This is to certify that the
thesis entitled

CONSONANTAL AND SYLLABIC ADAPTATIONS
IN ENGLISH LOANWORDS IN MANDARIN

presented by

Li-jen Shih

has been accepted towards fulfillment
of the requirements for the

M.A. degree in Linguistics

Major Professor's Signature

May 10, 2004

Date

CONSONANTAL AND SYLLABIC ADAPTATIONS IN ENGLISH LOANWORDS IN MANDARIN

By

Li-jen Shih

A THESIS

Submitted to
Michigan State University
In partial fulfillment of the requirements
For the degree of

MASTER OF ARTS

Department of Linguistics and Germanic, Slavic, Asian and African Languages

2004

ABSTRACT

CONSONANTAL AND SYLLABIC ADAPTATIONS
IN ENGLISH LOANWORDS IN MANDARIN

By

Li-jen Shih

This thesis examines consonantal and syllabic adaptations that English forms undergo when borrowed into Mandarin Chinese (Standard Chinese). I argue that English loanword input to Mandarin is best treated as acoustic signals without any phonological structures. My argument is based on the observation that English non-contrastive features may appear in the output of the loanword adaptation and that two English segments in an onset cluster may merge into one.

I also argue that when English forms enter Mandarin, the acoustic signals are interpreted using the allophones of Mandarin rather than the phonemes. This fact suggests that although the Operative Level of the loanword adaptation and the lexical level of Mandarin have the same function, their inputs are composed of segments from different sources.

Finally, I argue that the preservation-deletion asymmetry found in the coda liquids is attributed to the difference in salience. I suggest that though liquids are unsalient in nature, English coda liquids that are preceded by front vowels are perceived as salient and thus must be preserved in Mandarin loanword adaptation.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 Outline

This thesis examines consonantal and syllabic adaptations that English forms undergo when borrowed into Standard Chinese, which I refer to as Mandarin throughout this thesis simply for convenience. These two types of adaptations can be seen in the borrowing of the proper name *Louise*, *Louise* → [lu.i.sɨ], where [z] is adapted to [s] by devoicing, and [ɨ] is epenthesized at the end of the form to create a new syllable.[1] Clearly, the consonantal adaptation is triggered by Mandarin segment inventory constraints, which disallow voiced obstruents, and the syllabic adaptation is triggered by the phonotactic constraints, which only permit [n] and [ŋ] in the coda position of a syllable. The adaptation will be analyzed within the framework of Optimality Theory (Prince & Smolensky 1993) in this thesis.

The data are primarily drawn from common English proper names listed in the appendix of the Oxford Advanced Learner's Dictionary of Current English (1984), supplemented with those collected myself. Since tones are irrelevant to the analyses, they are omitted.

---

[1] Coda liquids in the English forms sometimes are found to be deleted in the adaptation, e.g., *Mark* → [ma.k^{h}ə]. Details with respect to coda liquid deletion are provided in §3.5.3.

Three things need to be noted here. First, most borrowings through transliteration in Mandarin are proper names. The way Mandarin deals with non-proper-name new words from foreign sources is usually to look at how the objects represented by these words function. 'Computer' is a good example:

(1)

[tʲan][2]	'electricity'
[naw]	'brain'
[tʲannaw]	'computer'

Since most foreign words that enter Mandarin through transliteration are proper names, they serve as the bulk of the data in this thesis.

Second, I simply assume that American English is the main source of the data because of the great American influence on the media. However, it is possible that some of the loanwords are based on British English due to the domination of British English in East Asia in the past. Whether we are dealing with British English or American English as the source language makes a slight difference in the analysis. For example, it is known that British English replaces post-vocalic [r] with a schwa or simply deletes it. If the loanwords are based on British English, then post-vocalic [r]

---

[2] In this thesis I adopt Duanmu's (2000) proposal that at the surface level, a syllable-initial consonant and a pre-nuclear glide merge into a single segment in a way that the glide palatalizes or adds a secondary articulation to the preceding consonant. Details about Mandarin syllable structure will be shown in §1.4.

may not be in the input.

