

DEPARTMENT OF LANGUAGE AND LINGUISTICS

UiT

THE ARCTIC
UNIVERSITY
OF NORWAY

AN OPTIMALITY THEORETIC ANALYSIS OF ESL CODA ACQUISITION BY
VIETNAMESE LEARNERS

Hoang Yen Thi Vu

ENG-3991 Master Thesis in English Linguistics

Autumn, 2014



**AN OPTIMALITY THEORETIC ANALYSIS OF ESL CODA ACQUISITION BY
VIETNAMESE LEARNERS**

Thesis submitted for the degree of
Master in English Linguistics at Uit The Arctic University of Norway, Norway

By

Hoang Yen Thi Vu

DEPARTMENT OF LANGUAGE AND LINGUISTICS
UIT THE ARCTIC UNIVERSITY OF NORWAY, NORWAY

November 2014

DECLARATION

I declare that:

This thesis is a presentation of my original research work and does not involve plagiarism or collusion.

The dissertation has not been submitted elsewhere.

The work was done under the guidance of my supervisor, MARTIN KRÄMER and submitted in Department of Language and Linguistics at UIT The Arctic University of Norway.

Date: 30/10/2014

Name and Signature

Hoang Yen Thi Vu

ADKNOWLEDGEMENT

First and foremost, it is a pleasure to thank those who made this thesis possible. Thank to Department of Language and Linguistics for giving me a chance to complete the thesis.

Especially, I would like to express my sincere gratitude to my supervisor, Professor MARTIN KRÄMER for his enthusiasm, his inspiration, and his great efforts to encourage me in all the time of the research. Throughout my thesis-writing period, his encouragement, advices, and guidance provided a good basis for my thesis. I would have been lost without him.

I would like to show my gratitude to the coordinator, Åsne Øysteinsdotter Høgetveit, Collins Joe for helping me during the time of thesis writing.

I wish to thank my previous teacher Truong Sa Nguyen, and my best friends: Hung Thanh Nguyen, Tan Thi Nguyen, Duy Ngoc Nguyen, Nha Uyen Thi Le, Tuan Viet Le, Nha Vi Ngoc Tran, and Thien An Vo for their helps, advices, and spirit encouragement through the difficult times.

I would like to express my thankfulness to my cousins Ngoc Phuong Tran, Ha Thi Du, Mai ly Tran, Quang Huy Tran, Mai Huong Hoang and others in Norway for guiding and helping during my study period in Norway.

Last but not the least; I wish to thank my family in Vietnam, especially my parents for raising me, supporting me, and teaching me. To them I dedicate this thesis.

ABSTRACT

This thesis is a case study of Optimality Theory (OT) analysis in English second language (hereafter, ESL) coda acquisition. OT can contribute to account for conflicts of constraint rankings in areas of interlanguage development. In this case study of ESL Vietnamese, OT is applied into the previous studies on coda production to account for rates of production types, asymmetry between onset and coda contrasts as well as variation during the acquisition process. The question arises as to how to figure out the acquisition process of ESL Vietnamese based on the analysis of OT. The essential theories which deal with ESL Vietnamese involve OT and some other models, such as Partially Ordered Constraints (POC), and positional faithfulness. Upon application, the results suggest that OT analysis in ESL Vietnamese can resolve the conflicts of constraint rankings on coda productions. Furthermore, the model POC can generally resolve variation of ESL coda production in investigated stages.

Index Terms: English Second Language, Optimality Theory, Partially Ordered Constraints, ESL Vietnamese

TABLE OF CONTENTS

ADKNOWLEDGEMENT	ii
ABSTRACT.....	iii
LIST OF FIGURES	vii
LIST OF ABBREVIATIONS.....	viii
CHAPTER 1: INTRODUCTION	1
1.1 Rationale of the study.....	1
1.2 Purposes and Objectives of the Study	2
1.3 Research Questions	2
1.4 Value of the study	3
CHAPTER 2: LITERATURE REVIEW	4
2.1 THE LANGUAGE BACKGROUND.....	4
2.1.1 The introduction of Vietnamese phonology	4
2.1.1.1 Vietnamese syllable structure	4
2.1.1.2 Vietnamese consonantal system	6
2.1.1.3 Consonant distribution.....	8
2.1.2 The introduction of English consonant system and syllable structure	9
2.1.2.1 English consonant system.....	9
2.1.2.2 English syllable structure and consonant distribution	10
2.1.3 The similarities and differences between English and Vietnamese consonant systems and syllable structures.....	13
2.1.4 Vietnamese learners' ESL coda acquisition	14
2.1.4.1 ESL coda productions.....	14
2.1.4.2 Reasons for deviation from target forms	17
2.2 THE THEORETICAL BACKGROUND	19
2.2.1 The basic concepts of Optimality Theory	19
2.2.2 Optimality theory in second language acquisition	20
2.2.3 Variation theories	21

2.2.4 Positional faithfulness	22
CHAPTER 3: OPTIMALITY THEORETIC ANALYSIS OF ESL CODA ACQUISITION	25
3.1 SINGLE CODAS	25
3.1.1 Nguyen and Brouha's (1998) data collection	25
3.1.2 Discussion.....	28
3.1.2.1 Constraints utilized in the analysis	28
3.1.2.2 Positional faithfulness.....	29
3.1.2.3 Positional faithfulness and Vietnamese speakers' ESL production types.....	41
3.2 CODA CLUSTERS	50
3.2.1 Data Collection.....	50
3.2.1.1 Sato's (1984) data collection.....	50
3.2.1.2 Nguyen's (2008) data collection	52
3.2.2 Discussion.....	54
3.2.2.1 Constraints used in the analysis.....	54
3.2.2.2 OT analysis of ESL coda cluster acquisition.....	54
3.2.3 A short summary	65
CHAPTER 5: CONCLUSION AND LIMITATIONS	66
REFERENCES	68
APPENDIX A.....	74
APPENDIX B	76
INDEX.....	78

LIST OF TABLES

Table 2.1. Vietnamese syllable structure (Sato 1984: 46)	5
Table 2.2. Vietnamese consonant phonemes (Thompson, 1987: 19)	6
Table 2.3. Vietnamese consonant phonemes (Ngo, 2001: 8)	7
Table 2.4. Vietnamese onsets and codas (Nguyen, 1998: 83)	9
Table 2.5. English consonant phonemes (Roach, 2009: 63).....	9
Table 2.6. The ESL consonant confusion of Vietnamese students.....	13
Table 3.1. Nguyen and Brouha's participant profile (1998: 78)	25
Table 3.2. Production types of ESL single codas (Nguyen and Brouha, 1998:81)	26
Table 3.3. Syllable-final neutralization (Nguyen and Brouha, 1998: 81).....	27
Table 3.4. A comparison of predicted and collected percentages.....	48
Table 3.5. Tai's coda cluster production (Sato, 1984: 51-52)	50
Table 3.6. Thanh's coda cluster production (Sato, 1984: 53-54)	51
Table 3.7. Tai and Thanh's coda cluster production	51
Table 3.8. Production of ESL coda clusters (Nguyen, 2008: 8)	52
Table 3.9. Production of ESL coda clusters in percentage	53
Table 3.10. Nguyen's (2008) ESL coda cluster production in percentage values.....	64

LIST OF FIGURES

Figure 2.1. The segmental diagram of Vietnamese syllable structure	5
Figure 2.2. The syllable structure of an English monosyllabic word	11
Figure 2.3. The syllable structure of an English two-syllable word	11
Figure 2.4. The mapping of input to output in OT grammar (Kager, 1999: 8).....	19
Figure 3.1. The segmental structures of an affricate and a fricative.....	33

LIST OF ABBREVIATIONS

L1:	First language
L2:	Second language
NL:	Native Language
IL:	Interlanguage
TL:	Target Language
ESL:	English second language
UG:	Universal grammar
US:	United State
IPA:	International Phonetic Alphabet
C:	Consonant/Constraint
V:	Vowel
CV:	Consonant-vowel syllable structure
CVC:	Consonant-vowel-consonant syllable structure
2MFC:	Two members of final codas
OT:	Optimality theory
POC:	Partially ordered constraints

CHAPTER 1: INTRODUCTION

1.1 Rationale of the study

Second language (L2) acquisition has been widely developed with a large number of major works dedicated to it (Eckman, 1983; Benson, 1988; Broselow *et al*, 1998; Hancin-Bhatt and Bhatt, 2000; Broselow, 2004; Hansen, 2004; Edwards, 2006). First language (L1) transfer prominently majors in the development of L2 acquisition, particularly at the earlier stages (Hancin-Bhatt and Bhatt, 2000; Broselow, 2004). Indeed, it is one of major influences to account for aspects in L2 coda acquisition (Benson, 1988; Sato, 1984; Broselow *et al*, 1998; Nguyen and Brouha, 1998; Hancin-Bhatt and Bhatt, 2000; Edwards, 2006). For instance, ESL Chinese refers to coda repair strategies as devoicing, deletion, or epenthesis (Broselow *et al*, 1998), whereas ESL Vietnamese refers deletion as the most likely production type with respect to coda clusters (Sato, 1984), but as neutralization with single codas (Nguyen and Brouha, 1998). Beside L1 transfer, L1 proficiency level (Weinberger, 1987), markedness (Broselow *et al*, 1998; Hancin-Bhatt and Bhatt, 2000; Edwards, 2006; Nguyen, 2008), linguistic environment (Benson, 1998; Nguyen, 2008), and other external factors (Tarone, 1987; Le, 2007) can also contribute to account for these aspects of L2 productions.

Universal grammar is also assumed to account for aspects of the L2 acquisition process (Broselow *et al*, 1998). With regard to the universal syllable structure (CV), unfortunately, there are not so strong evidences for this structure (Hansen, 2004). However, the simpler syllable structure gets more accuracy in production than the more complex (Hansen, 2004; Anderson, 1987). For instance, the complex syllable structure is restricted in ESL Thai and Chinese (Hancin-Bhatt and Bhatt, 2000; Weinberger, 1987; Broselow *et al*, 1998). With respect to ESL Vietnamese, the simplification of complex structure in ESL production seems to cause the different common repairs, such as deletion with coda clusters in Sato (1984) and Nguyen (2008) while neutralization and target production with single codas in Nguyen and Brouha (1998). Further, the simplification of complex codas is much more common than that of complex onsets (Sato, 1984; Edwards, 2006). We should propose one or more theories to resolve these above areas of L2 acquisition.

In recent times, Optimality Theory, proposed by Prince and Smolensky (1993), and later expanded by McCarthy and Prince (1994), has been developed to explain phonological

alternations. The OT framework suggests that surface forms arise from the interaction of conflicting constraints. In L2 acquisition, there are relatively few published studies which focus on OT analyses of L2 acquisition; nevertheless, these studies, in fact, can provide strong evidences that OT can resolve aspects of L2 acquisition (Hancin-Bhatt and Bhatt, 2000; Broselow *et al*, 1998). Specifically, it can account for the types and frequency of repair by L2 learners, as well as the asymmetry between complex onsets and complex codas in production (Hancin-Bhatt and Bhatt, 2000). In the case of ESL Vietnamese, there is still little work on OT analyses of coda production. Therefore, this thesis will provide an OT analysis of ESL coda development of Vietnamese learners.

1.2 Purposes and Objectives of the Study

Purposes:

The goal of this thesis is to provide an OT analysis of ESL coda acquisition by Vietnamese speakers.

Objectives:

The objectives of this thesis are as follows:

- To understand which coda production types of Vietnamese speakers occur in ESL acquisition
- To identify how OT accounts for these production types in various stages of ESL acquisition

1.3 Research Questions

The main research question of the thesis is “How Optimality Theoretic analysis accounts for ESL coda acquisition by Vietnamese speakers?” To resolve the main question, the specific questions should be analyzed as follows:

1. What kinds of production type Vietnamese speakers use to cope with ESL codas?
2. How does Optimality Theory (OT) account for these production types at various stages of acquisition?

1.4 Value of the study

On the thesis, the later readers get benefits from the thesis in the extent that they can use it as an idea for related studies. Indeed, they at least see similarities as well as contrasts of the consonant system and syllable structure between Vietnamese and English. They also can know which production types Vietnamese learners use to cope with ESL codas. Further, the readers can see how OT accounts for aspects of ESL coda acquisition by Vietnamese speakers.

The following chapters present an OT analysis of ESL coda acquisition by Vietnamese learners. Chapter II examines previous studies, which will form the basis of the OT analysis. More specifically, the first of the chapter will examine similarities and differences between English and Vietnamese consonant systems and syllable structures, production types of ESL coda that Vietnamese learners favor using. The second part reviews previous theoretical developments related to the later analysis. Chapter III presents an OT analysis of two aspects of ESL coda productions. The first is an analysis of single codas whose data is previously collected by Nguyen and Brouha (1998), and the second is of coda clusters given in Sato (1984) and Nguyen (2008). The final chapter includes a whole summary of main findings based on the OT analyzes as well as their limitations. The literature review chapter will focus on related work in order to prepare for the analysis to follow.

CHAPTER 2: LITERATURE REVIEW

This chapter focuses on two major parts: language and theoretical backgrounds. The language background introduces the consonant system and syllable structure of two languages: English and Vietnamese, comparisons between them, and ESL coda production by Vietnamese learners. The theoretical background mentions essential theories, including Optimality Theory, positional faithfulness, and Partially Ordered Constraints, to prepare for the analysis on ESL coda acquisition.

2.1 THE LANGUAGE BACKGROUND

2.1.1 The introduction of Vietnamese phonology

Vietnamese is spoken by more than 76 million Vietnamese people in Vietnam and more than 2 million abroad. It belongs to the Mon-Khmer group of language (Ngo, 2001: 5-7). However, some scholars classify Vietnamese as a Tai language since it shares tonal similarities with other Tai languages. The Vietnamese writing system originates from the period of 207 BC- 939 AD as Vietnam was still a province of China and adapted almost all Chinese cultures. At that time, it was named as ‘Chu Han’ that mainly utilized Chinese characters. Until the thirteenth century, some Vietnamese Buddhist scholars created a new writing system called ‘Chu Nom’, which has survived until the present day, in the form of Vietnamese poetry. Nevertheless, the current official form of Vietnamese had emerged by the sixteenth and seventeenth centuries as a group of European Catholic missionaries aimed to establish a new writing system based on the Roman alphabet. Since 1624, the orthography of a French Catholic missionary formed a foundation for the Vietnamese writing system in all current regions of Vietnam (Ngo, 2001: 5-7).

2.1.1.1 Vietnamese syllable structure

Vietnamese, as described by Nguyen (1967) and Thompson (1987), is a monosyllabic tone language. The Vietnamese syllable structure allows consonants to occur in either onset or coda position. Syllables can take the following forms:

Table 2.1. Vietnamese syllable structure (cited by Sato 1984: 46)

V	VC	CwV
CV	CVC	CwVC ¹

One can argue that Vietnamese allows consonant clusters in onset if /w/ is considered as a glide instead of a semivowel. Nevertheless, Nguyen (1998) argues that there are no consonant clusters in either onset or coda position. He defines a word with respect to syllable forms as follows.

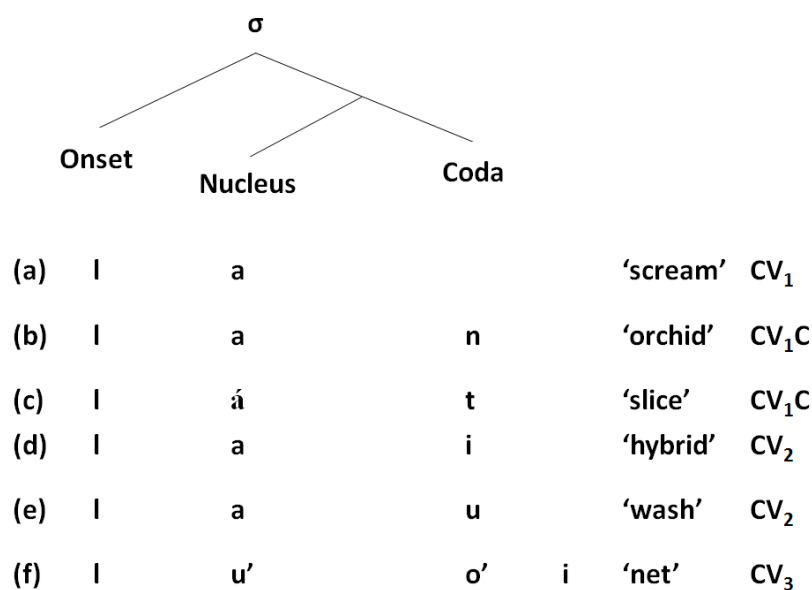
$$(1) \quad (C) V_{1/2/3} (C)$$

Nguyen (1998: 82)

Within the above forms, V_1 is interpreted as a single vowel while V_2 is referred as a diphthong and V_3 as a triphthong. Interestingly, V_1 , as Nguyen (1998: 82) suggests, is possibly the glide /w/. Put it in another way, he illustrates Vietnamese syllable structure in the following segmental diagram.

Figure 2.1. The segmental diagram of Vietnamese syllable structure

(Adapted from Nguyen, 1998: 82)



¹*Note: V is vowel or diphthongs, C is consonant and w is /w/.

In the above diagram, Vietnamese syllable structure permits coda consonants as well as single vowels, diphthongs, triphthongs. The diphthongs or triphthongs form as the vocalic codas combine with their corresponding nuclei. Nevertheless, they stand alone without any following single consonants or consonant clusters (Nguyen, 1998: 82).

Nguyen (1967)'s inventory of phonemic syllables shows evidence that Vietnamese language preferred the closed-CVC syllable. In total 4467 tokens, 3437 (76.9%) end in consonants. However, Sato (1984) argues that 4.5% of open syllables in Nguyen (1967)'s inventory are added to closed syllable proportion as Thompson (1959) states that all syllables with a low-level tone end in glottal stops. It contributes to the result that 81.4% of total syllables end in consonants and yields an estimate that Vietnamese language prefers closed syllable structure.

