a set of potential candidates and *EVAL* selects the most harmonic output form among those candidates by the form of constraint interaction. This grammatical system is represented in (24) below.

(24) The grammar as an input-output mechanism (Kager 1999: 19)

GEN (Input) ➔ {cand1, cand2…..cand$_n$}

EVAL {cand1, cand2…..cand$_n$ } ➔ Output

In this grammatical mechanism, candidates are compared, and consequently, the most harmonic output is chosen as the least violated one in terms of a hierarchy of violable

[17] There is a controversial issue regarding the existence of levels in OT. For instance, some researches in OT also recognise intermediate levels in their theoretic frameworks (e.g. Kiparsky 2000 and Bermúdez-Otero in preparation).

constraints. Constraints are, in fact, available in rule-based phonology, but there is an obvious difference between derivational frameworks and OT.[18] For example, every possible output necessarily violates at least some constraints during its evaluation phase. Therefore, how to handle conflicting constraints is one of the main mechanisms in OT (i.e. how OT grammar chooses the optimal form. The ranking of constraints takes charge of that role in general). On the other hand, rules and constraints in rule-based (derivational) approaches are inviolable. Therefore, in this framework, the final output form is derived after observing all the relevant rules and constraints.

Let us compare two frameworks by representing their structural mechanisms respectively. First of all, the mechanism of rule-based theory is schematised in (25).

(25) Derivational model

		R1		R2		R3		R*n*		
		↓		↓		↓		↓		
/Input/	→	F1	→	F2	→	F3	→ ……..	→	[Output]	

(In this diagram, R: rule, F: form)

As shown in (25) above, the output form of each rule is taken to be the input for the next rule. Therefore, we need to wait for the last rule to be applied in order to get the final output form of a given input. However, a completely different mechanism is utilised within

[18] Constraints in rule-based phonology are typically assumed to be non-violable filters. If a form violates a constraint it does not surface. Thus, violable OT constraints are very different in this regard.

the framework of OT. For instance, the concept of 'Strict domination' is proposed (Kager 1999: 22).

(26) Strict domination: violation of higher-ranked constraints cannot be compensated for by the satisfaction of lower-ranked constraints.

The following tableau indicates that the second candidate will be optimal even though the total number of violation is greater.

(27) An example of 'Strict domination' (Kager 1999: 22)[19]

	CON1	CON2
a. candidate a	*!	
b. ☞ candidate b		**

In this tableau, the candidate *b* is an optimal output because it has no violation of the higher-ranked CON1. The violation of CON2 does not have any effect on deciding the optimal output form among candidates in that the violation of CON1 of candidate *a* is fatal. In this way, for each column we have to determine which candidates incur the lowest number of violations.

As stated above, OT is composed of a set of grammatical structures different from earlier models in various ways. After considering all the points regarding OT, the basic tenets of OT can be summarized below in (28).

[19] In this tableau, CON represents a constraint and '!' a fatal candidate. The optimal form is indicated by the '☞'

(28) Main claims of standard OT (Prince and Smolensky 1993)

a. UG produces a set of constraints that are universal in all grammars (Universality).

b. The constraints are violable (Violability).

c. Constraints are ranked on a language-specific basis (Constraint ranking).

d. There is no intermediate level between an input and an output (Parallelism).

e. Well-formed structures in a language are outputs that best satisfy the language's constraint ranking (Inclusiveness).

2.3.2 *Segmental representations in ET*

Government Phonology is one of the sub-theories under the name of ET. It appears as an alternative approach to feature theory, such as Distinctive Feature Theory, in some traditional works of phonology (e.g. Chomsky & Halle 1968). Element Theory has been developed in theoretical frameworks such as Dependency Phonology (e.g. Anderson & Ewen 1987), Particle Phonology (Schane 1984) and Government Phonology (Kaye *et al* 1985 and 1990, Harris 1994, and Harris & Lindsey 1995). Most of the frameworks based on ET build on some ideas of autosegmental phonology. Namely, phonological structures are assumed to be built of autosegmental tiers to which phonological elements are attached. What is particularly interesting here is that these elements are the smallest unit in this framework and independently pronounced for themselves. For instance, a feature [high] from traditional approaches cannot be pronounced for itself, but for ET an element |A| is pronounced as [a].[20] In addition, segments are made up of elements in this model. In other words, segments are expressible by a combination of elements, or elements themselves (Harris 1994: 97). For

[20] Elements are indicated by a capital letter and they are set between | | in order to differentiate them from features.

example, [e] is represented as the combination of two elements, |A| and |I|. This is how segmental representations are built in this framework. As mentioned above, some aspects of segmental representations in this theoretical framework can give an analytic background to the main issue in this thesis. Therefore, phonological elements of vowels and consonants are described in the next section and it will help us to see how segmental representations are presented in ET.

2.3.2.1 *Vocalic elements*

Element Theory assumes that there are three basic vocalic elements, |I|, |U|, and |A|. As mentioned above, they are pronounceable in isolation. In other words, the phonetic interpretations of |I|, |U|, and |A| are given as [i], [u], and [a] respectively. For other vowels these elements can combine to represent 'so-called' complex vowels.[21] A combination of two or more elements is called as an expression. This sort of mechanism (fusing or compounding of elements) is very important in this framework since it can lead to a full vowel inventory. Although a basic five-vowel system has already been presented in (13) above, it is repeated again here to see their segmental representation.

(29) A basic five-vowel in Harris (1994:97)

Vowels	Representations
I	|I|
E	|A,<u>I</u>|

[21] The details of the concept of 'complexity' will be discussed in 2.3.3.

A	|A|
O	|A,U|
U	|U|

As already described, vowels are basically represented by three elements such as |I|, |U|, and |A|. In addition, these elements are combined in order to derive different vowel qualities, for instance *e* and *o* as shown in (29) above. In this way, other vowels are generated on the basis of different combinations of elements or assigning the headedness to each element. Some vowels other than a basic five-vowel system are presented in (30) below.

(30) a. [ɛ] = |I, A|

b. [ɔ] = |U, A|

c. [y] = |I, U|

However, this is not sufficient for some languages, especially those which contain a centralized reduced vowel [ə] in their vowel inventory. Harris (1994) and Harris & Lindsey (1995) suggest that the neutral element which is symbolized as @[22] is needed in order to cover the full vowel system. The element @ is the only element which can be regarded as a targetless[23] vowel in terms of articulatory movement. Therefore, it can be assumed that this neutral element does not change the realisation of the vowel. On the contrary, the situation becomes interesting when this neutral element is head of a combination. For instance, [a] and

[22] In previous literatures (e.g. in Kaye *et al* 1985), this was referred to as the cold vowel, v°.

[23] It means that the neutral element does not have a salient property in ET (Brockhaus 1995: 105)

[i] can be represented as a combination of |A| + |@| and |I| + |@| respectively (the head of each fusion is |A| and |I|) since the addition of the element |@| does not affect the quality of the vowel when it resides in non-head position. On the other hand, if the element |@| becomes the head of the combination, this can yield [ɑ] and [ɪ].This is illustrated in (31).

(31) a. |@| + |A| = [a]

b. |@| + |I| = [i]

c. |A| + |@| = [ɑ]

d. |I| + |@| = [ɪ]

The use of this neutral element '@' will be discussed more in detail later in this thesis. In this subsection, the basic use of elements for vowels has been presented. The following section will indicate some consonantal elements within this framework.

2.3.2.2 Consonantal elements

There are several different proposals in the element-based literature regarding the issue of how many elements are needed for consonants. Among them, Harris & Lindsey (1995) and Brockhaus (1995) argue that ten elements are pertinent to the representation of consonants. According to them, consonantal elements are divided into three parts; place elements, manner elements and laryngeal elements. Let me illustrate elements in detail in (32) below.

(32) Consonant elements (Brockhaus 1995: 105)

Element	Articulatory		Acoustic	
	Salient property	Unmarked property	Label	Manifestation
U = [u]	Labial	Back, high, tense	Falling	Fall in spectral amplitude
R = [ɾ]	Coronal	Tap	Rising	Rise in spectral amplitude
I = [i]	Palatal	Non-labial, high, tense	Extremity	Large spectral gap
A = [a]	Non-high	Non-labial, tense	Mass	Convergence of F1 & F2
@ = [ə]	None	Non-labial, back, lax	Centrality	Central spectral change
H = [h]	Narrowed	Glottal	Noise	Aperiodic spectral change
ʔ = [ʔ]	Occlude	Glottal	Edge	Abrupt spectral change
N = [ŋ]	Nasal	Non-labial, back	Murmur	Low frequency intensity
L = L	Slack vocal folds		Voicing	Fall in pitch (F0)
H = H	Stiff vocal folds		Voiceless	Rise in pitch (F0)

First of all, place elements are A, I, U, R and @. Brockhaus (1995: 106) notes that |I| correspond to palatals, |A| to uvular and pharyngeals, |U| to labials, |R| to coronals and |@| to velars respectively. Secondly, |h|, |ʔ| and |N| can be treated as manner elements. The |h| is interpreted as ‘noise’ element and is thus associated with segments such as plosives, fricatives and affricates which show noise when articulated (by narrowing in the vocal tract).

In addition, |ʔ| is connected to nasal and oral stops and laterals as well in that the occlusion is the main character of this element. Thirdly, the element |N| is present in the representation of nasal segments, and it is associated with a lowering of the velum. Lastly, the elements |L| and |H| are related to laryngeal gestures. Namely, |L| indicates slack vocal folds and |H| stiff vocal folds (Brockhaus 1995: 106 and Cyran 1995: 19). In other words, from an acoustic point of view, |L| is associated with fully voiced segments, while |H| refers to voiceless segments. (More discussions will be followed in chapter 3.)

Let us consider some examples of the internal make-up of consonants. Elements for consonants also join together in order to make complex consonants just as vocalic elements do, as discussed above. For example, [w] only has the element |U| which is meant to be a labial, and a fusion of |U| and |h| represent a segment [f] which includes two elements: a labial and a noise. Furthermore, the combination of |U|, |h| and |ʔ| denote a [p] in that this segment is specified by at least three characteristics like a labial, a noise, and an occlusion. This sort of elemental fusion is very crucial in this framework because consonant lenition is carried out by the loss of elements that they contain. More details about loss of elements will be discussed in the next section, and the concept of complexity is also brought out to understand the theoretical system in this theoretical modelling.

For the analysis of data presented in this thesis, I adopt Harris(1994)'s element system for vowels and Brockhaus(1995)'s one for consonants respectively. Therefore, those vocalic and consonantal systems will be utilized when needed for the theoretical analyses later in this thesis.

2.3.3 *The concept of 'Complexity' and 'Loss of Element'*

In this section, the concept of complexity and its application to phonological weakening phenomena are explored. However, before I deal with this topic, previous approaches to the concept of 'complexity' in phonology need to be considered in order to narrow down the focus of this thesis. Defining phonological complexity has been carried out in many different phonological traditions. According to Chitoran & Cohn (2009: 21), the question of phonological complexity has been implicitly and explicitly connected to notions such as markedness, effort, and naturalness. For example, the notion of markedness may be thought to contain 'complexity' in a phonological system. Namely, if a segment is referred to as more marked than another, then that segment shows the presence of some phonological specification the other segment does not have (Trubetzkoy 1939, 1969) [24]. In addition, the notion of effort has also been discussed in the phonological literature in terms of complexity. In this approach, the higher complexity, the more difficult segments are generated (Kirchner 2001). Finally, the term 'naturalness' literally refers to a natural and unmarked process in phonology, especially in the framework of Natural Phonology (Donegan and Stampe 1979). The theoretical connection between markedness and naturalness seem to have commonality in interpreting the concept of complexity. For instance, an unmarked process in phonology can be interpreted as a natural one in that unmarked phenomena are assumed to be produced easier than marked ones.

The concept of segmental complexity will play a critical role in analysing phonological weakening processes of consonants and vowels in this current approach. As shown above,

[24] In other words, a voiced segment (e.g. /d/) is treated as more complex in the linguistic system than a voiceless one (e.g. /t/) in that the former is regarded as more marked than the other in this theoretical model since /d/ has the additional voicing specification.

there have been several different assumptions surrounding the definition of complexity. However, in my thesis, the notion of complexity is utilised in a specific way. As represented in 2.3.2, a segment is made up of elements, and the 'complexity' is calculable in terms of the number of elements (Harris 1990: 255). In fact, if one segment contains more elements than the other, the former is seen as more complex segment in this approach.

Let us now turn to the issue of how this segmental complexity can be applied to weakening processes in this framework. In ET, phonological processes are analysed by theoretical tool of segmental composition and decomposition, and this mechanism is operated by loss or addition of elements. In other words, decomposition (loss of element) is interpreted as reduction of segmental complexity, and composition (gaining an element) as an increase of segmental complexity. Therefore, weakening processes are characterised as decreasing complexity of segments on the one hand whereas strengthening is seen as an increse of segmental complexity on the other. This is demonstrated below.

An example of decomposition is given where lenition is treated as the loss of element. Similarly, in vocalic system, vowel raising, lowering or reduction may be viewed as the decomposition of a compound.[25] For example, Harris (1990, 1994) examines lenition phenomena with segmental decomposition. In Harris' analysis, a spirantisation can be expressed as the loss of the element [ʔ] and debuccalization the loss of the element 'R'. The example in (9) above is shown in (33) again in order to see this model more carefully.

(33) Harris (1990: 124, repeated from (9) above)

t → s → h → ø

[25] For more details, see the section 4.4.1.2 below and consult Crosswhite (2001 & 2004) as well.

x x x (x)

| | |

h h h

| |

R R

|

ʔ

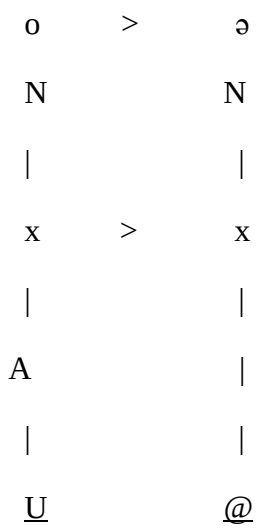
In (33), lenition phenomena are represented by eliminating an element a segment holds. This chart is in fact known as a lenition trajectory (Lass 1984: 178)[26]. A lenition trajectory indicates the path which a lenited segment may follow, and this is represented by a theoretical method of decomposition in this model. Turning back to processes represented in (33), we see; i) spirantisation (t > s), ii) debuccalization (s > h), iii) deletion (h > ø)[27]. Ultimately, lenition is defined as referring to any processes which show the decreasing number of elements that a segment holds. Again, this sort of process implies the reduction of complexity in this model.

More interestingly, vowels are treated in the same way as consonants are when weakening phenomena are considered in this theoretical modeling. One example which was also presented in (14) is illustrated again in (34) below.

[26] Lass (1984)'s lenition trajectory includes two movements; sonorisation type and opening type. In (33), opening type is presented.

[27] Deletion is regarded as one of the examples of lenition phenomena in the literature since deletion takes place in sites where lenition usually occurs. However, Lavoie (2001: 164) indicates that lenition as deletion "is not sufficiently predictive to be considered a full theory of lenition".

(34) Vowel reduction in unstressed positions (Harris 1994:113, seen above in (14) and shown here again for more detailed explanation)[28]



As shown in (34), a vowel [o] loses its elements such as |A| and |U| when it appears in weak positions. That is to say, vowel reduction is analysed as decreasing complexity of a segment. For instance, in English, an unstressed vowel 'ə' only holds a single element |@| as the head of the segmental representation.

In this subsection, the concept of complexity and its interaction with weakening phenomena are discussed. The following section will consider how Optimality Theory can contribute to the understanding of the issue, namely, unifying consonant lenition and vowel reduction.

2.3.4 **COMPLEX (Element) constraint family and the analysis of weakening processes*

[28] In (34), 'N' represents a nucleus, 'x' a phonological timing, and '@' an element which does not involve any active elementary content.

In the previous section, some notions of ET and how this framework sees consonant lenition and vowel reduction were introduced and exemplified. The main issue of this current section is to consider how some aspects of segmental representations demonstrated above can be combined with the mechanism of constraint interaction in OT. Before that, some theoretical implications of previous approaches are shortly reviewed here.

Since Chomsky & Halle (1968) foundational treatise on generative phonology, the focus of attention in classical generative phonology lies on rules and rule interactions in an individual language. Namely, these rules and the ordering of them are language specific. However, with the advent of non-linear phonology, the main interest in phonology changed to issues exploring phonological representations. In fact, phonological theories concerning representational problems have sought to find universal principles and its application to both representations and operations applying to them. For example, these general principles cannot be violated and if violated it is resolved by providing some language-specific parameter in that system. On the contrary, OT is designed to establish the grammar of particular languages with the ranking of universal constraints which are violable. In my thesis, some features of segmental representation in ET are intended to be present within the constraint system of OT. More details are shown below.

As mentioned above, in this PhD thesis, Optimality-Theoretic analysis of consonant lenition and vowel reduction can be significantly supported by the notion of segmental representation in ET. For instance, the constraint such as *COMPLEX[Element][29] is introduced in this thesis and it would play a dominant role for deriving both consonant lenition and vowel reduction. Let me describe this below in (35).

[29] This constraint is interpreted as 'assign one violation mark for every complex element in a segment'

(35) *COMPLEX[Element]: Assign one violation mark for every complex element in a segment.

Namely, the interaction between the constraint such as *COMPLEX[Element] and the faithfulness constraint (e.g. IDENT I-O) can trigger the loss of segment's element in relevant environments, consequently weakening phenomenon. A simple tableau relevant to consonant lenition is demonstrated in order to show how it works in this thesis.

(36) Spirantisation in Optimality Theory

Input /p/	*COMPLEX[Element]	IDENT I-O
/p/ [U, ʔ, h,]	!***	
☞ /f/ [U, h,]	**	*

The notion of positional constraint in Optimality Theory and the relationship between prosodic environment and weakening process will be discussed in detail later in this thesis. However, I suggest that the mechanism of element loss in representational theory can contribute to the development of Optimality-theoretic analysis for unifying weakening processes by incorporating them into the constraint system in Optimality Theory.

On the basis of some theoretical analyses regarding weakening processes which will be discussed in chapter 3 and 4, consonant lenition and vowel reduction can be analysed in a single theoretical mechanism, such as the interaction between *COMPLEX[Element] constraint and the faithfulness constraint. The question does arise though that its applicable domain of consonants and vowels might appear not to be identical, in other words, it looks like there are two unrelated constraints with the same name, one governing the behaviour of

vowels and one the behaviour of consonant. What I'm proposing is that *COMPLEX[Element] is a family of constraints, and that one member of the family governs vowels and the other governs consonants. The unification, then, results from consonant lenition and vowel reduction resulting from constraints of the same type or family.

2.4 Summary

In this chapter, I have reviewed previous approaches to consonant lenition and vowel reduction within various theoretical frameworks. First of all, various types of lenition processes were accounted for in a unified theoretical way. For instance, in element-based approaches, the concept of 'loss of element' gives us a combined theoretical mechanism in analysing different types of lenition processes (e.g. Harris 1994). In addition, the effort minimisation constraint shown as LAZY also was provided as an integrated account of lenition phenomena within OT framework (e.g. Kirchner 1998/2004).

It has also been discussed that the phonological concepts such as sonority-hierarchy and lenition trajectory (mainly associated with diachronic changes) showed the plausible argument especially in terms of the direction of lenition processes. Furthermore, several English data regarding lenition were demonstrated. By doing so, we can conclude that different types of lenition processes can be managed within a unified way.

A definition of vowel reduction and previous analyses regarding this weakening phenomenon have also been presented. Vowel reduction has a complicated history in terms of its phonological behaviour. In fact, vowels in English have been modified diachronically from the viewpoint of both quantitative and qualitative change. In addition, they were often

eliminated in unstressed position. After all, these weakening patterns including deletion significantly affected the vocalic system in English as a whole.

I have claimed that the loss of element or reduction of complexity within the framework of Element Theory can shed some light on a unification of consonant lenition and vowel reduction because these theoretical mechanisms successfully control both phenomena.

The following chapters will support that claim and pursue consonant lenition and vowel reduction in more detail by suggesting an integrated *COMPLEX[Element] constraint family.

Chapter 3. The Voicing of Initial Fricatives in Old and Middle English

3.1 Introduction

This chapter investigates a phonological weakening process of consonants in English and provides a theoretical account of the voicing of initial fricatives particularly in the Old and Middle English period. This phenomenon has been called "Old English Fricative Voicing" (Lass 1994), "Voicing of initial fricatives in Middle English" (Fisiak 1984), and "Southern English Fricative Weakening" (Honeybone 2012). The voicing of initial fricatives in the history of English is well known among English historical phonologists and philologists, and has long been discussed in the discourse of both historical and theoretical phonology (for example, Sweet 1874 and 1924, Wyld 1907 and 1927, Jespersen 1933 and 1949, Wardale 1949, Mossé 1852, Bennet 1955, Luick 1964, Jordan 1974, Brunner 1960 and 1970, Dobson 1968, Fisiak 1968 and 1984, Strang 1970, Wright & Wright 1984, Poussa 1985, Lass 1991-93, Hogg 1992, Nielsen 1994, Milward 1996, Smith 1996 and Honeybone 2001). This phenomenon has been seen in the Southern and South-western dialects of Old and Middle English and it has generally been regarded as a phonological progression in those regions between two periods (Nielsen 1994: 19).

The goal of this chapter is twofold. The first goal is to examine the nature of consonant weakening processes (i.e. lenition) within the framework of OT, and the other is to support the main idea of this thesis which seeks to find a unified account of consonant lenition and vowel reduction in English. In this regard, the voicing of initial fricatives in English fits in with the object of this PhD project because this phenomenon particularly involves the process

of ‘voicing’ as shown in its naming above, and ‘voicing’ is considered as one of the points on lenition trajectories in phonology (e.g. Lass 1984: 178).

The key questions to be investigated in the current chapter are as follows.

i) How do we analyse lenition phenomena in terms of segmental representation?

ii) How can these representational elements be integrated into the constraint ranking and evaluation mechanisms in OT?

iii) Do the data of Initial Fricative Voicing from Old to Middle English give us any insight in this regard?