Third, Chinese characters influence the loanword adaptation to some degree. Every Chinese character corresponds to a syllable and possesses a meaning. Therefore, when a loanword enters Mandarin, Mandarin speakers prefer to have a Mandarin form that is composed of characters with positive meanings. At the initial stage of borrowing, a loanword entry may have several Mandarin forms. At a latter stage, a particular form is chosen and enters dictionary. This standardized form may not be as phonetically close to the input as the others. However, as we will see in §3.4, there is a limit to how far the form could be from the input. Otherwise, we would find a Mandarin form that is entirely different from the input. Our data show that only a few types of feature changes are made when the character selection factor exerts its influence. The interaction of the character selection with the faithfulness constraint reveals that some feature changes make more difference in perception than others.

Silverman (1992) investigates English loanwords in Cantonese and proposes that 'loanwords do not come equipped with their own phonological representation...the input to loanword phonology is merely a superficial non-linguistic acoustic signal' (p.289). He also suggests that in order for the incoming acoustic signals to surface in accordance with the borrowing language's phonotactic constraints, they must go through two separate, yet ordered levels: the Perceptual Level and the Operative

Level. At the first Level, the acoustic signals are replaced with the native feature matrices that are most approximate to their properties. The output of this level is the input of the second level, at which some necessary phonological processes apply, such as epenthesis and deletion. These two viewpoints are maintained by Yip (1993), but she argues that no rules are involved in the course of loanword adaptation and reanalyzes the data in the framework of the Optimality Theory. Paradis & Lacharité (1997) take an opposite position with respect to the nature of loanword input. They claim that 'often, loanwords enter the borrowing language (L1) with structures (that is, segments and sequences) that are, from the point of view of L1, ill-formed' and that 'most of our results are incompatible with phonetic approximation views ... (for example, Silverman 1992, Yip 1993) (p.380). Although they agree that loanword input is the phonological output of the lending language, they admit that it is not clear whether the input is the output of L1 at the lexical or postlexical level.

In this thesis, I will show that when Mandarin borrows words from English, it is the output of the postlexical level of English that forms the basis of the loanword input. The evidence is mainly drawn from the observation that English non-contrastive features such as aspiration in voiceless obstruents may appear in the Mandarin corresponding segments. Furthermore, I will argue that English loanword input enters Mandarin without structures. This is to say that the input is best viewed as superficial acoustic signals. I will support this claim by showing that two English segments may merge into one in the course of the adaptation.

In this thesis, I will also argue that the loanword adaptation not only operates on the output of the postlexical level of English, but also operates on the output of the postlexical level of Mandarin. I will show that the acoustic signals are interpreted as phonological representations using Mandarin allophones, rather than using its phonemes.

Finally, I will show in this thesis that while vowel epenthesis is very much preferred to consonant deletion as a strategy to repair ill-formed syllable structures (e.g., *Louise* → [lu.i.si] *[lu.i], *G̲reg* → [kə.lej.kə] *[lej.kə]), liquid codas tend to delete when preceded by back vowels (e.g., *Bar̲bara* → [pa.pa.la] *[pa.ər.pa.la]). I suggest that this fact is due to their relative unsalience as compared to those liquids preceded by front vowels and other illicit coda consonants such as obstruents.

The remaining sections of this chapter are organized as follows. §1.2 is a literature review, which includes Silverman (1992), Yip (1993) and Paradis & Lacharité (1997). §1.3 is a brief overview of Optimality Theory. §1.4 introduces the Mandarin sound inventory and syllable structure. In Chapter 2, I will present the data and point out their main characteristics. More specifically, §2.1 comments on unchanged loanwords, and §2.2 discusses loanwords that undergo adaptation. In

Chapter 3, I will present my analyses, which are further divided into three sections: In §3.1 I provide evidence for Silverman's view on the nature of the input; §3.2 discusses the operations regarding feature changes at the Perceptual Level; §3.3 discusses the phonological processes at the Operative Level. In Chapter 4, I present the conclusion.