2.1.1.2 Vietnamese consonantal system

The Vietnamese language consists of three main dialects: northern, central, and southern. It contains no standard pronunciation; nevertheless, the influence of northern dialect in most regions is greater than other dialects (Ngo, 2001). Thompson (1987) further argues that an educated Hanoi citizen will have the most standard Vietnamese pronunciation. He suggests a Vietnamese consonant system with different places of articulation: labial, apical, laminal, dorsal and glottal. The consonant system also differentiates fortis, lenis, and nasal manners of articulation. He describes those Vietnamese consonants in term of IPA² sound system (see table 2.2 below).

Table 2.2. Vietnamese consonant phonemes (Thompson, 1987: 19)

			Labial	Apical	Laminal	Dorsal	Glottal
Fortis oral consonant	Stop	Voiceless	p	t	c	k	
		Voiced	b	d			
Lenis oral consonant		Voiceless	f	t ^h	s	x y	h
		Voiced	v	l	z		
Nasal			m	n	ɲ	ŋ	

² International Phonetic Alphabet - a sound system that is used internationally, abbreviates IPA.

Remarkably, the approximant /r/ gets no attention from Thompson (1987) in the table above. There is some anecdotal evidence that an educated Hanoi citizen might produce it as [z] in their speech (Kirby: 2011).

In the course of Vietnamese language study, Ngo (2001) describes Vietnamese phonological consonant system with respect to the places and manners of articulation that are partly different from Thompson's (1987).

Table 2.3. Vietnamese consonant phonemes (Adapted from Ngo, 2001: 8)

Manner \ Place		Labial	Alveolar	Retroflex	Palatal	Velar	Glottal
Stop	Voiceless	p	t	ʈ	c	k	
	Voiced	b	d				
	Voiceless aspirated		t ^h				
Fricative	Voiceless	f	s	ʃ		x	h
	Voiced	v	z	ʒ		ɣ	
Nasal		m	n		ɲ	ŋ	
Lateral			l				
Rolled			r ³				

Trill (or rolled r) forms as an active articulator (usually the tip of the tongue) vibrates rapidly against the passive articulator (Briton and Brinton, 2000: 25). Ngo (2001) explains that the rolled /r/ occurs only in the borrowing words or in some other Vietnamese dialects. With this argument, it should be said that the alveolar approximant /ɹ/ and rolled /r/ occur in Vietnamese (Nguyen, 1998, Ngo, 2001). Further, as Thompson (1987) suggests above, the educated Hanoi citizen whose pronunciation is considered the most standard in Vietnamese. Nevertheless, this person may produce /r/ as /z/ in his speech (Kirby, 2011). It thus provides an implication that the alveolar approximant /ɹ/, rolled /r/ occur in Vietnamese, but they are dependent on different contexts.

³ The rolled /r/ only occurs in loanwords or some other dialects of Vietnamese (Ngo, 2011)

2.1.1.3 Consonant distribution

Onsets

There are 23 initial consonants listed on the above table, in addition to two semivowels /j, w/ (Ngo, 2001). Unlike Thompson (1987)'s research, Ngo (2001) presents the evidence that the voiceless stop /p/ does not occur in onsets, except in loanwords. Likewise, some consonants have particular graphemes, as with the onset phonemes /k/, /ɣ/, and /ŋ/. The voiceless stop velar /k/ is realized as the grapheme <c> whenever it precedes the mid and back vowels and as <k> before the front vowels (Ngo, 2001: 9). Furthermore, Thompson (1987) lists in detail that /k/ is written as the grapheme <k> when it precedes the vowels /i, e, ε, y/ and as <c> before others. The onset phoneme /ŋ/ is written as <ng> when preceding the vowels /i, e, ε/, but as <ng> if it precedes other vowels. The fricative velar /ɣ/ has two graphemes: <g> or <gh>. Its realization as <gh> occurs if it precedes the front vowels /i, e, ε/, such as *ghi, ghe, ghê*; and as <g> before other vowels except /i, e, ε/ (Thompson, 1987: 6-7)

Codas

Coda (abbreviated as Co) is a part of syllable that places after the nucleus and consists of any syllable-final consonants, such as /s/ in *his* or /nθ/ in *month* (Trask, 2004). In Vietnamese, there are eight segments in codas: three voiceless stops /p, t, k/, three nasals /m, n, ŋ/ and two semi-vowels /j, w/ (Sato, 1984; Ngo, 2001). Tuan (2011) claims that the phoneme /p/ is one of the voiceless stops that occur in a coda without releasing. Kirby (2011) also strengthens this argument by giving Michaud's evidence (2004) that no released stops /p, t, k/ occur at the coda positions. Further, both nasals and stops can be unreleased in the coda positions (Osburne, 1996). The velar nasal /ŋ/ has several different allophones. Kirby (2011) illustrates the variable characters of velar nasal /ŋ/ with respect to the descriptions of *kinh* [kiŋ] 'Vietnamese people'. In more detail, the grapheme <nh> is expectedly produced as /ɲ/, but realized as /ŋ/ as it follows one of /i, e, ε/ vowels. Furthermore, the phoneme /ŋ/ is explored to be labial-velar assimilated as it follows the back rounded vowels /u, o, ɔ/ (Kirby, 2011: 382). The grapheme <ng> is expected to pronounce as [ŋ], but is realized as an articulated labial-velar [ŋm̚], such as *ông* [oŋm̚] 'grandfather'. In the same place of articulation with [ŋ], the voiceless stop /k/ is pronounced as an articulated labial-velar /k̚/ whenever it follows one of those rounded back vowels /u, o, ɔ/ such as *học* [hɔk̚] 'study'.

Nguyen and Brouha (1998) strengthen the evidence by presenting a table of existing consonantal sounds in both onset and coda positions (see table 2.4).

Table 2.4. Vietnamese onsets and codas (Nguyen, 1998: 83)

Onsets			Codas		
	t	k	p	t	k
b	d	g			
	f	s			
	v	z			
m	n	ŋ	m	n	ŋ
	l	ɹ			

2.1.2 The introduction of English consonant system and syllable structure

2.1.2.1 English consonant system

Roach (2009) mentions English consonant phonemes based on the places and manners of articulation. There are eight places of articulation: bilabial, labio-dental, dental, alveolar, post-alveolar, palatal, velar, and glottal and six manners including plosive, fricative, affricative, nasal, lateral and approximant (see table 2.5).

Table 2.5. English consonant phonemes (adapted by Roach, 2009: 63)

	Bilabial	Labio-dental	Dental	Alveolar	Post-alveolar	Palatal	Velar	Glottal
Nasal	m			n			ŋ	
Stop	p b			t d			k g	
Affricate					tʃ dʒ			
Fricative		f v	θ ð	s z	ʃ ʒ		x	h
Approximant				ɹ		j	w	
Lateral				l				

Stops

Roach (2009) specifies the stop phonemes /p, t, k, b, d, g/ in terms of bilabial, alveolar and velar places of articulation and voicing. The stops /b, d, g/ are full-voiced while /p, t, k/ are partly voiced and voiceless based on the different contexts.

Fricatives

English fricatives occur in labio-dental, dental, alveolar and palato-alveolar places of articulation and distinguish fortis/lenis in all places except the glottal place. In each place of articulation, a pair of fricative phonemes is distinguished from fortis and lenis features. With the fortis fricatives, they realized with more energy and voice, whereas lenis ones have only a little voicing or no voice in the initial and final position. They are only voiced at the middle position. (Roach: 2009)

Affricates

Affricates seem to be complicated since they start as stops and end with fricatives (Roach, 2009). To take an example, the affricate /tʃ/ begins with alveolar plosive /t/ and ends with a post-alveolar fricative /ʃ/. As we can see the table 2.5, there are only two affricatives /tʃ/ and /dʒ/ at the same post-alveolar place. They are possibly a combination of the two manners of articulation: stop and fricative.

Nasals

A nasal may be defined as a sound made while air escapes through the nose (Ladefoged, 2012: 54). Ogden (2009) states that English has only three nasals /m, n, ŋ/ that are all voiced and occur at bilabial, alveolar, and velar places of articulation; nevertheless, they have different distributions. In detail, [m, n] exist in either initial or final position while [ŋ] only occurs finally. Expanding on Ogden's (2009) statement, Roach (2009) explains that [ŋ] frequently exists at the middle position if it combines with [g] or [k].

2.1.2.2 English syllable structure and consonant distribution

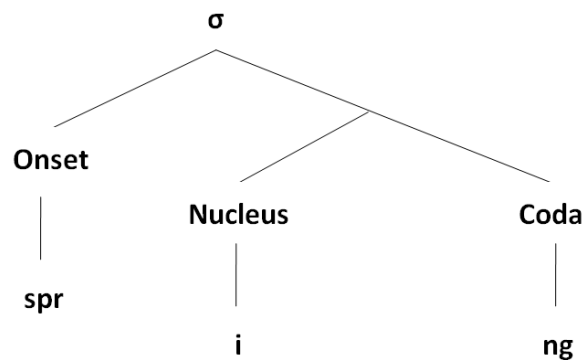
Brinton and Brinton (2000) focus on an intermediate level between segments and affixes/words: the syllable. An English syllable may optionally start with one to three consonants in onset

position, and end with one to four consonants in the codas (Brinton and Brinton, 2000: 75). See (2).

(1) (C) (C) (C) V_o (C) (C) (C) (C)

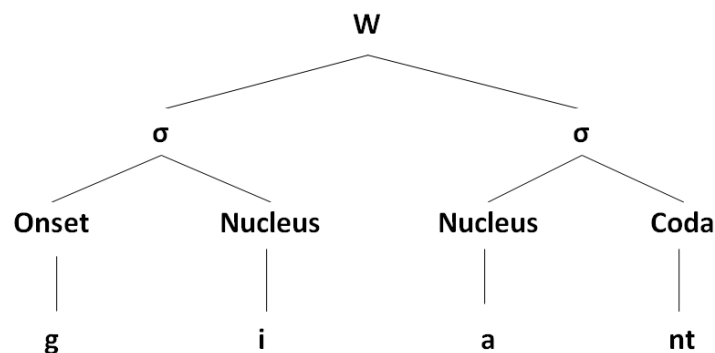
Opposed to Vietnamese, English is a polysyllabic language, that is, it allows more than one syllable in a word (Brinton and Brinton, 2000; Jensen, 1993). Brinton and Brinton (2000) present the different syllable structures given below.

Figure 2.2. The syllable structure of an English monosyllabic word



The above figure represents the syllable structure of the monosyllabic word *spring*. In detail, the onset consists of three consonants, and the coda is two consonants. Brinton and Brinton (2000) present the two-syllable word *giant* to demonstrate the polysyllabic structure of English (See figure 2.3)

Figure 2.3. The syllable structure of an English two-syllable word



As discussed above, English onsets allow up to three consonant segments (Jensen, 1993). Jensen (1993: 66-70) describes in more detail that single onsets can begin with any consonant phoneme

from the English inventory, except /ʒ/, and /ŋ/. An onset cluster of two consonant segments can be heard in words such as *dream*, *blow*, or *glass*. Onset clusters of three consonantal segments are more restricted than those of two segments.

English codas are more problematic to analyze. Coda clusters of two consonants can be heard in words such as *dreamt*, *bolt*, *fold*, or *bulk*. The clusters of three-coda consonants are much more restricted, e.g., *midst*, *next*, *sixth*. One more matter that is interesting is that a cluster of four coda consonants appears if a cluster of three consonants combines to an inflectional suffix. In brief, the English syllable structure allows complex forms in either onset or coda position.

Interestingly, not all codas keep their underlying forms, such as *damn*, which is expected to pronounce as [damn], but is instead realized as [dam] (Brinton and Brinton, 2000; Jensen, 1993).

The clear question arises as to why *damn* is sounded out with [dam], rather [damn]. The *n*-deletion is as /n/ follows a nasal, but precedes nothing (Jensen, 1993: 167). Another interesting fact is that /g/ is deleted as in the word *sign*, and /b/ is deleted as in *bomb* (Jensen, 1993). For the prenasal *g*-deletion, as Jensen (1993: 210) points out, /g/ is deleted when it follows a vowel, but precedes a nasal coda. For the *b*-deletion in *bomb*, Halle and Mohanan (1985) illustrates the cause by generating the so-called non-coronal deletion. See how it illustrates.

(2) Noncoronal deletion

[-son]

+voice → ∅ / [+nasal]_____]

-cor

The recent section has briefly discussed syllable structures and consonant phonemes of two languages: Vietnamese and English. In general, these two language systems have both similarities and contrasts on these aspects. Nevertheless, Vietnamese seems to prefer the less complex syllable structures than English does. The following section will generally mention two languages' similarities as well differences which may cause problems for Vietnamese learners in their ESL production.

2.1.3 The similarities and differences between English and Vietnamese consonant systems and syllable structures

Hwa-Froelich *et al.*, (2002: 226) illustrates the similar consonants of both English and Vietnamese language, including /m, n, ŋ, t, j, w, h/. However, for the experience of two languages, I cannot agree with the idea that the consonants /f, v, s, d, k, l, r, z/ are not similar between the two languages. If two consonant systems given in Ngo (2001) and Roach (2009) are compared, the nasals /m, n, ŋ/, stops /d, t, k/, fricatives /s, z, h/, and approximant /l/ are completely similar (See table 2.3 and 2.5). The stops /p, b/, fricatives /f, v/, and approximant /r/ are nearly the same. The similarity of these consonants seem to help Vietnamese learners acquire them easily in their ESL production. Nevertheless, their differences on other consonant phonemes may cause difficulties or confusions for them (Ha, 2005; Tuan, 2011). Tuan (2011) claims that Vietnamese students find it confusing to pronounce ESL consonants, such as /p, θ, ð, ʃ, dʒ, tʃ, ʒ/. The possible reason is that these consonants seem like those of Vietnamese, but have different places and manners of articulation. In more detail, Hwa-Froelich *et al.*, (2002: 267) agrees regarding the Vietnamese’s mispronunciation of the following ESL consonants (see the table 2.6).

Table 2.6. The ESL consonant confusion of Vietnamese students

IPA	Confused with
/θ/	/t, s/
/ð/	/d, z/
/p/	/b/
/dʒ/	/z/
/ʒ/	/z, dʒ/

Ha (2005) concurs with them about Vietnamese learners’ confusion in her study. She demonstrates the sound confusion, such as /tʃ/ is confused with /t/, /ð/ with /d, z/, /s/ with /ʃ/, /p/ with /b/, and /θ/ with /t^h/. The consonants /p, θ, ð, ʃ, dʒ, tʃ, ʒ/ cause difficulties for Vietnamese speakers, especially in the medial and final positions (Tuan, 2011). As listed above, Nguyen and Brouha (1998) support this argument with a table of consonant phonemes that occur in both onset and coda position (see table 2.4 above). Those consonants /p, θ, ð, ʃ, dʒ, tʃ, ʒ/ have no equivalent phonemes between the two languages, except /p/ (Nguyen, 2008; Nguyen, 1998) (see

table 2.3 above). The consonant /p/ exists only at the final position without releasing (Nguyen, 1998). It is thus likely that Vietnamese speakers mispronounce it when producing ESL words containing /p/, such as /pen/ (Tuan, 2011).

In the previous section, it was stated that English allows complex syllable structure in either onset or coda position. In more detail, an onset cluster of English is probably up to three consonant segments, but that of Vietnamese is only a single segment (Nguyen, 1998), or up to two segments (Emerich, 2012). Further, a coda cluster of four consonants may occur in English codas. By contrast, this is not possible in Vietnamese since this language only allows single codas (Nguyen, 1998). In brief, the above sections seem to provide an implication that English complex codas may cause much more difficulties for Vietnamese learners. The next section, thus, will discuss Vietnamese learners' production of ESL codas based on two different types: single codas and coda clusters.

2.1.4 Vietnamese learners' ESL coda acquisition

2.1.4.1 ESL coda productions

Single codas

Nguyen and Brouha (1998: 79-89) focus on investigating ESL single codas by Vietnamese speakers between 24 and 45 years old. None of the speakers began learning before the age of 12. The investigation concentrates on the production of 15 consonant codas distinguished from two different groups: I and II. Group I comprises /-θ, -ʃ, -ð, -tʃ, -dʒ, -ʒ/ that are not found in Vietnamese. Group II, by contrast, consists of consonants / -b, -g, -d, -f, -v, -s, -z, -l, -l/ that occur in Vietnamese, but only in onsets. The result shows that there are four main production types: target production, neutralization, deletion, and epenthesis. Neutralization and target production get higher percentages, whereas deletion and epenthesis account for very low percentages among production types. To speak in detail, in 120% total percentage, target production gets up to 46.5%, neutralization to 60 % while deletion only accounts for 8.3% and epenthesis for 4.8%. The reason for 120% total percentage is that some errors are categorized to the same process (p79). Regarding neutralizations, devoicing, sibilant / fricativization, unreleasing, and stopping occurred more frequently than other processes. Less common

neutralizations included fronting, backing, /-st/ substitution, /-n/ substitution, and others⁴ (p79-81).

To explain why devoicing, unreleasing and stopping are more common, we can observe the table of Vietnamese consonant phonemes (table 2.4) in both onset and coda positions (Nguyen 1998). The consonant system allows the voiceless stops /p, t, k/ in codas, but not voiced stops. Nguyen (2008: 1, 11) further points out that the feature [+voice] is less preferred than [-voice] in Vietnamese learners' coda production. Besides, both nasals and voiceless stops are unreleased in coda position (Osburne, 1996). Therefore, we may infer that Vietnamese L1 transfer contributes to their ESL surface forms. First, the dis-preference of feature [+voice] in coda position may cause devoicing in ESL production. Next, voiceless stops in codas may cause stopping in the production. The unreleased voiceless stops and nasals in L1 codas further may leads to the unreleasing process. This investigation of Nguyen and Brouha (1998) has well-related data for the OT analysis. Thus, their data will be described more in the chapter III that focuses on the OT analysis of Vietnamese learners' ESL coda production.