In this chapter, I suggest a combined theoretic account of a specific lenition phenomenon involving the combination of two approaches namely Element Theory (e.g. Harris 1994) and Optimality Theory (Prince and Smolensky 1993, henceforth OT), and this combination of frameworks differentiates this account from previous analyses. As discussed in Chapter 2, I argue that the *COMPLEX[element] constraint family, where ‘element’ refers to one of the primitives of Element Theory, plays a central role in analysing lenition process in this thesis. In addition, it will be shown throughout the thesis that phonological processes such as consonant lenition and vowel reduction can be accounted for within the constraint interaction between positional faithfulness constraints such as IDENT[element] and the integrated constraint *COMPLEX[element] which I propose in this thesis.

As for the above (‘do the data of Initial Fricative Voicing from Old to Middle English give us any insight in this regard?’), there is support from Middle English examples such as ***u****if* / ***f****if* ‘five’ (Fisiak 1984: 5) which is regarded as spelling evidence for the initial fricative voicing in (southern) Old English (In this example, <u> in ***u****if* represents [v] sound.). For

more details of it, the orthographic forms such as ***u****ader* / ***f****ader* 'father' and ***z****enne* / ***s****ynne* 'sin' (Luick 1964: 934), where the first of each pair show the evidence of the affected dialect and the second of each pair the forms of the unaffected one, indicate that certain varieties of English had clearly been undergone the process of the initial fricative voicing. Examples such as these corroborate this claim, given that they show a change of the whole set of fricatives in one dialect of English (e.g. f, θ, s, ʃ > v, ð, z, ʒ) since this is an important point for lenition theory to unify different types of changes.

This chapter will have three major parts. The first part of this chapter (section 3.2) shows the consonant system in Old English, in order to help readers to understand the remainder of this chapter. The subsequent section (3.3) reviews previous approaches to the initial voicing of fricatives in some dialects of Old English and illustrates some relevant data of this process. In addition, section 3.4 deals with a theoretical analysis of this particular phenomenon and shows further investigations of the data shown in 3.3. The final section gives a brief summary and conclusion.

3.2 The Consonant System in OE

3.2.1 *General introduction to the consonant system in OE*

In this section, Old English consonants will be listed and briefly discussed. When traditional Old English handbooks (e.g., Wright & Wright 1925, Campbell 1959, Luick 1914-1940, and many others) are considered, they do not agree on the phonetic content of the consonants, although the systems that the authors present appear similar. One example of consonant system from Old English handbooks is represented in (37) below.

(37) Old English consonant system (Wright & Wight 1925: §8)

*Vl: voiceless / Vd: voiced

		Labial	Inter-Dental	Dental	Guttural	Palatal
Explosive	Vl	p, pp		t, tt	c, cc	c, cc
	Vd	b, bb		d, dd	g, gg	g, gg
Spirants	Vl	f, ff	þ, þþ	s, ss	h, hh	h, hh
	Vd	f	þ	s	g	g
Nasals		m, mm		n, nn	n	n
Liquids				l, ll, r, rr		
Semi-vowel		w				

Wright & Wright's (1925) consonant system in Old English shown in (37) above represents not a phonetic description, but orthography in Old English period.[30] For example, the voiceless and voiced labial spirants <f>[31] are interpreted as [f] and [v] depending on its position within a sentence respectively. In addition, <g> has four different phonetic values i.e., [g], [ɣ], [ʤ], and [i] and its phonetic distribution is also determined by the position of the letter <g> within a word. As shown in Wright & Wright's example above, most traditional

[30] Many traditional handbooks such as Wright & Wright (1925) and Campbell (1959) tend to consider the orthography system rather than a phoneme and allophones to clarify their phonetic values.

[31] In this thesis, / / represents a phonemic status, [ ] a phonetic, and < > a spelling respectively.

handbooks concerning Old English phonology make use of spelling system when they illustrate consonant system at that time.

On the contrary, some relatively recent Old English handbooks (e.g. Hogg 1992/2011 and Lass 1994) employ phonetic and phonemic symbols in order to describe the consonant system in Old English. Among those materials, some authors have also shown different views on a corresponding relation between a phoneme and allophones within Old English consonant inventory. For instance, Hogg (2011: §2.56, §2.61 and §2.78(3)) argues that the phoneme /ɣ/ is the preferred one between allophones [g] and [ɣ] in the early Old English period, and continues to claim that this phonemic status may have changed to /g/ in the late Old English. On the other hand, some authors (e.g. Lass 1994: 78) establish the phoneme /g/ for the two allophones [g] and [ɣ] from early Old English. However, although each author has a different view on this issue, there is a general consensus among historical linguists that the consonant system in Old English is analogous to that of Modern English. It will be shown in (38) and (39) below.

Below, two consonant systems in Old English are illustrated. The table (38) presents the early Old English (approximately ad 449 – 800) consonant system and the table (39) the late one respectively. The reason why two consonant systems in Old English are compared is that, in my opinion, it is the best way to see how Old English consonant system is developed at a glance. First of all, Hogg (2011: 246) presents the early Old English consonant system as given below.

(38) Stage 1: The early Old English consonant system (Hogg 2011: 246)[32]

	Labial	Dental	Palatal	Velar
Voiceless stops	/p/	/t/	-	/k/
Voiced stops	/b/	/d/	-	-
Voiceless fricatives	/f/	/θ/	-	/x/
Voiced fricatives	-	-	-	/ɣ/
Sibilants	-	/s/	-	-
Nasals	/m/	/n/	-	-
Liquids, approximants	-	/l, r/	/j/	/w/

The specifics of the consonant system in Old English will not be discussed in this section since that is not the focus of this thesis, but some of them are mentioned here in order to help readers in understanding Old English consonant system. As stated above, the consonants of Old English are relatively analogous to those of Present-Day English. However, they are not identical. For example, according to the table (38), there are three voiceless stops such as /p/, /t/, and /k/, but only two voiced stops, /b/ and /d/ as a phoneme.[33] The

[32] In (37), all consonants could have a length contrast except /j, w/. In other words, geminate consonants exist in this consonant system.

[33] This is a controversial claim in the literature. As shown in (38) here, Hogg (2011: 42) argues that "Diachronically the preferred analysis might be /ɣ/, but synchronically it might be /g/. On the other hand, the use of both /ɣ/ and /g/ was advocated for the purpose of exposition". For more details, see

disharmony in the consonant inventory between Old English and Present-day English looks significantly different when the set of fricatives are compared. For example, there were only voiceless fricatives, /f, θ, s/ as phonemes in Old English. There are of course voiced fricative sounds in Old English, but these only occur as allophones between voiced sounds such as *wul**f**as* 'wolves' for [v] in the medial position and ***f**olc* 'folk' for [f] in the initial position.[34] In addition, the voiceless velar fricative /x/ has three different sounds depending on its position. For instance, in a word like *hēah* 'high', the phoneme /x/ is pronounced as [h] initially and as [x][35] finally. In addition, the [ç] sound is shown in a medial position; *niht* [niçt] 'night'.

As described above, there are some discrepancies between Old and Present-day English. Now, let us represent consonant system in late Old English (approximately ad 800 – 1066)[36] and consider how the inventory of consonants has changed through Old English period.

(39) Stage 2: The late Old English consonant system (Hogg 2011: 43)

	Labial	Dental	Palatal	Velar
Voiceless stops	/p/	/t/		/k/
Voiced stops	/b/	/d/		/g/[37]

Hogg (2011: §2.78(3)).

[34] This kind of relationship is referred as 'complementary distribution' in general. In this case, voiced fricatives are in complementary distribution with voiceless ones.

[35] Only some dialects of English still keep this sound (e.g. *lo**ch*** in Scottish English).

[36] It has usually been suggested that the OE begins when the roman troops were withdrawn (around 410-499), and ends with the event of Norman conquest (1066).

[37] I put /g/ in this inventory instead of /ɣ/ in the original source. Hogg (2011: 43) mentions that "/g/ is probably the preferred analysis for the late Old English when the initial <g> had become [g].

Voiceless fricatives	/f/	/θ/	-	/x/
Sibilants	-	/s/	/ʃ/	-
Affricates		/ʧ, ʤ/		
Nasals	/m/	/n/	-	-
Liquids, approximants		/l, r/	/j/	/w/

In comparison with the table (38), the late Old English shows some significant changes in terms of its consonant system. For example, /ʧ, ʤ, ʃ/ emerge as new phonemes in (39) and the development of those phonemes is considered here. First of all, the palatal sibilant /ʃ/ is indicated by the spelling <sc>, and developed by palatalization[38] of */sk/[39].

- Palatalisation of */sk/: **skip* > *sċip* 'ship', **disk* > *disċ* 'dish', **fisk* > *fisċ* 'fish' (Hogg 2011: 7.17(4))

Besides these typical examples, palatalization occurs in many different environments; e.g., *sċeacan* 'shake' (initially before back vowel), *þersċe* 'I thresh' (medially only except before back vowel, *þerscan* 'thresh', and *æsċ* 'ash' (after any front vowel) (Hogg 2011: §7.17(4)).

[38] There is another phonological process which is referred to as 'assibilation' for the development of /ʃ/ in Old English period. See Luick (1914-1940: §691A1) and Hogg (2011: §7.37) for more details.

[39] An asterisk '*' in this context means a reconstructed form which is based on comparative (historical) linguistics in particular.

Second of all, two affricates /ʧ, ʤ/ appear in late Old English. These phonemes are represented by the spelling <ċ, ċċ> and <ġ, ċġ> and the former is linked to voiceless affricates and the latter to voiced ones. Examples of the voiceless affricate are shown here; *ċild* 'child' and *dīċ* 'ditch' (Hogg 2011: §2.66). In addition, some instances of voiced affricates are also found; *senġan* 'singe' and *eċġ* 'edge' (Hogg 2011: § 2.67). [40] These new phonemes developed from Germanic /k, g/ by the application of palatalization and assibilation processes (for instance, *[c] > /ʧ/ and *[g] > /ʤ/. For the full details, see Hogg 2011: §7.15 and Campbell 1959: §431-39).

In this subsection, two versions of Old English consonant system – an early system and a late one - are indicated. In the next subsection (3.2.2), some aspects of Old English fricatives which are the main data in this chapter are discussed in detail, especially its phonemic status from Old to Middle English.

3.2.2 *When did voiced fricatives develop phonemic status?*

In this subsection, I discuss some issues concerning the phonemicisation of voiced / voiceless fricatives[41] in Old and Middle English. This section is a prerequisite for analysing some particular data which I consider in this chapter. In other words, voicing of initial fricatives is the main materials to be investigated here, and this process probably has some effect on a phonemicisation of voiced fricative in some dialects of Old English. Therefore, a

[40] The new phoneme /ʤ/ represents a very restricted distribution. As shown in examples, /ʤ/ was only found after /n/ and word-final position.

[41] In this section, only /f, θ, s/ are considered. The velar fricative /x/ is excluded in that this phoneme has a somewhat different and complex history than other fricatives. This will be dealt with in the chapter 6.

typical phonemic status of voiceless / voiced fricatives in Old English needs to be considered before we go any further on any discussion of this process.

Nearly all traditional Old English handbooks have dealt with voicing (and devoicing) of fricatives (Sweet (1874, 1924), Wyld (1907, 1927), Jespersen (1933, 1949), Wardale (1949), Mossé (1852), Bennet (1955), Luick (1964), Jordan (1974), Brunner (1960, 1970), Dobson (1968), Fisiak (1968), Strang (1970), Wright & Wright (1984), Hogg (1992), Lass (1992), Milward (1996) and Smith (1996)). In addition, their descriptions of this process look very similar. For instance, in Old English, [v], [ð], and [z] are analysed not as separate phonemes, but rather as allophones of phonemes /f/, /θ/, and /s/ respectively. In fact, voiced fricatives only occur between voiced sounds[42]. The table (40) shows some distribution of voiceless and voiced fricatives in Old English.

(40) The distribution of fricatives in Old English (Laker 2009: 214 and Hogg 2011: §7.54)[43]

<f, þ, s> = [f, θ, s]					<f, þ, s> = [v, ð, z]		
#_	_#	V_V̄	C [–VOICE]_V	V_C [–VOICE]	V̄_V	C[+VOICE] _V	V_C [+VOICE]
fōt 'foot'	*wul**f*** 'wolf'	*befaran* 'go	*(scip-**f**yrd)* 'fleet'	*Sō**f**te* 'soft'	*ġerē**f**a* 'reeve'	*þur**f**an* 'need'	*swe**f**n* dream'

[42] However, there is more specific environment regarding this process. Voiced fricatives do not occur between voiced sounds when the immediately preceding syllable is unstressed. For example, words such as *be**f**aran* 'go round', *ġe**þ**anc* 'mind', and *a**s**endan* 'send foth' indicate that fricatives ***f***, ***þ***, and ***s*** are voiceless respectively (Hogg 2011: §7.54). See the table (40) for the detailed description.

[43] As Laker puts it in the footnote 4 in his article (Laker 2009: 214), there is no simplex word which contains [f] in the environment like C[-Voice]_V. *Scip-fyrd* is a compound word of two words such as *scip* 'ship' and *fyrd* 'army.

þ*orn* ‘thorn’ ***s****unu* ‘son’	*bæ****þ*** ‘bath’ *hū****s*** ‘house’	round’ *ġeþanc* ‘mind’ *asendan* ‘send forth’	*strenc****þ****u* ‘strength’	*snī****þ****st* ‘cut 2.Sg.’ *cy****s****te* ‘kissed’	*snī****þ****an* ‘cut’ *ċēo****s****an* ‘choose’	*fur****þ****or* ‘further’ *clǣn****s****ian* ‘cleanse’	*fæ****þ****m* ‘embrace’ *bō****s****m* ‘bosom’

As shown in (40) above, voiceless [f, θ, s] occur initially, finally and medially while voiced [v, ð, z] only occur between voiced sounds if a preceding vowel is stressed in Old English.

As for a phonemicisation of voiced fricatives, there have been a number of studies which cover this topic (for instance, Kurath 1956, Sledd 1958, Lass 1992: 57-61; 2006: 62, Trnka 1982: 224-231, Laker 2009 and Minkova 2011). It is difficult to find any consensus about when this phonemicisation of a voice contrast of fricatives in Old and Middle English takes place because each author has different views on this issue to a certain extent. Therefore, it is not possible to review all previous research in this section since the question of the exact timing of the phonemicisation is not the focus of this thesis. However, there is some degree of consensus about a phonemicisation of voiced fricatives.

It is generally agreed among historical linguists that the influence from French loanwords is considered as the most potent factor for the phonemicisation of a voice contrast of fricatives in Middle English. In other words, this phonemicisation of voiced fricatives is

related to one of the phenomena in Middle English period.[44] Basically, voiced fricatives in the Old English period only occur medially, in fact, between voiced sounds. Therefore, if a phonemicisation of a voice contrast of English fricatives is considered, we need to figure out two problems separately; 1) 'when and how initial and final voiced fricatives are introduced in the history of English?', and 2) 'when and how a medial voiceless fricative was innovated (in the history of English)?' First of all, French loanwords bring an initial voiced sound in English phonemic system during Middle English. For instance, Old French vocabularies beginning with [v] and [z] such as *vertu* 'virtue', *vileynye* 'villainy', *zḗle* 'zeal', *and zodiac* 'zodiac' (Fisiak 1968: 60) are adopted and these voiced fricatives in initial position start pronouncing among people. Secondly, voiced fricatives appear in final position due to the loss of unstressed vowel, in fact, schwa 'ə'. Some relevant data are *liven* 'live', *bāthen* 'bathe', and *risen* 'rise'. Finally, a medial voiceless fricative is established by degemination of intervocalic geminate fricatives. In Old English, only geminate voiceless fricatives could occur in medial (intervocalic) positions, but, after simplification of geminate sounds, there appear a voice contrast of fricatives in this position.

3.3 Initial Fricative Voicing in Old and Middle English

3.3.1 *Previous explanations*

In 3.3, data and generalisation for initial fricative voicing in Old and Middle English are discussed. However, some previous approaches are reviewed in detail in this subsection before the main topic is fully addressed. It has been very well-known among historical phonologists that voicing of initial fricatives occur in the Southern and South-western

[44] See Laker (2009) for an alternative view on this matter.

(Kentish) English between Old and Middle English. Unlike other regions in England at those times, southern dialects underwent a unique development of fricatives especially in initial position. Therefore, in this section, the initial fricatives in the southern dialects and ones from other areas are compared in terms of the relation between a phoneme and allophones. In addition, some hypotheses which have attempted to explain this dissimilarity are also shown in 3.3.1.2. Finally, some data from the initial fricative voicing in Southern and South-western (Kentish) English are presented and discussed in 3.3.2.

3.3.1.1 *Geographical differences of a voice contrast of initial fricatives in ME*

Fisiak (1968) describes some contrasting development of voiceless / voiced fricatives in Old and Middle English in accordance with regional divisions in England. In addition, he explains both phonologically quantitative and qualitative modifications which can be seen as one of diachronic mechanisms in order to capture a phonemic status of fricatives. The latter is represented first. According to Fisiak (1968: 57-61), it has been observed that both quantitative and qualitative changes to phonological segments tend to happen through the history of English. More importantly, they interact with each other and it usually results in bringing something new into the phonemic system in the language. As for a quantitative changes first, geminate fricatives [ff, þþ, ss] occur in an intervocalic environment in Old English, and these long (geminate) consonants contrast with short (single) ones. When the elimination of geminate consonants occurs intervocalicallly, a qualitative innovation could follow. In fact, these simplified fricatives [f, þ, s] appear between voiced sounds where previously only voiced fricatives [v, ð, z] could turn up. Consequently, it results in the

emergence of new phoneme such as /v, ð, z/ in that voiceless and voiced fricatives do not show complementary distribution relation any more.[45]

Turning to the main point, geographical distributions of initial fricatives in Middle English are presented here. Following Fisiak (1968: 59-60)'s classification, three areas are considered here. First of all, in the North and Midlands dialects, the intervocalic /v, z, ð/ appear to be the separate phonemes first around 12th century, and then the initial /v, z/ show a phonemic status after the arrival of French loanwords (e.g., *vertu* 'virtue', *vileynye* 'villainy', *zȩ̄le* 'zeal', *zodiac* 'zodiac' as mentioned in 3.2.2 in this chapter). Secondly, the contrasts between /f, s/ and /v, z/ first appear in initial position in the South and West midlands and in London about 13th century when French loanwords were brought into these regions. After that, intervocalic /v/ and /z/ were found about 14th century. Thirdly and finally, the Southern dialects show a somewhat different picture from other areas regarding initial voiceless / voiced fricatives. In fact, voiced fricatives such as [v, z] appeared in the initial position in the Old English period. Therefore, in the Southern dialect, the influence of French loanwords does not affect the distribution of voiceless and voiced fricatives, especially in the initial position. For more details of it, some previous approaches and hypotheses about the Southern innovation of initial fricative voicing are discussed in the next subsection.

3.3.1.2 *Endogenous innovation vs. exogenous innovation*

It has been proposed that there are two possibilities for explaining initial fricative voicing in the Southern dialects. The first one is that the initial fricative voicing in English takes place independently in Old and Middle English. In other words, it is treated as an

[45] See Kurath (1956) for a full explanation of this issue.

endogenous change. This view is proposed by some traditional historical grammarians such as Jespersen 1891, Campbell 1959, and Brunner 1965. For example, Jespersen (1891) claims that the initial fricative voicing in Southern dialects should occur when the preceding sound is a vowel; *ilke* ***u****ondunges* and *one* ***u****reond* vs. *þeos* ***f****ondunges* and *mot* ***f****leon*[46] (Jespersen 1891: 173-76 and Nielsen 1982: 21). According to their theories, an initial voicing phenomenon can be regarded as one of the independent phonological processes which took place in some dialects of Old and Middle English. That is, they do not see any external pressure (e.g. foreign language contact) for this development.

On the other hand, the other possibility can be referred to 'the Continental hypothesis' (Fisiak 1984: 5) which treats this voicing as the Germanic innovations before they come to England (e.g. Sweet 1888: 139 and Bennet 1955). For instance, Bennet (1955) argues that the initial voicing of fricatives is a "Low Franconian process acquired by the Jutes and Saxons who later settled in Kent and the South-West and brought to England (Bennet 1955: 368-369)". According to this hypothesis, the initial fricative voicing could occur before Old English period, which means that it could be treated as the Germanic process rather than English innovation. However, the problem of this hypothesis is that there is no orthographic evidence which shows this phenomenon. Now, some relevant data will be show in 3.3.2.

3.3.2 *Data*

There is some difficulty in collecting some data which reveal the initial voicing of fricatives in the Southern dialects. It is because dialects from these regions are not part of the standardisation process in English. Therefore, there is little orthographic evidence which

[46] The bold symbols are the affected sounds.

show this phonological innovation (Honeybone 2002: 71-72). Nevertheless, there is some English spelling recorded to indicate the initial fricative voicing.

The evidence of fricative voicing in ME is given from handbooks. Hogg (1992: 283) and Bennet (1955: 367) indicate that the earliest examples of the change are <uif> 'five' in the Guild Statute of Bedwyn (Wiltshire c.925-50) and <uilmenum> 'film dat. pl.' (c.950). More frequent examples start occurring in the mid-11th century. Luick notes that evidence for the change is also found in misspellings, e.g., <finter> for <winter> and <fivel> for <wivel> 'beetle' in the Kentish Coloured Glosses of the 11th century. Luick (1964: 934) points out that the process is very clearly shown for /f/ to /v/ in two 13th century West-Midland manuscripts: Ancren Riwle and the Cathrine Group. In these texts <v> occurs in sentence initial and after vowels and voiced consonants. Luick (1964: 933) argues that the change first took place in these positions. Voiceless fricatives were retained when voiceless sounds preceded them. Jespersen gives <Þeo**s** **f**ondunges> ~ <ilk**e** **u**ondunges>; <scheawe**ð** **f**orð> ~ <scea**u** **u**orð>; <Þ**e** **u**eorðe> ~ <Þe**t** **f**eorðe>; <Þ**e** **v**ifte> ~ <Þe**t** **f**ifte>; <min**e** **u**aon> ~ <hi**s** **f**aon>.

In 3.3, previous explanations for the initial fricative voicing in the Southern dialects of Old and Middle English and some relevant data were demonstrated. In the next section, theoretical analysis of the initial fricative voicing will be represented and discussed in detail.