1.2 Literature Review

1.2.1 Silverman (1992)

Silverman investigates English loanwords in Cantonese and gives several suggestions. First, he argues that loanwords do not enter the borrowing language with their own phonological representation; instead, loanword input consists of a sequence of non-linguistic acoustic signals. Behind this view is the assumption that speakers of the borrowing language have no access to the phonological system of the lending language.

The second suggestion Silverman makes is that loanword phonology contains two distinct, ordered levels. The first level, termed the Perceptual Level, is a stage at which the acoustic signals are parsed into segment-sized chunks for which the native feature matrices that are closest to their articulatory and/or acoustic properties are provided. In addition to feature matrices, prosodic representation such as syllable nodes and, in the case of Cantonese, a binary foot template is provided at this level as well. The processes at this level are constrained by the borrowing language's phonological system. It is not until the derivation reaches the second level, the Operative Level, that the raw materials undergo real phonological processes. At the second level, the borrowing language's phonotactic constraints hold and trigger various phonological operations, like epenthesis and deletion, so that the preliminarily processed materials can surface in conformity with the native syllable and metrical structure constraints. To exemplify the distinction of the Perceptual Level from the Operative Level, Silverman refers to the deletion of post-consonantal liquids:

(2) (p.290)

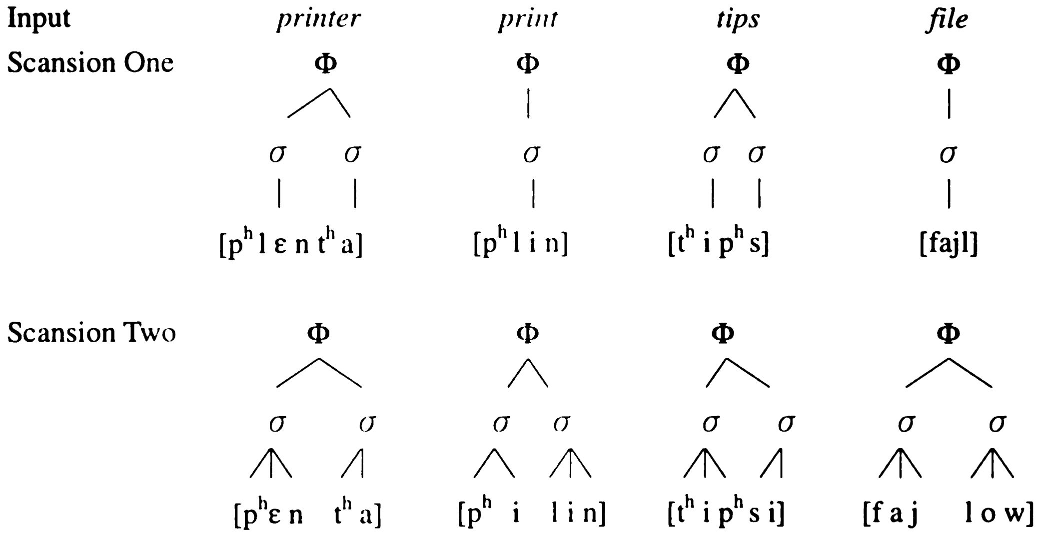
	English		Cantonese
a.	*break*	→	[pik.lik]
	print	→	[p^{h}i.lin]
	cream	→	[key.lim]
b.	*printer*	→	[p^{h}ɛn.t^{h}a]
	broker	→	[puk.k^{h}a]
	freezer	→	[fi.sa]

In (2), all the English forms begin with a stop-liquid cluster. In the Cantonese forms, however, only those in (2a) retain the liquid. One hypothesis is that Cantonese speakers only perceive the liquids in (2a) but not those in (2b). This hypothesis cannot be supported because a near-minimal pair is found, *print* → [p^{h}i.lin] vs. *printer* →