Coda clusters

Sato (1984) and Nguyen (2008) both investigate ESL coda cluster production by Vietnamese speakers. Nevertheless, the subjects of these studies differ in their levels of proficiency. Nguyen's (2008) work carries out on nearly advanced-level students, whereas Sato's (1984) on the learners at the beginning level. It is reasonable to assume that the two different levels of proficiency can cause two different results. Nguyen (2008: 5-13) raises the question as to what types of "two member final codas" (2MFCs) are the most difficult for Vietnamese students. She finds the following answers: Voiceless obstruent clusters have a higher proportion of target production than their voiced counterparts. The 2MFCs consisting of a nasal and a voiceless obstruent also have a higher percentage of target production. Specifically, the expected production of 2MFCs that consists of nasal and voiceless stops is very high. From the speakers' coda cluster production, we can conclude that nasal and voiceless stops are the most preferred in coda consonant clusters.

Nguyen (2008)'s report reveals that Vietnamese learners prefer the repair strategies to cope with their 2MFCs production. Also, coda cluster reduction has been found as a very common repair

⁴ See the definitions of neutralization, devoicing, /st/ and /n/ substitution, fronting, stopping, unreleasing and backing in the appendix A

strategy of Vietnamese learners (Nguyen, 2008: 11). Sato (1984, cited by Nguyen 1998) also predicts the dis-preference of codas as opposed to onset clusters, because Vietnamese does not allow clusters in codas. In addition, more difficulties arise if Vietnamese speakers acquire syllable-final structure. Within this restructuring, their repair strategies could be deletion of a cluster, deletion one segment of the cluster, reduction of a cluster through vowel epenthesis, or neutralization in which one or more segments can be changed (Nguyen, 1998: 47).

In their study of coda clusters, Nguyen (2008) and Sato (1984) have both similarities and discrepancies on the result. One similarity is that epenthesis is nearly absent in their collected data. Nevertheless, they record different types of neutralization. Neutralization occurs only 1% in Sato's (1984) data, whereas it occurs in 44.3% of word-list reading and 25.2% of spontaneous production in Nguyen (2008). The speakers' level of proficiency may account for the different results. Participants in Nguyen's (2008) belong to advanced-level English learners; on the contrary, those in Sato's (1984) are beginning-level ones.

Deletion and reduction of coda consonant clusters are attested among Vietnamese speakers (Osburne, 1996; Nguyen, 2008; Sato, 1984). In most instances of Osburne's (1996) analysis, the nasals at all places of articulations are kept, rather being reduced or deleted. For the coda cluster [nt], the nasal [n] prefers to be remained, as [ædzʌsmen] *adjustment*, instead of [ædzʌsment]. The word *involvement* is realized as [ɪnɪvɔlmən], *comments* as [k^həmən], *funds* as [fʌn], and *sometimes* as [sʌmtajm] (Osburne, 1996: 170). One possible reason for this pattern is that nasals are allowed in Vietnamese coda position (Nguyen, 1998; Nguyen 2008; Sato, 1984). This could explain why Vietnamese speakers prefer nasals in codas, rather than other consonants in their ESL production.

As Osburne (1996) mentions, Vietnamese speakers have difficulty with fricative codas. Le (2007) finds that two inter-dental fricatives /θ, ð/ are realized as alveolar stops [t, d], but only with onset positions. In the research of ESL single codas, Nguyen and Brouha (1998) discovers interesting repair strategies of ESL fricative codas, including deletions, devoicing, epenthesis, sibilation / fricatization, and stopping. A large number of fricative codas were sibilated or transformed to stops (Nguyen and Brouha; 1998). Nevertheless, Sato (1984) and Nguyen (2008) see most of the deletion of fricatives occurring in coda cluster. Sato (1984, cited by Osburne 1996) provides an example of how the word *just* is pronounced: The Vietnamese L1 speaker produced [ju[̃]t̚] with unreleased stop [t̚], instead of the fricatives [s], as [jʌs]. Also, the studies of Sato (1984), Nguyen (2008) provide with the well-related data on ESL coda cluster production.

Hence, it should be suggested that the data description of two investigations in the Chapter III to account for aspects of ESL coda cluster acquisition.

2.1.4.2 Reasons for deviation from target forms

Nguyen (2008: 2-6) mentions that the reasons for repairs of ESL coda clusters involve markedness, L1 transfer, linguistic environment, and task variation. The triggers for repairs fall into two categories: internal and external (Nguyen *et al.*, 1998). Internal factors cause “the variations in the second language learner’s system” whereas external factors have an effect on learners’ performances (Nguyen, 1998: 83). The following sections will mention some of these factors.

Internal factors

- L1 transfer

Many researchers have proposed that L1 transfer is one of the main factors that affect the second language acquisition (Oblin, 1989; Eckman, 1983; Schachter, 1991, Gass *et al.*, 1983). Odlin (1989: 27) defines transfer as “the influence resulting from similarities and differences between the target language and any other language that has been previously acquired”. Language transfer accounts for phenomena whereby speakers substitute some aspects of L2 (or L3, L4) structure by L1 forms in their speech or writing (Schachter, 1991; Gass *et al.*, 1983). Greenberg (1983, cited by Sato, 1984) gives an example to illustrate why L1 transfer has effect on the acquisition process. Turkish does not allow onset clusters, except in loanwords. Greek and Japanese, by contrast, do not allow coda clusters. Therefore, Greenberg finds that Turkish speakers have the highest percentage of errors with onset clusters whereas the Greek and Japanese speakers have higher error rates with coda clusters. In Sato’s (1984: 45) report, Greenberg (1983) concludes that the L1 transfer affects syllable structure in interlanguage production. L1 transfer is most prominent in the early stage of L2 acquisition (Broselow, 2004). In the case of ESL coda acquisition, it would be possible to say that the effect of L1 transfer is prominent in Vietnamese learners’ production (Sato, 1984; Le, 2007; Nguyen, 2008; Nguyen, 1998; and Osburne, 1996). Any L2 phonological theory must include the possibility of Vietnamese phonological influence as the learners acquire English phonology. For example, Greenberg (1978) considers that nasals are more marked than liquids in terms of universal grammar (UG). This implies that nasals should cause more difficulty for Vietnamese learners than liquids. Nevertheless, his hypothesis is not correct since Nguyen (1998) and Nguyen (2008)

report that nasal sounds are much easier to produce than liquids in coda position for Vietnamese speakers. Nguyen (2008: 11) attributes this to L1 transfer, since Vietnamese allows nasals in coda position, but not liquids. Therefore, it is likely that Vietnamese phonology has an effect on Vietnamese learners' production during their ESL acquisition process.

External factors:

- Age

Elman (1993, cited by Le, 2007: 1) considered age effects in second or foreign language acquisition with respect to memory capacity. It has been claimed that adults have a larger working memory capacity to work with syntax or morphology, but lose some detail memory to work with phonological contents (Tarone, 1987; Long, 1993: 198). After puberty, they cannot achieve native-like phonology of the second language. However, they may develop well in aspects: syntax, morphology, or discourse (Tarone, 1987). Despite this, the findings of Le (2007), Lenneberg (1967) and Thompson (1991) appear to confirm that the earlier a person starts to learn a language, the better he or she acquires it. The case studies of Nguyen (2008) and Le (2007) describe a wide range of Vietnamese participants who started learning English after the age of 12. Their preferred production types of ESL codas are repairs, rather target production. Therefore, it seems that age is one of factors accounting for Vietnamese learners' problem in L2 acquisition.

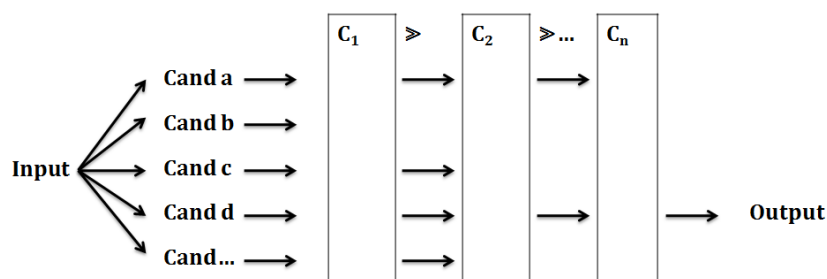
2.2 THE THEORETICAL BACKGROUND

2.2.1 The basic concepts of Optimality Theory

Optimality theory is a framework in theoretical linguistics, as proposed by Alan Prince and Paul Smolensky (1993), and later expanded by many others, especially McCarthy and Prince (1994). It is utilized to resolve aspects in phonology, but is not common in other linguistic areas.

There are three main components in the theory: GEN, CON, and EVAL. GEN takes the input and generates a set of potential output candidates. Among the output candidates, some are identical to the input, but others are modified or unrecognizable. CON is assumed to be universal and takes place in every language. CON consists of two basic types: **Markedness** and **Faithfulness**. Markedness constraints penalize the output candidates which have a marked structure (see the appendix B). By contrast, faithfulness constraints make sure that the output in some extents resembles with its input. The markedness and faithfulness constraints can conflict. The ranking conflicts can be resolved by domination. Domination means that if there is a pair of conflicting constraints, the one with a higher-ranking dominates the lower-ranked one. EVAL receives the set of candidates from GEN, evaluates them by considering the set of constraints and chooses the most optimal output. The most optimal output is the candidate which best satisfies the set of constraints. It means that all constraints can be violable, but the violation of high-ranked constraints is more serious than the violation of low-ranked constraints. The candidate, which has the fewest violations against the high-ranked constraints, will be chosen as the optimal output. Kager (1999) gives the mapping of input to output in OT grammar below:

Figure 2.4. The mapping of input to output in OT grammar (Adapted from Kager, 1999: 8)



The evaluation of constraint ranking is formulated by a tableau. The top row is filled in with the input and then the set of ranked constraints. The high-ranked constraints are placed from the left and descend the ranking gradually to the right. The column on the far left is placed next to a set

of possible output candidates, into which one of them is chosen and entered as the optimal output. The other columns illustrate the constraint violations. Each violation is demonstrated by an asterisk. The fatal violation which is enough to prevent the candidate to be optimal, is indicated by an exclamation mark '!'. The optimal output that best satisfies the constraint ranking is indicated by this symbol '☞'. A simple tableau is illustrated as follows.

Tableau 2.1

/input/	Constraint 1	Constraint 2
Cand a	*!	
☞ Cand b		*

2.2.2 Optimality theory in second language acquisition

L2 acquisition is a large topic with many different aspects. In linguistics, many researchers are concerned with theories to account for its phenomena (Tarone, 1987; Hayes, 2004; Greenberg, 1983; Broselow, 2004). Broselow (2004) argues for the use of an OT framework in explaining L2 acquisition. It has been proposed that in the initial stage of first language acquisition, markedness constraints outrank faithfulness constraints (Gnanadesikan, 1995; Prince and Tesar, 2004; Fikkert, 2007). However, in the course of L2 acquisition, learners are strongly affected by the rankings of L1 grammar in the early stage. Hence, the set of constraints is ranked according to the L1 grammar (Broselow, 2004). During the process of L2 acquisition, learners must re-rank constraints to generate L2 forms (Broselow, 2004: 54).

Broselow (2004: 55) proposes the OT model of L2 acquisition as follows.

Initiate state: L1 rankings, based on NL⁵ data

Input: TL⁶ data, causing some rankings for IL⁷ grammar

Final state: Grammar ranging from fossilization of interlanguage to full mastery of L2 grammar

⁵ NL: Native Language

⁶ TL: Target Language

⁷ IL: Interlanguage

Elsewhere, Tsimpli (2006), Bayley and Preston (1996) have a large discussion on variation in the process of L2 acquisition. Broselow *et al.*, (1998), Anderson (1987), and Weinberger (1987) found that Chinese learners prefer repair strategies such as devoicing, deletion, and epenthesis in ESL coda acquisition. On the contrary, Vietnamese learners prefer neutralization with respect to single codas and deletion with respect to coda clusters (Nguyen, 1998; Nguyen 2008; Sato, 1984).

2.2.3 Variation theories

Partially Ordered Constraints (POC)

Kiparsky (1993) and Reynolds (1994) propose an extended model of OT called Partially Ordered Constraints (POC). The model is developed in more detail in the discussion of Anttila *et al.* (1998). It results in the variation by “a total ordering from a ranked set of constraints” (Coetzee and Pater, 2011: 408). In the model, a grammar is defined as a partial ordering than an absolute ordering. A partial ordering, as defined by Anttila (1998: 527), is a binary relation that is “irreflexive, asymmetric, and transitive”. As the grammar is utilized for evaluating a candidate set, one of the total orders matching with the partial order is randomly selected. As a result, the variation results as some of these total orders choose different candidates as their optimal outputs. Coetzee and Pater (2011: 408) give the following example to illustrate how the model works:

Grammar: $C_1 \succ C_2, C_1 \succ C_3$

Tableau 2.2. First possible ranking: $C_1 \succ C_2 \succ C_3$

/input ₁ /	C ₁	C ₂	C ₃
☞ Cand ₁			*
Cand ₂		*!	
Cand ₃	*!		

Tableau 2.3. Second possible ranking: $C_1 \gg C_3 \gg C_2$

/input ₁ /	C ₁	C ₃	C ₂
Cand ₁		*!	
☞ Cand ₂			*!
Cand ₃	*!		

The two constraints C₂ and C₃ both rank lower than C₁, but there is no evidence that C₂ outranks C₃. One of possible rankings between C₂ and C₃ will be selected as /input₁/ is inserted to the grammar. If the output Cand₁ is optimal under one ranking and Cand₂ under another ranking, a language with the /input₁/ can generate two surface forms: either Cand₁ or Cand₂, instead of Cand₃.

2.2.4 Positional faithfulness

Positional Faithfulness has been proposed by Beckman (1995, 1998) to explain positional neutralization using OT. The aim in explaining positional neutralization is to “capture the typological asymmetry of the neutralization” (Smith, 2000: 204). In the work of the theory, “each faithfulness constraint in the grammar has a specific version relativized to every strong position” (Smith, 2000: 204). Beckman (2013) provides the positional faithfulness constraints that have the general forms.

IDENT-*Position* (F)

Let β be an output segment in a privileged position P and α the input correspondent of β . If β is $[\gamma F]$, then α must be $[\gamma F]$. Correspondent segments in a privileged position must have identical specifications for [F].

Beckman (2013: 11)

He provides the ranking for positional phonological asymmetries in the following schema.

$$\text{IDENT-Position(F)} \gg C \gg \text{IDENT (F)}$$

Beckman (2013: 11)

F is any phonological feature and C is any constraints that affect F’s distributions. The positional faithfulness constraint in the schema ranks above the constraint C. The constraint C further

dominates the free-context faithfulness constraint IDENT(F). For example, Lombardi (1999) uses positional faithfulness to illustrate syllable-final neutralization in German. German is one of languages that allow voiced obstruents in onsets, but not in codas. The positional faithfulness ranking is to make sure that the voice obstruents are possibly in the onset position, but not in the coda:

$$\text{IDENTOns(Lar)} \gg *Lar \gg \text{IDENT(Lar)}$$

IDENTOns(Lar)	Consonants in the position stated in the Laryngeal Constraint should be faithful to underlying laryngeal specification
*Lar	Do not have Laryngeal features
IDENT(Lar)	Consonants should be faithful to underlying laryngeal specification.

Lombardi (1999: 347-367)

In more detail, the positional faithfulness constraint IDENTOns(Lar) is to maintain the voiced obstruents in the onset position. The markedness constraint *Lar gives a voiced obstruent a violation mark, but not a voiceless obstruent. The ranking of the positional faithfulness constraint IDENTOns(Lar) over the markedness constraint *Lar ensures that voiced obstruents are preserved in an onset position. Laryngeal neutralization occurs in codas as the markedness constraint *Lar outranks the faithfulness constraint IDENT(Lar). In Vietnamese voicing, only surfaces in onsets, but not in codas. Vietnamese learners, therefore, have difficulty in pronouncing voiced segments in ESL coda position (See the tableau 2.1).

Tableau 2.4. Final syllable neutralization

/did/	IDOns(Lar)	*Lar	IDENT(Lar)
a. did		*!*	
☞ b. dit		*	*
c. tid	*!		*
d. tit	*!		*

2.3 A short summary

This chapter has examined key information related to the Optimality Theoretic analysis of ESL coda acquisition by Vietnamese speakers. It first provides general similarities and contrasts between English and Vietnamese consonants and syllable structures. Certain similarities may provide a positive transfer for Vietnamese speakers who acquire English, specifically, the existence of nasals and voiceless stops in both Vietnamese and English codas. The differences between the two languages, by contrast, may cause repair strategies in ESL production. The second section discussed ESL coda production by Vietnamese learners regarding single codas and coda clusters. Within the single codas, neutralization and target production are the most likely production types. With the coda clusters, deletion is the most preferred repair strategy. A question arises why different strategies are adopted for singletons and clusters. OT and OT-like theories are proposed to answer this question. The following chapter will address in more detail how OT accounts for ESL coda acquisition by Vietnamese learners.

CHAPTER 3: OPTIMALITY THEORETIC ANALYSIS OF ESL CODA ACQUISITION

The preceding chapter discussed the data and theories required for the OT analysis. Therefore, this chapter will focus on how OT can account for ESL coda acquisition by Vietnamese speakers. The discussion is carried out in two major parts: single codas and coda clusters. First, OT will be shown to address the data of ESL single codas given by Nguyen and Brouha (1998). Second, it is shown to work with coda clusters that data are given in Sato (1984) and Nguyen (2008). The data description in Chapter II mentioned general information on ESL coda production. However, additional data will be presented below.

3.1 SINGLE CODAS

3.1.1 Nguyen and Brouha's (1998) data collection

The following discussion is based on data of Nguyen and Brouha's (1998: 77-91), whose investigation centers on ESL single coda production.