3.4 Theoretical Analysis of Initial Fricative Voicing in Old English

As shown in 3.3.2 above, the number of pieces of orthographic evidence of voicing of initial fricative is relatively low in English since only southern dialects of English are affected by this process, and these southern dialects contribute little to developing standard Modern English. However, although it seems that this process is unimpressive in terms of linguistic

development in English, this phenomenon is worth investigating in that some notable data which have been affected by this process can still be seen in southern dialects of Present-day English in the UK.

In the course of the preceding sections, I presented a set of data which are relevant to initial fricative voicing in English and also showed how they are selected, providing some backgrounds of Old and Middle English such as the Old English consonant system, a phonemicisation of a certain set of segments, and geographical and social factors of initial fricative voicing in the southern Old English. In this section, this weakening phenomenon is accounted for within the framework of Optimality Theory. In fact, there have been discussions which deal with the origin and the date of the initial fricative voicing in southern Old and Middle English (e.g. Bennet 1955, Wakelin & Barry 1968, Fisiak 1984, Poussa 1985, Voitl 1988, Wakelin 1988, Lass 1991-1993, and Nielsen 1994).[47] However, there have been very few theoretical analyses of this phenomenon (for instance, Honeybone 2002 and 2012). In other words, previous literatures regarding the voicing of initial fricative in the southern Old English have centred not on the process itself but on the non-(purely) phonological conditions such as geographical distribution and language contact. Therefore, due to the absence of theoretical discussion on this process, this section is intended to provide theoretical analysis of the voicing of initial fricative in Old and Middle English and make a contribution to our understanding of lenition theory. Furthermore, it will ultimately provide us an answer in part for the main goal of this thesis, which is to seek to find a unified account of consonant lenition and vowel reduction. Before a theoretical analysis of this lenition

[47] See some details of these previous discussions about the voicing of initial fricative in Old English in 4.3 above.

process is considered, some general aspects of lenition site and other relevant issues are discussed below in 3.4.1.

3.4.1 *The voicing of initial fricatives in southern Old English and its phonological environment*

When the voicing of initial fricatives in the southern Old English is considered, the first thing to look at is its phonological environment. Reflected in its label, this phenomenon occurs in initial position in the word. However, this may yield some undesirable consequences in terms of a general treatment of weakening and positions. For instance, Escure (1977) points out that the strength and weakness of a consonant is quite closely connected to its environment. To make it clearer, she offers a set of environments which is likely to show how a segment is weakened in terms of its environment. However, let me recall Escure's hierarchy of consonant in terms of manner feature. Let me show this again in (41) below.

(41) Hierarchy of major-class and manner feature (Escure 1977:60, seen in chapter 2 above)

Weaker	1	2	3	4	5	6	Stronger
Ø	Glides	Liquids	Nasals	voiced fricatives	voiced stops / voiceless fricatives	voiceless stops	

From this hierarchy, we can see that how consonants are reduced (or strengthened according to their strength value. In addition, Escure provides the environmental hierarchy for consonant strength below in (42).

(42) Positional hierarchy for consonant strength (Escure 1977: 58)

- Final position – a) V__C## or VC__##

b) V__C#

c) V__#C

d) V__##

- Intervocalic - e) V__V

f) V__#V

g) V#__V

- Initial – h) ##__V

According to the hierarchy shown in (42) above, hierarchical strong/weak positions are arranged in terms of consonant deletion. Escure (1977: 58) claims that an initial position is the least likely to hold this kind of weakening phenomenon (i.e. deletion in this context) whereas a weakening process usually occurs in weak positions such as intervocalic or word-final positions. In other words, there is a clear positional preference for weakening process. She argues that consonantal strength can be defined as "a function of its position in the utterance (Escure 1977: 57-58)" since weakening in intervocalic position assumes weakening

in final position, and weakening in initial position indicates weakening in both intervocalic and final positions. In line with this thinking, a consonant weakening or deletion can also be defined as a methodical reduction process, depending on their position in the word.

However, the application of this hierarchy to the initial fricative voicing in southern Old English is problematic. According to Escure's assumption, when a voicing occurs in initial position, all other positions such as intervocalic and final must also show voicing phenomenon. However, there is no credible evidence that voiced fricatives only remain after the voicing of initial fricative is innovated in the southern Old English.

Honeybone also represents a set of environments which are concerned with this issue. I describe these in (43) below.

(43) Honeybone (2002: 175, 235)

A. word-final – [___#]

B. coda or pre-consonantal – [___c]

C. intervocalic or medial – i) foot-internal and post-stress – [v́___(v)]

ii) foot-initial and pre-stress – [(v)___ v́]

D. onset or post-consonantal – [c___]

E. word-initial – [#___]

(# = word boundary, c = any consonant, v = any vowel, and v́ = any stressed vowel)

In this environmental scale for lenition illustrated above in (43), Honeybone (2002: 175) states that the positions like A, B and C-i) act as the site which is likely to promote lenition, while C-ii), D and E are regarded as the site which is likely to prevent segments from leniting.

Let us return to the original point of this section. According to the scales shown in (7) and (8) above, lenition might be expected to be prohibited in word-initial position. Therefore, it might be argued that the voicing of initial fricative in the southern Old English should be treated as an untypical example due to those scales (42) and (43). Namely, positions such as h) in (42) and E in (43) where both are treated as lenition inhibition sites are puzzling. The problem of this issue is that there have not been clear explanations about an environmental aspect of the voicing of initial fricative in the southern Old English in the previous literature. It seems that this positional problem remains unsolved theoretically and philologically. Notwithstanding, it is not the crucial focus of this current thesis, so I will not go further into details on lenition and environment. However, some interesting points which are relevant to this issue are considered here.

First of all, it needs to be pointed out that the relation between lenition and lenition environments should not be considered as an absolute condition. According to the survey in Honeybone (2002), lenition can occur in word-initial position in many languages.[48] Furthermore, the concept of 'lenition inhibition' which has been argued by Honeybone (2001 and 2002) helps us understand how voicing takes place in initial position. In short, even though word-initial position has not usually been regarded as a typical lenition site, it does not mean that this position completely resists weakening processes. Therefore, when 'so-called' typical lenition sites such as intervocalic and word-final positions permit a lenition

[48] See Honeybone (2002: 174-193) for more details.

process to occur in some language system, then an initial position of that language can possibly be held some weakening processes. Namely, a core of 'lenition inhibition' hypothesis is that weak positions such as word-medially and word-finally inhibit lenition less than strong positions such as word-initially.

Second of all, it has been suggested that the voicing of initial fricative in the southern Old English takes place intervocalic positions at a word level or a sentence level. In other words, this is based on the assumption that this initial fricative voicing in southern Old English is motivated by intervocalic voicing between two words or sentences. In fact, in terms of the scales illustrated in (42) and (43) above, the primary environment for the voicing of initial fricative in the southern Old English might be g) in (42) or C-ii) in (43). For example, Nielsen (1994: 21) refers to Jespersen (1891: 173-176)'s argument that the voicing of initial [f] > [v] occurs intervocalic positions between two words such as '*ilke **u**ondunges'*. In this case, initial fricative /f/ in a word like '***u**ondunges'* is voiced when the former word (i.e. *ilk**e***) terminates in a vowel. Therefore, the initial <u> in '***u**ondunges'* indicates the change from voiceless fricative [f] to voiced [v]. Consequently, this voicing process takes place between vowels across word boundary.[49]

[49] The example of *ilke uondunges* is taken from Jespersen. As for the environment of initial fricative voicing in ME, Luick argues that the change took place in sentence initial position and after vowels and voiced consonants. In line with this, Jespersen gives the examples such as <Þeo**s** **f**ondunges> ~ <ilk**e** **u**ondunges>; <scheawe**ð** **f**orð> ~ <scea**u** **u**orð>; <Þ**e** **u**eorðe> ~ <Þe**t** **f**eorðe>; <Þ**e** **v**ifte> ~ <Þe**t** **f**ifte>; <min**e** **u**aon> ~ <hi**s** **f**aon>. These orthographic evidence for the process is found in ME manuscripts such as 'Ancren Riwle' and 'the Cathrine Group' even though data provided by Jespersen are given with no glossses. *ilke uondunges* is clearly ME data, so it can be argued that the final 'e' in *ilke* has already been deleted (apocope). However, I argue that the voicing of initial fricatives occurred between voiced segments before the apocope of schwa in ME, and this can be supported by a number of spelling evidence.

In a similar way, Wakelin & Barry (1968) indicates that initial voicing in the southern Old English probably 'originated in the sentence in intervocalic positions (Wakelin & Barry 1968: 59)'. Here, it is worth noting in full Wakelin's statement below.

> "Common sense suggests that a compromise solution is necessary here. I suspect that initial voicing became a feature of South-Western English, from whatever sources, during the Old English period, that its initial impetus was being lost during the Middle English period, but that some early French loans got it and came down through the ensuing centuries in this traditional form, while others adopted it by analogy to a lesser extent even after the Middle English period. The dialect writers are ambiguous, since on some occasions they may be transcribing genuine traditional forms which had been passed down in the writer's place of origin or habitation for centuries, while on others they may be indicating voicing indiscriminately."
>
> Wakelin & Barry (1988: 636)

The point to note about Wakelin & Barry's statement addressed above is that they use the expression such as 'from whatever sources', which means that the voicing of initial fricative in the southern Old English is driven by very equivocal sources[50].

Finally, Bauer (2007: 619) argues that lenition and position are not cause and effect relation but separate constructs. In other words, he claims that lenition should be defined as

[50] As discussed before, it is still debated among scholars whether the voicing of the initial fricative in the southern Old English resulted from the influence of the continent (e.g. a feature of the Anglo-Saxon) on the one hand, or was an independent process of Old English on the other (e.g. intervocalic voicing between words). See more details in 4.3.1 above.

an independent phonetic process regardless of its position even though prosodic positions may affect weakening processes in some way. In this regard, Bauer criticises Escure's environmental hierarchy shown in (42) with some weakening data from various languages and says that Escure's generalisation does not fit in with the mechanism operating between lenition and position. In order to make the argument clearer, a passage from his paper is quoted below. In this passage, C represents a 'change' and NC 'no change' respectively.

Bauer (2007) surveys positional weakening patterns depending on various languages. This is illustrated in (44) below.

(44) Positional weakening patterns in different languages

	Change	Word-initially	Intervocalically	Word-finally	Source
Non-rhotic English	/r/ > Ø	NC	NC	C	Escure (1977: 58)
Old Norse to Old Danish	ka:ka > ka:ge, sak > sag	NC	NC	C	Haugen 1982: 80
Proto-Dravidian	[*j] > Ø	C	NC	NC	Krishnamurti 2003: 142, 154
Middle Indo-Aryan	/s/ > /h/	C	C	NC	Masica 1991
US & NewZealand English	/t/ > [ɾ]	NC	C	NC	-
Proto-Malayo-Javanic	*q > Ø initially; *q > [h] finally	C	NC	C	Nothofer 1975

As shown above, some languages present a proper patterning in terms of Escure's positional hierarchy (e.g. a) anc b)), but others do not match with it (e.g. c) ~ f)). In this regard, Bauer argues that lenition should not be treated as a process affected by a certain position even though position can be served as one of the influential factors when lenition is considered in phonology. Let us return to our data (i.e. the voicing of initial fricative in southern Old English), and apply them to Escure's environmental hierarchy. It has generally been accepted (for instance, Fisiak 1984 and Honeybone 2002) that voiceless fricatives in southern Old English become voiced word-initially and medially, and remain unchanged when they are adjacent to a voiceless segment and in a final position.[51] In other words, this pattern does not entirely match Escure's generalisation as shown in (42) above because it represents the pattern C/C/NC. Therefore, Bauer's argument can support the fact that there should not be a straightforward solution regarding weakening and position.

Taking those opinions described above together, it is very difficult to determine how a voicing process appears in initial position in the southern Old English. After all, the focus of this chapter lay on how to treat a 'voicing' phenomenon in theoretical phonology, and its environmental condition does not play a crucial role in analysing this particular phenomenon. In line with this thinking, we mainly focus on a 'voicing' process from the next section.

3.4.2 *What is 'voicing'*?

3.4.2.1 *Traditional approaches*

[51] However, it has not been fully agreed among scholars due to the lack of evidence.

It has been observed that a 'voicing' phenomenon is typically regarded as one of the lenition processes, especially as a sonorisation type in diachronic phonology (see Lass 1984: 178)[52]. In addition, a process of fricative voicing has also been a common phenomenon in the phonology of Old and Middle English. A number of handbooks covering English language and phonology hold at least one small section for this fricative voicing (for instance, Campbell 1959: §444-451[53], Lass & Anderson 1975: 174-183, and many others). Therefore, some traditional rule-based approaches regarding the voicing of fricatives are reviewed in this subsection. If intervocalic position[54] is thought of as initially triggering environment by which the voicing of an initial fricative in southern Old English is caused, it is then worth going over those traditional analyses in that intervocalic positions are crucial for fricative voicing in these previous studies. Below, some representative examples of previous rule-based approaches of a fricative voicing are introduced in (45).

(45) A traditional analysis of a fricative voicing

a. Malsch (1971: 70)'s fricative voicing rule

$$\begin{bmatrix} -\text{sonoran} \\ +\text{continua} \\ -\text{voiced} \\ -\text{long} \end{bmatrix} \rightarrow [+\text{ voiced}] \,/\, [+\text{voiced}] \_\_\_\_\_ [+\text{voiced}]$$

[52] Lass (1984) divides a consonant lenition process into two types; an opening type and a sonorisation type. However, a voicing process which can be described as a sonorisation type lenition has been treated with completely different mechanisms in Element-based approaches. These are illustrated in this chapter.

[53] These sections also include devoicing of spirants in Old English (Campbell 1959: §446-451).

[54] An intervocalic position in this context includes the one between words or sentences.

b. Lass & Anderson (1975: 176) - Voice distribution in OE fricatives

(a) + obstruent → [– voice] / #

[+ obstruent]

(b) + obstruent → [+ voice] / [– obstruent] _____ [– obstruent]

+ continuant

The most striking point of the fricative voicing rules illustrated in (45) above is that traditional rule-based approaches normally utilise a binary feature such as [+voice] and [–voice]. In fact, this way of assigning binary values to a phonological feature has been applied to most traditional theoretical discussions, especially in segmental phonology. For instance, a voicing process can be expressed by a feature change like from [–voice] to [+voice] as described in (45). In this current thesis, binary feature values are, however, rejected and single-valued features are employed. This will be discussed in detail in the next subsection.

3.4.2.2 *Laryngeal contrast in single-valued feature theory*

In comparison to traditional approaches, a 'voicing' phenomenon has been interpreted in a quite different way within the framework of a single-valued feature theory[55]. As shown in 3.4.2.1 above, consonantal voicing has been represented by a binary feature such as [+voice] or [-voice] within a traditional generative theory. For instance, the segments /b, d, g, v, ð, z, ʒ/ are represented by [+voice] and /p, t, k, f, θ, s, ʃ/ are [-voice] in terms of their laryngeal state. On the other hand, a single-valued feature system comes into the picture when it was revealed that a traditional binary feature system in itself has some drawbacks to the classification of laryngeal contrasts (e.g. Thai voice contrasts, see the table (46) below).

[55] For more details of Element Theory, see Chapter 2 above.

There have been several proposals which handle laryngeal contrasts within the framework of Element Theory. In this subsection, two well-known works those of Harris (1994) and Brockhaus (1995) are mainly considered, and then the concept of 'laryngeal realism' is also introduced in 3.4.2.2.2 below. According to Harris (1994), laryngeal elements are represented by the element H and L. The former element can be described as stiff vocal cords and the latter one as slack vocal cords. These two elements basically create four different laryngeal states such as L (voiced), H (voiceless aspirated), None (Neutral), and L & H (Breathy). These laryngeal elements works well when dealing with the voicing contrast in various languages and this will be demonstrated in 3.4.2.2.2 below. However, before I go further on this issue, the phonetic aspect of the element H and L needs to be dealt with in order to help us understand the attributes of them more deeply.

3.4.2.2.1 *Phonetic grounding for the element H and L*

In traditional phonological theories (e.g. SPE), 'voicing' has been treated as a relatively simple process. In fact, it is always represented from a binary feature point of view. However, the voicing of consonants has been based on somewhat complicated phonetic components in different versions of Element Theory. For instance, Brockhaus (1995) considers several acoustic cues for the voicing in terms of physical phenomena. These phonetic cues are 'vocal fold vibration', 'voice onset time', 'spectral properties', and 'properties of the release burst'[56]. In this way, the elements H and L can also be defined in terms of phonetic cues (e.g. Harris 1994: 133).

[56] There is a general description of these acoustic cues in Brockhaus (1995: 116-18).

In Harris's term, the element H is described as 'stiff vocal folds', and is connected to voiceless (fortis) obstruents. On the other hand, the element L is described as 'slack vocal folds', and is also associated with voiced series of obstruents. In fact, both 'stiff vocal folds' and 'slack vocal folds' inherently emerge from acoustic phonetics (e.g. Stevens 2000: 251). For instance, the feature [+stiff vocal folds] induces a high fundamental frequency, and [+slack vocal folds], on the contrary, gives rise to a low fundamental frequency. In addition, these features reveal existence and nonexistence of vocal fold vibration. In other words, voiced sounds hold a feature [+slack vocal folds], voiceless sounds [+stiff vocal folds]. Neutral (lenis) sounds have neither of these elements.

Another interesting point to be considered regarding the elements H and L is that these features are said to be related to tone systems in vowels. For example, [+stiff vocal folds] is equivalent to high tone, and [+slack vocal folds] to low tone. Furthermore, a mid tone corresponds to a voiceless unaspirated (lenis) consonant which is assumed to possess neither of these two elements. In phonology, according to Harris (1994), there is a close association between a fully voiced consonant and a low tone in vowels, and also between an aspirated consonant and a high tone.

3.4.2.2.2 *Laryngeal contrast in Element Theory*

There are some reasons why a monovalent feature theory is preferable for analysing laryngeal contrasts over a binary one in the phonological system. First of all, as Ewen and van der Hulst (2001: 110) state, a feature [voice] cannot fully describe the laryngeal contrasts of an obstruent system. In other words, the two-way expression (i.e. voiced vs voiceless) for laryngeal contrasts of consonants can only show a restricted power when it attempts to

represent them. For example, a language like Thai requires three types of laryngeal specifications. Some examples from this language are given in (46) below.

(46) Laryngeal contrasts in Thai (Harris 1994: 135)

	Element	Thai
Voiced	L	*báa* 'shoulder'
Neutral	-	*páa* 'forest'
Voiceless aspirated	H	*p^háa* 'split'

In addition, Harris (1994) observes that the two-way expression for laryngeal contrasts is also inadequate for the exhaustive categorization of laryngeal contrasts in English and French. Some examples are illustrated in (47).

(47) Laryngeal contrasts in English and French (Harris 1994: 135)

	Element	English	French
Voiced	L	-	*beau* 'beautiful'
Neutral	-	*Bay*	*peau* 'skin'
Voiceless aspirated	H	*Pay*	-

According to Harris's observation represented in (47), the voiceless stops such as /p, t, k/ in English are truly voiceless and aspirated in initial position. However, the voiced ones such as /b, d, g/ is not truly voiced, but phonetically voiceless. On the other hand, the /b, d, g/ is fully voiced in French, and the /p, t, k/ is voiceless unaspirated sounds.

Honeybone (2002: 127) gives a further indication that a voicing contrast of stop series is expressed in a different way between two language groups; one for Romance and Slavic languages such as Spanish and Russian and the other for Germanic languages such as English and German. For example, the former group shows that the /b, d, g/ series appear with vocal fold vibration (i.e. fully voiced) in most phonological environments, and the /p, t, k/ series with neither vocal fold vibration nor aspiration. On the other hand, in Germanic languages, the /b, d, g/ series do not appear with fully voiced, and the /p, t, k/ series show a voiceless aspirated in most phonological environments. Taken as a whole, it is suggested that the /b, d, g/ in Germanic languages (e.g. English) and /p, t, k/ in Romance and Slavic languages (e.g. French) are regarded as the same category as the example of neutral illustrates in (47).

Let me now summarise what Harris and Honeybone argue for three types of laryngeal contrasts of stops in three different languages.

(48) Three types of laryngeal states

	English	French	Thai
Fully voiced (L)		/b, d, g/	/b, d/
Neutral (voiceless unaspirated)	/b, d, g/	/p, t, k/	/p, t, k/
Voiceless aspirated (H)	/p, t, k/		/ p^h, t^h, k^h/

If this laryngeal contrast system is applied to other languages, it can be argued that languages are divided into two groups which can be referred to as H-language and L-language. In H languages such as English and German, the element H is active in its

phonological system, while the element L is phonologically active in L languages such as French and Spanish.

Honeybone (2002) calls this approach 'laryngeal realism'[57]. In addition, he proposes a set of segmental symbols which reinforce the classification of laryngeal contrasts in the system of 'laryngeal realism'. It is shown in (49) below.

(49) Symbols for segments (Honeybone 2002: 138)

Neutral	Voiceless aspirated	Voiced
/pº, tº, kº/: no H or L	/pʰ, tʰ, kʰ/: H	/b, d, g/: L
/fº, θº, xº/: no H or L	/fʰ, θʰ, xʰ/: H	/v, z, ɣ/: L

According to the table (49), the letters <p, t, k> in English correspond to /pʰ, tʰ, kʰ/, and <b, d, g> to /pº, tº, kº/ respectively. In French, the letters <p, t, k> are equivalent to /pº, tº, kº/, and <b, d, g> to /b, d, g/ respectively. Voicing of stop series in English is now described as the change from /pʰ, tʰ, kʰ/ to /pº, tº, kº/, and this contains the loss of laryngeal articulation (i.e. it actually refer to the loss of laryngeal element in an element-based approach). Honeybone labels it as 'delaryngealisation', and states that "Delaryngealisation is, in fact, the obvious companion that we might expect to contrast with debuccalization because the former involves loss of constriction in the larynx but retention of constriction in the oral cavity and the latter involves loss of constriction in the oral cavity but retention of constriction in the larynx (Honeybone 2002: 140).

[57] As for the elements H and L, Honeybone (2002) uses a different expression for them. For example, the element H corresponds to |spread|, and the element L to |voice| respectively.

3.4.3 *Theoretical analysis*

3.4.3.1 *Markedness and Faithfulness*

As discussed in chapter 2 above, this thesis is intended to provide a certain type of theoretical mechanism which can be compatible with both consonant lenition and vowel reduction. In this subsection, I argue that the Optimality Theoretic approach I am presenting below can offer a unified analytical method for those phenomena, which have been thought of as an independent process in the previous phonological literature.[58] As this chapter is mainly focused on consonant lenition, an obstruent voicing process as one of the typical lenition phenomena is examined within the framework of a combined theory of Element and Optimality Theory.