[p^hɛn.t^ha]. It is unlikely that Cantonese speakers perceive the liquid in *print* but not the one in *printer*. Silverman suggests that the liquids in (2a) are retained because the retention makes the output forms bisyllabic. In (2b), on the other hand, since the retention of the liquids would make the output forms exceed bisyllabicity, they are deleted, and the resulting output forms are, again, bisyllabic. The main point here is that the liquids in both (2a) and (2b) must be perceived first, and it is at the second level, where Cantonese phonotactic constraints hold, that the decision of whether they should be retained or deleted is made.

The third suggestion is that at the Perceptual Level, syllable nodes are provided for the most salient segments. The segments perceived as syllabic include vocalic sonority peaks and phonetically salient consonants such as [s]. Silverman claims that the salience of [s] is due to its duration and sibilance. When [s] occurs post-vocalically, either pre-consonantal or form-final, it is perceived as syllabic and provided with a syllable node. Some derivations are shown in (3):

(3) (p.319)



At the Perceptual Level (Scansion One), the acoustic signals are parsed into segment-sized chunks for which the native feature matrices that most approximate their properties are provided. In addition, the vocalic sonority peaks and the most phonetically salient consonants are assigned syllable nodes, which associate with a binary foot template. At the Operative Level (Scansion Two), Cantonese phonotactic constraints hold and real phonological processes such as epenthesis and deletion apply. Thus, the liquid in *printer* gets deleted, while those in *print* and *file* are retained through vowel epentheses. The phonetically salient consonant [s] in *tips*, as it appears form-finally, is perceived as syllabic at the Perceptual Level and thus is retained by epenthesizing [i] after it at the Operative Level.

The fourth suggestion is that Cantonese loanword phonology exists as a separate grammar from the native phonology. This suggestion is based on the observation that those phonological processes applying at the Operative Level are hardly found in the native phonology. For example, Cantonese native phonology involves no such processes as epenthesis, deletion or resyllabification, while those processes are clearly found at the Operative Level of Cantonese loanword phonology.

1.2.2 Yip (1993)

Like Silverman, Yip examines English loanwords in Cantonese. Though she adopts Silverman's claims that some of the contrasts existing in English such as voicing are never perceived by Cantonese speakers and that the processes loanwords undergo are divided into two levels, she argues that no rules are involved and the data can be accounted for within the framework of Optimality Theory. From OT's perspective, loanwords are those words that are borrowed from a language possessing a set of ranked well-formedness constraints into a language possessing a different set of ranked well-formedness constraints. As borrowing proceeds, some adjustments regarding segmental and/or prosodic structures may be made to meet the new set of constraints. These adjustments are minimal; in other words, the output forms are made as close to the input forms as possible as long as the new set of constraints can be satisfied. Yip claims that the most crucial constraints in Cantonese loanword phonology are: (i) a set of syllable structure constraints, (ii) the preference for

bisyllabic words, and (iii) the force that makes the output as close to the input as possible.

It is suggested in Silverman (1992) that the most phonetically salient segments of the input are provided with syllable nodes. Yip notices that although this suggestion succeeds in accounting for the fact that [s] is consistently preserved while liquids are not, it fails to explain why it is always the stops rather than the liquids that are preserved in pre-vocalic stop-liquid clusters (e.g., *printer* → [pʰɛn.tʰa]), given that neither is provided with syllable nodes. By showing evidence found in speech errors, she argues that liquids are less salient than stops and this relative unsalience makes liquids more vulnerable to deletion unless other factors such as the pressure of bisyllabicity are involved.

Another argument Yip makes is that loanword phonology should not be viewed as a separate grammar from the native phonology. She shows that the phonological processes found at the Operative Level actually can be motivated in the native phonology. In order to explain why some phonological processes observed in the loanword phonology are never found in the native phonology, Yip suggests that the input for which such processes are needed are never present in the native phonology. To illustrate the motivation of epenthesis in Cantonese native phonology, Yip refers to augmentation of kinship names: they are usually monosyllabic but can be augmented by adding the prefix [a], given that they are subject to a bisyllabic minimum. For example, *Yip* can be augmented as [a jip].