Participants: The data are elicited from eight Vietnamese speakers around 24 - 45 years old. All participants live in United State (US): five women were enrolled in High Beginning and Intermediate ESL classes, Fairfax County, Virginia, and three men were employed in Fairfax County. Their average spent living in the US was four years, ranging from one to eight years. Five of the participants began learning English at age 12, two at 22, and one at 25. All of the participants started learning English in Vietnam before moving to the US (See table 3.1).

Table 3.1. Nguyen and Brouha's participant profile (1998: 78)

Participants	Age	Sex	Vietnamese Dialect	Age Starting English	Years in USA
S1	24	F	Southern	22	2
S2	26	M	Central	12	5
S3	27	F	Southern	12	1
S4	28	M	Southern	22	6
S5	29	F	Southern	25	2
S6	29	F	Southern	12	1
S7	29	F	Southern	12	2
S 8	45	M	Northern	12	8

Tasks: The data was gathered to investigate the production of ESL single codas. Nguyen and Brouha (1998) thus worked on 15 single codas split up into two separate groups. Group I contains consonants/-θ, -ʃ, -ð, -tʃ, -dʒ, -ʒ/ that do not exist in Vietnamese consonant phonemes. Group II, on the other hand, consists of / -b, -g, -d, -f, -v, -s, -z, -l, -ɹ/ that occur only in onsets in Vietnamese. Each coda is expected to produce three times within three tasks and eight participants. The three tasks comprise repeating words after a native speaker, reading simple sentences ending in the target word, and using the frame sentence, 'I say'. The recording process took place in the house of one transcriber. In total expected 1080 tokens, 1074 of them were recorded and transcribed, but six rest tokens were missed.

Results: Out of 1074 tokens, 500 (46.5 %) were target production, 90 (8.3%) deletion, 52 (4.8 %) epenthesis, and 654 (60%) feature changes (note: a single token can contain more than one production type.). The greatest difference between group I and group II are target production and deletion. It seems that the ratio of target production in group II doubles that of group I. Deletion in group I get only one-third of those in group II, whereas epenthesis in group I nearly doubles those of Group II. With epenthesis, Nguyen and Brouha (1998) explain that the subjects 1 and 6 produce the grapheme e to the sounds [i, I, ə] as it occurs in the word-finally, causing epenthesis.

Unlike the above cases, neutralization of both groups has no prominent changes (See table 3.2).

Table 3.2. Production types of ESL single codas in total 'percentages in brackets' (Nguyen and Brouha, 1998:81)

	Target (n= 500)	Deletion (n= 90)	Epenthesis (n= 52)	Neutralization (n= 654)
Group I	137	20	33	322
Group II	363	70	19	332
Total (%)	500 (46.5)	90 (8.3)	52 (4.8)	654 (60)

Variation of syllable-final neutralization

In the case of Vietnamese speakers, syllable-finale neutralization is clarified as different sub-processes: devoicing (dev), fricativization/sibilization, unreleasing (unrel) and others that consist of

/st/ substitution, fronting (front), stopping (stop), backing (back), and final /n/ substitution⁸ (See table 3.3).

Table 3.3. Syllable-final neutralization (Nguyen and Brouha, 1998: 81)

	Dev	Fricatization/ sibilation	Unrel	Others					
				/-st/	front	back	stop	/-n/	others
Group I	40	107	50	29	14	27	55		
Group II	99	35	131	11	7	8	18	16	7
Total	139	142	181	40	21	35	73	16	7

With neutralization, the two groups both exhibit devoicing, fricativization/sibilation, unreleasing, /st/ substitution, fronting, backing, and stopping. However, the remainders of the sub-processes occur only in the group II.

The common sub-processes in both groups otherwise catch the difference in number. 40 devoiced out of 654 neutralized tokens in group I gets nearly a half of those in group II (90 out of 654). Furthermore, unreleased consonants (50 out of 654) of group I only gets one-third of those in the group II (131 out of 654). The remainders in the group I are more than those of group II (see table 3.3). Furthermore, there are a number of /st/ substitutions in both groups while the language allows no consonant clusters in codas (Nguyen, 1998). Nguyen and Brouha (1998) accounts for the fact that /st/ substitution takes place based on two main reasons. First, since two consonants, /s/ and /t/ are coronals and homorganic, the cluster /st/ is easier to be acquired. Second, the cluster /st/ used in the past tense and superlative morphology, as with *passed*, *kissed*, *happiest*, *greatest* has been previously taught to the learners. It implies that the learners may overuse or misapply the cluster in their production. To account for unreleasing, they mention the so-called timing slots. Timing slots in Vietnamese are filled with many pieces of information, as with vowel, tone, onset, coda, and stress (Nguyen and Brouha, 1998: 86). To adjust English timing slots is difficult for Vietnamese learners. For example, the Vietnamese word [mɛt¹] *mét* 'meter' involves many pieces of information, such as the onset [m], vowel [ɛ], coda [t], and rising tone [¹] (Kirby, 2011). Osburne (1996) further mentions that stops are

⁸ See definitions of the sub-processes in the appendix A

unreleased in coda position. Hence, acquiring an English stop with releasing is thus difficult for the learners. Nevertheless, Nguyen and Brouha (1998) are not clear about why fricatives in both groups are unreleased. The number of unreleased fricatives accounts for 50 with the group I and 23 with the group II. I propose the idea that a fricative token may undergo two processes: stopping, and unreleasing. This answers for why a token, as they describe above, can comprise more than one production types. The following section is going to discuss the OT analysis in detail.

3.1.2 Discussion

3.1.2.1 Constraints utilized in the analysis

Faithfulness constraints

- (3) DEP-IO: Every segment of the output has a correspondent in the input.
- (4) IDENT-IO (F): Output correspondents of an input [γ F] segment are also [γ F]
- (5) MAX-IO: Every segment of the input has a correspondent in the output.

McCarthy and Prince (1995: 16)

- (6) IDENT (ONSET) A syllable onset is identical to its input correspondent.

Zoll (2004: 366)

Alignment constraints

- (7) Align (Prwd, σ) Any PrWd-edge coincides with a syllable-edge.

McCarthy and Prince (1993:19)

- (8) Align- σ -L Align (σ , L, PrWd, L) align the left edge of every syllable with the left edge of prosodic word

- (9) Align- σ -R Align (σ , R, PrWd, R) align the right edge of every syllable must with the right edge of prosodic word

Markedness constraints

- (10) *[-cont, +cont] Assign one violation mark for every segment that contains [+continuant] and [-continuant] features
- (11) *[+ant, +dist] Assign one violation mark for every segment that contains [+anterior] and [+distributed] features
- (12) *[-ant, +dist] Assign one violation mark for every segment that contains [-anterior] and [+distributed] features
- (13) *[+continuant] Assign one violation mark for every segment with the feature [+continuant]
- (14) *[+laryngeal] Do not have laryngeal feature

Lombardi (1999: 22)

- (15) *[+approximant] Assign one violation mark for every segment with the feature [+approximant]

3.1.2.2 Positional faithfulness

As mentioned in 2.2.4, Lombardi (1999) utilizes positional faithfulness to account for German syllable-final neutralization. German allows voiced obstruents in onsets, rather in codas. The ranking to maintain the faithfulness of feature [+voice] in onset position is the most likely choice. The constraint ingredient consists of the positional faithfulness constraint IDENT_{Ons}(Lar), the markedness constraint *Lar, and faithfulness constraint IDENT(Lar). The constraint IDENT_{Ons}(Lar) must dominate *Lar to ensure that the voice obstruents keep in onsets, but not in codas. Additionally, the fact that the markedness constraint *Lar ranks above the faithfulness constraint IDENT(Lar) makes it possible to generate the syllable-final neutralization.

(16)

/rad/	IDOns(Lar)	*Lar	IDENT(Lar)
a. rad		*!	
☞ b. rat			*
/gut/			
☞ a. gut		*	
b. kut	*!		*

Looking at the above tableau; we can see the interaction of three constraints: IDOns(Lar), *Lar, and IDENT(Lar). The fact that the constraint *Lar ranks higher than IDENT(Lar) causes devoicing of the input /rad/ in coda position. Furthermore, the ranking of IDOns(Lar) over *Lar leaves the outputs that maintain voicing in onsets.

In Vietnamese, the onset contrast may contain a larger range of consonants: fricatives, approximants, stops, and nasals. However, the coda contrast can only include voiceless stops /p, t, k/, and nasals /m, n, ŋ/ (Nguyen, 1998; Benson, 1988). This means that Vietnamese onsets can be occupied with fricatives, voiced stops and approximants, but codas cannot. Hence, we should consider the positional faithfulness in this case. First, we must assume that markedness constraints prohibit fricatives, approximants, and voiced stops. Second, since they can only be kept in ESL onsets, a positional faithfulness constraint must dominate the markedness constraints. The positional faithfulness constraint was originally proposed with the features in strong positions, such as IDENT-ONSET (voice) (Lombardi, 1996; Beckman, 1997). In Zoll (2004), the positional faithfulness constraint IDENT (ONSET) is mentioned to keep the onset syllables identical to the input. In this case, we consider IDENT (ONSET) to keep fricatives, approximants, and voiced stops being identical in onsets.

(19) IDENT (ONSET) "A syllable onset is identical to its input correspondent."

(Zoll, 2004: 366)

(17) The ranking schema for positional faithfulness

IDENT (ONSET) ≫ The markedness constraints

For the sake of clarity, we should understand what a markedness constraint is. De Lacy (2010: 3) argues that markedness constraints give "violation marks based solely on the form of the output representation", such as *DORSAL. In detail, the markedness constraint *Dorsal gives one violation mark for each element [dorsal] in the output. Thus, the following markedness constraints are based on De Lacy's (2010) argument.

-Group I

As in the section 3.1.1, the ESL single codas are divided into two separate groups. We first mention the group I. The dental fricatives /θ, ð/, affricatives /tʃ, dʒ/, and fricatives /ʃ, ʒ/ do not exist in the Vietnamese consonant system. For that reason, they may be the biggest obstacles among consonants for the ESL learners. It implies that markedness constraints violated by these consonants must be very high in the ranking hierarchy. In detail, the group should be divided into three sub-groups: dental fricatives /θ, ð/, post-alveolar fricatives /ʃ, ʒ/, and post-alveolar affricates /tʃ, dʒ/. The error rate of the sub-group /tʃ, dʒ/ is the highest, that of /ʃ, ʒ/ is the second highest, and that of /θ, ð/ is the least (Tuan: 2011). Furthermore, in each group, the consonant that contains the feature [+voice] have a higher error rate than the one do not (Tuan, 2011), which implies that the voiced sounds tended to be harder to acquire. Regarding to the ranking between those sub-groups, the markedness constraints: *[-cont, +cont], *[-ant, +dist], and *[+ant, +dist] should be considered. The arguments for ranking are stated below.

The feature [anterior] is utilized to differentiate coronal sounds in front of the alveolar ridge from those behind the alveolar bridge (Hall, 2007: 324). The feature specifications for CORONAL and [anterior] in (18) illustrates that [+anterior] holds for dentals and alveolars whereas [-anterior] for retroflexes, palato-alveolars and palatals. However, labials and dorsals are unmarked for these features (Hall, 2007).

(18) Matrix of feature specifications for [anterior] (Adapted from Hall, 2007: 324)

	labials	dentals	alveolars	retroflexes	palato-alveolars	palatals	velars
CORONAL		✓	✓	✓	✓	✓	
[anterior]		+	+	-	-	-	

To Sagey (1986: 278), "the feature +distributed describes a constriction formed by the tongue front that extends for a considerable distance along the direction of airflow and [-distributed] to a constriction formed by the tongue front that extends only for a short distance along the direction of airflow". It is utilized to distinguish apical from laminal sounds. The distinction can hold for stops, fricative, nasals, and laterals. Keating (1988: 6) further provides a matrix to distinguish coronal fricatives from six places of articulation:

(19)

	θ ð	ʃ ʒ	s z	ʃ, ʒ	ʃ ʒ	ç j
CORONAL	✓	✓	✓	✓	✓	✓
[anterior]	+	+	+	-	-	-
[distributed]	+	+	-	+	-	+

The markedness constraint *[+ant, +dist] assigns one violation mark for every segment that involves both anterior and distributed features. The markedness constraint *[-ant, +dist], by contrast, assigns one violation mark for every segment that contains non-anterior, but distributed features.

(20) *[+ant, +dist] Assign one violation mark for every segment that contains [+anterior] and [+distributed] features

(21) *[-ant, +dist] Assign one violation mark for every segment that contains [-anterior] and [+distributed] features

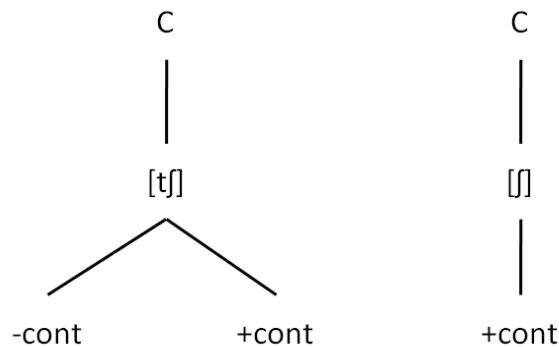
These two markedness constraints *[-ant, +dist], and *[+ant, +dist] are key to distinguishing dental fricatives from post-alveolar fricatives. The sub-group of dental fricatives /θ, ð/ has the least percentage of error patterns. Hence, *[+ant, +dist] must rank below *[-ant, +dist] to ensure

that they are easier to be acquired. The interaction of two markedness constraints is presented in (22).

(22) *[-ant, +dist] ≧ *[+ant, +dist]

Among the above sub-groups, that of affricates is the hardest to acquire. The Vietnamese speakers seem to follow universal grammar (UG) in preferring fricatives to affricates. Affricates are more marked than fricatives since they contain more complex segments than fricatives. See the structures represented by Lombardi (1990: 370).

Figure 3.1. The segmental structures of an affricate and a fricative



The insertion of the markedness constraint *[-cont, +cont] is a key to avoiding affricate from being an optimal output. Since the affricates /tʃ, dʒ/ are interpreted as the most difficult ones to acquire, the markedness constraint *[-cont, +cont] is the highest ranked among the suggested markedness constraints.

(23) *[-cont, +cont] Assign one violation mark for each segment that contains [+continuant] and [-continuant] features

(24) *[-cont, +cont] ≧ *[-ant, +dist] ≧ *[+ant, +dist]

- Group II

In Vietnamese, the consonants /b, g, d, f, v, s, z, l, ɹ/ are allowed only in onsets. Those consonants are clarified as three different types: voiced stop, fricative, and approximant. Three markedness constraints: *[+laryngeal], *[+approximant], and *[+continuant], each one assigns a violation mark for each segment that contains any laryngeal, approximant or continuant feature respectively. We first mention the markedness constraint *[+approximant].

Clements (1990: 292-293) regards glides, liquids, and vowels as [+approximant], and stops, fricatives and nasals as [-approximant]. The markedness constraint *[+app] assigns a violation mark to [+approximant] sounds, such as liquids.

- (25) *[+approximant] or *[+app] Assign one violation mark for every segment with the feature [+approximant]

Hall (2007:319) further mentions Halle and Clements's (1983: 7) consideration of the feature continuant. Continuants are "formed with a vocal tract configuration allowing the airstream to flow through the midsagittal region of the oral tract" (Hall, 2007: 313). The feature [+continuant] holds for fricatives, rhotics, glides, and vowels, but [-continuant] involves stops, nasals, and lateral approximants like /l/. In Vietnamese, fricatives are not allowed in codas. Thus, the markedness constraint *[+cont] is to prevent codas that contain the feature [+continuant] from being optimal.

- (26) *[+continuant] or *[+cont]: Assign one violation mark for every segment with the feature [+continuant]

Hall (2007: 317) mentions the role of laryngeal features in accounting for the contrast in voicing, aspiration and breathy voice. They can further distinguish plain sounds from ejectives and implosives. These features are commonly utilized to account for phonological processes, such as assimilation or dissimilation with voicing or/and aspiration in it, and particularly devoicing in final position. In more detail, Lombardi (1999) uses laryngeal features to account for syllable-final devoicing in German. In Vietnamese, voiced stops /b, d, g/ and aspirated stops /t^h/ are not allowed in codas. To make a difference in voicing and aspiration, the markedness constraint *[+lar] is proposed to assign a violation mark to any laryngeal feature. With ESL single codas, it gives a violation mark for any coda that contains either [+voice] or [+spread glottis]. Thus, the markedness constraint *[+lar] should be equally ranked with the two constraints mentioned above.

- (27) *[+laryngeal] or *[+lar]: Do not have laryngeal feature

Lombardi (1999: 22)

As far as consonants of group II are concerned, the markedness constraints should be *[+app], *[+cont], *[+lar]. The markedness constraint *[+app] *[+cont], and *[+lar] to violate consonants

with the features: approximant, continuant, and laryngeal, such as the fricatives /f, v, s, z/, voiced stops /b, d, g/, and liquids /l, ɹ/.

In conclusion, the markedness constraints *[-cont, +cont], *[-ant, +dist], and *[+ant, +dist] prevent ESL codas of group I from being optimal. Further, *[+app], *[+cont], and *[+lar] are to violate the laryngeal, continuant and approximant features in codas of group II. However, codas of group I should be less preferable than those of the group II since they never occur in Vietnamese (see table 3.2). Therefore, the markedness constraints *[-cont, +cont], *[-ant, +dist], *[+ant, +dist] should be more highly ranked than *[+app], *[+cont], *[+lar]. See (28).

(28) *[-cont, +cont] ≫ *[-ant, +dist] ≫ *[+ant, +dist] ≫ *[+app], *[+cont], *[+lar]

- The ranking hierarchy reflecting L1 grammar in the initial stage of ESL acquisition

Notice that already, in cases of L2 acquisition, the learners are strongly affected by the rankings of L1 grammar in the initial stage. It leads to the idea that the constraint ranking reflects Vietnamese grammar in the first stage of ESL acquisition. Hence, the ranking hierarchy reflecting Vietnamese grammar should be considered. Again, the fricatives /f, v, s, z/, voiced stops /b, d, g/, and approximants /-l, -ɹ/ can only place in Vietnamese onsets. Hence, the positional faithfulness constraint IDENT (ONSET) ranks above the markedness constraints *[+app], *[+cont], and *[+lar] to maintain these above consonants in this ESL onset position. The ranking is given in (29).