It has been presented in previous sections that Element Theory (e.g. Harris 1990, 1994 and Brockhaus 1995) claims to advocate a single-valued feature system which differs from traditional rule-based theories in order for a proper theoretical analysis of laryngeal contrasts in languages. What is needed for developing an integrated theoretical mechanism for those weakening processes is to find how these privative features (i.e. elements) are employed when computation in OT is carried out through constraint interaction.

Before pursuing this, two basic types of OT constraints are represented first; *Markedness constraint* and *Faithfulness constraint*. In short, markedness constraints solely consult output forms, and make them keep (or lose) relevant phonological properties. On the other hand, faithfulness constraints look both output and input forms and demand them to be identical. In this way, the interaction between markedness and faithfulness constraints can

[58] As discussed in Chapter 2 above, there have been few attempts to unify consonant lenition and vowel reduction in the previous literature.

result in various kinds of phonological patterns. For instance, those two different constraint families are conflicted with each other when coda devoicing in German is computed in OT. These are introduced below in (50).

(50) Beckman, Jessen, and Ringen (2009: 239)

a. IDENT[voi]: An input segment and its output correspondent must have the same specification for [voice]

b. *VOICODA: Voiced obstruents are prohibited in codas.

In this case, a devoicing occurs when a markedness constraint, *VOICODA dominates a faithfulness constraint, IDENT[voi]. The relevant constraint ranking and tableau is illustrated below in (51).

(51) Coda-devoicing in German (Beckman, Jessen, and Ringen 2009: 239)

gru/z/l+ig	*VOICODA	IDENT[voi]	*VOIOBS
☞ a. gru[s].lig		*	
b. gru[z].lig	*!		*

On the contrary, if the markedness constraint is outranked by all (relevant) faithfulness constraints or any particular markedness one which is conflicted with each other, it means that processes (e.g. epenthesis or deletion) are prohibited by the order of the constraint ranking. More interestingly, the situation becomes complicated when positional faithfulness and contextual markedness constraints are involved. This will be demonstrated later in this section when lenition (i.e. voicing in this section) is considered since lenition phenomenon is particularly connected to the interaction between positional and contextual constraints. Before we deal with that issue, previous OT analyses regarding voicing processes are

reviewed in order to see how a 'voicing' has been treated in theoretical phonology. Subsequently, it will be argued that a combined OT constraint such as *COMPLEX[Element] plays a critical role in analysing lenition phenomena in this chapter.

3.4.3.2 *Previous OT approaches on 'voicing' processes*

3.4.3.2.1 *Smith (2008)*

Smith (2008) divides lenition into two different categories. One is referred to 'the neutralisation to the unmarked' lenition, and the other to 'sonority-increasing' lenition. It has been argued (Lavoie 2001 and Cser 2003) that the former is connected to coda or word-final positions where neutralisation often takes place while the latter is usually linked to intervocalic positions. In addition, these two lenition patterns clearly show the opposite direction in terms of 'markedness'. For example, when debuccalisation which is one example of 'the neutralisation to the unmarked' is considered, a glottal sound is chosen because this sound is typically regarded as unmarked sound (de Lacy 2006). On the other hand, it is generally suggested that voiced obstruents are more marked than voiceless ones.[59] Therefore, 'sonority-increasing' lenition such as voicing and spirantisation[60] result in more marked sounds.

[59] It is supported by the language typology, for instance, that some languages (e.g. English) have both voiced and voiceless obstruents while others (e.g. Finnish) have voiceless members only. There are no languages which have voiced obstruents only (Zsiga 2013: 41).

[60] When this process is considered, lenition is defined as a kind of phonological process where a segment becomes more sonorous, for instance, voiceless sounds to voiced one (Voicing) and stops to fricatives (spirantisation). According to the concept of 'markedness', voiceless stops are the least marked sound, and fricatives are somewhat more marked one than stops in terms of 'markedness'. What Smith wanted to show is that lenition takes two opposite directions; one for the neutralisation to the unmarked, and the other for sonority-increasing (here, more marked sounds). Finally, the

As mentioned before, debuccalisation is a good example to elucidate some characteristics of 'the neutralisation to the unmarked' lenition pattern in that it certainly exhibits a neutralisation process in coda position. It is shown in the tableau (52).

(52) The neutralisation to the unmarked lenition (Smith 2009: 529) - a case of debuccalisation in coda[61]

/kap/	*PLACE(coda)	IDENT[Place]	*PLACE
a. kap	*!		**
☞ b. kaʔ		*	*
c. ʔaʔ		**!	

In this tableau, the constraint ranking can be described as Positional markedness » Faithfulness » Context-free markedness in respect of the discussion regarding the interaction between positional and contextual constraints demonstrated in 3.4.3.1 above.

In addition, sonority-increasing lenition can be exemplified with intervocalic voicing lenition. The pivotal constraint which is associated with this weakening phenomenon is described below in (53).

(53) INTER-V-VOICE (Kager 1999: 325)[62]: Intervocalic consonants are voiced.

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markedness among consonants is irrelevant to vowels in that consonants and vowels are completely different categories in terms of their properties in phonology.

[61] In this constraint ranking, the faithfulness constraint is positional (i.e. ID[Place](ons)).

[62] Hayes (1999) shows the same constraint like INTERVVOI: Assign one '*' to each output segment that is [-son, -voi] in the context V_V.

This constraint can be defined as contextual markedness constraint and this can be conflicted with context-free markedness constraint such as *OBSVOI and faithfulness constraint such as IDENT[voi]. The relevant constraint ranking is as follows.

(54) Intervocalic voicing: INTERVVOI » IDENT[voi] » *OBSVOI

On the whole, Smith's argumentation for lenition has a persuasive power. She represents a detailed analysis of lenition while classifying two different lenition categories such as 'neutralisation to the unmarked' lenition and 'sonority-increasing' lenition. However, there are some drawbacks of Smith's claim in terms of a consolidated explanation of different types of lenition because lenition phenomena should be divided into two groups with respect to their environments. A proposed theoretical mechanism in this thesis can give a partial answer for this analytic weakness by providing the constraint such as *COMPLEX[Element] that can be applied to all types of lenitions. In line with this thinking, it seems that Kirchner (1998, 2004)'s argument (e.g. the LAZY constraint) also give us a similar idea in terms of the unification of lenition processes. Therefore, this is briefly discussed before my analysis is illustrated.

3.4.3.2.2 *Kirchner (1998, 2004)*[63]

Unlike Smith's analysis of voicing phenomenon, Kirchner (1998, 2001, 2004) argues that a unified manner can be applied to various types of lenition processes. In order to satisfy this goal, he claims that the constraint such as LAZY cover a wide range of lenition phenomena. This, then, raises the question 'what is the LAZY constraint?'

[63] The key arguments of Kirchner (1998, 2004) have already been mentioned in chapter 2.

Kirchner (1998, 2004) argues that the notion of 'reduction of articulatory effort' is crucial for accounting for lenition phenomena and this is supported by phonetic and physiological evidence.[64] In this regard, the effort minimization constraint which is called 'LAZY'[65] is developed in this model. It is shown in (55) below.

(55) LAZY: Minimise articulatory effort (Kirchner 2011: 87)

The LAZY constraint interacts with the faithfulness constraints in order to capture an ideal result for lenition processes. For example, all lenition processes such as spirantisation, degemination, debuccalisation, and voicing are accounted for within a unified manner. These are illustrated below in (56).

(56) Lenition in Kirchner's model (1998: 27)

- Spirantisation: LAZY » PRESERVE (continuant)
- Degamination: LAZY » PRESERVE (length)
- Debuccalisation: LAZY » PRESERVE (place features)
- Voicing: LAZY » PRESERVE(voice)
- No Preserve constraint: no lenition occurs.

As shown in (10) above, Kirchner claims that lenition patterns can be captured on the basis of the same constraint-ranking mechanism, namely, LAZY » lenition-blocking constraints.[66] However, there is an objection on Kirchner's argument. For instance, Honeybone points out that if it requires too many supplementary constraints such as all

[64] In his model, the effort cost is interpreted as "a mental estimate of the biomechanical energy required for articulatory production for each candidate (Kirchner 2004: 314)". In fact, this effort cost is calculated in terms of the violation of LAZY and faithfulness constraints.

[66] See for some critical arguments against Kirchner's view in chapter 2.

general types of faithfulness constraints and relevant positional faithfulness ones (e.g. PRESERVE (continuant/#_) in order to satisfy the correct output forms, this analysis then loses its explanatory power by those constraints by virtue of '*Occam's razor*'[67]

3.4.3.3 *A combined theory of lenition*

In this section, I propose a theoretical analysis of an intervocalic voicing process within the framework of Element of Optimality Theory. This idea is not entirely new. For instance, Polgárdi (2006) has presented 'a combined theory of Government Phonology and Optimality Theory' (e.g. this is the title of the Chapter 2 in her book in 2006). It seems that her approach is different from the current one of this thesis in some way. To clarify the difference between two approaches, I briefly describe Polgárdi (2006)'s theoretical background here. I think that her theoretical development looks very interesting in many points. Among them, the most notable thing to look at is that Polgárdi has tried to integrate two different approaches with one theoretical system in order to examine phonological processes more effectively. For instance, it is well-known that Government Phonology has a number of inviolable principles and language-specific parameter settings, and what Polgárdi has been trying to work is that she removes those parameters and principles by replacing them to OT constraints and constraint ranking. In Polgárdi (2006), her main concerns are vowel harmony and disharmony in languages, and she has applies those phonological processes to a combined theory of Government Phonology and Optimality Theory.

[67] It states that among competing hypotheses, the hypothesis with the fewest assumptions should be selected. In other words, the simplest explanation is usually the correct one.

For a bit more details of it, some representative constraints in Polgárdi are illustrated below. Polgárdi uses some principles from Government Phonology such as 'Government' and 'Licensing', which work in conjunction with melodic structures, in order to build a combined theoretical model.

(57) Polgárdi (2006: 31)

a. PROPER GOVERNMENT (PG)

An ungoverned nucleus properly governs a preceding empty nucleus

b. GOVERNMENT LICENSING (GL)

A governing onset must be licensed by a nucleus which is not properly governed

Polgárdi's claim has not attracted much phonologists' attention when she brought it to general phonological discussions. However, the primary idea that she tried to combine some aspects from both Government Phonology and Optimality Theory is still worth pursuing in some ways. In this thesis, some of her ideas will be reflected in a different way especially when weakening phenomena are considered within the framework of an integrated theoretical model of Element and Optimality Theory. The combined OT analysis that I propose in this subsection is different from Polgárdi's one. For example, Polgárdi employs GP notions such as licensing and government as critical components of OT constraints, but in this current approach I mainly make use of 'elements' themselves from Element Theory in order to devise relevant constraints which will be crucial for the analysis of lenition phenomena.

3.4.3.3.1 **COMPLEX[Element]and alternative analysis*

Before the main analysis is illustrated, let us recall subsegmental representations of fricatives which are shown in Chapter 2 above. They are repeated here.

(58) Representation of a voice contrast in English labial fricatives in Element Theory

a. Voiceless aspirated labial fricative:

/fʰ/ - [h, U, H], /sʰ/ - [h, R, H], /θʰ/ - [h, R, H]

b. Voiceless unaspirated (neutral) labial fricative:

/f˚/ - [h, U], /z˚/ - [h, R], /ð˚/ - [h, R]

When Element Theory is concerned, weakening processes such as consonant lenition and vowel reduction can be defined as element loss or decomposition of element structure, and it can be reflected in voiceless-voiced contrast as shown in (45). In this regard, we can see that voicing phenomenon in English can be described as loss of the element 'H'.

To encode this weakening pattern into an optimality-theoretic analysis, we see that the following constrains are involved:

(59) Element-based constraints

a. *COMPLEX[Element]: Assign one violation mark for every element in a segment.

b. IDENT I-O[Element]: Assign one violation mark to any pair of corresponding input and output segments that do not agree with the number of 'element'.

The constraint ranking regarding consonantal voicing in Element Theory can be illustrated using the following tableau in (60).

(60) Consonant voicing in Element Theory

Input /pʰ/	*COMPLEX[Element]	IDENT I-O[Element]
a. pʰ [U, ʔ, h, H]	!****	
☞ b. pº [U, ʔ, h]	***	*

As observed in (60), the underlying form /pʰ/ surface as [pᵊ] by the fact that the markedness constraint (e.g. *COMPLEX[Element]) is ranked higher than its faithfulness counterpart (e.g. IDENT I-O[Element]). This constraint, *COMPLEX[Element], needs to be revised when it is applied to real data later in this section, but at this point this shows how an integrated constraint works in this thesis.

*COMPLEX[Element] plays a critical role for deriving consonant lenition phenomena. In addition, the interaction between *COMPLEX[Element] and the faithfulness constraint (e.g. IDENT I-O) is also an important role in selecting a correct output form in relevant environments, for example intervocalic positions.

As mentioned just above, *COMPLEX[Element] has to be amended to make it relevant to OE fricative voicing processes. Namely, the voicing of fricatives in OE normally occurs in intervocalic positions. Therefore, this contextual restriction should also be encoded into the constraint itself. In line with this, an updated version of *COMPLEX[Element] is shown below.

(61) *COMPLEX[Element](V_V): Assign one violation mark for every element in a segment iff a segment is in an intervocalic position.

Now, let us recall examples of voicing of initial fricatives in southern OE again and apply them to the ranking including the constraint shown in (62).

(62) The initial fricative voicing in Southern Middle English

- ***v****olk* 'folk', ***v****ader* 'father', ***z****enne* 'sin', ***z****wȳn* 'swine' (Bennet 1955: 367)

As we can see in (62), initial fricatives are voiced in OE, especially in South of England.[68] OE fricative voicing can be captured when *COMPLEX[Element](V_V) dominates IDENT I-O[Element] within the constraint ranking.

However, one problem arises in terms of environmental aspect. As we discussed in 3.4.1 above, how can an 'initial' position be resolved in terms of a voicing phenomenon? As discussed above, I argue that (southern) OE initial fricative voicing is initially triggered by intervocalic environments between words or sentences. Therefore, it is possible that the constraint like *COMPLEX[Element](V_V) can be extended to word-initial fricative (which is preceded by a vowel) only in southern dialects of OE.

(63) *COMPLEX[Element](V_V): Assign one violation mark for every complex element iff a segment is in an intervocalic position including across word-boundary.

Therefore, this can be illustrated in (64) below.

(64) Voicing of an initial /f/ in intervocalic position across a word-boundary

V./**fʰ**ader/ 'father'[69]	*COMPLEX[Element](V_V)	IDENT I-O[Element]
a. V./**fʰ**ader/ [U, h, H]	!***	
☞ b. V./**fº**ader/ [U, h]	**	*

(The bold letters show the affected sound by intervocalic voicing.)

Another problem however arises when the mechanism of element loss is minutely considered. For instance, when *COMPLEX[Element](V_V) dominates IDENT I-O[Element], there is no reason that the laryngeal element must be removed instead of other elements. For

[68] The relevant details and discussions are represented in 3.3.

[69] '.' represents a word boundary in this thesis.

example, the voiceless aspirated labial fricative, /f/, consists of three elements such as U, h, and H. When this sound appears intervocalically, we expect a voicing process by deleting the laryngeal element 'H' through the relevant constraint ranking. This is illustrated below in (65).

(65) Voicing of /fʰ/ intervocalically

V./**fʰ**ader/ 'father'	*COMPLEX[Element](V_V)	IDENT I-O[Element]
a. V./**fʰ**ader/ [U, h, H]	!***	
☞ b. V./**fº**ader/ [U, h]	**	*
💣 c. V./h(?)ader/ [h, H]	**	*
💣 d. V./w(?)ader/ [U, H]	**	*

The three candidates such as (65b), (65c), and (65d) incur the same number of violations in the tableau (65). In order to make the correct output form to be selected, a high-ranked markedness constraint which controls the element H needs to be involved in this constraint ranking. Before we consider which type of constraint is needed, the internal nature of the element H is needed to be checked in order to bring a proper constraint into this situation.

According to Harris (1994: 134), in traditional rule-based approaches, 'aspiration' is thought of as non-contrastive and it is always added to voiceless plosives by aspiration rule in relevant environments. On the contrary, in Element Theory, the element H is interpreted as

'aspiration' in fortis obstruents, and this is reflected at underlying level. Therefore, a constraint like *ASPIRATE(V_V) would work well with other constraints such as *COMPLEX[Element](V_V) and IDENT I-O[Element] for choosing a correct output candidate since we do not want to have a sound which contains 'H' element in intervocalic positions.

(66) *ASPIRATE(V_V)

No an aspirated element is allowed in an intervocalic position.

Therefore, candidates (65c) and (65d) are ruled out due to violating the high-ranked constraint *ASPIRATE(V_V). On the other hand, the optimal candidate (65b) satisfies the high-ranked constraint *ASPIRATE(V_V). This is illustrated in (67).

(67) Voicing of /f/ intervocalically (updated)[70]

V./**fʰ**ader/ 'father'	*COMPLEX[Element] (V_V)	*ASPIRATE (V_V)	IDENT I-O[Element]
a. V./**fʰ**ader/: [U, h,H]	!***	*	
☞ b. V./**fº**ader/**:** [U,h]	**		*
c. V./h(?)ader/: [h, H]	**	!*	*
d. V./w(?)ader/: [U,H]	**	!*	*

[70] In a diachronic point of view, language change can be interpreted as reranking of constraints in the framework of OT. In line with this, the constriant ranking represented in this chapter is only relevant to a particular dialect which is Southern and South-eastern Middle English. Therefore, in these dialects, aspirated obstruents do not surface at that time.

3.5 Summary

In this chapter, I have provided an Optimality-theoretic analysis of lenition process, focusing on voicing of initial fricatives in southern Old English. In addition, I discussed the nature of elements themselves, and how they play a central role in choosing the correct form through constraint interaction.

In section 3.2, I presented the consonant system in OE. According to many handbooks, OE consonants had undergone various changes. To see this more clearly, I compared two consonant systems such as the early OE consonant system and the late OE one. In addition, the phonemic status of OE vowels also presented.

In section 3.3, preliminary elements regarding initial fricative voicing in OE were discussed. For instance, geographical differences of a voice contrast of this phenomenon are considered. In addition, two possibilities for accounting for initial voicing in the southern OE dialect are examined as endogenous and exogenous innovations.

Southern OE initial fricative voicing was examined in detail in section 4. In particular, its environmental issue where this lenition process can occur is discussed. Namely, initial fricative voicing in southern OE was initiated by word or sentence assimilation.

Finally, a combined theoretic approach to voicing of initial fricative in southern OE was presented. In order to capture this phonological process, three representative constraints were proposed such as *COMPLEX[Element](V-V), IDENT I-O[Element], and *ASPIRATE(V_V). By doing so, initial fricative voicing in OE was expressed by the interaction among those constraints.

Chapter 4 Vowel Reduction: Unstressed Vowels in Old and Middle English

4.1 Introduction

This chapter explores the vowel reduction process from OE to ME. Vowel reduction is a common phonological phenomenon. Therefore, many studies over many years have tried to adequately define vowel reduction. There are typically two different kinds of definition regarding vowel reduction in the previous literature. For example, it has been suggested that vowel reduction can be described as neutralisation of vowel contrasts (Crosswhite 2001 and Flemming 2005) or centralisation of vowel quality (Tiffany 1959 and Fourakis 1991) when they are in unstressed environments. However, it seems to a certain extent that there is a commonality among those researchers even though they indicate different descriptions for vowel reduction phenomenon. For instance, as mentioned above, the neutralization of vowels usually means that vowel contrast in a certain position is diminished, especially in an unstressed vowel inventory. In other words, vowels lose some features when they show up in unstressed syllables.[71] Interestingly, the neutralisation of unstressed vowels actually makes it modified that the affected vowels are consequently drawn into a centralized area, 'schwa'. Therefore, the concept of centralisation of vowels may have something in common with neutralisation of vowels in this regard and it can also be argued that the former (i.e. centralisation) may be a subcategory of the latter (i.e. neutralisation).

In addition, most investigations regarding vowel reduction have assumed that vowel reduction typically occurs in unstressed position. For instance, traditional handbooks (e.g. Campbell 1959) indicate that stress plays a crucial role in deciding whether or not vowels are

[71] This will fully be illustrated by the mechanism of 'element loss' from an element-based approach later in this chapter.

subject to reduction process. On the contrary, it should be pointed out that stress is not solely responsible for vowel reduction phenomenon. Namely, there are other factors that can be involved in vowel reduction process. For example, some phonetic elements such as vowel duration and fundamental frequency, and the interaction between vowels and consonants may play a role. Those factors will also be considered in detail in this chapter. In the end, it will be argued that vowel reduction should be seen not as a unitary operation, but the result of various conditions.

In Present-day English (henceforth, PE), vowel reduction process is a common and an ongoing linguistic phenomenon. It is observed that vowel reduction in PE is more noticeable than OE and ME vowel reduction in terms of connected speech factors though connected speech evidence for OE and ME is not entirely unambigous. For instance, Giegerich(1992) shows a somewhat different picture for vowel reduction. When he deals with vowel reduction in his book, he separates two different environments of vowel reduction: citation form and connected speech. According to Giegerich, in connected speech, schwa can occur in positions in which corresponding citation forms have full vowels; and in such cases the reduction of the vowel can be put down to a loss of stress. A pair of example is given below.

- potato /pəteto/ / potato peeler [pətetə pilə].

Along with this example, he continues to argue that there is a difference between the citation form and connected speech. The former could contain the secondary stress, but, on the other hand, the latter may produce a vowel without the secondary stress that leads to vowel reduction. This case can be supported by two factors; one is the loss of foot in the

suprasegmental structure, and the other is the loss of distinctive features in the segmental representation of the vowel. In other words, motivations for vowel reduction in PE are explained by not only at the word-level, but also at the sentence-level such as connected speech.

Vowel reduction has been treated as a frequent phonological phenomenon in the field of linguistics. This particular process has often been investigated in both synchronic and diachronic studies. For instance, as shown in the previous section, the development of OE word *naman* to ME *name*[72] is a good example of a diachronic analysis of vowel reduction.