1.2.3 Paradis & Lacharité (1997)

The loanword analyses done by Paradis & Lacharité (1997) are based on a statistical investigation of segmental and syllabic malformations found in a corpus of 545 French loanwords in Fula. They observe that the illicit segments are preserved via minimal adaptation in a vast majority of cases but are deleted when contained in prohibited syllable structures. Paradis & Lacharité come to the conclusion that input information is maximally retained in the output unless preserving it would violate what they call the Threshold Principle, by which the maximal number of steps needed to repair an illicit structure within a constraint domain is set at two for all languages. The examples in (4) and (5) briefly illustrate their points:

(4) Three ways of adapting illicit /v/ (p.400)

/v/ → [w] (62/81 cases of adaptation – 76.5%)

French			Fula	Gloss
avocat	/avɔka/	→	awɔka	'lawyer'
civil	/sivil/	→	siwil	'civil'

/v/ → [b] (14/81 cases of adaptation – 17.3%)

livre	/livr/	→	li:ba:r	'book'
vinaigre	/vinɛgr/	→	binɛgara	'vinegar'

/v/ → [f] (5/81 cases of adaptation – 6.2%)

mouvement	/muvma/	→	mufmaŋ	'movement'
télévision	/televizjɔ/	→	tɛlɛfisjɔŋ	'television'

As shown in (4), illicit /v/ can be adapted in three ways: (i) inserting [+sonorant] (/v/ → [w]), (ii) delinking [+continuant] (/v/ → [b]), and (iii) delinking [+voice] (/v/ → [f]). Note that the repair strategy in (i) is much more frequently employed than those in (ii) and (iii) (the occurrences of /v/ → [w] make up more than three-fourths of the instances). The reason for this striking gap is that in /v/ → [w] all the information contained in /v/ is preserved (/v/ is adapted by adding [+sonorant]), but in both /v/ → [b] and /v/ → [f] some information in /v/ is lost.

(5) Two ways of fixing an ill-formed syllable

a. Vowel epenthesis (p.406, 407)

French			Fula	Gloss
drapeau	/dr̲apo/	→	da̲r̲apɔ	'flag'
boisson	/bw̲asɔ̃/	→	bu̲w̲asɔŋ	'drink'
course	/kurs̲/	→	kurs̲i̲	'course'

b. Consonant deletion (p.408)

voyou	/vw̲aju/	→	w̲aju	'bum'
cuivre	/kɥ̲ivr̲/	→	k̲ir̲i	'copper'
biscuit	/biskɥ̲i/	→	bisk̲i	'biscuit'

Fula does not allow complex onsets/codas. To fix this structure, either a vowel is epenthesized to break the consonant cluster (5a) or one of the consonants is deleted (5b). Vowel epenthesis is considered a two-step process (nucleus insertion plus vowel spreading, e.g. /dr̲apo/ → da̲r̲apɔ, or glide spreading, e.g. /bw̲asɔ̃/ → bu̲w̲asɔŋ), satisfying the Threshold Principle. It is only when an illicit consonant is contained in complex onset/coda that consonant deletion takes place. In this situation, repair by vowel epenthesis requires three steps (two for epenthesis of a vowel and one for adaptation of the illicit consonant), going beyond the limit set by the Threshold Principle. As a result, the illicit consonant undergoes deletion, which takes only one step.