(29) IDENT (ONSET) ≫ *[+app], *[+cont], *[+lar]

However, it has been mentioned that the dental stops /θ, ð/, affricatives /tʃ, dʒ/, and fricatives /ʃ, ʒ/ do not occur in Vietnamese at all. Thus, the markedness constraints: *[-cont, +cont], *[-ant, +dist], and *[+ant, +dist] must rank higher than IDENT (ONSET) in the initial stage. This is to ensure that these consonants never surface faithfully in either onset position.

(30) *[-cont, +cont] ≫ *[-ant, +dist] ≫ *[+ant, +dist] ≫ IDENT (ONSET)

The combination of two ranking hierarchies: (29) and (30) can generate a new ranking in which IDENT (ONSET) ranks above *[+app], *[+cont], *[+lar], but below *[-cont, +cont], *[-ant, +dist], and *[+ant, +dist]. See (31).

(31) *[-cont, +cont] ≫ *[-ant, +dist] ≫ *[+ant, +dist] ≫ IDENT (ONSET) ≫ *[+app],
*[+cont], *[+lar]

Furthermore, one thing to remember is that the consonants in group I are banned in Vietnamese consonant system and those of group II occurs only in onsets. In the initial stage, the learners have difficulty in acquiring the consonants of group I in both onsets and codas, and those of group II in codas. To account for this fact, the faithfulness constraint IDENT-IO must be ranked below markedness constraints *[-cont, +cont], *[-ant, +dist], *[+ant, +dist], *[+app], *[+cont], and *[+lar]. Such a ranking can ensure that the consonants /-θ, -ʃ, -ð, -tʃ, -dʒ, -ʒ/ are not faithful in both onsets and codas, and /-b, -g, -d, -f, -v, -s, -z, -l, -ɹ/ are not faithful in codas.

(32) *[-cont, +cont] ≫ *[-ant, +dist] ≫ *[+ant, +dist] ≫ IDENT (ONSET) ≫ *[+app],
*[+cont], *[+lar] ≫ IDENT-IO

To sum up, it can be argued that the constraint ranking in the initial stage of ESL acquisition is the same as the L1 grammar. The section has discussed the interaction of positional faithfulness constraint with markedness constraints that violate features in consonants of two groups in the initial stage. The next section will discuss this interaction of data given in Nguyen and Brouha (1998).

The interaction of positional faithfulness constraint and markedness constraints in Nguyen and Brouha's (1998) data

- Group I

As was explained in the above section, the markedness constraints *[-cont, +cont], *[-ant, +dist], *[+ant, +dist] outrank IDENT (ONSET) and IDENT-IO in the initial stage.

(33) *[-cont, +cont] ≫ *[-ant, +dist] ≫ *[+ant, +dist] ≫ IDENT (ONSET) ≫ IDENT-IO

During the process of ESL acquisition, these constraints get demotion and then rank below the faithfulness constraint IDENT-IO. The higher-ranking constraints, such as *[-cont, +cont], and *[-ant, +dist] take more time to demote than *[+ant, +dist] since they move across more strata than *[+ant, +dist]. In the lawsuit of advanced-level learners, the positional faithfulness constraint IDENT (ONSET) and IDENT-IO must dominate those markedness constraints.

Nevertheless, in this case, we focus on the intermediate-level Vietnamese speakers given in Nguyen and Brouha (1998). We assume that, in this stage of acquisition, the constraint ranking is unstable since the markedness constraints can be demoted in the ranking hierarchy. It means that the markedness constraints can be higher or even lower IDENT (ONSET) and IDENT-IO.

Our task is to assume the constraint ranking in this stage. In their Nguyen and Brouha's (1998) report, the target production of these codas of group I only gets a low percentage (21.5%). Thus, the assumption is that 50% of the rankings are the dominance of *[-cont, +cont], *[-ant, +dist], and *[+ant, +dist] over IDENT (ONSET) and IDENT-IO. Another 50% is that two constraints: IDENT (ONSET) and IDENT-IO and these markedness constraints are unranked.

50% of the rankings are the domination of the markedness constraints over IDENT (ONSET) and IDENT-IO.

(34) *[-cont, +cont] ≫ *[-ant, +dist] ≫ *[+ant, +dist] ≫ IDENT (ONSET) ≫ IDENT-IO

(35)

/ðiz/	*[-cont, +cont]	*[-ant, +dist]	*[+ant, +dist]	IDENT (ONSET)	IDENT-IO
a. ðiz			*!		
☞ b. diz				*	*
c. dis				*	*!*

The above tableau illustrates the markedness constraints *[-cont, +cont], *[-ant, +dist], and *[+ant, +dist] dominating the positional faithfulness constraint IDENT (ONSET) and IDENT-IO. Candidate (a) is rejected since it gets a fatal violation mark against *[+ant, +dist]. Such fatal violation mark leaves candidate (b) and (c) behind. However, (c) fatally gets two violation marks of IDENT-IO, which leads to be rejected. As a result, the outranking of the markedness constraints over IDENT (ONSET) and IDENT-IO can avoid candidates containing features [-cont, +cont], [-ant, +dist], and [+ant, +dist] to be optimal.

50% of the rankings are that two faithfulness constraints IDENT (ONSET) and IDENT-IO and the markedness constraints are unranked. However, IDENT (ONSET) ranks higher IDENT-IO. See (36).

(36) {(*[-cont, +cont] ≫ *[-ant, +dist] ≫ *[+ant, +dist]), (IDENT (ONSET) ≫ IDENT-IO) }

(37)

/ðiz/	*[-cont, +cont]	*[-ant, +dist]	*[+ant, +dist]	IDENT (ONSET)	IDENT-IO
☞ a. ðiz			*		*
☞ b. diz				*	*
c. dis				*	*!*
/wið/					
☞ a. wið			*		
☞ b. wit					*

This tableau shows that the markedness constraints and two constraints IDENT (ONSET) and IDENT-IO are unranked. With the input /ðiz/, the candidate (a) cannot be rejected even though it gets a fatal violation mark against *[+ant, +dist]. Since these markedness constraints and two constraints: IDENT (ONSET) and IDENT-IO are unranked, both candidates (a) and (b) can be optimal. The candidate (c) is rejected because it fatally gets two violation marks from IDENT-IO. With the input /wið/, the fact that the markedness constraints are unranked with IDENT-IO means that both candidates (a) and (b) can be optimal.

In brief, from this assumption, the consonants /θ, ʃ, ð, tʃ, dʒ, ʒ/ commonly get 25% of target production and 75% of repair strategies in codas

Group II

The next argument is to apply the positional faithfulness to the case of group II consonants. As explained above, the consonants /-b, -g, -d, -f, -v, -s, -z, -l, -r/ are allowed in Vietnamese but only in onsets. This entails that Vietnamese language has a wider range of contrasts in onsets than in codas. In the initial stage, the L2 learners are strongly affected by L1 transfer (Broselow, 2004). The positive transfer is in the sense that English and Vietnamese both share the consonants in onsets. The learners find it easier to produce them in this position. This can be captured in OT by ranking the positional faithfulness constraint IDENT (ONSET) over the markedness constraints *[+app], *[+cont], and *[+lar], and these markedness constraints dominate IDENT-IO. This ensures that the approximant, continuant, and laryngeal features are maintained in onsets, rather in codas:

(38) IDENT (ONSET) \gg * [+app], * [+cont], * [+lar] \gg IDENT-IO

(39) The interaction of two faithfulness constraint and markedness constraints * [+app], * [+cont], * [+lar] in the initial stage

/did/	IDENT (ONSET)	* [+app]	* [+cont]	* [+lar]	IDENT-IO
a. did				**!	
b. tid	*!			*	*
c. tit	*!				**
☞ d. dit				*	*

In the above tableau, the interaction of the positional faithfulness constraint IDENT (ONSET) with * [+app], * [+cont], and * [+lar] makes coda-devoicing the optimal repair strategy. The high-ranking of IDENT (ONSET) immediately rejects two candidates (b) and (c) since those candidates contain a devoiced segment in an onset position. That leaves candidates (a) and (d). These two candidates both keep voicing in the initial position but only (d) devoices the coda segment. This means that the two fatal violation marks of the candidate (a) against * [+lar] leaves (d) as the optimal candidate. The new ranking means that approximant, continuant, or laryngeal features of ESL consonants are maintained in onsets, but not in codas.

However, in the later stages of acquisition, the markedness constraints * [+app], * [+cont], and * [+lar] is demoted to the position after IDENT-IO. In the middle stage, we should leave the group of the three constraints and IDENT-IO unranked. Hence, it can be predicted that the consonants of group II can get neutralization and target production can get the ratio 1:1 in ESL production. Assume that 50% of the constraint rankings are to rank * [+app], * [+cont], and * [+lar] above IDENT-IO, and the rest of rankings is that IDENT-IO dominates * [+app], * [+cont], and * [+lar]. Combine to (34), (36) and (38); we have the following assumed constraint rankings.

50% of the rankings

(40) * [-cont, +cont] \gg * [-ant, +dist] \gg * [+ant, +dist] \gg IDENT (ONSET) \gg * [+app], * [+cont], * [+lar] \gg IDENT-IO

50% of the rankings

(41) $\{(*[-cont, +cont] \gg *[-ant, +dist] \gg *[+ant, +dist]), (IDENT (ONSET) \gg IDENT-IO)\} \gg * [+app], * [+cont], * [+lar]^9$

(42)

/ðiz/	*[-cont, +cont]	*[-ant, +dist]	*[+ant, +dist]	IDENT (ONSET)	*[+app]	*[+cont]	*[+lar]	ID-IO
a. ðiz			*!			**	**	
b. ðis			*!			*	*	*
☞ c. dis				*			*	**
d. diz				*		*!	**	*

The above tableau illustrates that candidates (a) and (b) are immediately rejected because they fatally violate $*[+ant, +dist]$. These fatal violation marks leave candidates (c) and (d) behind. The fact that the candidate (d) gets a fatal violation mark against $*[+cont]$ leaves (c) to be optimal. This shows that learners prefer no dental fricatives in onsets, no feature $[+voice]$ in codas.

(43)

/ðiz/	*[-cont, +cont]	*[-ant, +dist]	IDENT (ONSET)	*[+ant, +dist]	ID-IO	*[+app]	*[+cont]	*[+lar]
☞ a. ðiz				*			**	**
b. ðis				*	*!		*	*
c. dis			*!		**			
d. diz			*!		*		*	**

The remainder of the rankings shows that IDENT (ONSET) and IDENT-IO are unranked with $*[-cont, +cont]$, $*[-ant, +dist]$, and $*[+ant, +dist]$, but above $*[+app]$, $*[+cont]$, and $*[+lar]$. The tableau shows one of the rankings in the assumption (41). With the input /ðiz/, the demotion of

⁹ The group of constraints $*[-cont, +cont]$, $*[-ant, +dist]$, $*[+ant, +dist]$ is unranked with the group of IDENT-ONSET and IDENT-IO. However, $*[-cont, +cont]$ must rank higher than $*[-ant, +dist]$, $*[-ant, +dist]$ must be higher than $*[+ant, +dist]$, and IDENT-ONSET must be higher than IDENT-IO.

*[+ant, +dist] to the place after IDENT (ONSET) prevents (c) and (d) from being optimal. The candidate (b) is next rejected since it gets the violation mark against IDENT-IO. Such violation leaves the optimal candidate (a).

This section discussed the positional faithfulness in Nguyen and Brouha's (1998) data. The next section deals with the interaction of the positional faithfulness and ESL production types of the Vietnamese learners.

3.1.2.3 Positional faithfulness and Vietnamese speakers' ESL production types

- Vietnamese speakers' production types

The aim of this section is to discuss the conflict in the constraint ranking of ESL production types. Nguyen and Brouha (1998) find four primary production types with respect to the Vietnamese learners as they acquire single codas. They consist of target production, epenthesis, deletion, and neutralization. The question arises as to what accounts for this variation phenomenon. Partially ordered constraints (POC) thus should be discussed in this section.

- Partially ordered constraints (POC)

It has been suggested that speakers could modify ESL codas production types due to L1 transfer. Sato (1984), and Benson (1988) mention that Vietnamese prefers a closed-syllable structure. Hence, in the case of ESL single codas, this assumption is that the learners prefer production types that support closed syllable structure. Epenthesis and deletion support the open syllable structure, while neutralization and target production prefer the closed-syllable one. Therefore, neutralization and target production should be more common than epenthesis and deletion.

We should conduct a general review of Partial Order Constraints (POC) as a potential explanation for the variation. POC results in the variation by "a total ordering from a ranked set of constraints" (Coetzee and Pater, 2011: 408). In the work of the model, grammar is defined as partial orders rather than a total order. As the grammar is utilized for evaluating a candidate set, one of the total orders matching with the partial order is randomly selected. As a result, the variation results as some of these total orders choose different candidates as their optimal outputs.

(44) Grammar: $C1 \succ C2, C1 \succ C3$

(45) First possible ranking: $C_1 \gg C_2 \gg C_3$

/input ₁ /	C ₁	C ₂	C ₃
☞ Cand ₁			*
Cand ₂		*!	
Cand ₃	*!		

(46) Second possible ranking: $C_1 \gg C_3 \gg C_2$

/input ₁ /	C ₁	C ₃	C ₂
Cand ₁		*!	
☞ Cand ₂			*!
Cand ₃	*!		

In (44), the grammar includes two partial orders. The first partial order is the outranking of the constraint C₁ over C₂, and the second is C₁ over C₃. These two constraints C₂ and C₃ both rank lower than C₁, but there is no evidence that C₂ outranks C₃. One of the possible rankings between C₂ and C₃ will be selected as the /input₁/ is inserted to the grammar. If the output Cand₁ is optimal under one ranking and another Cand₂ under another ranking, it is necessary to confirm that a language with the /input₁/ possibly generates two surface forms: either Cand₁ or Cand₂, but not Cand₃.

The interaction between DEP-IO and IDENT-IO and the markedness constraints

The next task is to apply POC to ESL single coda production. To find out how it works, we first address the fact that the open-syllable structure is dispreferred in Vietnamese (Thompson, 1987; Sato, 1984; Benson, 1988; Nguyen and Brouha, 1998). In the case of ESL single codas, it can be noted that epenthesis supports the open-syllable structure. For example, Nguyen and Brouha (1998) account for the fact that the subjects 1 and 6 produce the grapheme e to the sounds [i, I, ə] as it occurs in the word-finally causes epenthesis. With the appearance of the sounds [i, I, ə] in word-finally, epenthesis results in the open-syllable structure. It implies that the dispreference of open-syllable structure in Vietnamese leaves epenthesis to be an uncommon repair strategy on ESL single codas (Benson, 1988; Sato, 1984). We must therefore examine the interaction between two faithfulness constraints: IDENT-IO and DEP-IO.

McCarthy and Prince (1995: 16) propose the general schema of DEP constraint family that involves the faithfulness constraint DEP-IO.

(45) The general schema of DEP constraint family

Every segment of S_1 has a correspondent in S_2 ¹⁰

(46) A domain-specific instantiation of DEP constraint family

DEP-IO: Every segment of the output has a correspondent in the input.

(Prohibits phonological epenthesis)

McCarthy and Prince (1995: 16) further propose the general schema of IDENT(F) constraint family which involves the faithfulness constraint IDENT-IO (F).

(47) The general schema of IDENT(F) constraint family

IDENT(F) Let α be a segment in S_1 and β be any correspondent of α in S_2 .

If α is $[\gamma F]$, then β is $[\gamma F]$.

(Correspondent segments are identical in feature F.)

(48) A domain-specific instantiation of IDENT(F) constraint family

IDENT-IO (F) Output correspondents of an input $[\gamma F]$ segment are also $[\gamma F]$.

The faithfulness constraint DEP-IO prohibits epenthesis, whereas the faithfulness constraint IDENT-IO is a key factor to maintaining the coda features. To take an example, if the coda consonant /d/ is identical to its input /did/, the output refers a closed-syllable structure. Due to L1 preference of closed-syllable structure, the constraint DEP-IO must dominate IDENT-IO to ensure that the coda segment is kept in ESL production.

(49) DEP-IO \gg IDENT-IO

Furthermore, markedness constraints will assign violation marks for feature segments that have marked structures. For example, the markedness constraint $*[+cont]$ prevent the feature continuant to be optimal. In the case of ESL single coda by Vietnamese learners, the higher

¹⁰ String S_1 (base, input, etc.), and String S_2 (reduplicant, output, etc.)

ranking of *[+cont] over IDENT-IO causes neutralization. The thing is that neutralization supports the closed syllable structure in this case. The fricative /ð/ in /wið/ is neutralized as /t/, but it still keeps the closed syllable structure. Due to the preference of closed syllable structure, the constraint DEP-IO must dominate the markedness constraint.

(50) DEP-IO \gg Markedness constraints

In brief, the faithfulness constraint DEP-IO ranks above IDENT-IO and markedness constraint to ensure that consonant segments maintain in codas.

The interaction between MAX-IO and IDENT-IO and the markedness constraints

Furthermore, with ESL single coda, deletion supports the open-syllable structure. In detail, if when the coda consonant /d/ of the input /did/ is deleted, the output /di/ refers to open-syllable structure. Since the learners prefer close-syllable structure, it is not surprising that deletion is not a preferred production type. The faithfulness constraint MAX-IO is used to prevent deletion:

(51) MAX-IO: Every segment of the input has a correspondent in the output.

(McCarthy and Prince, 1995)

Again, since deletion is not a common production type, the constraint MAX-IO must rank above the markedness constraints and IDENT-IO so that the optimal candidate maintains its coda segment. See (52) and (53).