Vowel reduction is also a popular topic in phonetic studies. In phonetics, vowel reduction can be interpreted as various changes in the acoustic quality of vowels such as changes in duration, loudness, articulation, and so on. The concept of centralisation is also frequently addressed in the phonetic literature. That is, when pronouncing any unstressed vowels, the amount of movement of the tongue is reduced, and this is characterised as something that vowels are moving towards a centralised area, schwa. In this regard, there have been a number of phonetically-based analyses of vowel reduction. For example, according to Flemming (2005), a durational difference is a crucial factor for vowel reduction. He argues that, especially in fast speech, vowels are reduced due to physical limitations of the articulatory organs, which means that the tongue cannot move to a prototypical position fast or completely enough to produce a full-quality vowel. On the contrary, in phonology, vowel reduction is dealt with in a somewhat different way. For instance, phonological vowel reduction usually entails neutralisation of vowel contrasts in unstressed positions.

[72] See 4.2.1 for more details of this change.

This chapter is organized as follows. In section 2, I show the whole set of vowel reduction data from OE to ME in order to give more general background of this investigation. Section 3 presents various factors for vowel reduction. It will help us to understand the nature of vowel reduction in more detail. In section 4, previous analyses of vowel reduction are reviewed and alternative analysis is illustrated within the framework of an integrated theory of Element and Optimality Theory. This combined theoretical approach will provide a compelling argument about vowel reduction process. Finally, section 5 offers a brief summary and conclusion.

4.2. Data for Vowel Reduction in English

The main goal of this section is to provide a good deal of relevant data of vowel reduction from OE to PE. It has generally been noted in previous literature (e.g. Giegerich 1992 and Hogg 1992) that vowels in unstressed syllables tend to be reduced in English. According to Lass (1994), phonological and phonetic properties of vowels are closely related to stress assignment depending on their positions. In other words, strong and weak syllables in OE show a different formation respectively in terms of vowel quality in OE. For instance, it has been observed that processes such as shortening (of long vowels), deletion (of short vowels), and loss of final schwa often occur in weak syllables (i.e., unstressed syllables) whereas strong syllables usually do not hold these changes. In this regard, the relevant data from OE, ME and PE are demonstrated in turn.

4.2.1 *Vowel reduction in OE*

In this subsection, the development of unstressed vowels (syllables) in OE is represented. Let us present relevant examples in (68) below.

(68) Data for vowel reduction in OE (Campbell 1959: 153-160)

A. Final unaccented vowels

a. *æ*, *e* and *i* fell together in a sound written *e* in unstressed syllables. *æ* and *i* remain undisturbed only in very early texts.

- *æ* to *e*: stān*e*s, stān*e*, ġief*e*, tung*e*, gōd*e*, help*e*, dēmd*e*, cor*e*n, rīdend*e*

- *i* to *e*: win*e*, end*e*, ield*e*st, rīd*e*s, rid*e*, nered*e*, æppel, b*e*- (prefix), ġ*e*- (prefix), n*e* and b*e* (unaccented words)

b. the formative elements *-iġ, -ić, -isċ, -ing, iht, -liċ* are generally not subject to the change *i* > *e*.

- miht*iġ*, ēow*ić*, Engl*isċ*, pen*ing*, stæn*iht*, strong*liċ*

- but, *e* is fairly frequent before back vowels

miht*e*ġu, fīft*e*ġum, wel*e*ġode, Den*e*scan, pen*e*ngas, eall*e*nga, Bas*e*ngum, strongl*e*ċu

c. In late OE, *-iġ* often changes to *–i*, and is reduced to *e* before a heavy syllable.

- dysel*ić*, mihteli*ċe*

d. In the second elements of compounds, with reduction of stress, *æ* and *i* (after shortening, if long) can become *e* as in fully unaccented syllables

- *æ*: *ǽfe*st ‘lawful’, *æ rn* ‘house’, *ēored*, *hancred* ‘cock-crow’, *āwer* ‘anywhere’, *hired* ‘household, *Ælfred, Æpelmer, ġenēoleċa, fullestan, ōnettan, ōrettan*

- *i*: *nēawest* ‘neighbourhood’, *ǽrest* ‘resurrection’, *fyrwet* ‘curiosity’, *endlefan, enetere* ‘a year old’, names in *–ferp*,

- *i* from *y*: *cynren* ‘generation’, *æfest, nosterl*, ymbhwerft

e. unstressed *u* is always well preserved after accented *u*.

- *sunu, wudu, duguþ*

- *u* > *o*: *uulioc-, helostr, seto, sċeado*

- similar change *u* > *o* occurs in the second element of compounds of obscured meaning

oroþ, fracoþ, ofost, þorh, oþ

B. Medial unaccented vowels

a. There is a strong tendency for the first of two successive back vowels to be reduced to a sound written *e*.

- *fugelas* (<*fugol*), *roderas* (<*rodor*), *heoretas* (<*heorot*), *ġedwimeru* (<*ġedwimor*), *eafera* (<*eafora*), *adesa* (<*adosa*), *nafela* (<*nabula*)

- verbs: *swutelian* (<*swutol*), *staþelian* (<*staþol*), *gaderian* (<*geador*)

Diachronically, there is one single trend which is connected with not only OE but also the history of English in general. That is, sounds tend to be reduced in unstressed positions. For example, the development of OE words *naman* 'name' to ME *name* could be a god example to show how a sound is developed diachronically. In fact, the OE noun *naman* 'name' was probably pronounced as [naman]. Subsequently, the *naman* in OE changed its segmental shape to *name* [namə] in ME. The crucial thing to be pointed out here is that the vowel on the second syllable, which does not contain any stress, is affected by reduction process, for instance, a change from [naman] to [namə].[73]

It has been claimed in traditional studies that unstressed vowels have gradually merged and become less peripheral relative to the vowel space. According to Campbell (1959), until about AD 700, all unstressed front vowels had become /e/. The only exception is that [i] is

[73] There are, of course, other phonological changes involved in this example, for example, processes such as final coda deletion. However, such phonological processes are not considered since they are not directly relevant to this research.

preserved in derivational suffixes such as *–ig, -inġ, -iscė* (e.g. *mihtiġ* 'mighty', *cyning* 'king', *Englisċ* 'English').[74] However, a unique change such as *hāliġ* < **hāleġ* < **hālæg* < **hailag* are also found. In this case, unstressed [e] was raised to [i] before a palatal consonant, [ġ]. Therefore, I assume that all the relevant cases with <i> probably had an immediately following palatal consonant. As for the back vowels, the unstressed *u, o, a* had combined to become one unstressed back vowel and then this amalgamated vowel became confused with the unaccented *e*. In this way, the number of vowels in unstressed positions gradually reduced in this period.

4.2.2 *Unstressed vowels in ME*

It has been observed (Mossé 1952, and many others) that vowels are reduced in unaccented positions in Old and Middle English. In ME, there are two characteristics of vowel reduction. First of all, there is a levelling of full vowels to schwa 'ə' when they appear in unstressed environments. Secondly, there is a strong tendency towards deletion phenomenon after passing through the intermediate stage of [ə]. Some relevant data are shown in (69) below.

(69) Reduction of unstressed vowels from OE to ME (Mossé 1952)

a. The OE vowels *a, o, u* in word-final and inflexional endings merged into *e.*

OE	ME
sōna 'at once'	*sōne*

[74] This might be due to the secondary stress assignment of the syllable.

dogga ‘dog’	*dogge*
tūnas ‘villages’	*tūnes*
tungan ‘tongues’	*tungen*
helpan ‘help’	*helpe(n)*
sċeadu ‘shade’	*schāde*
talu ‘story’	*tāle*
gladost ‘gladdest’	*gladest*
macod ‘made’	*māked*
tungum ‘by tongues’	*tungen*
bundon ‘(they) bound’	*bunden*

b. From the 12th century final *–e* became the neutral vowel [ə], and then was dropped.

- *whanne* ‘when’ > *whan*, *þanne* ‘then’ > *þan*, *bute* ‘but’ > *but*, *ȝese* ‘yes’> *yes*

c. OE already had syncope of the post-tonic vowel before liquids (shown in (1B-a) above such as *fugol* ‘bird’). The same phenomenon appears in ME in a much more extended fashion.

- OE *fæderas* ‘fathers’ > ME *fadres*
- OE *munecas* > ME *monkes, munkes*

d. Vowels in unaccented prefixes: there is generally a reduction of these prefixes with a change of vowel.

- OE *ġe-* > ME *i-, e-* (*enōgh, iwis*)
- OE *of-, on-, ond-* > ME *a-* (*adrēdan* < **ofdrǽdan, anōn* < *on, ān*)
- OE *ymbe-* > ME *um*(b)- (*umstride* ‘astride’, *umwhīle* ‘now and then’)

As shown in the previous sections, unstressed syllables tend to act somewhat differently from stressed ones. For example, vowels in unstressed syllables are unstable in terms of the status of vowel quality, and thus tend to be neutralised. As a result, the number of vowel contrasts in unstressed positions becomes fewer than the stressed ones. In addition, the vowels are often less peripheral, so that the product of neutralisation may be mid central *ə*. Many handbooks have claimed that all weak vowels except /i/ have merged in one value, usually spelled <e> by the eleventh century. Therefore, we can see pairs of examples such as *æfter ~ æftor, sunu ~ sune, heafod ~ hæued.*[75]

4.2.3 *Vowel reduction in PE*

In PE, the reduced vowel /ə/ has a very high frequency of occurrence in unaccented syllables. In articulatory term, its quality can simply be characterised as a central vowel with neutral lip position. Now, some examples in PE are shown in (70).

(70) Data for vowel reduction in PE (Burzio 2007)

a. Word-final vowel reduction

- Connecti*cu*t, idi*o*t, chari*o*t, chevi*o*t, myri*a*d, pyram*i*d, peri*o*d, inval*i*d

b. Word-medial vowel reduction

- carp*e*nter, comp*e*nsation, cont*e*mplation, ser*e*ndipity, conc*e*ntrate, aff*i*rmation, conf*i*rmation, cons*e*rvation, cons*u*ltation, conv*e*rsation, inf*o*rmation, lam*e*ntation, pres*e*rvation, transp*o*rtation, us*u*rpation

(The affected vowels are presented in italicized.)

[75] As for these examples, the former of each pair shows OE word while ME examples are shown in the latter of each pair.

4.3 Various Factors for Vowel Reduction in English

From the previous section, it can be assumed that the presence and absence of stress is probably the most responsible for vowel reduction phenomenon because almost the whole data regarding reduction appear in unstressed environments. However, it is also possible that there are other factors affecting the vowel reduction phenomenon since stress is a necessary but not a sufficient condition for causing reduction. Therefore, in this section, various factors for vowel reduction are considered.

4.3.1 *Various factors for vowel reduction*

A basic assumption for vowel reduction has always been a certain fact that this phenomenon occurs in unstressed and/or weak syllables, even though various phonological frameworks have treated it differently. Previous studies of vowel reduction in English have suggested that several factors play a role in the choice of reduction, deletion and even retention of vowels in unstressed syllables. Among those factors, the relationship between stress and reduction has become the most common and persuasive one since vowel reduction usually occurs in unstressed positions. However, the analyses of this kind, which only emphasize the role of stress, have been attacked by different approaches that deal with other factors for vowel reduction. Along with the development of phonetic and cross-linguistic studies such as Crosswhite 2001, Flemming 2005 and Burzio 2007, other factors such as the interaction between consonant and vowel, pitch accent and frequency effect are examined within various frameworks. Therefore, some relevant examples are given below.

First of all, the list of possible factors for vowel reduction is shown in (71) below.

(71) Some factors for vowel reduction

a. Stress: only unstressed vowels get reduced

b. Frequency: vowels in more frequent words tend to be reduced more easily than those in non-frequent ones.

c. Syllable type: vowels in open syllables are easier to be reduced than those in closed syllables.

d. Position in word: vowels in word-final position tend to be reduced

e. Vowel quality: high vowels are not as likely to undergo reduction as non-high vowels

f. Interface between V and C

g. Phonetic factors

As listed in (71), the role of stress has been considered as one of the main factors influencing vowel reduction. In other words, the lack of stress easily causes the change of vowel features. In addition, all of the traditional studies (Lass & Anderson 1975 and Hogg 1992) mainly focus on the relationship between syllable quantity and stress. For example, these studies claim that long vowels in OE are shortened in weak syllables (in this case, weak syllables have no stress). On the other hand, the frequency effect can also be one of possible factors for vowel reduction. It is well known that high frequency words are easily subject to ongoing phonological changes to a greater extent or at a faster rate than low frequency words (Hooper 1976, Bybee 2000). According to Bybee (2000), a reduction process in phonology has an effect on lexical items in terms of production. High frequency items thus have more exposure to the articulatory forces of production and after all they undergo change such as reduction at a faster rate.

Furthermore, some factors such as syllable types and position in word may be treated as one type of reduction categories. As shown in the list above, vowels in open syllables are reduced more easily than ones in closed syllables. At the same time, vowels in the word-final position tend to be reduced. Therefore, it is very likely that vowels in word-final open syllables are subject to reduction process. Furthermore, phonetic factors such as the durational difference and the measurement of vowel energy relatively recently have become one of the main cues for vowel reduction (e.g. Flemming 2005). Finally, the interaction between vowel and consonant is also treated as an important factor for vowel reduction (e.g. Burzio 2007).[76]

4.3.1.1 *Minkova (1991)*

Minkova (1991) gives analysis of the linguistic entity represented by *–e* in ME. In her view, the degree of reduction of unstressed vowels varies depending on whether they appear in syllables preceding or following the stressed syllable. From a cross-linguistic perspective, there is a "widespread trend for weakening of the pronunciation from the beginning of the word towards its end" (Minkova 1991). To make it clear, she cites Bolinger's (1981) argument in her book. Bolinger (1981) distinguishes between two types of reduction, which are stable and unstable reduction. These are differentiated by the position of the unstressed vowel. Bolinger (1981) also indicates that "Stable reduction is typically found in the final syllables. It is also in the final syllables that reduction tends to stabilize most quickly. In other positions, reduction is less stable and one may be able to speak of alternations, where this wavering is most noticeable is in initial, immediately pre-tonic position".

[76] Some relevant works were critically reviewed in chapter 2 and more details concerning theoretical issues are presented later in this chapter.

She also states that the incipient reduction of the originally full vowels in syllable following the first root syllable is due to lack of stress. Diachronically, lack of stress has had the consequence of phonetic reduction. With this in mind, she introduces another argument claimed by Bolinger (1989). According to Bolinger (1989), he attempts to account for a vowel reduction by stress assignment. Namely, the reduced vowels form their own independent system and are not capable of attracting stress. Therefore, absence of stress is considered as a consequence of the reduced vowel system.

Syllable quantity can also be a factor vowel reduction in the history of English. It has been suggested by Minkova (1991) that *–e* disappeared early after long root syllables such as *hōli* 'holy'and *hārdi* 'hardy', but not after short root syllables such as *manie* 'many' and *bisie* 'busy'. This just shows the deletion, but assumption can be made that vowel reduction could happen first in this environment, and then the reduced vowel could disappear. Therefore, this example is put into the scope of reduction at this moment.

4.3.1.2 *Burzio (1994, 2007)*

Burzio argues that the perceptibility of vowel distinctions usually decreases due to the reduced energy of unstressed vowels, causing the neutralisation of vowel distinctions. At the same time, he also proposes that stress is a necessary but not sufficient condition for vowel reduction in English, since there are certainly non-reduced vowels among the unstressed syllables. In line with this argument, he claims that the weakening of perceptual properties causes a vowel and a consonant to be neutralised into [ə] and to an unmarked oral place respectively. So then, what is the weakening of perceptual properties? He accounts for this concept by suggesting the dispersion theoretic approach (Steriade 1994a, 1997). Contrasts are

neutralised where the perceptual property is weakened, and these phenomena typically occur in the coda positions for consonants and in the unstressed positions for vowels. This argument is simply linked to Flemming's idea in the previous chapter. What Fleming suggests is that there are constraints adopted for vowel reduction: to maximize the distinctiveness of contrasts; to minimize articulatory effort; to maximize the number of contrasting vowels (These constraints are also related to Burzio's ones below).

However, some unstressed vowels fail to reduce when followed by a non-prevocalic, non-coronal obstruent. (Compare Adiróndack, Connécticət). This means that there must be a special relationship between the vowel and the coda consonant. These data needs further detailed investigation. In the final syllable, two different environments like vowel + velar and vowel + stop are presented. The former does not show the vowel reduction because it is satisfied with the condition shown above (velar: non-prevocalic non-coronal obstruent), but the latter shows the reverse. Then, how do these non-prevocalic non-coronal obstruents prevent vowels in an unstressed syllable from neutralising (reduction)? Some constraints are provided to manage this matter. They are shown in (72) below

(72) Constraints related to the interaction between consonant and vowel when unstressed (Burzio 2007).

- Ident-P: The consonant place specified in the input, in terms of distinctive features or their acoustic correlates, must be present in the output.

- Delta E: Maximize the energy difference between stressed and unstressed vowels.

If Ident-P is ranked highly, Delta-E is unavoidably violated to give optimal form. If a vowel is reduced, it also causes a coda consonant to neutralise to an unmarked oral place, which goes to the violation of Ident-P. Therefore, a vowel in an unstressed syllable does not turn to schwa in this environment. In sum, it is observed that V-to-C relations can be a critical cue for vowel reduction.

4.3.1.3 *Griffen (1998)*

Griffen suggests that vowel reduction is a phenomenon in which the vowel in an accented syllable is shifted toward the mid-central position when the accent is removed from the syllable. According to him, the accent consists of two phonetic features: stress and pitch. He then argues that vowel reduction is attributed to pitch accent rather than stress. It is a somewhat different argument from the definition of vowel reduction in this dissertation, so it is dealt with in detail. He uses Welsh, a language that contains two separate accent systems, to support this analysis. In Welsh, while the primary stress occurs on the penultimate position the primary pitch occurs on the final position. When we look at the data such as *byr* 'short', *byrder* 'shortness' from Welsh, the final vowel of the word *byr* maintains its own quality which is [ɨ], but the penultimate vowel of the word *byrder*, which has primary stress, has been reduced to [ə]. In this way, vowel reduction in Welsh is seen to be caused not by the absence of stress in the syllable, but by the loss of the high pitch accent.

It seems that Griffen's argument is reasonably straightforward, but there are some drawbacks in it. For example, Hannahs (2007: 250) argues that schwa in Welsh does not represent a reduced vowel. In addition, it seems that Griffen's data is too restricted in terms of the cross-linguistic perspective. For instance, even though some languages such as Welsh show evidence about vowel reduction that is due to the loss of the pitch accent, there are few

languages depending on the condition of this kind. Finally, Welsh also shows that vowels tend to be reduced in unstressed syllables although we can see some counterexamples above. Therefore, the pitch accent may be one of several possible factors for vowel reduction, but it is not a dominant or an important factor on its own as it stands.

4.3.2 *Diachronic aspects of vowel reduction*

In this subsection, I present an interesting data from one dialect of OE, showing a seemingly counterexample against the general argument about the relation between stress and vowel reduction. This is called the Great Kentish Collapse, and it is illustrated in this section.

4.3.2.1 *Great Kentish Collapse*

In the previous sections, it is repeatedly argued that vowel reduction can occur in unstressed position, and this claim has been supported by various traditional handbooks and discussions in theoretical phonology. However, from a diachronic point of view, one challenging phenomenon arises when a certain dialect of OE is concerned. In fact, Kentish shows a somewhat different situation with respect to the reduction process. It has been observed that there occurs a reduction-like phenomenon in stressed syllables, especially for the set of front vowels. In order to develop this particular phenomenon clearly, a vowel inventory in pre-OE is presented first, and the development of Kentish vowels is then illustrated below. In pre-OE, we would get the maximal set of front vowels as shown in (73) below.

(73) Front vowels in pre-OE

- i y e ø æ / i: y: e: ø: æ:

In short, this set of (front) vowel inventory had become reduced depending on the development of individual dialect of OE, which later led to the separation of these dialects.[77] However, the striking change among OE dialects occurs in Kentish. Let us see how vowels in Kentish are changed in (74).

(74) The development of vowels in Kentish (Anderson 1996)[78]

a. West Germanic /a:/ > /e:/, not /æ:/: *mege* 'kinsman'
b. West Gemanic /a/ > /e/, not /æ/ (when in a first fronting environment): *glednes* 'gladness', *efter* 'after'
c. West Germanic /ai/ > /e:/, not /æ:/ (when i-mutated): *gedele* 'distribute'
d. West Germanic restored /a/ > /e/, not /æ/ (when i-mutated): *hlet* 'load'
e. Pre-OE /o:/ > /e:/ (when i-mutated): *oferferdan* 'cross'
f. Pre-OE /o/ > /e/ when i-mutated): *efst* 'hurry'
g. Pre-OE /u:/ > /e:/, not /y:/ (when i-mutated): *brecð* 'enjoy', *drege* 'dry'
h. Pre-OE /u/ > /e/, not /y/ (when i-mutated): *gerdels* 'girdle', *gelden* 'golden'
i. Pre-OE /i/ (immediately preceded by /w/ > /e/ (when i-mutated): *werðnes* 'dignity'

Turning to the main point of this current research in Kentish, all front vowels in stressed syllable appear as mid-front /e/ (Kentish *hēdan* 'hide', *clēne* 'clean' vs West Saxon *hŷdan, cléne*. from Lass 1992). This phenomenon is traditionally called the Great Kentish Collapse. At first glance, it seems that a phonological development of this kind in Kentish

[77] For example, /æ/ undergoes second fronting in Mercian to /e/, and /ø/ in West Saxon undergoes unrounding to /y/.

[78] Basically, these developments in Kentish have been discussed by previous works such as Luick (1921-1940) and Campbell (1959). For instance, Luick mentioned that the Kentish developments of this kind above are regarded as an individual process in relevant contexts. In addition, according to Campbell, it is simply because Kentish affects front vowels (Campbell 1959).

dialect is quite similar to a general definition of vowel reduction where it shows that vowels are falling together, becoming less peripheral, neither high nor low.