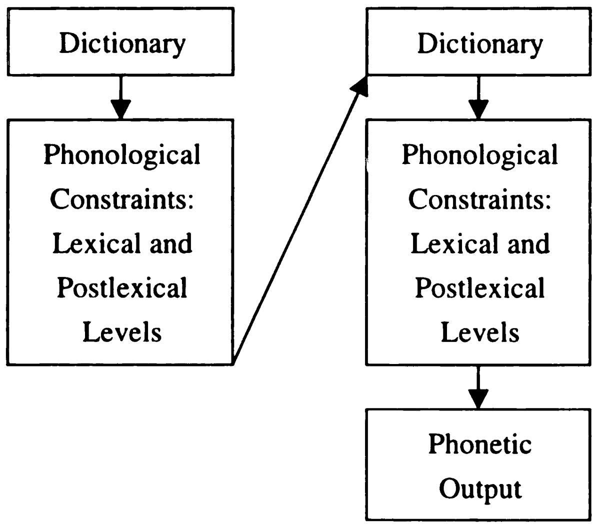
Unlike Silverman, Paradis & Lacharité claim that loanwords enter the borrowing language with structures. They argue that 'the input is immediately interpreted as a phonological representation by L1 (the borrowing language) and handled by its constraint set' (p.380).

Following Yip (1993), Paradis & Lacharité reject Silverman's view that loanword phonology constitutes a separate grammar from the native phonology. They suggest that regarding loanword adaptation processes as rules results in the separate grammar view. If phonological processes are considered to be reactions to constraint violations, then the fact that in Cantonese some processes are specific to loanword adaptation can be explained: native words never violate the constraints that are responsible for such processes.

The schema in (6) represents Paradis & Lacharité's loanword model:

(6) (p.394)

The lending language The borrowing language



Paradis & Lacharité's loanword model differs from Silverman's in two fundamental aspects. The first is with respect to the nature of the input. In Silverman's model, the input consists of acoustic signals, while in Paradis & Lacharité's, the input contains phonological representations of the lending language, although they do not state which level. The second aspect is regarding whether there is such a thing as loanword phonology. Silverman argues for its existence by stating that the processes applying at the Operative Level of Cantonese loanword phonology are hardly observed in the native phonology. Following Yip, Paradis & Lacharité suggest that the absence of such processes in Cantonese native phonology is due to the lack of input for which such processes are needed.

1.3 Main Issues

In §3.1, I will show that when English forms are borrowed into Mandarin, the input is the output of the postlexical level of English. Evidence is obtained from the observation that many English allophonic features appear in the Mandarin forms, which forces us to assume the presence of those features in the input. An example is a Mandarin syllable which corresponds to English syllable-final [ʃ]. Our data show that English syllable-final [ʃ] is matched to Mandain [çi] or [çy], e.g., *Bush* → [pu.çi], *Cash* → [k^{h}aj.çy] ([ʂɨ] is another Mandarin syllable to which English syllable-final [ʃ] is matched, but it is irrelevant to the present discussion). To account for the emergence of [labial] in [çy], it seems necessary to assume that this particular feature is present in the input (note that English [ʃ] contains the non-contrastive feature [labial]), and for some reason it is deleted in *Bush* → [pu.çi]. If one analyzes it the other way around by assuming that this feature is not present in the input but inserted in *Cash* → [k^haj.çy], then one has to explain where this feature is from. Unfortunately, this does not seem to be possible.

Recall Silverman's claim that at the Perceptual Level, the acoustic signals are parsed into segment-sized chunks, and these chunks are provided with the native segments that are closest to their acoustic/articulatory properties. It is not clear whether 'the native segments' are referred to as the phonemes or the allophones of the borrowing language in his article. Our data show that 'the native segments' Silverman talks about have to be the allophones. I mention in the preceding paragraph that English syllable-final [ʃ] may be matched to the Mandarin syllable [çi]. If it is a Mandarin phoneme that fills in the chunk containing the acoustic signals of [ʃ] at the Perceptual Level, then the phoneme serving this work is probably [s] or [ʂ], given that they are closest to [ʃ] in terms of acoustic/articulatory properties. [ç] is not a choice because it is an allophone in Mandarin (Lin 1989, Duanmu 2000). These two segments in this particular position then are evaluated by Mandarin phonotactic constraints at the Operative Level and judged as illicit structures (only [n] and [ŋ] are allowed in the coda position). Due to their salient nature, they are retained by epenthesizing an apical vowel after them (Lin 1992), yielding the output forms [sɨ] and [ʂɨ]. In this way, [çi] can never be derived. If it is the allophone [ç] that is provided at the Perceptual Level, then we have no problem deriving the syllable [çi]. At the Operative Level, [ç] in this particular position is judged as an illicit structure and is fixed by vowel epenthesis. The inserted vowel obtains its quality from the preceding [ç] through assimilation, yielding the attested output form [çi]. In §3.2.2, I will give a complete analysis arguing that at the Perceptual Level, the English acoustic signals are replaced by Mandarin allophones rather than Mandarin phonemes.