(52) MAX-IO \gg Markedness constraints

(53) MAX-IO \gg IDENT-IO

In sum, deletion and epenthesis in this case supports the open-syllable structure. Hence, MAX-IO and DEP-IO must rank higher than IDENT-IO and the markedness constraints.

The interaction between two faithfulness constraints: MAX-IO and DEP-IO

With the ranking of DEP-IO and MAX-IO, there is no evidence that DEP-IO must dominate MAX-IO or vice versa. However, as Sato (1984), Nguyen and Brouha (1998), and Nguyen (2008) mention, epenthesis is the least common production types of Vietnamese learners. To account for this fact, we should consider two alignment constraints: Align- σ -L, and Align- σ -R. McCarthy and Prince (1993:19) propose the constraint Align (PrWd, σ) to align the edge of every prosodic word with the edge of every syllable. In some languages, the high ranking and

specifying in a particular edge of this constraint will make extra-syllabic segments banned (McCarthy and Prince, 1993).

Note that this usage of alignment constraints is different from that in Kager's (1999: 117-121) work, where the constraint Align-L is used to align the left edge of the "Grammatical word" with the left edge of the prosodic word, and Align-R is to align the right edge of the "Grammatical word" with the right edge of the prosodic word. In the case of Vietnamese ESL coda production, we are interested in syllable alignment, rather than grammatical words:

(54) Align- σ -L Align (σ , Left, PrWd, Left) coincide the left edge of the syllable with the left edge of the prosodic word.

(55) Align- σ -R Align (σ , Right, PrWd, Right) coincide the right edge of the syllable with the right edge of the prosodic word.

Since Vietnamese is a monosyllabic language, the learners prefer not to add the extra segments in ESL codas. This can answer why epenthesis in three investigations, (Sato (1984), Nguyen and Brouha (1998) and Nguyen (2008) is the least common production type. Hence, the constraints Align- σ -L and Align- σ -R should rank higher than MAX-IO and DEP-IO in the constraint ranking in the initial stage of ESL acquisition.

(56) Align- σ -L, Align- σ -R \gg MAX-IO, DEP-IO

One thing to remember is that the learners in Nguyen (2008) are nearly advanced level of proficiency, in Nguyen and Brouha (1998) are middle-level, and in Sato (1998) are basic-level. Epenthesis is the least common strategies of these learners. It implies that the constraints Align- σ -L and Align- σ -R rank above MAX-IO and DEP-IO in every stage of ESL acquisition.

The interaction between IDENT-IO and the markedness constraints

With the interaction between IDENT-IO and the markedness constraints, it has been suggested that the markedness constraints should rank above faithfulness constraints in the initial stage. Such ranking makes sure that the consonants in group I are not faithful in both onset and coda position, and those of group II are not faithful in codas.

(57) The initial stage:

Align- σ -L, Align- σ -R \gg DEP-IO, MAX-IO \gg Markedness constraints \gg IDENT-IO

These markedness constraints will be demoted in the later stage of ESL acquisition. The important fact is that the learners in Nguyen and Brouha (1998) are considered as in the middle stage. Therefore, the constraint ranking of IDENT-IO and these markedness constraints is unstable in this stage. In detail, we cannot assure that IDENT-IO ranks above the markedness constraint or vice versa.

To conclude, the following partial orders have been proposed:

(58) The partial orders

The first partial order: Align- σ -L, Align- σ -R \gg DEP-IO, MAX-IO

The second partial order: DEP-IO \gg Markedness constraints

The third partial order: DEP-IO \gg IDENT-IO

The fourth partial order: MAX-IO \gg Markedness constraints

The fifth partial order: MAX-IO \gg IDENT-IO

Combining these above partial orders, we generate the total orders presented in the following hierarchy.

(59) {Align- σ -L, Align- σ -R \gg DEP, MAX} \gg {IDENT-IO, Markedness constraints}

With (59), the number of possible rankings is eight in total. Let us look at the following factorial typology for more detail.

Factorial typology

(60) Align- σ -L \gg Align- σ -R \gg DEP-IO \gg MAX-IO \gg IDENT-IO \gg Markedness constraints

(61) Align- σ -L \gg Align- σ -R \gg DEP-IO \gg MAX-IO \gg Markedness constraints \gg IDENT-IO

(62) Align- σ -L \gg Align- σ -R \gg MAX-IO \gg DEP-IO \gg Markedness constraints \gg IDENT-IO

(63) Align- σ -L \gg Align- σ -R \gg MAX-IO \gg DEP-IO \gg IDENT-IO \gg Markedness constraints

(64) Align- σ -R \gg Align- σ -L \gg DEP-IO \gg MAX-IO \gg IDENT-IO \gg Markedness constraints

(65) Align- σ -R \gg Align- σ -L \gg DEP-IO \gg MAX-IO \gg Markedness constraints \gg IDENT-IO

(66) Align- σ -R \gg Align- σ -L \gg MAX-IO \gg DEP-IO \gg Markedness constraints \gg IDENT-IO

(67) Align-σ-R ≧ Align-σ-L ≧ MAX-IO ≧ DEP-IO ≧ IDENT-IO ≧ Markedness constraints

- The positional faithfulness applied to the learners' productions in Nguyen and Brouha (1998)

Again, we have assumed the following rankings based on the positional faithfulness theory.

(68) 50% of the rankings:

*[-cont, +cont] ≧ *[-ant, +dist] ≧ *[+ant, +dist] ≧ IDENT (ONSET) ≧ *[+app], *[+cont],
*[+lar] ≧ IDENT-IO

(69) 50% of the rankings:

{(*[-cont, +cont] ≧ *[-ant, +dist] ≧ *[+ant, +dist]), (IDENT (ONSET) ≧ IDENT-IO)} ≧
*[+app], *[+cont], *[+lar]

Furthermore, the eight possible rankings derive from the POC theory. See (70).

(70) {Align-σ-L, Align-σ-R ≧ DEP-IO, MAX-IO} ≧ {IDENT-IO, Markedness constraints}

Applying the rankings arisen from positional faithfulness into (70), we have total rankings.

(71) Total orders:

{Align-L, Align-R ≧ DEP-IO, MAX-IO} ≧ { *[-cont, +cont] ≧ *[-ant, +dist] ≧ *[+ant, +dist],
IDENT (ONSET), IDENT-IO, *[+app], *[+cont], *[+lar] }¹¹

¹¹ 50% of the rankings is that *[-cont, +cont] ≧ *[-ant, +dist] ≧ *[+ant, +dist] rank above IDENT-ONSET and IDENT-IO

50% of the rankings is that *[-cont, +cont] ≧ *[-ant, +dist] ≧ *[+ant, +dist] are unranked with IDENT-ONSET and IDENT-IO

The constraint IDENT-ONSET ranks above IDENT-IO and *[+app], *[+cont], *[+lar].

The constraints IDENT-IO is unranked with *[+app], *[+cont], *[+lar].

The total orders presented in (71) are calculated according in POC. In detail, two partial orders: $C1 \succ C2$ and $C1 \succ C3$ raise two possible total orders: $C1 \succ C2 \succ C3$ and $C1 \succ C3 \succ C2$. Hence, the total ordered rankings in (72) is calculated according to this rule. However, the ranking calculation obeys the assumption of (68) and (69). The result is given below.

Result:

Group I

Total rankings: $4 \times 14 = 56$ rankings (100%)

Neutralization: $4 \times 11 = 44$ rankings (78.5%)

Target production: $4 \times 3 = 12$ rankings (21.4%)

Group II

Total rankings: $4 \times 14 = 56$ rankings (100%)

Neutralization: $4 \times 7 = 28$ rankings (50%)

Target production: $4 \times 7 = 28$ rankings (50%)

From a total of 56 rankings, neutralization accounts for 78.5% with respect to consonants from group I, while target production is 21.5%. Regarding consonants in group II, neutralization and target production both account for 50%. The fact that the ratio of target and neutralization implies that there are no instances of epenthesis and deletion. Compare to the real collected data in table 3.4, we get the following result.

Table 3.4. A comparison of predicted and collected percentages

	Group I		Group II	
	Predicted percentages	Real collected percentages	Predicted percentages	Real collected percentages
Target	21.5%	26.9%	50%	46.3%
Neutralization	78.5%	62.8%	50%	42.3%
Epenthesis	0	6.4%	0	2.4%
Deletion	0	3.9%	0	8.9%

The analysis can predict that neutralization and target production get higher proportions than deletion and epenthesis. Moreover, regarding neutralization and target production, it can predict the production rate of each group. Regarding group I, the rate of target production is nearly one-third of neutralization, whereas, with group II, the rate of target production is the same to that of neutralization. In conclusion, the analysis can predict the rate of target production and neutralization for both groups. However, it is surprising that epenthesis and deletion gets no rate in the result.

The question arises as to how to explain this. Epenthesis, as found by Nguyen (2008) and Sato (1984), is not a common repair strategy in the case of Vietnamese ESL speakers. In this case, as Nguyen and Brouha (1998) explained, the speakers could have got confusion on grapheme production in which the grapheme *e* to the sounds [i, I, ə] as it occurs in the word-finally, causing epenthesis.

The analysis predicts no deletion, whereas the collected data showed that the deletion accounts for 8.3% of the outputs. It could be more complicated to account for this process. There could be two assumptions for this cause. First, Vietnamese diphthongs or triphthongs form as the glides /w, j/ combine with their corresponding vocalic nuclei. Furthermore, Nguyen (1998: 82) states that Vietnamese diphthongs or triphthongs occur in open syllables (i.e. without any following consonants). Hence, it is not surprising that the Vietnamese speakers could have removed the single codas after diphthongs or triphthongs in their ESL production due to the L1 transfer. Second, the glide segments of English diphthongs /aj/, /əj/, /aw/, as Osburne (1996: 174) suggests, function as consonants. The main point to remember is that Vietnamese syllable structure prefers the close-syllable structures; further, it does not allow the coda to be complex. Thompson *et al.* (1987) mentions that the consonants could be deleted due to the CVC-syllable preference of the learners. Therefore, in a complex coda containing a glide, one of the segments should be dropped. Osburne (1996) points out the rule of cluster reduction in which the second segment is removed if the clusters consist of two coda syllables. For this reason, glides [j, w] are maintained while other second segments are dropped. These assumptions may account for deletion in the collected data given in Nguyen and Brouha (1998); nevertheless, it belongs to the cluster codas' discussion. We should mention the deletion process in terms of cluster coda below.

3.2 CODA CLUSTERS

3.2.1 Data Collection

The next analysis works on Sato's (1984) and Nguyen's (2008) data that focus on ESL coda cluster production.

3.2.1.1 Sato's (1984) data collection

Participants: The participants are two brothers: Tai and Thanh upon to US. Tai is ten years old and Thanh twelve years old. Both of them are enrolled in two different classes in a local public school outside Philadelphia. Tai was in a mixed third and fourth-grade class, but Thanh in a sixth-grade class. None of them gets ESL instruction before they arrive in US. Two participants could be described as the ESL beginning-level learners.

Tasks: The data is based on tape-recording of unstructured, informal conversation collected in three times during ten months of study. Time I occurs in the week two and three, time II in week nineteen and twenty, and time III in week thirty-six and thirty-seven.

Table 3.5. Tai's coda cluster production (Sato, 1984: 51-52)

Process	Time 1 (n=47)	Time 2 (n=96)	Time 3 (n=116)
Target	7	9	22
Neutralization	0	0	3
Cluster reduction	33	83	80
Cluster deletion	7	4	11
Total	47	96	116

Table 3.6. Thanh's coda cluster production (Sato, 1984: 53-54)

Process	Time 1 (n=52)	Time 2 (n=91)	Time 3 (n=87)
Target	3	2	18
Neutralization	3	2	1
Cluster reduction	37	68	58
Cluster deletion	9	19	11
Total	52	91	87

Table 3.7. Tai and Thanh's coda cluster production

Production	Time 1		Time 2		Time 3	
	n	%	n	%	n	%
Target	10	10	11	6	40	20
Neutralization	3	3	2	1	4	2
Cluster reduction	70	70	151	81	138	67
Cluster deletion	16	16	23	12	22	11
Total	99	100	187	100	204	100

3.2.1.2 Nguyen's (2008) data collection

Participants: The participants include five Vietnamese speakers around 20-31 ages. They are enrolled in an American university. They are considered as nearly advanced-level students with TOEFL scores around 550-575, based on Proficiency Guidelines of the American Council for the Teaching of Foreign Language (ACTFL Proficiency Guidelines). All of them start to learn English at age 12 in Vietnam. The average year of English learning is 12 years ranging from five to sixteen years while the average year of living in US is 11 months ranging from six to thirteen months.

Task: The collected data is distinguished from three different tasks: wordlist, reading text, and semi-structured interview. The wordlist consists of 72 words split into different types of two members of coda clusters: clusters containing a nasal, clusters containing a liquid, clusters containing voiced obstruents, and clusters containing voiceless obstruents. The reading text consists of 552 words long, in which the middle paragraph of this text is specially designed to get more nature pronunciation. Interview is designed in terms of semi-structure that includes casual questions about popular backgrounds and a map description. The map description is to get the participants' sound patterns of street names described in the word-list. This interview is like the best context to get natural pronunciation. Before starting, each participant is allowed to have a general look on the word-list and the reading text. After they finished with two above tasks, they have several minutes on interview.

Table 3.8. Production of ESL coda clusters (Nguyen, 2008: 8)

Coda cluster production	Wordlist (n=300)	Reading text (n=180)	Interview (n=51)
Target	59	26	15
Deletion	99	112	132
Epenthesis	9	0	4
Neutralization	133	42	51

If we calculate the above table on percentage values, we now have the following table.

Table 3.9. Production of ESL coda clusters in percentage

Coda cluster production	Wordlist (%)	Reading text (%)	Interview (%)
Target	19.7	14.4	7.4
Deletion	33	62.2	65.3
Epenthesis	3	0	1.9
Neutralization	44.3	23.3	25.2

3.2.2 Discussion

3.2.2.1 Constraints used in the analysis

(73) *COMPLEX^{CODA} *CC]_σ ('Codas are simple')

Kager (1999: 97)

(74) *[+cons, -cont, -voice] Assign one violation mark for every segment with
the features [+consonantal], [-continuant] and [-voice]

3.2.2.2 OT analysis of ESL coda cluster acquisition

- The ranking arguments for the production of ESL coda clusters in Sato (1984)

It should be noted that the subjects in Sato's (1984) data are regarded as ESL beginning-level learners; therefore, we may regard their production as evidence of the initial ranking in ESL acquisition by Vietnamese speakers. Broselow (2004) mentions that L1 transfer strongly affects L2 production in the initial stage. Hence, the phonological grammar in Sato's (1984) ESL data should be close to the grammar of Vietnamese. The single coda discussion concluded with an argument for the constraint rankings in the initial stage. This discussion will connect with the previous rankings in section 3.1 to work on ESL coda clusters.

Positional faithfulness

As was mentioned, the group of affricatives /-tʃ, -dʒ/ and fricatives /θ, ʃ, ʒ, ð/ are entirely absent from Vietnamese phonology. The group of voiced stops /-b, -g, -d/, fricatives /f, v, s, z/, and approximants /l, ɹ/ can only occur in onsets. Due to L1 transfer in the initial stage of acquisition, the coda clusters of group I can be not faithful in both onset and coda positions, and those of group II not faithful in codas. Hence, the group of markedness constraints *[-cont, +cont], *[-ant, +dist], and *[+ant, +dist] must dominate IDENT (ONSET), which in turn must dominate *[+app], *[+cont], *[+lar]:

(75) *[-cont, +cont] ≧ *[-ant, +dist] ≧ *[+ant, +dist] ≧ IDENT (ONSET) ≧ *[+app],
*[+cont], *[+lar]

Since the consonants of group II are not allowed in codas, the markedness constraints *[+app], *[+cont], *[+lar] must rank above IDENT-IO to prevent these consonants from being faithful in ESL codas.

(76) *[-cont, +cont] ≧ *[-ant, +dist] ≧ *[+ant, +dist] ≧ IDENT (ONSET) ≧ *[+app],
*[+cont], *[+lar] ≧ IDENT-IO

In the discussion of ESL single codas, Nguyen and Brouha's (1998) give no attention to the production of voiceless stops and nasals. However, these segments are discussed by Sato (1984). Sato (1984) did not mention in detail the productions of nasals or voiceless stops in codas. However, in Nguyen's (2008) study, she concludes that a coda cluster of a nasal and a voiceless stop gets the highest rate of target production among other clusters. The reason for this is that Vietnamese codas can be occupied by nasals and voiceless stops (Nguyen, 1998; Benson, 1988). In ESL production, L1 transfer leads these consonants to be sounded out in codas.

Furthermore, in the discussion of ESL singleton codas, we predicted that the presence of glides effects the rate of deletion on single coda consonants. This section pays attention to glide production. Sato (1984) mentions that glides can be placed in Vietnamese codas. Nguyen (1998) argues that Vietnamese diphthongs or triphthongs form as the glides /w, j/ combine with their corresponding vocalic nuclei. They stand in open syllables without any following consonants. Hence, it should be suggested that an ESL glide coda is easy for the learners, even in the initial stage of ESL acquisition.

Finally, we have the constraint ranking in the initial stage.

(77) *[-cont, +cont] ≧ *[-ant, +dist] ≧ *[+ant, +dist] ≧ IDENT (ONSET) ≧ *[+cont], *[+app],
*[+lar] ≧ IDENT-IO

In conclusion, this section has mentioned that the Vietnamese grammar strongly reflects the constraint ranking in the initial stage. The next section is going to discuss the ranking arguments for production types given in Sato (1984).