However, there is a difference between Kentish development and others in some ways. For instance, this Kentish vowel reduction becomes problematic when we look at this phenomenon more carefully because it takes place in stressed syllables. Namely, vowels in stressed syllable are merged into /e/ in Kentish dialect. In addition, this merger, from all vowels to /e/, completely removes vowel contrasts in stressed positions. On the contrary, in non-Kentish dialects, vowels are reduced in unstressed syllables as usual, but it does not really affect the vowel inventory of that dialect. The following is an example of non-Kentish English.

OE: *æfter ~ æftor*; *sunu ~ sune*; *heafod ~ hæued* (Lass 1992)

These examples show that vowels in unstressed syllable merged in one value, usually spelled <e>. The interpretation of these <e> spellings in unstressed syllables would normally be the 'neutral' vowel [ə]. However, vowel contrasts still exist in this dialect, regardless of how vowels in unstressed position merged into the colourless vowel [ə].

Therefore, vowel reduction phenomenon is intrinsically associated with weak positions, whereas vowel merger or change in stressed syllables shown in Kentish dialect should be treated as not reduction process but vowel collapse as reflected in its name, Great Kentish Collapse.[79]

[79] The point of the Great Kentish Collapse is that vowels in Kentish dialect show somewhat unique change in the history of English. In fact, GKC and OE vowel reduction are just different phonological process in many points. What I was trying to show by comparing two different phenomena in this subsection is that it seems that one of explanations regarding vowel reduction looks similar to the

4.3.2.2 *Vowel reduction in other languages*

A positive argument for stress being the most important factor to define vowel reduction was discussed in this subsection. In addition, it is worth noting that the fact that stress is a necessary but not sufficient condition for vowel reduction is also considered. This definition such as 'Stress can be a necessary but not a sufficient one' can gain more power when languages other than English are considered. For instance, in the view of cross-linguistic perspective, some languages such as Finish, Hindi, and classical Spanish still have the unreduced vowel in an unstressed position. On the other hand, a language like Slovene has a reduced vowel in the stressed position (e.g. /e/ appears as a schwa vowel [ə] in stressed environments. After having seen these evidences, one can conclude that stress cannot play a role for the reduction process in these languages. It could be right in part, but except for those particular situations, most languages allow unstressed vowels to be reduced. In addition, expect in very rare cases, reduced vowels in any languages are always located in the unstressed position. After all, stress can still be regarded as a decisive factor for vowel reduction, and possibly the most dominant one among the various factors when dealing with vowel reduction.

4.4. Theoretical Analysis

In this section, the optimality-theoretical analysis of vowel reduction with special attention to Old and Middle English is demonstrated. In addition, the phonological vowel

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change in the Great Kentish Collapse, namely vowels becomes less peripheral, neither high nor low (e.g., vowels become /e/ in this dialect.). I do not simply argue that the Great Kentish Collapse is not regarded as vowel reduction since it takes place in stressed positions. On the contrary, they are different phonological processes occurred in different regions, even though their similarities may be found in some ways.

reduction and phonetic vowel reduction are compared in terms of constraint-based approach. In short, phonetic vowel reduction indicates that this weakening usually results in a qualitative and an articulatory change of vowels. On the other hand, a phonological vowel reduction concerns a phonemic change of a vowel inventory in general. I think both approaches should be treated as an important condition in understanding the nature of reduction process. Therefore, some relevant data in OE and ME with respect to vowel reduction are discussed, and how OT deals with these data is also demonstrated.

4.4.1 *Previous analyses*

A number of previous approaches have dealt with vowel reduction within different frameworks. It can be divided into three sub-parts: phonetically-based approach, system-changing approach, and traditional approach. Each approach has its own definition of vowel reduction by adopting different theoretical frameworks. In order to understand vowel reduction in detail, these previous works are reviewed and discussed here.

4.4.1.1 *Phonetically-based model of vowel reduction*

Vowel reduction has been a common topic in phonetic research since vowel reduction itself results from various phonetic factors such as sonority, duration, loudness and articulation. In this regard, Flemming (2005) suggests an analysis of a phonetically-motivated vowel reduction by taking up Liljencrants and Lindblom (1972)'s generalization of vowel inventories in terms of a principle of maximal perceptual contrast between vowels. According to Flemming, vowel reduction is basically the neutralization of vowel contrasts in unstressed syllables. More specifically, in his view, vowel reduction principally removes height

contrasts, and only removes backness or rounding contrasts under restricted conditions in terms of the cross-linguistic survey. Flemming (2005) argues that two essential constraints are adopted for analysing vowel reduction. For example, these constraints are motivated by phonetically-grounded principles: 1) 'the preferences to maximize the distinctiveness of contrasts' and 2) 'to minimize articulatory effort'. In addition, he also claims that there is another constraint, which is described as 'a preference to maximize the number of contrasting vowels'. The third constraint is actually originated from considerations of communicative efficiency because one vowel can carry more information by the increase of the number of contrasting vowels.

Vowel reduction occurs when these constraints conflict. Flemming (2005) insists that vowel reduction process is strongly related to vowel duration. For example, unstressed vowels are usually shorter than stressed ones, and thus it is more difficult to gain distinct vowel contrasts in unstressed vowel inventory than stressed one since vowel contrast is easily manifested when vowel duration is relatively long. Therefore, it is not possible to get the same number of vowel contrasts in stressed and unstressed syllables due to the difference of vowel duration.

4.4.1.2 *System-changing model of vowel reduction*

Crosswhite (2001) agrees with Flemming's argument that vowel reduction changes the pattern of vowel contrasts. However, there is dissimilarity between two analyses. Flemming argues that vowel reduction process leads vowel contrast to be neutralised, particularly in unstressed positions, and neutralisation of vowel contrast is probably the only option to take in this analysis when reduction occurs. On the contrary, Crosswhite claims that vowel

reduction can either reduce vowel contrasts or change the system of a vowel inventory. Crosswhite (2001) shows the most inclusive explanation of vowel reduction patterns by applying the OT framework. Therefore, in order to capture the characteristics of phonological vowel reduction in terms of the Optimality-theoretic approach, Crosswhite's (2001) work is reviewed here.

In general, OT approach has tried to find out the general motivation for unstressed vowel reduction, and to develop a factorial typology generating all and only attested patterns vowel reduction through the reranking of constraints or particular constraint types (especially in Barnes 2006). The assumption that the phonological grammar must be responsible for both modeling individual competence and for producing a full accounting of crosslinguistic phonological typology is central to the program of Optimality Theory (Prince and Smolensky 1993).

In Crosswhite (2001), she intends to make a typological survey of vowel reduction patterns in the languages of the world. Crosswhite claims that two types of vowel reduction are distinguished with respect to both in their phonetic motivations and formal implementations. These two different types of reduction patterns are called contrast-enhancing reduction and prominence-reducing reduction in unstressed positions respectively. First of all, contrast-enhancing vowel reduction is a neutralisation process whereby "undesirable or perceptually challenging vowel contrasts are limited to the stressed position." (Crosswhite 2001: 22). Vowel reduction of this find is found in a language like Algueres Catalan. In this language, mid vowel /e/ and /o/ in the unstressed syllable is reduced to /a/ and /u/ respectively. This type of reduction can increase vowel contrastivity. Therefore, the definition of contrast-enhancing vowel reduction is derived from the licensing-by-cue

approach to the positional neutralisation argued by Steriade (1994). According to Steriade, contrasts are set out by speakers only in positions where the phonetic cues which make those contrasts perceptually robust are present and strong. In addition, Steriade (1994) identifies duration as the phonetic cue most indispensable for accurate perception in terms of contrasts of vowel-quality. In this way, the most perceptible vowel contrasts will easily be licensed in less durational position, while the whole inventory of contrasts may be realized in stressed vowel inventory.

Following Steriade's argument, Crosswhite gives her arguments by showing two essential questions: why specifically mid vowels are targeted by so many reduction systems, and why the resulting systems of unstressed vowels are so often /i, u, a/. For this argument, some previous studies on the basis of phonetic analyses on cross-linguistic regularities in the shape of vowel inventories are needed. These are described as follows: optimal dispersion in the vowel space (Liljencrants and Lindblom 1972; Flemming 1995), the quantal stability of the corner vowels, meaning the tendency to keep stable acoustic realizations even with a degree of articulatory variation (Stevens 1986), and the tendency for certain pairs of formants to approach and enhance one another in each of the corner vowels (Stevens 1986), increasing their perceptual salience.[80] Among them, the perceptual salience is regarded as an important factor because peripheral vowels [i, u, a] are most favoured by contrast-enhancing unstressed vowel reduction. Crosswhite formalises these observations in OT using licensing constraints, formulated as follows:

[80] Consult Barnes (2006) for more details and theoretical backgrounds.

(75) Constraint on contrast-enhancing vowel reduction (Crosswhite 2001, repeated from (19) above)

- Lic-Q/ß: The vowel quality Q is only licensed in context ß.

Where Q = any vowel quality or a natural vowel class

ß = any context that enhances the perception of Q

In the case of unstressed vowel reduction, a typical contrast-enhancing constraint is in (76).

(76) Lic-Noncorner/Stress: Non-corner vowels are licensed only under stress (Crosswhite 2001).

The effect of this constraint is to ban the realization of mid vowels categorically from unstressed syllables. An example of a system produced by the interaction of this constraint with general faithfulness constraints on the relevant features

The second type of vowel reduction system Crosswhite proposes is prominence-reducing (unstressed) vowel reduction. While the contrast-enhancing reduction is subject to eliminating indistinct contrasts from positions in which they are unlikely to be perceived well, the core of prominence reduction is the removal of particularly loud and lengthy vowel qualities from unstressed syllables. For example, Bulgarian shows an example of the prominence reduction. In Bulgarian, /e/ reduces to /i/, /o/ to /u/, and /a/ to /ə/ respectively in the unstressed position.

The basic idea of prominence reduction is that prominent positions should match prominent segments, while non-prominent segments should be placed on non-prominent positions. Even though the concept of prominence is varied, Crosswhite (2001) considers

prominent segments as those which are more sonorous, where sonority is a complex property of segments derived from a combination of phonetic factors, including at least duration and low-frequency amplitude. In other words, prominent positions for purposes here are stressed syllables. In view of OT, prominence reduction is realised in a similar generalisation where Prince and Smolensky (1993) use to derive the role of sonority in syllabification. Crosswhite assumes two phonetic scales, one of accentual prominence and the other of vowel prominence, as shown in (77) below.

(77) Phonetic scales for prominence-reducing unstressed vowel reduction (Crosswhite 2001)

a. Accentual Prominence:

stressed > unstressed

b. Vowel Prominence

a > ɔ, ɛ > e, o > i, u > ə

The first scale in (77a) indicates the fact that the stressed syllables are more prominent than the unstressed, while the second in (77b) presents the familiar sonority hierarchy (Prince and Smolensky 1993). The contrast-enhancing unstressed vowel reduction is actually attested in various languages of the world, but in this section, the prominent-reducing vowel reduction is more applicable to the data in ME. For instance, from the ME data such as *sōne* and *dogge*, it is argued that the final position would be the non-prominent position; therefore, non-prominent vowels should be aligned by prominence constraints.

The essential idea of Crosswhite (2001) is that there are two different motivations for vowel reduction depending on languages. However, the problem arises in some languages, as Crosswhite has already stated. In a language like some Russian dialects, two types of

reduction described occur in the same language. It means that these two constraints should figure out whether which one is stronger than the other, because they target same vowels which are in unstressed position. The solution that she provides us here is that prominence reduction is limited to extra short syllables which occur in different places in different languages: for example, Russian: all unstressed syllables except the immediately pretonic one. In contrast, Contrast-enhancing reduction can occur in unstressed syllables with normal duration. Her definition of vowel reduction is the neutralisation of two (or more) phonemic vowels when unstressed. In line with her definition, I think she tried to find the sub-inventory of vowels cross-linguistically when syllables are unstressed. That is, the number of vowels in vowel inventory is changed systemically.

Finally, there are two reasons that Crosswhite's work should be reviewed in this chapter. Firstly, she shows a vast range of vowel reduction across the world and this gives us a better understanding of vowel reduction in general. Secondly, both contrast-enhancing sonority-increasing vowel reduction proposed by Crosswhite can be accounted for within the theoretical analysis I propose here. In other words, Crosswhite divides vowel reduction into two groups and gives us OT account with different constraints and rankings respectively. In this thesis, *COMPLEX[Element] constraint can provide a unified account among those seemingly different reduction phenomena.

4.4.1.3 *A traditional approach to vowel reduction*

Linguistic phenomenon of weak syllables shows a quite different picture from that of the strong ones in the history of English phonology. According to Lass (1994), the weak position is the main place for the shortening of long vowels, deletion of short vowels, cluster

simplifications, and loss of final segments. In addition, he also claims that there is a kind of 'cause and effect' relationship between the initial stress and the post-stress loss. In Krahe (1963)'s argument which is cited by Lass, the cause of these weakening processes is the strong dynamic initial accent.[81] Lass (1994) proposes that there are at least three crucial tendencies in weak syllables. First of all, complex nuclei should be simplified in weak syllables. Therefore, long vowels are shortened and diphthongs are monophthongised to short vowels. Second of all, short vowels are lost in this particular environment. Finally, the articulation of vowels is modified in weak syllables. In other words, if unstressed vowels in word-final position are not deleted, they are shown as corner vowels such as /i/, /u/ and /a/.

Hogg (1992) also presents a general description of vowel reduction in the history of English. In effect, there is one single and apparent trend which applies not only to the OE period but also to the history of English as a whole. This trend is illustrated as follows: sounds tend to be reduced so that, for instance, long vowels become short, short vowels lose their distinctive phonetic properties and merge as the reduced vowel schwa, and the shortened ones are lost. At the time of OE, a merger between vowels often appeared in unstressed syllables. For example, front vowels in the unstressed position merged together as /e/. In addition, /i/ and /æ/ are merged as /e/. This /e/, which resulted from the merger, should be discussed with respect to vowel quality. Within this traditional approach, this merged /e/ is defined as a phenomenon where the vowel in the unstressed syllable is shifted toward the mid-central position such as schwa [ə]. Then, why is this merged vowel a schwa? The answer to this question is illustrated next.

[81] However, this argument is undetermined by other evidence. For instance, many languages have initial stress, but there is no such weakening processes at all in that position.

First of all, prosodically or morphologically weak positions are targeted for reduction. Unstressed syllables or affixes are the most probable position of this kind. For example, when the vowel is in a stressed syllable like *able*, it is pronounced as [eibl]. However, if the same vowel is in an unstressed position like *available*, it is realized as the reduced or centralized mid-central vowel like [əveiləbl]. Second, a reduction process usually involves the neutralization of vowel contrasts. In other words, it shortens the size of the vowel systems that exist in strong positions. For example, Anderson (1994) argues that an unstressed position typically displays a system of contrasts no greater than that associated with a stressed position. Most traditional analyses adopt this trend. Therefore, he claimed that vowels in unstressed syllables in OE tended to be reduced; Long vowels > short vowels, short vowels > lost their phonetic characteristics or merged. This merged vowel thus can be a schwa.

4.4.2 *Alternative analysis*

In this subsection, I propose a theoretical analysis of vowel reduction within an integrated theory of Element and Optimality Theory. As dealt with so far, this PhD thesis intends to offer a unified account of weakening processes (e.g. consonant lenition and vowel reduction) in English. In chapter 3, a combined OT constraint such as *COMPLEX[Element] played a central role in accounting for voicing process in English while providing the interaction between *COMPLEX[Element] and its corresponding faithfulness and markedness constraints. To achieve the main goal of this thesis, *COMPLEX[Element] is employed once again in order to explain how vowel reduction phenomenon is resolved by constraint interaction within OT. By doing so, we can probably claim that a unified theoretical

mechanism works for two different phonological processes such as consonant lenition and vowel reduction.

4.4.2.1 *AIU model*

4.4.2.1.1 *Vocalic elements*

In an element-based approach, elements are considered to play a prominent role in the representation of segments. For vowels, there are three basic elements such as I, U, and A. Each element stands for its own phonetic feature. For example, [A] stands for *a*, [I] for *i*,and [U] for *u* respectively. In addition, other vowels can be derived from a combination of these basic elements. For instance, *e* consists of [A, I], *o* [A, U] respectively. In this way, every vowel can be represented within AIU model.

To establish full range of vowel inventory, dependency relations between elements need to be accounted for. In much the same fashion as the previous formation for consonants, this particular configuration makes this model express the whole set of vowel in the system. In dependency relations of this framework, the head element can be expressed by underlined one (e.g. *e* = [I, A] *o* = [U, A]). One good example regarding dependency relations is seen at the Great Vowel Shift in Modern English (Harris 1994: 106). In Great Vowel Shift, vowels are enormously changed within the English vowel inventory. Among them, /æ:/ is changed to /e:/ (e.g. ‘mate’) and /ɒ:/ to /o:/ (e.g. ‘boat’) respectively. However, some problem arises with these examples. Pairs of *æ* / *e* and *ɒ* / *o* are exactly the same in terms of their elemental make-up. These are described below.

(78) Harris (1994: 106)

(a)	æ:	>	e:	(b)	ɒ:	>	o:
	x		x		x		x
	I		I		U		U
	A		A		A		A

As shown in (78), dependency relations can give an answer for representing various vowel qualities. However, before we describe full vowel inventory in English, the neutral element is also handled here. The neutral element [@] may simply be connected to schwa. Schwa vowel is expressed as the element [@] alone. This neutral element is interpreted as various ways according to different theories. For instance, this [@] element is roughly equivalent to 'centrality' in Dependency Phonology (e.g. Anderson & Ewen 1987), the 'cold' vowel in Government Phonology (e.g. Kaye, Lowenstamm & Vergnaud 1985), and 'empty' segment missing any vocalic feature in Particle Phonology (Schane 1984). In element theory, [@] is affiliated to non-peripheral category which can be interpreted as non-palatal, non-open, and non-labial (Harris 2005: 24).

Now, the English vowel system is illustrated in terms of element-based approach.

(79) English vowel system[82]

i	[I, @]	U	[U, @]
ɪ	[I, @]	ʊ	[U, @]
e	[A, I, @]	o	[A, U, @]

[82] Diphthongs are excluded here because they are not the focus of this research.

ɛ	[A, I, @]	ɔ	[A, U, @]
æ	[A, I,@]	ɒ	[A, U, @]
ʌ / ə	[@] / [@]	a / ɐ	[A, @] / [A, @]

4.4.2.1.2 *Vowel reduction in Element-based approach*

Within the AIU framework, vowel reduction is represented as the suppression of vocalic elements. According to Harris (2005), vowel reduction yield two different vowel systems, for instance, centralized values or the corner values *a, i, u.* Harris argues that he tried to find out the unified account for these two vowel systems. On this basis, Harris makes a general definition of vowel reduction. First of all, vowel reduction process target positions that are prosodically or morphologically weak, in fact unstressed syllables or affixes. Second of all, a reduction phenomenon neutralizes contrasts, invoking contracted versions of vowel systems that occur in strong position. The core of vowel reduction on this analysis is to lose the phonetic information. In short, a reduction decreases the amount of phonetic information carried by vocalic speech signals. Both Flemming and Harris assumed that the acoustic effect such as speech signal, vowel duration and perception can have a decisive role for vowel reduction. They analogously insist that it is impossible to realize the same number of vowel contrasts in stressed and unstressed syllables because of the nature of the reduction process. Consequently, the number of vowels on unstressed positions is declined in terms of the vowel inventory.

A centralised version of vowel reduction seems to be active in English. Let me show one example of English vowel reduction in (80) below.

(80) Vowel reduction in English

a > ə ‘available [əˈveɪləbl]’

N N
| |
x > x
| |
A |
| |
@ @

In (80), vowel reduction is expressed by the loss of the element [A]. In the next subsection, some OE data regarding vowel reduction will be pursued.

4.4.2.2 **COMPLEX[Element] and a combined theory of vowel reduction*

In this subsection, a combined analysis of Element and Optimality theory is illustrated with OE and ME data. As illustrated above, vowel reduction occurs in unstressed vowels in OE. Therefore, ME data shows that vowels in word-final positions (where stress is not assigned) change their vocalic value. First of all, the relevant constraints are represented in (81).

(81) Element-based constraints

a. *COMPLEX[Element]: Assign one violation mark for every complex element in a segment.

b. IDENT I-O[Element]: Assign one ‘*’ to any pair of corresponding input and output segments that do not agree with the number of ‘element’.

Then, the constraint ranking with respect to vowel reduction is illustrated using the following tableau in (82).

(82) Vowel reduction

Input /e/	*COMPLEX[Element]	IDENT I-O[Element]
a. [e] - [A, I, @]	!***	
☞ b. [ə] - [@]	*	**

In this tableau, the underlying form /e/ surface as [ə] by the ranking that markedness constraint outranks its corresponding faithfulness constraint. However, *COMPLEX[Element] cannot be satisfied with OE data since it may affect stressed vowels . In other words, this particular markedness constraint should be operated with unstressed vowels. Therefore, *COMPLEX[Element] needs to be revised.

(83) *COMPLEX[Element](ŭ: unstressed vowels): Assign one violation mark for every complex element for unstressed vowels.

Now, unstressed vowels in (80) are only targeted by this constraint. It has been suggested (e.g. Hogg 1992 and Lass 1994) that a large number of words underwent a vowel reduction process during the period between OE and ME. The question under consideration is that why and where this reduction process occurs. First of all, vowel reduction in OE would usually occur in the final position of words. In other words, it occurs on the unstressed syllables because stress usually tends to go to the first syllable in OE. In addition, there is a spelling change, which means that the final vowel in unstressed positions is changed into <–*e*> in the identical way. The feature of this <–*e*> spelling can be defined as the centralized (non-high or low).

(84) Unstressed vowels in ME

*sōn**e*** ‘at once’	*COMPLEX[Element] (ŭ: unstressed vowels)	IDENT I-O[Element]
a. [e] - [A, I, @]	!***	
☞ b. [ə] - [@]	*	**

In this way, vowel reduction from OE to ME can be resolved through the interaction between *COMPLEX[Element](ŭ: unstressed vowels) and IDENT I-O[Element].

4.5 Summary

In this chapter, I dealt with Optimality-Theoretic analysis of vowel reduction with special attention to data from OE and ME. Most importantly, unstressed vowels in OE are targeted by constraints such as *COMPLEX[Element](ŭ: unstressed vowels), and in consequence of that, unstressed vowels in ME

An account of the vowel reduction in OE and ME within the frameworks of Element and Optimality theory is provided. First of all, stress plays a decisive role in vowel reduction phenomenon. In other words, it has been argued that presence or absence of stress is the key component for this weakening process even though there are some counterexamples that need to be considered.