1.4 Optimality Theory: Markedness, Faithfullness and Constraint Interaction

OT (Prince & Smolensky 1993, Kager 1999) sees the grammar of a language as a system of conflicting forces. These forces are universal and exist in the grammar in the form of constraints. The forces or constraints can be divided into two basic groups — markedness and faithfulness. Markedness constraints state that unmarked structures are universally favored over marked structures. For example, an open syllable is favored over a closed syllable (NO-CODA); only some types of consonants can serve as the coda in many languages (CODA CONDITION); a voiceless obstruent is favored over a voiced obstruent (VOICED OBSTRUENT PROHIBITION (VOP)), and so on. Each faithfulness constraint states that the output must preserve the properties of the input, which can be defined in terms of features, segments, or prosodic structures. For example, the output segment must have the same value for the feature [voice] as the input segment (IDENT-IO(voice)); segments in the output must have correspondents in the input (DEP-IO); and the output must have the same linear order of the segments as the input (LINEARITY-IO). Faithfulness to the input can be understood as pressure to preserve lexical contrasts.

Markedness constraints and faithfulness constraints are inherently in conflict. The English proper name *Luke* surfaces as [lu.kʰə], where [ə] is epenthesized at the Operative Level. The epenthesis of [ə] indicates that the markedness constraint CODA CONDITION is satisfied. However, the satisfaction of CODA CONDITION is accomplished at the cost of violating the faithfulness constraint DEP-IO.

This example shows us that for two conflicting constraints, one has priority to be satisfied over the other. This idea is built into OT in the form of hierarchical ranking, in which one output candidate surfaces as the actual output because it incurs lesser constraint violations than others.

The interactions of constraints can be represented by a tableau. In a tableau, output candidates are listed vertically in a random order, while the constraints are arranged horizontally in a rank-descending order from left to right. (7) shows the tableau in which [lu.k^hə] is selected as the output.

(7)

luk^h 'Luke'	CODA CONDITION	DEP-IO
☞a. lu.k^hə		*(ə)
b. luk^h	*(k^h)!	

'☞' marks the optimal output candidate. The optimal output candidate is (7a) because the other candidate violates the higher-ranked CODA CONDITION. A violation of a constraint is marked by '*'; '!' denotes that the violation of the particular constraint is fatal; and the shading of a cell indicates the violation(s) of the corresponding constraint is irrelevant to the result.

1.5 The Mandarin Sound System

1.5.1 Consonants

Mandarin has nineteen underlying consonants, which are listed in (8):

(8) (Lin 1989, Duanmu 2000)

	labial	dental	retroflex	velar
stop	p	t		k
	p^h	t^h		k^h
affricate		ts	ʈʂ	
		ts^h	$ʈʂ^h$	
fricative	f	s	ʂ	x
nasal	m	n		ŋ
liquid		l	r	