The ranking arguments for the production types of ESL coda clusters

Again, the two participants in Sato (1984) are both at a low-level proficiency; therefore, we can consider the constraint ranking in their production consistent with the ranking in the initial stage. In the discussion of the single codas, we mentioned the ranking arguments of the constraint set:

Align- σ -L, Align- σ -R, IDENT-IO, MAX-IO, DEP-IO and the markedness constraints. Notice that neutralization and target production support the preference of closed-syllable structure, rather epenthesis and deletion. Hence, MAX-IO and DEP-IO must rank above IDENT-IO and the markedness constraints that are violated by consonants in group I and II. For the interaction between MAX-IO and DEP-IO, there is no evidence that DEP-IO is higher than MAX-IO or vice versa. However, in Sato (1998) and Nguyen (2008), epenthesis is the least common strategy with respect to the production of ESL coda cluster. To account for this fact, we considered two constraints: Align- σ -L, Align- σ -R. Since Vietnamese is a monosyllabic language, it allows the left edge of the syllable to align with the left edge of prosodic word, and the right edge of the syllable to align with the right edge of the prosodic word. Hence, we assumed to rank Align- σ -L, Align- σ -R above MAX-IO, and DEP-IO. The high ranking of the constraints Align- σ -L and Align- σ -R can account for the fact that epenthesis is the least common repair strategy in this stage. For the interaction between IDENT-IO and the markedness constraints, the markedness constraints should rank higher than IDENT-IO to prevent the consonants in both groups I and II from being faithful in ESL codas in the initial stage.

(78) The constraint ranking in the initial stage:

Align- σ -L, Align- σ -R \gg MAX-IO, DEP-IO \gg Markedness constraints \gg IDENT-IO

Combining (77) and (78), we generate the following ranking hierarchy.

(79) Align- σ -L, Align- σ -R \gg MAX-IO, DEP-IO \gg *[-cont, +cont] \gg *[-ant, +dist] \gg *[+ant, +dist] \gg IDENT (ONSET) \gg *[+cont], *[+app], *[+lar] \gg IDENT-IO

(80) The tableau illustrates the constraint rankings of the learners in the initial stage.

/mʌnθ/	Al- σ-R	Al- σ-L	DEP- IO	MAX- IO	*[-cont, +cont]	*[-ant, +dist]	*[+ant, +dist]	ID- Ons	*[+app]	*[+cont]	*[+lar]	ID- IO
a. mʌnθ							*!			*		
● b. mʌnt												*
c. mʌn				*!								
d. mʌθ				*!			*			*		
e. mʌnθə	*!	*!	*									
f. nʌnt								*!				**
h. nʌn				*!				*				*
g. mʌt				*!								*

The tableau illustrates that candidate (e) is immediately rejected because it fatally gets two violation marks against Align-σ-L and Align-σ-R. The candidates (c), (d), (h) and (g) that violate MAX-IO are next rejected, leaving (a), (b), and (f) behind. The fatal violation against *[+ant, +dist] stops the candidate (a) from being optimal. With the two final candidates (b) and (f), (f) violates IDENT (ONSET) since the onset consonant /n/ of this candidate is not faithful to the input in onsets. This leaves candidate (b) as the most optimal. Regarding the candidate (b), the final segment /θ/ of coda cluster /nθ/ turns to be /t/ in the output. It implies that the neutralization is the most likely production type in the initial stage.

Nevertheless, it is not consistent with the result of the ESL coda cluster production in Sato (1984). The data shows that deletion is the most likely production type (See the table 3.7).

The main task is to find a constraint that can prevent neutralization from being the most common production type. Notice that Vietnamese is one of monosyllable languages and has no complex syllable structure in codas (Thompson, 1987; Sato, 1984; Benson, 1988; Nguyen 1998). Regarding OT, the markedness constraint *COMPLEX^{CODA} given in Kager (1999) is to prevent the complex forms in codas.

(81) *COMPLEX^{CODA} *CC]_σ('Codas are simple')

Kager (1999: 97)

In the initial stage, due to the strong effect of L1 transfer, the constraint *COMPLEX^{CODA} is suggested to rank above faithfulness constraints to reflect the Vietnamese grammar.

Ranking schema:

Vietnamese grammar: *COMPLEX^{CODA} ≫ FAITH

In particular, *COMPLEX^{CODA} must rank very high in the constraint hierarchy, above the rest of the ranking in (79). The high-ranking of this constraint is to ensure that epenthesis, neutralization, and target production are restricted.

(82) *COMPLEX^{CODA} ≫ Align-σ-L, Align-σ-R ≫ DEP-IO, MAX-IO ≫ *[-cont, +cont] ≫ *[-ant, +dist] ≫ *[+ant, +dist] ≫ IDENT (ONSET) ≫ *[+app], *[+cont], *[+lar] ≫ IDENT-IO

In the investigation of ESL coda clusters, Osburne (1996) shows the deletion rule of coda clusters is that, if the coda clusters contain two segments, the second segments are preferably deleted. For triple coda clusters, the first segment prefers to be kept, and the remainders are deleted. He argues nothing about whether stops are more marked than nasals or glides and vice versa. However, from the instances given in his data, we can infer that, in an ESL coda cluster, the nasals and glides are preferred to be kept, rather than voiceless stops.

(83) Nasals, glides, and voiceless stops in the production of ESL coda clusters

(Adapted from Osburne, 1996: 165-174)

a. 'adjustment'	[ædʒʌsmɛn]	*[ædʒʌsmɛn]
b. 'comments'	[k ^h amɛn]	*[k ^h amɛts]
c. 'right'	[raj]	
d. 'out'	[aw]	
e. 'pain'	[p ^h ein]	*[p ^h ej]
f. 'phone'	[fown]	*[fown]
h. 'team'	[t ^h ijm]	*[t ^h ij]

It may infer that a voiceless stop is preferably deleted as it follows a glide. However, if a nasal follows a glide, both of them are kept. Therefore, we can argue that voiceless stops are more marked than nasals and glides in the case of coda cluster. Hence, the markedness constraint *[+cons, -cont, -voice] must be added in the ranking hierarchy. As was explained in ESL single

coda discussion, the feature [-continuant] holds for stops. Further, Hall (2007) mentions that the feature [+consonantal] is involved in stops. However, to differentiate voiceless stops from the voiced ones, the feature [-voice] is a choice. In a small brief, a voiceless stop contains the feature [+consonantal], [-continuant] and [-voice]. The markedness constraint * [+cons, -cont, -voice] is violated every segment with the features [+consonantal], [-voice] and [-continuant] that contains in these consonants.

(84) * [+cons, -cont, -voice] Assign one violation mark for every segment with the features [+consonantal], [-continuant] and [-voice]

Since the Vietnamese codas can be occupied with the voiceless stops, the markedness constraint * [+cons, -cont, -voice] must rank after IDENT-IO. See (90).

(85) *COMPLEX^{CODA} ≧ Align-σ-L, Align-σ-R ≧ DEP-IO, MAX-IO ≧ * [-cont, +cont] ≧ * [-ant, +dist] ≧ * [+ant, +dist] ≧ IDENT (ONSET) ≧ * [+app], * [+cont], * [+lar] ≧ IDENT-IO ≧ * [+cons, -cont, -voice]

(86) The tableau considers the high-ranking of the constraint *COMPLEX^{CODA}.

/mʌnθ/	*CC σ	Al- σ-L	Al- σ-R	DEP- IO	MAX- IO	* [-cont, +cont]	* [-ant, +dist]	* [+ant, +dist]	ID- Ons	* [+app]	* [-cont]	* [+lar]	ID- IO	* [+cons, -cont, -voice]
a. mʌnθ	*!							*			*			
b. mʌnt	*!												*	*
c. mʌn					*									
d. mʌθ					*			*!			*			
e. mʌnθə		*!	*!	*										
f. nʌn					*				*!					
h. mʌt					*								*!	*

The tableau shows the interaction of the markedness constraint *COMPLEX^{CODA} with the ranking in (79). The high-ranking of *COMPLEX^{CODA} immediately rejects two candidates (a) and (b) since they contain a complex coda. The candidate (e) is next rejected because it fatally violates Align-σ-L and Align-σ-R. That leaves (c), (d), (f), and (h) behind. However, the constraint (d) is rejected since it fatally gets a violation of * [+ant, +dist]. The candidate (f)

violates IDENT (ONSET) since the onset /n/ is not faithful to the input. With two final candidates (c) and (h), (h) violates IDENT-IO, leaving (b) to be optimal. The optimal output is the one in which the second segment of coda cluster is deleted.

In brief, the high ranking of *COMPLEX^{CODA} in the hierarchy leads to the result that the learners utilize deletion as the most likely production type in this stage of acquisition. This result is approximately consistent with the result in Sato (1984), which is 86% of coda cluster deletion and reduction for time I, 93% for time II, and 78% for time III (see table 3.7).

The ranking arguments for the production of ESL coda clusters given in Nguyen (2008)

A new question arises as to what the ranking in later stages of ESL acquisition is. In the later stages of acquisition, the ranking affected by L1 grammar is changed to generate L2 surface form (Broselow, 2004). In the case of ESL Vietnamese, in the later stages, the markedness constraints *COMPLEX^{CODA}, *[-cont, +cont], *[-ant, +dist], *[+ant, +dist], *[+app], *[+cont], and *[+lar] should be considered for demotion.

In the final stage, *COMPLEX^{CODA} is demoted to the level after MAX-IO and DEP-IO, whereas *[-cont, +cont], *[-ant, +dist], *[+ant, +dist], *[+app], *[+cont], and *[+lar] after IDENT-IO. See the following hierarchy.

Initial Stage:

*COMPLEX^{CODA} ≫ Align-σ-L, Align-σ-R ≫ DEP-IO, MAX-IO

≫

*[-cont, +cont] ≫ *[-ant, +dist] ≫ *[+ant, +dist] ≫ IDENT (ONSET) ≫ *[+app], *[+cont], *[+lar] ≫ IDENT-IO ≫ *[+cons, -cont, -voice]

Final Stage:

Align-σ-L, Align-σ-R ≫ DEP-IO, MAX-IO ≫ *COMPLEX^{CODA}

≫

IDENT (ONSET) ≫ IDENT-IO ≫ *[-cont, +cont], *[-ant, +dist], *[+ant, +dist], *[+app], *[+cont], *[+lar], *[+cons, -cont, -voice]

With this argument, the OT analysis should be constructed more on Nguyen's (2008) data which focuses on ESL coda cluster production. The data is obtained from three different tasks: word-list, reading task, and interview. Here, one of these tasks should be considered for analysis. Among these tasks, I propose to work on the reading task. Since the subjects' proficiency in Nguyen (2008) is consistent with nearly advanced level, the constraint ranking in the initial stage must be re-ranked. At this stage, it should be noted that the constraint ranking is unstable. It means that the constraints C_1 can sometimes be a rank higher C_2 , but sometimes it can also be lower. Broselow *et al.*, (1998) mentions that the instability of constraint rankings accounts for variation in the interlanguage development. To account for this variation, one variation model should be considered.

In the above discussion on single codas, we examined the data by way of the variation model POC in which total orders are formed by partial orders. In regards to this model, its results can almost predict Nguyen and Brouha's (1998) data for rate of each production type. To gain an understanding of how this model works, we should first consider the partial orders.

Assume that the group of the markedness constraint $*\text{COMPLEX}^{\text{CODA}}$, alignment constraints: Align- σ -L, Align- σ -R, and faithfulness constraints: DEP-IO, MAX-IO rank higher than the constraints IDENT (ONSET), IDENT-IO, and the markedness constraints.

(87) The first partial order

{*Complex, Align- σ -L, Align- σ -R, DEP-IO, MAX-IO}

⊃

{IDENT (ONSET), IDENT-IO, *[-cont, +cont], *[-ant, +dist], *[+ant, +dist], *[+app], *[+cont], *[+lar], *[+cons, -cont, -voice]}

In the group of constraints *Complex, Align- σ -L, Align- σ -R, DEP-IO, MAX-IO, there is evidence for another partial order. Noticed in the discussion of single codas, epenthesis has no priority to occur, even with advanced-level learners (Nguyen, 2008; Nguyen and Brouha; 1998; Sato, 1984). Therefore, the two alignment constraints Align- σ -L, Align- σ -R must be worse than DEP-IO and MAX-IO to make sure that epenthesis is restricted.

(88) The second partial order

{Align- σ -L, Align- σ -R} ⊃ {DEP-IO, MAX-IO}

Combining with the constraint $*\text{COMPLEX}^{\text{CODA}}$, we have the following total orders of this group presented in (89).

$$(89) \quad \{*\text{COMPLEX}^{\text{CODA}}, \{\text{Align-}\sigma\text{-L, Align-}\sigma\text{-R}\} \gg \{\text{DEP-IO, MAX-IO}\}\}$$

To continue, we employ the next group of constraints

$$(90) \quad \{\text{IDENT (ONSET)}, \text{IDENT-IO}, *[-\text{cont}, +\text{cont}], *[-\text{ant}, +\text{dist}], *[\text{+ant}, +\text{dist}], *[\text{+app}], *[\text{+cont}], *[\text{+lar}], *[\text{+cons}, -\text{cont}, -\text{voice}]\}$$

It should be noted that, in every stage of ESL acquisition, the constraint IDENT (ONSET) must rank above IDENT-IO, $*[\text{+app}]$, $*[\text{+cont}]$, $*[\text{+lar}]$, and $*[\text{+cons}, -\text{cont}, -\text{voice}]$.

(91) The third partial order

$$\text{IDENT (ONSET)} \gg \{\text{IDENT-IO}, *[\text{+app}], *[\text{+cont}], *[\text{+lar}], *[\text{+cons}, -\text{cont}, -\text{voice}]\}$$

Furthermore, voiceless stops can occur in Vietnamese codas; hence, in every stage of ESL acquisition, they can be preserved within these codas. This leads to a position where the group of constraints $*[-\text{cont}, +\text{cont}]$, $*[-\text{ant}, +\text{dist}]$, $*[\text{+ant}, +\text{dist}]$, $*[\text{+app}]$, $*[\text{+cont}]$, $*[\text{+lar}]$, and IDENT-IO rank above $*[\text{+cons}, -\text{cont}, -\text{voice}]$.

(92) The fourth partial order

$$*[-\text{cont}, +\text{cont}], *[-\text{ant}, +\text{dist}], *[\text{+ant}, +\text{dist}], *[\text{+app}], *[\text{+cont}], *[\text{+lar}], \text{IDENT-IO} \gg *[\text{+cons}, -\text{cont}, -\text{voice}]$$

To combine ordered rankings in (87) (88), (91), and (92) can result in the total rankings given below.

(93) The total orders

$$\{*\text{COMPLEX}^{\text{CODA}}, \{\text{Align-}\sigma\text{-L, Align-}\sigma\text{-R}\} \gg \{\text{DEP-IO, MAX-IO}\}\}$$

\gg

$$\{*[-\text{cont}, +\text{cont}], *[-\text{ant}, +\text{dist}], *[\text{+ant}, +\text{dist}], \{\text{IDENT (ONSET)} \gg \{\text{IDENT-IO}, *[\text{+app}], *[\text{+cont}], *[\text{+lar}]\}\}\} \gg *[\text{+cons}, -\text{cont}, -\text{voice}]$$

Like the discussion of ESL single coda production, the calculation of the total orders presented in (93) is according to POC. In detail, two partial orders: $C1 \gg C2$ and $C1 \gg C3$ forms two possible total orders: $C1 \gg C2 \gg C3$ and $C1 \gg C3 \gg C2$. Hence, the total order rankings in (93) can be calculated according to this rule.

Results:

Group I

Total rankings: $2 * 50 = 100$ rankings (100%)

Deletion: $2 * 35 = 70$ rankings (70%)

Neutralization: $2 * 12 = 24$ rankings (24%)

Target production: $2 * 3 = 6$ rankings (6%)

Group II

Total rankings: $2 * 50 = 100$ rankings (100%)

Deletion: $2 * 35 = 70$ rankings (70%)

Neutralization: $2 * 6 = 12$ rankings (12%)

Target production: $2 * 9 = 18$ rankings (18%)

Total (In average)

Total rankings: $2 * 50 = 100$ rankings (100%)

Deletion: $2 * 35 = 70$ rankings (70%)

Neutralization: $(24+12)/2 = 18$ rankings (18%)

Target production: $(6+18)/2 = 12$ rankings (12%)

The average result of data analysis shows that in the reading task, deletion rises to 70%, neutralization to 18% and target production to 12%. From this result, we can confirm that, in the reading task, deletion is still the most likely production type, rather than neutralization or target production. The next step is to compare these results with the actual collected data from reading text, as given in Nguyen (2008).

Table 3.10. Nguyen's (2008) ESL coda cluster production in percentage values

Coda cluster production	Word-list (%)	Reading text (%)	Interview (%)
Target	19.7	14.4	7.4
Deletion	33	62.2	65.3
Epenthesis	3	0	1.9
Neutralization	44.3	23.3	25.2

In sum, the above results almost predict the rates of deletion, target production, and neutralization. Furthermore, at this stage of acquisition we can also see the emergence of two production types: target production and neutralization.

3.2.3 A short summary

In summary, OT can account for some aspects of ESL coda acquisition. That is, OT accounts for conflicts of constraint ranking in the case of ESL single coda production. It is applied to analyze the data given in Nguyen and Brouha (1998) in which the subjects are at the middle level of proficiency. At this stage of acquisition, POC can account for the variation and predict the rate of production types. In detail, it can answer why neutralization and target production are the most common production types. In the discussion of ESL coda cluster, OT is utilized to analyze data given in Sato (1984) and Nguyen (2008). The constraint ranking in Sato (1984) is consistent with ranking in the initial stage of ESL acquisition. Since Vietnamese allows no complex syllable structure in codas, the constraint *Complex^{CODA} ranks very in the initial stage. That leads to the result that deletion is the most likely production. In the later stages, the constraint hierarchy is reranked, the demotion of *Complex^{CODA} and the other markedness constraints leave the emergence of neutralization and target production in later stages. The POC further can predict the rate of production types in Nguyen's (2008) reading task. In summary, OT and other theories that are proposed to use can resolve some aspects of ESL coda acquisition by Vietnamese learners in Sato (1984), Nguyen and Brouha (1998), and Nguyen (2008).