The first aim of this chapter has been systematically to show how vowel reduction should be defined in terms of phonetic and phonological perspectives. First of all, various factors for vowel reduction were examined. For example, I have shown several potential candidates such as stress, duration, and the interaction between vowel and consonant. It is

suggested that stress is the most influential and important factor for vowel reduction among various conceivable factors. Furthermore, I presented a representational analysis of vowels in order to make it the argument clearer. More interestingly, some phonological process in Kentish dialect of OE, which seems to resemble the typical definition of vowel reduction presented in this chapter, is also discussed. Even though Great Kentish Collapse looks quite similar to what is referred to as vowel reduction in this current chapter, the phonemic change in Kentish should not be considered as a reduction process since its phonemic development is completely different from that of other dialects.

Next, an integrated analysis of OE and ME vowel reduction was provided. In this chapter, I argued that vowels in word-final unstressed position are positively affected by reduction process, especially in OE period. In line with this, some relevant constraints were presented such as *COMPLEX[Element](ŭ: unstressed vowels) and IDENT I-O[Element] in order to deal with those reduction processes.

Finally, the constraint *COMPLEX[Element] needs to be made more concrete here. As indicated in 2.3.4 above, I argue that the *COMPLEX[Element] constraints I use belong to a single constraint *family*, with differing members of that family applying to consonants and to vowels. In that way, the unification does not reside in the same constraint (e.g. *COMPLEX[Element]) governing both consonant lenition and vowel reduction, rather it lies in the fact that both processes result from the pressure to satisfy the constraints in the *COMPLEX[Element] family.

Chapter 5. Theoretical Historical Phonology

5.1. Introduction

In this chapter, we return to the original points stated in chapter 1 above. As mentioned, this thesis has two major points to be investigated. One is mainly concerned with a theoretical development of phonological enterprise. For instance, a unified account of two different phonological processes (i.e. consonant lenition and vowel reduction) has been proposed within the framework of Element and Optimality Theory, as illustrated in chapter 3 and 4. The other point of the thesis is to explain how a theory can work with diachronic data effectively. The first point has relatively fully been demonstrated in the previous chapters, but the latter one has not yet been considered in detail. In conjunction with the second point, the issue of 'what is the locus of phonological change' will also be investigated because this theme can possibly give us a partial answer for 'What is 'Theoretical Historical Phonology'. Therefore, these topics are explored in this chapter.[83]

5.2 Theoretical Historical Phonology I: What Is It?

In this section, a complementary relation between theory and (synchronic and diachronic) data is illustrated, by showing a relatively recent argumentation surrounding the

[83] There are, of course, remaining questions regarding the first issue, namely a unification of consonant lenition and vowel reduction. For example, a relation between weakening phenomenon and phonological constituents such as sonority, stress patterns, and (typological vs. phonetic) markedness needs still to be investigated more in detail. In addition, the constraint, *COMPLEX[Element] needs to be justified with more examples especially for lenition processes since in previous chapters a voicing process has solely been explored. While these issues will not be exhaustively investigated here, they will, of course, be investigated in future research.

question, ‘What is Theoretical Historical Phonology?’. Basically, linguistic theory has been developed in order to offer a better understanding of both linguistic changes (diachronically) and alternations (synchronically). A number of phonological theories have emerged as a tool to deal with sound system and change of human languages for the last few decades. In this regard, the next subsection titled ‘Theory of Phonology” will serves as a starting point for a discussion of phonological theory and its essential role of data analysis.

5.2.1. *Theory of phonology*

It has generally been presented that two different types of theoretical approaches are addressed when we deal with phonological processes: rule-based approach and constraint-based approach. We have touched on this issue in chapter 2 above, but in this subsection, I take this topic again since it helps us understand topics of this current chapter. As seen in previous chapters, each theoretical approach has its own unique system handling various phonological processes. In this subsection, these theoretical mechanisms are partly illustrated below, and by doing this, we can see how theories work with data. What is more, we try to understand how they differently deal with data and what theoretical analysis mean in terms of language change.

Rule-based theoretical approaches have been developed since Chomsky & Halle (1968) launched the early generative phonology. Since then, many linguists have proposed different versions of generative phonological theories on the basis of *The Sound Pattern of English* (1968). In general, rule-based analyses build a set of rules and rule ordering, and derive a surface form from an underlying form by applying it to a (rule-based) derivational modelling. In this subsection, Lexical Phonology (Kiparsky 1982, Mohanan 1982) is exemplified in

order to show how a rule-based model works well on linguistic data. In Lexical Phonology (henceforth, LP), some phonological rules are inviolable and can be applied either cyclically or non-cyclically depending on their cyclic domains. In this way, derivational mechanism and cyclic/non-cyclic rules in LP can give us a hint for how a certain set of rules can act as a decisive role in phonological processes. A relevant example is given below in (85).

(85) An example of LP with English word 'divinity' (Mohanan 1986)

Lexical module		
[dɪviin]	[ɪtɪ]	Underlying Representation
[dɪvˆin]	___	Stress Assignment
[[dɪvˆin] [ɪtɪ]]		Affixation
[[dɪvˊn] [ɪtɪ]]		Trisyllabic Shortening
[dɪvˊnɪtɪ]		Lexical Representation
Postlexical module		
[dɪvˊnɪɾɪ]		Flapping
[dɪvˊnɪɾɪ]		Phonetic Representation

In (85) above, a set of rules appear and are ordered, and applied to data in consecutive order. Interestingly, there are two cycles in this derivation: the lexical module and the postlexical module in (85). It simply shows that phonological rules in LP are divided into two levels, namely one only available in lexical level and the other can be active after the end of derivation in lexical level (postlexical division). As shown in (85) above, flapping always occurs in intervocalic position can only affects words when these items are applied to all lexical rules. At this point, we will consider no further details of lexical and postlexical levels

of derivation in LP because this is beyond the goal of current thesis, and we thus leave this LP-related matter in this subsection although it certainly demonstrates how rules work on linguistic data through derivation.[84]

Let me consider constraint-based approach. It is OT that represents a typical constraint-based framework in phonological literature. In short, OT is composed of a set of universal and violable constraints.[85] Constraints make a specific hierarchical ranking depending on languages and show conflicting nature each other (e.g. Kager 1999). Ultimately, this mechanism is essential to select an optimal output among possible input candidates. For instance, we can compare examples of voicing contrast in Dutch and English (Kager 1999: 14-17). Dutch does not have voicing contrast in final obstruents while English does. Let me illustrate how OT deals with two opposing phenomena and relevant constraint are followed in (86) below.

(86) Voice contrast in final position in Dutch and English (Kager 1999: 14)

a. *VOICED-CODA: Obstruents must not be voiced in coda position

b. IDENT-IO[voice]: The specification for the feature [voice] of an input segment must be preserved in its output correspondent.

With these two constraints, voice contrast in final position in Dutch and English is phonologically expressed below in terms of different constraint rankings.

[84] See Mohanan (1986) and Kiparsky (1982) for more details in LP.

[85] The key elements and mechanism of OT have been presented in Chapter 1 above.

(87) Voicing contrast in Dutch and English within OT framework

a.Neutralisation of voice contrast of final position in Dutch

/bɛd/	*VOCED-CODA	IDENT-IO[voice]
☞ a. [bɛt]		*
b. [bɛd]	*!	

b. Preservation of voice contrast of final position in English

/bɛd/	IDENT-IO[voice]	*VOICED-CODA
a. [bɛt]	*!	
☞ b. [bɛd]		*

The essential point we need to draw from those tableaux shown in (87) is that languages differ in their ranking of constraints as indicated above. Therefore, in Dutch, the output form [bɛt] is selected with respect to its constraint ranking (*Voiced-Coda ›› IDENT-IO[voice]) among potential candidates. On the other hand, in English, voicing contrast in final obstruents is preserved by the reverse ranking against Dutch one. In fact, *Voiced-Coda ranks lower than IDENT-IO[voice] in this language. Thus, the candidate [bɛd] is chosen as the optimal form of the input /bɛd/. Consequently, Dutch and English have separate segment types in final consonant position by different constraint ranking and interaction respectively.

Two different theoretical models such as a rule-based approach and a constraint-based one were illustrated in this subsection in order to show how a theory deal with phonological processes in their own ways. The following is the discussion of the role of diachronic data in phonological theory. After considering a theory and data in 5.2.1 and 5.2.2 respectively, we

then discuss the issue of how theoretical phonology can inform historical data. This will be touched on in 5.2.3 below.

5.2.2 *Historical data in Phonological change*

On the whole, there have been two traditions regarding linguistic fields: synchronic approach vs. diachronic approach. In this subsection, I mainly focus on what evidence there is for the diachronic approach are and how diachronic data can be linked with synchronic phonological theories. A fundamental question arises when diachrony is concerned in terms of linguistic discussion: how do linguists take advantage of historical data? According to McMahon (1994), if we want to understand a language better, we need to understand the change of that language. This statement entails some critical points to all subcategories of linguistics. For instance, in phonology, diachronic sound change and theoretical linguistic frameworks are subject to cooperation with each other in order to capture the nature of language. In this subsection, the development of /h/ in the history of English is briefly demonstrated as one example supporting McMahon's statement above.

5.2.2.1 */h/-deletion in OE*

Let me indicate some OE data below in (88) which often yield important changes in OE phonemic system.

(88) Allophonic distribution of /h/ in OE (Hogg 1992: §5)

a. [h]: *heard* ‘hard’, *behı́ndan* ‘behind’
b. [x]: *seah* ‘he saw’, *feohtan* ‘to fight’
c. [ç]: *miht* ‘might’, *ehta* ‘eight’

In (88) above, the three phonetic sounds of /h/ in OE have undergone different phonological changes throughout the history of English. In addition, the deletion pattern at each period differs in terms of their phonological environments. For example, Wright & Wright (1925) show different phonological environments for deletion pattern in OE as shown in (89).

(89) OE /h/-deletion (Wright & Wright 1925: §329)

a. Between a vowel and a following liquid or nasal

ēorod < **ēohrâd* 'troop'

hēla < **hôhila* 'heel'

wōne < *wōhne* 'perverse' (masculine, accusative, singular) / compare *wōh* (nominative)

b. Between a liquid and a following vowel

ēoles 'elk' (singular, genitive) / compare *eolh* 'elk'

wēales 'foreigner' (singular, genitive) / compare *wealh* 'foreigner'

c. Between vowels

flēan < **fleahan* 'to flay'

sēon < **sehan* 'to strain'

d. Between sonorant consonants

furlang furlong' < *furh* 'furrow' + *lang* 'long'

As shown in (89), /h/-deletion takes place in four different environments where these appear to be the site between sonorant sounds. However, the deletion of /h/ does not occur in the following positions as described in (90) below.

(90) No /h/-deletion in OE (Wright & Wright 1925: §325-328, Campbell 1959: §465)

a. Word-initial position

hūs 'house', *habban* 'to have', *hamor* 'hammer', *hēafod* 'head', *heard* 'hard',

heorte 'heart', *hīeran* 'to hear', *hungor* 'hunger', *hlaf* 'loaf', *hnīgan* 'to bend down'

b. Word-final position

hēah 'high', *nēah* 'near', *seah* 'he saw', *Þurh* 'through', *feoh* 'cattle, property',
rūh 'rough', *scōh* 'shoe', *tōh* 'tough', *wōh* 'preserve, bad', *wealh* 'foreigner'

c. Before voiceless consonants

brōhte 'he brought', *dohtor* 'daughter', *eahta* 'eight', *bohte* 'he bought', *cniht* 'boy',

feohtan 'to fight', *hleahtor* 'laughter', *lēoht* 'a light', *meahte* 'he might',
sōhte 'he sought'

d. In gemination

crohha 'crock', *heneahhe* 'sufficiently', *pohha* 'pocket', *tiohhian* 'to think, consider'

e. Root-initial stressed syllables

behíndan 'behind', *behéaldan* 'hold', *gehélpan* 'help', *tohéald* 'leaning',

tohrḗosan 'fall', *tohwéorfan* 'separate'

As shown in (90), /h/ is not deleted in those environments. When comparing data in (89) to those in (90), the phonological environments of both are clearly distinct. Namely, /h/-

deletion phenomenon can only take place when that sound resides in between sonorant sounds. However, this is not the end of story regarding /h/-deletion in OE when OE compounds are considered. In other words, OE compounds do not undergo deletion in the following environments where /h/ deletion is however expected.

(91) No /h/-deletion in compounds

a. Between vowels

hēah-ealdor 'a chief ruler', *nēah-ēaland* 'a neighbouring island',

hēah-engel 'an archangel'

b. Between a sonorant consonant and a vowel

Þurh-etan 'to eat through', *Þurh-irnan* 'to run through', *dur-here* 'folding door'

c. Between a vowel and a sonorant consonant

hēah-rodor 'the loft sky', *nēah-munt* 'a neighbouring mountain',

nēah-weat 'a piece of water that is near'

d. Between two sonorant consonants

Þurh-ræsan 'to run through', *furh-wudu* 'a fir-tree'

At this point, I briefly consider the interaction between phonological theory and historical data in OE. The presence of /h/ in (91) cannot be accounted for by environmental motivations (e.g. between sonorant sounds) in that /h/ acts differently in (89) and (91) respectively even though it seemingly appears at the same position. We can notice that some (morpho)-phonological effect (e.g. blocking effect at morpheme boundary) plays a role in the

case of (91) and this inconsistency between two examples shown in (89) and (91) is accounted for within a phonological theory. For example, Kim (2005) provides a prosodic template analysis of /h/-deletion phenomenon. According to him, /h/-deletion can be regarded as a phenomenon controlled by phonological conditions as well as morphological ones. Kim (2005) argues that /h/ is only deleted outside the template composed of the two-mora trochaic foot and subsequently makes a distinction between compounds and non-compounds in terms of this template framework. For instance, this framework accounts for the presence of /h/ in the second element of compounds such as *nēahēaland* shown in (91a).

(92) Template-based analysis of /h/-deletion in OE (Kim 2005: 433)

nēahēaland 'a neighbouring island'

↓

[*nēa*].[*heal*] *and*

In Kim's (2000) analysis, /h/ is not deleted since compounds in (92) consist of two templates and /h/ is within the second template. In this way, historical data is theoretically expressed in phonology. More importantly, this kind of collaboration between theory and history gives us a better understanding of our language and even its various aspects in present time. Further data will be followed with respect to /h/-deletion in the history of English.

5.2.2.2. */h/-deletion in ME*

/h/-deletion in ME has taken place several times at different stages. First of all, /h/ is deleted in the onset of stressed syllables when followed by another consonant (e.g. /hn-/, /hl-/, /hr-/, and /hw-/) in late OE and early ME. Before this happens, /h/ became weak

phonologically in preconsonantal position where those clusters such as /hn-/, /hl-/, /hr-/, and /hw-/ no longer alliterate with each other in late OE (Brunner 1965: §217). Secondly, about 12th century, /h/ is lost in prevocalic position in unstressed monosyllabic words. In particular, this affects forms of the personal pronoun and the neutral form hit which is attested without <h> as early as the Orrmulum (Luick 1921-40: §716.1 and Jordan 1974: §195). Finally, in the 14th and 15th centuries, /h/ is deleted in the coda of stressed syllables. Lutz (1985) states that this development is by no means consistent because different motivations take part in /h/-deletion in these periods. For instance, the influence of the phonological environment (e.g. coda as a weak position) plays a role in /h/-deletion, and analogical change and perhaps interference between dialects are also thought of as possible conditions. For instance, it is often observed (Luick 1921-40: §704, Brunner 1960: §378, and Wells 1982: 228-230) that /h/ is lost to a much greater extent in the southern dialects and in the standard language than it did in the northern dialects from a dialectal point of view.

Taking /h/-deletion from OE and ME into consideration, the phonological history of /h/ has attracted attention in the field of historical phonology. (e.g. Lass & Anderson 1975, Suzuki 1994, and among others). In other words, the study of deletion patterns within the framework of current phonological theories gives an idea of phonological structure in both early stages of English and in Present-day English. In the next section, relevant issues regarding this cooperation between theory and historical data in phonology will be discussed more in detail.

5.2.3 *The consequences of bringing theory and history together*

There are a number of relevant issues regarding the consequences of bringing together theory and history. One issue, for example, is to characterise what it is that theoretical historical phonologists do. The discussions in 5.2.2 give us a partial answer for that question; more details follow here. As presented in 5.2.1 above, there exist two different approaches (rule-based and constraint-based approaches) available to phonological processes, and these can also be applied to diachronic sound changes. In doing so, it would provide us one way of answering the question, 'how theoretical phonology can inform historical studies?'[86]

When diachronic change is considered in the field of linguistics, the question like 'how are diachronic changes characterised by theoretical linguistics?' may have often been followed. Generative frameworks suggest that language change can be treated as a relationship between different grammars. For example, Postal (1968) claims that it is not a sound itself but a grammar that undergoes certain kinds of changes. In line with this, one may argue that language change should be excluded from the aim of linguistic theory. However, there are good reasons to believe that sound change should be dealt with by phonological theory. For example, McMahon (2000a: 232) asserts that 'sound change' and 'synchronic phonological process' widely share their spectrum of interests, such as vowel shifts, metathesis, and insertion and deletion of segmental material. In addition, she also states that 'there is a practical problem of distinguishing of language change in progress' (McMahon 2000a: 232).

The discussion between the application of phonological theory and the explanation of historical sound change will give us a better understanding of the phenomena involved, and it

[86] This question may be transferred to 'how historical studies can inform phonological theory.' The crucial point from both questions is probably the same when these are considered within the framework of phonological theory.

also suggests that this is an area for further fruitful investigation to phonology in general (Holt 2003: 2). In relation to this point mentioned above, Hartman (1974: 123) gives us an important summary regarding the issue of historical change and phonological theory.

> ″Kiparsky (1965) and King (1969) - with the imprtus of Halle (1962) - have given us a theory of language change that differs from earlier theories in that it implies that language history is two-dimensional: that is, a historical grammar is not simply a list of sound-change laws in chronological order, but a diachronic series of synchronic grammars. Each synchronic grammar consists of a list of ordered rules, and historical changes include not only rule addition, but also rule loss, rule reordering, rule simplification, and restructuring of underlying forms. It is these additional types of change - principally rule reordering and simplification - that make phonological history different from synchronic phonology and thus interesting in its own right."
>
> (Hartman 1974: 123)

In rule-based theories, language change can be defined as a set of modifications of rule system which are described as rule addition, rule loss, reordering, inversion, and restructuring. There are attested examples for individual cases, but one instance of restructuring which I am most interested in is illustrated.

In the process of language acquisition, misformulation of adult's grammar can occur in a child's grammar. In fact, children might not recognise a rule at an earlier age. For instance, adults could contrast with /hw/ and /w/ in *whales* and *Wales* respectively in English, and this is consistent in Modern English such as Scottish English. On the contrary, in other dialects of

English such as Southern British English, there is a gradual merge between /hw/ and /w/, creating new rule (e.g. /hw/ → /w/ in onset position) in their adult grammar. (McMahon 1994: 42). Therefore, children in this dialect primarily hear /w/ in language development process. In other words, they learn language without previous history. Consequently, it leads children to a change of underlying representation between generations and further simplification of rule systems. This is one example of language change by restructuring in rule-based approach.

On the other hand, constraint-based theory has built a different mechanism from rule-based approach when diachronic data are analysed. For example, OT requires only surface evidence to meet the need for the proper grammar. Returning to the main issue, OT also deals with historical data to offer a better understanding of language change, even though its application to them may be rather different from rule-based approaches. According to Holt (2003), among various strategies in the OT framework, lexicon optimization is a one good example to illustrate how OT handles historical change. Under lexicon optimization, the least violated candidate among underlying forms might be selected by the learner in terms of constraint violations because this mechanism can urge the learner to minimize the violation of constraint, especially faithfulness at this point. In other words, the input which is the closest to the output form should be selected in OT.[87] Some relevant examples are shown below.

Especially in child language acquisition, children hear an output form that differs from the underlying representation which they have already made. Subsequently, he/she will store

[87] Inkelas (1995) presents that "Of all the possible underlying representations that could generate the attested phonetic form of a given morpheme, that particular underlying representation is chosen whose mapping to phonetic form incurs the fewest violations of highly ranked grammatical constraints."

that phonetic information in their mental representation. If it is persistently repeated, a hearer treats this new form as a lexicalising form since it can play the least violated form selected by the learner in their lexicon. This process can be described as lexical optimisation in respect of historical change. It actually violates the faithfulness constraint, but it is the way how children maximize the harmony of the grammar. Let me provide an example in German provided by Kiparsky (1965) regarding lexicon optimisation. Final devoicing of obstruents in German is very well-known phonological process. In terms of language acquisition process, this rule is learned via observation of alternations of the type *bun[t]:bun[d]e*; however, words like *ab, ob, weg* (i.e., a[p], o[p], we[k]) never alternate, so their final segments will always surface as voiceless via devoicing rule in German. In the end, when children acquire their language, they may eliminate the specification [+voice] from the underlying representation of the final segment of these forms, causing restructuring in the lexicon (Kiparsky 1965: 17).

Another significant issue regarding OT and diachronic change is the reranking of constraints. What OT basically assumes is that a an acquirer's phonetic input may lead to both reranking of constraints as well as to lexical restructuring via a principle of lexicon optimisation discussed above. OT is composed of a set of constraints which are violable and inherent conflicting mechanism between them. In this environment, if a hearer gets an output from a speaker which does not match with ranked constraints, he or she has a tendency to change the ranking of them. This is because a hearer wants to maintain the grammaticality of what he/she has heard. In this way, constraint reranking can cause language change between generations.[88]

[88] In constraint-based approaches, historical changes can be handled with the reranking of constraints. Namely, language change can be interpreted as grammar change over time, so grammar change can also be explained by the reranking of constraints.

In this section, I have attempted to show that there is a strong relationship between theory and history. First of all, it is represented that phonological theories, which have been developed in synchronic linguistics, can contribute to the understanding of a historical sound change. To put it in another way, we can also argue that historical data can deliver us a crucial hint for deciding on which theory is more useful or not when understanding our language. Secondly, I have discussed the basic issue of the field of theoretical historical phonology, by comparing two different arguments of sound change. Indeed, it gives us a comprehensive way of seeing what the problems are in the area of theoretical historical phonology, even while acknowledging that there are number of substantial problems to be investigated in future studies.