CHAPTER 5: CONCLUSION AND LIMITATIONS

In conclusion, the OT analysis of ESL Vietnamese has resolved the conflict of rankings on coda productions. It accounts for rates of target and non-target productions, or even the asymmetry between onsets and codas in production.

Within ESL single codas, OT can resolve the conflict to the extent that the constraint ranking reflects the influence of Vietnamese grammar which prefers CVC syllable structure. The preference of CVC syllable structure leads to the outranking of two faithfulness constraints DEP-IO and MAX-IO over IDENT-IO and markedness constraints to have target production and neutralization as the most common production types. Furthermore, the model POC can account for the variation of ESL single coda production with respect to mid-level learners. Besides, the positional faithfulness can resolve the larger range of the onset contrast over the coda one.

With ESL coda clusters, OT analysis can account for the fact that deletion is the most common repair strategy in the initial stage of ESL acquisition, target production and neutralization emerge in later stages. The constraint hypothesis strongly reflects the L1 grammar in the initial stage. Since Vietnamese grammar allows no complex syllable structure in codas, the markedness constraint *Complex^{CODA} ranks highest in the constraint ranking at the initial stage. The ranking suggests that deletion is the most likely production type. OT also accounts for the development of target production and neutralization in later stages. That is, in the later stages, the markedness constraint *Complex and markedness constraints that violate features containing in consonants of groups I and II are demoted to lower position in ranking hierarchy. Their demotion causes the emergence of target production and neutralization. POC can further resolve the variation in the sense that higher-ranking constraints are demoted to lower ranking positions in later stages of acquisition. At its investigation stage, indeed, it raised the instability in the constraint rankings which results in the variation. POC is to answer for variation as well as rates of production types in the investigated stage. In more detail, it can predict the rate of epenthesis, deletion, target production, and neutralization with Nguyen's (2008) data.

OT analysis in this study at least accounts for the conflicts in rankings of ESL coda productions by Vietnamese speakers; nevertheless, it still has some limitations on both analysis scales and results. The first limitation is that the model POC can only control to the extent that it accounts for the variation and gives the general prediction of rates of coda production types. To have the accuracy predictions, such as higher accurate percentage of production, Stochastic Optimality

Theory (St-OT) is the most likely model on variation to account for those conditions. To obtain a higher degree of accuracy, the next study, if possible, may look deeper into the role of St-OT. The another limitation is that OT analysis of Nguyen's (2008) data is just as restricted as the reading text; hence, it shall be concerned more with word-list and interview in later studies.

REFERENCES

- Anderson, J 1987: "The markedness differential hypothesis and syllable structure difficulty", in *Interlanguage phonology: The acquisition of a second language sound system*, pp. 279-291.
- Anttila, A., & Cho, Y. M. Y 1998: "Variation and change in Optimality Theory", in *Lingua*, 104 (1), pp. 31-56.
- Bayley, R., & Preston, D. R. (Eds.) 1996: *Second language acquisition and linguistic variation* (Vol. 10). John Benjamins Publishing.
- Beckman, J 1995: "Shona height harmony: Markedness and positional identity", in *University of Massachusetts occasional papers in linguistics*, 18, pp. 53-75.
- Beckman, J. 1998. Positional Faithfulness. PhD dissertation, University of Massachusetts.
- Beckman, J. N 1997 "Positional faithfulness, positional neutralisation and Shona vowel harmony", in *Phonology*, 14(01), pp. 1-46.
- Beckman, J. N 2013: *Positional faithfulness: an optimality theoretic treatment of phonological asymmetries*. Routledge.
- Benson, B. 1988: "Universal Preference for the Open Syllable as an Independent Process in Interlanguage Phonology", in *Language Learning*, 38 (2), pp. 221-235.
- Brinton, L. J and Brinton D M 2000: *The structure of modern English: a linguistic introduction*. John Benjamins Publishing.
- Broselow, E. 2004: "Unmarked structures and emergent rankings in second language phonology", in *International Journal of Bilingualism* 8.1, pp. 51-65.
- Broselow, E, Chen, S, and Wang, C 1998: "The emergence of the unmarked in second language phonology". *Studies in Second Language Acquisition*, 20, pp. 261-280.
- Clements, G. N 1990: "The role of the sonority cycle in core syllabification", in *Papers in laboratory phonology*, 1, pp. 283-333.
- Clements, G. N., & Halle, M 1983: *Problem Book in Phonology*.

- Coetzee, A. W., & Pater, J 2011: "The place of variation in phonological theory", in *The Handbook of Phonological Theory, Second Edition*, pp. 401-434.
- Crystal, D 2011: *Dictionary of linguistics and phonetics* (Vol. 30). John Wiley & Sons.
- De Lacy, P 2010: *Markedness and Faithfulness Constraints: CDLs*.
- Eckman, F. R. 1983: "Exchange The Importance Of The NL And TL In Interlanguage Phonology: A Response From Eckman1", in *Language Learning*, 33(3), pp. 383-387.
- Edwards, J. G. H 2006: *Acquiring a non-native phonology: Linguistic constraints and social barriers*. Bloomsbury Publishing.
- Elman, J 1993: "Learning and development in neural networks: The importance of starting small", in *Cognition*, 48, pp. 71-99.
- Emerich, G. H 2012: *The Vietnamese vowel system*. Doctoral dissertation, UNIVERSITY OF PENNSYLVANIA.
- Fasold, R. W., & Connor-Linton, J. (Eds.) 2006: *An introduction to language and linguistics*. Cambridge University Press.
- Fikkert, P 2007: "Acquiring phonology", in *Handbook of phonological theory*, pp. 537-554.
- Fromkin, V., Rodman, R., & Hyams, N 2013: *An introduction to language*. Cengage Learning.
- Gass, S. M., & Selinker, L 1983: *Language Transfer in Language Learning. Issues in Second Language Research*. Newbury House Publishers.
- Gnanadesikan, A 1995: *Markedness and faithfulness constraints in child phonology*. Unpublished manuscript, Rutgers Optimality Archive, ROA-67.
- Greenberg, C 1983: *Syllable structure in second language acquisition*. CUN Y Forum 9:41-64.
- Greenberg, J. H 1978: "Some generalizations concerning initial and final consonant clusters", in J. H. Greenberg, (Ed.), *Universals of human language*, Volume 2, Stanford: Stanford University Press, pp. 243-279.
- Ha, C. T 2005: "Common pronunciation problems of Vietnamese learners of English", in *Journal of Science - Foreign Languages*.

- Hall, T. A 2007: "Segmental features", in *The Cambridge handbook of phonology*, pp. 311-334.
- Halle, M., & Mohanan, K. P 1985: "Segmental phonology of modern English", in *Linguistic inquiry*, pp. 57-116.
- Hancin-Bhatt, B 2000: "Optimality in second language phonology: Codas in Thai ESL", in *Second Language Research*, 16(3), pp. 201-232.
- Hansen, J. G 2004: "Developmental sequences in the acquisition of English L2 syllable codas: A preliminary study", in *Studies in Second Language Acquisition*, 26(01), pp. 85-124.
- Hayes, B 2004: "Phonological acquisition in Optimality Theory: The early stages", in *Constraints in phonological acquisition*, pp. 158-203.
- Hwa-Froelich. D, Hodson W. B. & Edwards T. H 2002: "Characteristics of Vietnamese Phonology", in *American Journal of Speech-Language Pathology*, August 2002, Vol. 11, pp. 264-273.
- Jensen, J. T 1993: *English phonology* (Vol. 99). John Benjamins Publishing.
- Kager, R 1999: *Optimality Theory*. Cambridge University Press.
- Keating, P. A 1988: *A survey of phonological features*. Indiana University Linguistics Club.
- Kiparsky, Paul. 1993: 'Variable rules', Handout from Rutgers Optimality Workshop 1.
- Kirby, J. 2011: "Vietnamese (Hanoi Vietnamese)", in *Journal of the International Phonetic Association*, 41(3), pp. 381-392.
- Ladefoged, P 2012: *Vowels and consonants*. John Wiley & Sons.
- Le, L. H 2007: *Acquisition of English Pronunciation: A Study of Vietnamese EFL Learners*. ProQuest.
- Lenneberg, E 1967: *Biological Foundations of Language*. New York: John Wiley.
- Lombardi, L 1990: "The nonlinear organization of the affricate", in *Natural Language & Linguistic Theory*, 8(3), pp. 375-425.
- Lombardi, L 1996: *Positional faithfulness and the phonology of voicing in Optimality Theory*. Ms., University of Maryland, College Park.

- Lombardi, L 1999: "Positional faithfulness and voicing assimilation in Optimality Theory", in *Natural Language & Linguistic Theory*, 17(2), pp. 267-302.
- Long, M. H 1993: "Second language acquisition as a function of age: Research findings and methodological issues", in *Progression and regression in language*, pp. 196-221.
- McCarthy, J. J 2009: *Doing optimality theory: Applying theory to data*. John Wiley & Sons.
- McCarthy, J. J., & Prince, A 1993: *Generalized alignment*. Springer Netherlands, pp. 79-153.
- McCarthy, J. J., & Prince, A 1994: "The emergence of the unmarked: optimality in prosodic morphology". *NELS* 24, pp. 333–412.
- McCarthy, J. J., & Prince, A 1995: "Faithfulness and reduplicative identity", in Jill Beckman, Laura Walsh Dickey, Suzanne Urbanczyk (eds.), *University of Massachusetts Occasional Papers in Linguistics 18: Papers in optimality theory*. Amherst, MA: GLSA.
- Miccio, A. W., & Scarpino, S. E 2009: "Phonological Analysis, Phonological Processes", in Ball, M. J., Perkins, M. R., Müller, N., & Howard, S. (Eds.) 2009: *The handbook of clinical linguistics* (Vol. 56). John Wiley & Sons. pp. 412-477.
- Michaud, Al 2004: Final consonants and glottalization: New perspectives from Hanoi Vietnamese. *Phonetica* 61, pp. 119–146.
- Ngo, B. N 2001: "The Vietnamese language learning framework", in *Journal of Southeast Asian Language Teaching*, 10, pp. 1-24.
- Nguyen, A and Brouha, C 1998: "The production of word final consonants in English by L1 speakers of Vietnamese", in *Working papers in Linguistics*, Summer 1998, Vol 5. George Mason University, Fairfax, Virginia, pp. 73-94.
- Nguyen, A. 1998: *Consonants in Vietnamese-English Interlanguage*. George Mason University, pp. 81-94
- Nguyen, D. L 1967: "Phonemic sequences in Vietnamese", in *Zeitschrift für Phonetik, Sprachwissenschaft, und Kommunikationsforschung* 20 no. 4, pp. 325-359.
- Nguyen, N 2008: *Interlanguage Phonology and the Pronunciation of English Final Consonant Clusters by Native Speakers of Vietnamese*. Ohio University.
- Odlin, T 1989: *Language Transfer*. Cambridge, NY: Cambridge University Press.

- Ogden, R 2009: *An introduction to English phonetics*. Edinburgh University Press.
- Osburne, A. G 1996: "Final cluster reduction in English L2 speech: A case study of a Vietnamese speaker", in *Applied Linguistics*, 17(2), pp. 164-181.
- Prince, A., & Smolensky, P. (1993). 2004. *Optimality Theory: Constraint interaction in generative grammar*.
- Prince, A., & Tesar, B 2004: "Learning phonotactic distributions", in *Constraints in phonological acquisition*, pp. 245-291.
- Reynolds, William T. 1994. *Variation and Phonological Theory*. Ph.D. dissertation, Department of Linguistics, University of Pennsylvania.
- Roach, P 2009: *English Phonetics and Phonology: A Practical Course*, 4th Ed., Cambridge: Cambridge University Press.
- Sagey, E. C 1986: *The representation of features and relations in non-linear phonology*. (Doctoral dissertation, Massachusetts Institute of Technology).
- Sato, C. 1984: "Phonological processes in second language acquisition: Another look at interlanguage syllable structure", in *Language Learning* 34, pp. 43-58.
- Smith, J. L 2000: "Positional faithfulness and learnability in Optimality Theory", in *Proceedings of ESCOL* (Vol. 99), pp. 203-214.
- Tarone, E. 1987: "The phonology of interlanguage", in G. Ioup, & S. H. Weinberger (Eds.), *Interlanguage phonology: The acquisition of a second language sound system*. Cambridge, MA: Newbury House, pp. 70–87.
- Thompson, I 1991: "Foreign accents revisited: The English pronunciation of Russian immigrants", in *Language Learning*, 41, pp. 177-204.
- Thompson, L. 1959: "Saigon phonemics", in *Language* 35, pp. 454-476.
- Thompson, L. C. (Ed.) 1987: *A Vietnamese reference grammar* (Vol. 13). University of Hawaii Press.
- Trask, R. L 2004: *A dictionary of phonetics and phonology*. Routledge.

- Tsimpli, I.M 2006: "Variation in Second Language Acquisition", in *Encyclopaedia of Language and Linguistics*, (2nd Ed). Elsevier.
- Tuan, L. T 2011: Vietnamese EFL learners' Difficulties with English consonants. *Studies in Literature and Language*, 3(2), pp. 56-67.
- Weinberger, S. 1987: "The influence of linguistic context on syllable simplification", in *Interlanguage phonology: The acquisition of a second language sound system*, pp. 401-417.
- Zoll, C. 2004: "Positional asymmetries and licensing", in *Optimality theory in phonology: A reader*, pp. 365-378.

APPENDIX A

- Epenthesis:** As Fromkin *et al.* (2013: 247) defines, "the process of inserting a consonant or vowel is called epenthesis."
- Deletion:** Fasold and Connor-Linton (2006: 46) define, "deletion is the opposite of insertion. Instead breaking up a sequence of consonants with a vowel, a language may choose to delete one of the consonants (as in the loss of the initial [p] in pneumonia)".
- Neutralization:** "Neutralization is used in phonology to describe what happens when the distinction between two phonemes is lost in a particular environment." (Crystal, 2011: 326)
- Backing:** "Any phonological process in which the articulation of a segment, particularly a vowel, is moved backwards with the oral cavity, such as the retraction of /i/ to [ə] in New Zealand" (Trask, 2004:109).
- Devoicing:** "Any phonological process in which a segment which historically or underlyingly voiced loses its voicing, as when word-final voiced plosives became voiceless in German" (Trask, 2004:109).
- Fronting:** "The phonological process in which the articulation of a segment (especially a vowel) moves closer to the front of the mouth" (Trask, 2004:152).
- Stopping:** "The production of a fricative (or affricate) as the homorganic stop" (Miccio and Scarpino, 2009: 415)
- Sibilant:** Nguyen and Brouha (1998: 86) refer sibilant in their study as the use of sibilants, such as /s/, /z/, /ʃ/, /tʃ/, /ʒ/, /dʒ/ in the production of coda consonants.
- /st/ substitution:** Nguyen and Brouha (1998: 86) refer /st/ substitution in their study as the use of the cluster /st/ in the production of coda consonants.
- Final /n/ substitution:**
- Nguyen and Brouha (1998: 87) refer final /n/ substitution in their study as the use of the nasal /n/ to replace other coda consonants.

Unreleasing: Nguyen and Brouha (1998: 81, 84) in their study refer unreleasing as unreleased sounds occurs with coda voiced stops or other coda consonants, especially fricatives, and affricatives.

APPENDIX B

A set of constraints

Faithfulness constraints

IDENT (ONSET): "A syllable onset is identical to its input correspondent."

Zoll (2004: 366)

IDENT-IO(F) Output correspondents of an input [γ F] segment are also [γ F].

MAX-IO Every segment of the input has a correspondent in the output. (No phonological deletion)

DEP-IO Every segment of the output has a correspondent in the input. (Prohibits phonological epenthesis)

(McCarthy and Prince, 1995)

Markedness constraints

Kager (1999: 9) notes, "markedness constraints require that output forms meet some criterion of structural well-formedness". Requirements, such as vowels must not be nasal, syllables must not have codas or obstruents must not be voiced in coda position, "may take the form of prohibitions of marked phonological structures".

Below are some prominent markedness constraints.

*Complex: Assign one violation-mark for every complex onset or complex coda (McCarthy, 2009: 261)

*Lar Do not have Laryngeal features (Lombardi, 1999: 271)

Generalized Alignment

$\text{Align}(\text{Cat1}, \text{Edge1}, \text{Cat2}, \text{Edge2}) =_{\text{def}}$

$\forall \text{Cat1} \exists \text{Cat2}$ such that Edge1 of Cat1 and Edge2 of Cat2 coincide.

Where

$\text{Cat1}, \text{Cat2} \in \text{PCat} \cup \text{GCat}$

$\text{Edge1}, \text{Edge2} \in \{\text{Right}, \text{Left}\}$

(McCarthy and Prince, 1993:2)

$\text{Align}(\text{Prwd}, \sigma)$ Any PrWd-edge coincides with a syllable-edge.

(McCarthy and Prince, 1993:19)

$\text{Align-}\sigma\text{-L}$: $\text{Align}(\sigma, \text{L}, \text{PrWd}, \text{L})$ align the left edge of every syllable with the left edge of prosodic word

$\text{Align-}\sigma\text{-R}$ $\text{Align}(\sigma, \text{R}, \text{PrWd}, \text{R})$ the right edge of every syllable must coincide with the right edge of prosodic word

INDEX

- Affricates, 10
- Age, 18
- Alignment constraints, 45
- Closed syllable structure, 6
- Coda, 8
- ESL coda production, 14
- Fricatives, 16, 10
- L1 transfer, 17
- Monosyllabic word, 11
- Nasals, 14
- Neutralization, 14
- Onset, 8, 11
- Onset cluster, 11
- Open syllable structure, 6
- Optimality theory, 19
- Partially ordered constraints, 21
- Polysyllabic, 11
- Positional faithfulness, 22
- Second language acquisition, 20
- Stops, 10
- Diphthongs, 5
- Triphthongs, 5
- Vietnamese phonology, 4
- Vietnamese syllable structure, 4