5.3 Theoretical Historical Phonology II: What is the Locus of Phonological Change?

As stated above in this chapter, the second part of my PhD research considers an essential question: what is the role of phonological theory in understanding diachronic phonology? In considering this question, I discussed complementary relationship between theory and sound change in 5.2 above. In this section, I raise further ongoing issues in theoretical historical linguistics which is tied in with discussion from previous section: where do weakening processes such as consonant lenition and vowel reduction occur? In other words, the locus of linguistic change needs to be considered in connection with the main question. As seen from the previous subsection above, some attempts have been made to offer a plausible explanation of this issue (e.g. Kiparsky 2003, Hale 2003, Sankoff 2003, Sankoff & Blondeau (2007), and Honeybone 2007). For example, Hale (2003) argues that a ‘change’ can be conceived as the set of differences between the grammars through

acquisition only. On the contrary, Honeybone (2007) insists that sound change can occur both acquisition and in the speech of adolescents. I intend to show how a unified understanding of phonological weakening processes weighs on this issue: where must weakening be situated in terms of phonological change?

5.3.1 *Various factors in phonological change*

In this section, I mainly focus on what sort of factors (e.g. age, region, etc.) there are for the phonological change and how they contribute to defining the locus of change in phonology. To begin with, two pairs of words from PE are given here to find out how some factors such as age and regional difference can influence sound change to a certain extent. Below are some revealing examples shown in (93).

(93) Phonetic variation in PE (British Library: http://ww/bl.uk)

a. *tune* / *dune*

b. *cóntroversy* / *contróversy*

The interesting fact here is that the word *tune* is pronounced differently between generations. For instance, a high percentage of older speakers in the UK would insert a [y] sound in between the initial consonant *t* and vowel *u* in *tune* and between *d* and *u* in *dune* respectively. Consequently, they pronounce these words like [tyu:n] and [dyu:n] respectively. On the contrary, speakers in young generation have a strong tendency to blend the consonant and [y] sound into a [ʧ] and [ʤ] respectively. In this way, the word *tune* might sound like [ʧu:n] and *dune* like [ʤu:n]. How do we deal with this difference between old generation and young generation? Does this difference indicate that a phonological change can only happen in young generation rather than old ones, or both?

Now, let me turn to the other example shown above. The pair of *cóntroversy* and *contróversy* shows some noticeable changes between different regions. For instance, according to data from British Library, older speakers across the UK are likely to stress the first syllable of the word like *cóntroversy*, while younger speakers increasingly place the main stress on the second syllable, *contróversy*.

There are, however, other cases which reveal a regional condition. For example, some sound changes proceed gradually across generations and thus have an impact on a large group of words. In other words, some changes may be initiated in one particular geographic location and then remain locally applicable to them. The voicing of initial fricative in southern English discussed in chapter 3 above can be supportive evidence of this kind. At the same time, some other changes may propagate through broader regions and consequently affect all varieties of English. There are some examples that exhibit the second case.

(94) Loss of segments in the history of English (McMahon 1994: 15)[89]

a. Apocope: Middle English [na:mə] > Modern English *name*
b. Syncope: OE *munecas* > ModE *monks*
c. Haplology: OE *Engla-lond* > ModE *England*

As illustrated in (94), it can partly be inferred from these examples that phonological changes have a significant impact on sound system in most variety of English dialects. In other words, it can be argued that PE has established its phonological shapes through

[89] Apocope: the loss of one or more sounds from the end of a word; syncope: the loss of one or more sounds from the interior of a word; haplology: the elimination of a syllable when two consecutive identical or similar syllables occur.

phonological changes, namely the progress of segment loss in the history of English in this case.

5.3.2 *First language acquisition vs. lifespan change*

In this subsection, I represent two different arguments regarding the issue of the locus of phonological change. For instance, Hale (2003/2007) claims that linguistic change only takes place during first language acquisition process. In other words, a change can be interpreted as a reanalysis by an acquirer. On the other hand, Sankoff & Blondeau (2007) argue that people also make their linguistic change through their lifespan. These are considered below.

According to Hale (2003), linguistic changes happen only during first language acquisition. Basically, he makes a clear distinction between change and diffusion of that change by different sets of factors. Then, he argues that one set of factors cause a different phonological rule or representation and the other group of factors, on the other hand, control the diffusion of that phonological change. In order to look at his argument more in detail, let me describe Hale's filtering subsystems below.

(95) Modularity and the historical record (Hale 2003)

[Constraints on change]	Theory of change
↓	
[Constraints on diffusion]	Sociolinguistics
↓	
[Limitations of the documentary record]	Philology, history, etc.

↓

▌historical record ▌

Hale intends to illustrate with this diagram that the incident of each level can tell us specific result associated with different systematic function. For instance, Hale states that the role of diachronic linguistics is distinctly separated from others such as sociolinguistics shown in right side of a diagram presented in (95). According to the diagram shown above, the first filter indicated as constraints on change is connected to historical linguistics. Furthermore, the second one described as constraints on diffusion shows the role of sociolinguistics. Finally, "philology" takes the third part of this module system. What Hale's crucial argument is that linguistics change, which includes phonological, syntactic and semantic changes, should be located in the first level of this system. In doing so, we can focus only on "change" itself and its authentic meaning of change excluding sociolinguistic or philological factors. In accordance with Hale's model, linguistic change might be caused by differences between grammars of individuals, because people produce their own grammar respectively (Hale 2003: 345). By this fact, Hale argues that linguistic changes only take place when people learn grammar during the first acquisition process. In other words, the first language acquisition process can only be the locus of the change. However, there is an unclear point among Hale's arguments. He explains that the acquirer completes his or her grammar at some well-defined point in the acquisition process, but there is not enough explanation of what a well-defined point in the acquisition process is. I think it is crucial to figure this out because if that point is not clear we cannot say that change can only occur during the first language acquisition.

Reiss (2003) agrees with Hale's position regarding the issue of where linguistic change occurs. For instance, Reiss (2003) is completely consistent with Hale's view that generative linguistics must focus on I-language. According to him, 'language acquisition' can be a crucial part of 'language change' because it is conceived as a mapping between a set of 'input' grammars and an 'output' grammar that is constructed by the language acquisition device (or Universal Grammar). Moreover, Yang (2000) suggests that there are two crucial points for the theory of language change. One is a theory of language acquisition by child learners, and the other is the properties of child and parent language. In short, language change is determined by what kind of linguistic data language learners acquire during acquisition process. In addition, Lightfoot (1999) also presents the description of "what is language change?".

> "What is typically described as change in a language is the introduction of structural differences in the grammars of increasing numbers of individuals over time, that is, from one generation to the next. "
>
> (Lightfoot 1999).

According to Lightfoot, these structural differences are importantly the consequence of child language acquisition. In this way, Lightfoot insists that language learners, rather than adults, are the operators of language change.

At this point, we need to look at the ability to create language change between children and adults. In the field of acquisition theories, there is well-known hypothesis, which has been influential to language acquisition studies for a long time, and still adopted by acquisitionists in various ways, namely 'critical period hypothesis' (henceforth, CPH). CPH hypothesises that acquisition of linguistic structure is sensitive to the age of the child. For

example, children are likely to modify their grammar because they receive fairly large number of linguistic input in everyday life. On the contrary, adults are only concerned with the development of lexical inventory. What is, however, adults' role on language change except lexical development? Adults may not be able to affect 'language change' to the extent that children are, but they might have influence on the restructuring of children's grammars as providers of primary linguistic data to child acquirers.

The definition of language and grammar need to be demonstrated here. How do we define language and grammar respectively? First of all, the role of language should be considered. In general, speakers make use of individual's grammars in order to make social communication. The resulting similarity of grammars across individuals allow us to abstract somewhat to speak of the structures of languages. In other words, language can be represented as a social grammar and externalized language (E-language) at the same time.

Sankoff & Blondeau (2007) analyse /r/ in Montreal French as an example of language change. The crucial discrepancy between Hale and Sankoff & Blondeau is apparently the problem of the locus of language change. Namely, what Sankoff & Blondeau say about language change is that adults do change their language over time. According to them, most individual speakers followed across time were stable after the critical period, with phonological patterns set by the end of adolescence. However, it is not unusual for people to make significant changes through their life time. The sphere of chance for linguistic innovation or modification in later life may be expanded with rapid change in progress when linguistic variables take on social significance.[90] Apart from sociolinguistic approach,

[90] For instance, in sociolinguistics, age-sensitive variation for linguistic change has been a trademark for the past thirty years.

however, Sankoff & Blondeau suggests us 'lifespan change': “individual speakers change over their lifespans in the direction of a change in progress in the rest of the community. Such a pattern would be historical in character.” (Sankoff & Blondeau 2007: 562).

Sankoff analyses /r/ in Montreal French and uses all sixty of the reinterviewed subjects, comparing their 1971 data with their 1984 data. The conclusion is that change in community is a result of individual speakers, especially younger speakers. In data from in 1971 and 1984, a number of speakers in the fifteen-to-nineteen age range were already categorical [R] users when they were involved in this study. One key question that Sankoff try to answer on the basis of indirect evidence is how these young speakers acquire categorical [R] usage as part of their initial language acquisition as young children. Or did they join the pool of [R] users sometime between first language acquisition in early childhood and the age of fifteen? According to the result of this research, we could see such a significant minority of speakers making major changes in their pronunciation although we can also expect relative stability in later life. In short, we need to reconsider the relationship between L1 and later language acquisition, and between acquisition and change through this study. In other words, adults seem to be the agents with respect to community change, and they also affect the children’s language acquisition by giving linguistic input.

At this point, we need to touch on types of change in order to understand the ongoing issues here. There are largely two types of sound change: Neogrammarian sound change and lexical diffusion theory. This is not the main topic of this thesis, but, before I conclude the question of the locus of phonological change, I discuss what kind of changes does occur in that locus. In general, Hale’s argument may include Neogrammarian sound change, but Sankoff’s claim seems to have the property of lexical diffusion. Lexical diffusion refers to the

way that a sound change affects the lexicon. For instance, if a sound change is lexically gradual, individual words undergo the change at different rates or different times. On the other hand, if sound change is lexically abrupt, all the words of a language are affected by the sound change at the same rate. Neogrammarian sound change represents an exceptionless sound change and regular but gradient change. In addition, this type of sound change is conditioned by purely phonological factors.

In sum, all languages change over time and vary according to place and social setting. We can observe phonological change by comparing spoken English at different points in time. For instance, according to Wells (1982), the concept of using a single word refers to the pronunciation of a particular group of English words. He calls these word-groups lexical sets and uses a key word, such as *BATH* to identify them. For example, over the last two hundred years, the pronunciation of words in the *BATH* set, words such as *bath*, *grass*, *laugh* and *dance,* has changed in some parts of the UK. This gradual shift in pronunciation demonstrates a number of aspects of phonological change. The problem is that we need to consider what the locus of phonological change is. Through this chapter, I conclude that a phonological change occurs both first language acquisition and people's lifespan. In other words, we cannot ignore both properties when we talk about language change. The thing we need to pursue in the future is that which property between the two does have stronger effect on phonological change than the other.

5.4 Summary

I have considered various interesting topics in this chapter. First of all, I have discussed the close relation between theory and data, and considered what kind of role diachronic

phonology can do. In addition, the opposite question was also raised: how can contemporary theories deal with historical data?

Another issue arose in this chapter, the question of the locus of linguistic (phonological) change. Two representative arguments are discussed. Hale insists that linguistic change can only take place during the first language acquisition period, while other research revealed that changes occur in the acquisition period as well as adult-stages.

Chapter 6 Conclusion

In this thesis I have presented a comprehensive analysis of phonological weakening processes of Old and Middle English periods. In addition, where these weakening should be situated was also crucial part of this current research. I briefly summarise these two points.

This thesis had two main goals. The first was to generate a unified account of consonant lenition and vowel reduction in (the history of) English. To achieve this goal, I have firstly investigated various types of lenition phenomena such as voicing, spirantisation, debuccalisation and approximantization respectively. Many authors have attempted to define lenition phenomenon by applying different kinds of linguistic conception. For instance, the hierarchy of consonant strength proposed by Escure (1977) and Davenport & Hannahs (2010) seems compelling because this can show relatively exact pathway to almost all types of lenition phenomena. From a diachronic point of view, this consonantal strength approach also provides a plausible explanation for handling historical change of consonant. In regard with this approach, Lass's lenition trajectory works well especially when dealing with two different movements of weakened consonants (i.e. sonorisation type and opening type). Apart from this, several interesting approaches turn up. For example, Kirchner claims that effort minimizing force controls consonant lenition phenomena. This sort of articulation-based account also sheds light on uncovering the mechanism of lenition.

Vowels in unstressed positions are usually targeted on weakening phenomena. Some aspects of vowel reduction are fairly similar to those of consonant side. For instance, both consonant and vowel are likely to undergo weakening processes when they appear on the site

where stress has not been assigned. Therefore, it tells us that stress assignment to some extent affects weakening phenomena of consonants and vowels at the same time.

However, it is still remaining issue that what kind of mechanism can cover consonant lenition and vowel reduction at the same time. As indicated above, stress pattern may play a critical role in dealing with both weakening processes, but there is a counterexample which cannot be accounted for with stress patterning. In this thesis, we have dealt with voicing of initial fricatives in southern OE. In this phenomenon, a consonant of the onset in the stressed syllable is weakened. Furthermore, segmental strength hierarchy also shows some drawbacks regarding weakening in general. It has been observed that this approach can account for consonant lenition. However, if we extend our interest to vowel weakening phenomena, this segmental strength goes opposite direction. Namely, consonant strength is usually associated with sonority value. Stronger a consonant is, less sonorous it may be. In this way, some of lenition processes would be problematic. Vowel reduction can be defined as sonority-decreasing phenomena while lenition usually results in sonority-increasing process.

Taking those conflicting factors into consideration, an element-based approach can offer a unified account of consonant lenition and vowel reduction in a theoretical way. For example, both weakening can be captured by the notion of 'element loss' or 'suppression of complexity' in this framework. Vowels are usually reduced to a centralised vowel, schwa. This weakened vowel only holds a neutral element described as |@|. Therefore, any vowels moving towards schwa yield loss of elements that they contain. Consonants also can be dealt with the same mechanism with vowel reduction. For instance, according to consonant strength hierarchy, if any consonant is weakened and moved to weak segment position, the movement is also accounted for by losing elements. In this way, I have claimed that this

unified explanatory ability can be transferred into OT constraint mechanism. These ideas represent my central argument.

The second goal of my thesis is to find out what Theoretical Historical Phonology is. To answer this question, I have shown different types of theoretical approaches and historical data from Old and Middle English in chapter 5. Furthermore, I have tried to combine theory with historical data to see how phonological frameworks effectively deal with diachronic data. Ultimately, I have tried to figure out the role of diachronic phonology in the field of linguistics.

In regard to two objectives of my thesis just indicated above, three fundamental questions arose in this thesis. These are presented again here.

1) How do we represent phonological weakening phenomena in terms of segmental features or elements?

2) How can these representational elements be integrated into the constraint ranking and evaluation mechanisms in OT?

3) Do the historical data such as the initial fricative voicing and vowel reduction in Old and Middle English give us any insight in this regard?

As reviewed in this concluding chapter, the first question has been fully investigated throughout the thesis, but especially in chapter 2. Chapter 2 have offered a specific definition of consonant lenition and vowel reduction within different theoretical frameworks. First of all, the notion of segmental strength has been played an important role in dealing with consonant lenition. For instance, Lass (1984) suggested a typical lenition trajectory which includes lenition paths in terms of the sonority of consonant. In addition, phonetically-based

approaches to consonant lenition have also been proposed. In this way, I have examined a number of different types of theoretical approaches in order to look at the internal structure of consonant lenition phenomenon. An element-based approach has attracted my attention regarding this issue. Theoretical mechanisms such as loss of element and reduction of complexity within the framework of Element Theory can shed light on finding out a unified explanation of weakening processes.

Furthermore, vowel reduction was examined in a specific way. There are representatively two kinds of vowel reduction in the literature. Neutralisation can be defined as a reduction of vowel contrasts in a particular vowel inventory. On the other hand, centralisation is normally connected with phonetic vowel reduction. In many languages such as English, vowels in unstressed positions tend to be weakened. This weakening phenomenon may vary depending on languages. In a language like Russian, unstressed vowels can be changed to various shapes.

After taking a closer look at both consonants and vowels respectively, a unified account of two phonological processes has been explored in chapter 3 and 4. In those chapters, theoretical and phonological motivations for unifying consonant lenition and vowel reduction are revealed. There have been a few theoretical attempts dealing with both weakening phenomena. Chapter 2 began from the premise that phonological weakening processes from different domains (i.e. consonants and vowels) can be captured by means of certain theoretical framework. In this regard, I have developed a different version of Optimality theoretic analysis. I have employed a basic concept of element loss from element-based works such as Harris (1990, 1994), Brockhaus (1995) and Harris and Lindsey (1995).

Chapter 3 have dealt with the voicing of initial fricative in southern Old English. In this chapter, general introduction of consonant system in OE has been illustrated in order to help readers understand the main materials of this chapter. In OE, consonant system was relatively stable even though some remarkable modifications arose. Fricatives were all voiceless during OE periods, and voiced counterparts only turn up intervocalically. From the late OE, voiced obstruents began to appear on final and even initial positions. However, in the southern area of OE period, unusual phonological innovation takes place. Fricatives in initial positions are voiced systematically. There have not been crucial evidence or explanation to manage this voicing phenomenon, but two compelling arguments are proposed. Some (e.g. Fisiak 1984) argues that this unique voicing innovation affected by the continental phonological system. In fact, a certain region in the continent had already undergone voicing process, and then people acquired voiced fricative sound in their phonemic system came into England. Therefore, if it is right, voicing of initial fricative in English cannot be regarded as English innovation since it already occurred in the continental region. What I am supporting regarding this phenomenon is that the initial fricative voicing is an English innovation (e.g. endogenous vs. exogenous innovation). The voicing of initial fricatives in southern OE can also be accounted for by intervocalic voicing in word-level or sentence level. Therefore, voiceless fricative in the word-initial position is situated intervocalic environment when preceding word is terminated in vowel. I think this argument also has weaknesses in terms of theoretical mechanism, but nevertheless it can provide a useful explanation on voicing phenomenon in some dialect of English.

With this background, I have proposed OT-based analysis of consonant lenition in this chapter. The constraint such as *COMPLEX[Element] plays an essential role in analysing

voicing phenomenon in southern dialect of OE. As discussed in various places, the concept of element loss is transformed into a constraint within OT mechanism. This markedness constraint is conflict with a faithfulness constraint such as IDENT[Element]. In this way, when a segment appears in intervocalic position, then it is ready to be weakened by virtue of *COMPLEX[Element]V_V. It penalises any element in intervocalic position.

Chapter 4 dealt with Optimality-Theoretic analysis of vowel reduction with special attention to data from OE and ME is discussed. Most importantly, unstressed vowels in word-final positions in OE and ME are targeted by constraints such as *COMPLEX[Element](ŭ: unstressed vowels). Unlike consonants, vowels are relatively easy to change in OE period. Furthermore, vowels are sensitive to the existence of stress value. Bear this in mind, an account of the vowel reduction in OE and ME within the frameworks of Element and Optimality theory was provided in this chapter. Indeed, stress plays a decisive role in vowel reduction phenomenon. In other words, it has been argued that presence or absence of stress is key component for this weakening process even though there have been some counterexamples to be considered. The first consequence of this chapter is systematically to show how vowel reduction should be defined in terms of phonetic and phonological perspectives. First of all, various factors for vowel reduction were examined. For example, I have shown several potential candidates such as stress, duration, and the interaction between vowel and consonant. It is suggested that stress is the most influential and important factor for vowel reduction among various conceivable factors. Furthermore, I presented a representational analysis of vowels in order to make it the argument clearer. More interestingly, some phonological process in Kentish dialect of OE, which seems to resemble the typical definition of vowel reduction presented in this chapter, is also discussed. Even

though Great Kentish Collapse looks quite similar to what is referred to as vowel reduction in this current chapter, the phonemic change in Kentish should not be considered as a reduction process since its phonemic development is completely different from that of other dialects.

After considering preliminary elements, an integrated analysis of OE and ME vowel reduction was provided in 4.4. In this section, I argued that vowels in word-final position are positively affected by reduction process, especially in OE and ME periods. In line with this, some relevant constraints were presented such as *COMPLEX[Element](ŭ: unstressed vowels) and IDENT I-O[Element] in order to deal with those reduction processes. In a similar way, the constraint like *COMPLEX[Element](ŭ: unstressed vowels) does not allow any element in final unstressed position.

In the end, the aim of this dissertation is to make a contribution to the understanding of phonetic and phonological aspects of consonant lenition and vowel reduction. This study consistently shows where and how those weakening processes begin and how they should be modeled in a unified way. While stress plays a decisive role at stages of reduction from OE to ME, other factors such as the interaction between vowel and consonant may determine vowel reduction in PE. On the other hand, it can be argued that lenition phenomenon is not crucially affected by existing factors than vowels are.

Lastly, the question of 'What is Theoretical Historical Phonology' has been discussed in chapter 5 and it has two sub-goals. First, it has been shown how diachronic phonology can be handled within a certain kind of theoretical frameworks. In other words, phonological theories deal with historical changes in their own ways (e.g. change of rule ordering, rule addition, and rule loss in rule-based frameworks; reranking of constraints in constraint-based approaches). Furthermore, the second goal of this chapter is to explore where phonological

changes (e.g. weakening processes in this thesis) should be situated, since this is one of the critical points in which 'Theoretical Historical Phonology' is interested. For this point, two different arguments are discussed: acquisitionist' approach vs. lifespan change. By doing these works, we can improve the understanding of the nature of language change in terms of phonology.

What I do not consider in this thesis is to connect these two goals since it is probably beyond the scope of this PhD project (because the main focus of the thesis is to show the unification between consonant lenition and vowel reduction in a theoretical way), the connection between these two goals needs to be pursued in terms of future study.

Finally, I conclude that this thesis can shed some light on explaining phonological weakening processes by suggesting a unified theoretical mechanism. Although one could object to an OT approach to the problem, this PhD project is nonetheless written within the framework of OT, and that within OT the unification is expressed by the same type of constraint governing the processes involved.

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