Two things regarding (8) are noted here. First, Mandarin obstruents do not contrast in voicing. They are unspecified for [voice] at the lexical level and obtain the feature specification [−voiced] at the postlexical level by a UG default rule, in the sense that minus is the unmarked value for [voice] in obstruents. In contrast, English obstruents are distinguished in terms of voicing at the lexical level. As a result, when English forms enter Mandarin, [+voiced] obstruents must be devoiced (in some cases, [v] is adapted to [w] rather than [f]), as we will see in the data to be presented in §2.2.2. Secondly, Mandarin stops and affricates contrast in aspiration at the lexical level. Although English voiceless stops also contrast in aspiration, as the distinction between the first segment in [t^h]*op* and the second segment in *s*[t]*op*, it is at the postlexical level rather than at the lexical level that this contrast takes place. English voiceless stops are unspecified for aspiration at the lexical level, and a language-particular rule assigns them [+spread gl] at the postlexical level if they are syllable-initial.

In addition to the nineteen consonants, Mandarin has the three palatals [tç], [tç^h] and [ç]. They are considered allophones rather than phonemes because of their distributions: [tç tç^h ç] appear only before the high front vowels [i y] and the glides [j ɥ] while the dental sibilants [ts ts^h s], the retroflex sibilants [ʈʂ ʈʂ^h ʂ] and the velars obstruents [k k^h x] never do. (9) shows that [tç tç^h ç] are in complementary distribution with [ts ts^h s], [ʈʂ ʈʂ^h ʂ] and [k k^h x]:

(9) (Duanmu 2000: p.27)

	[tç tç^h ç]	[ts ts^h s]	[ʈʂ ʈʂ^h ʂ]	[k k^h x]
followed by [i y]/[j ɥ]	√	×	×	×
not followed by [i y]/[j ɥ]	×	√	√	√

Lin (1989) suggests that [tç tç^h ç] surface by the phonemes assimilating to [−back] of following [i y] or [j ɥ]. This process is illustrated in (10) using /ts ts^h s/:

(10)

Underlying Representation				Surface Representation		
/ts ts^h s/	+	/i y/ or /j ɥ/	→	[tç tç^h ç]	+	[i y] or [j ɥ]
		[−back]				[−back]

In many studies, a syllable-initial consonant and a following pre-nuclear glide are considered two independent segments. However, Duanmu (2000: §4) proposes that at the surface level the two segments merge into one, which is achieved via the glide palatalizing or adding a secondary articulation to the syllable-initial consonant. In the former case, the results are [tç tç^h ç] or [tç^w tç^{wh} ç^w], depending on which glide ([j] or [ɥ]) is involved. (11) shows the palatalization of [ts ts^h s] by a following [j] or [ɥ]:

(11)

Underlying Representation				Surface Representation
/ts ts^h s/	+	/j/	→	[tç tç^h ç]
/ts ts^h s/	+	/ɥ/	→	[tç^w tç^{wh} ç^w]

Notice the difference in the treatment of the glides between (10) and (11). In (10), they are independent segments at the phonetic level, while in (11) they merge with the preceding consonant. Duanmu's proposal is adopted in this thesis. In the discussion of Mandarin syllable structure, this issue will be elaborated in more detail.

1.5.2 Vowels

Mandarin has five underlying vowels, which are listed in (12):

(12) (Lin 1989, Duanmu 2000)

high	i y	u
mid	ə	
low	a	

Both the low vowel [a] and the mid vowel [ə] have several surface representations. However, agreement has not been reached among scholars with respect to how they should be transcribed. One thing that is clear is that within a syllable a preceding glide or a following segment may affect the two vowels' backness, but not their height. For instance, according to S. Xu (1980: p.184), the mid vowel [ə] surfaces as [E] if preceded by [j] (/jə/ → [jE] 'leaf') ([E] denotes a vowel that is higher than [ɛ] but lower than [e]) but as [o] if preceded by [w] (/wə/ → [wo] 'I'). Lin (1989: p.51–52) claims that [a] surfaces as [ɑ] if followed by [w] or [ŋ] and that [ə] always becomes [e] if adjacent to a high front glide and [o] if adjacent to a back glide. In this thesis, [e ə o] and [a] represent the surface forms of the mid vowel and low vowel, respectively.

In addition to the five underlying vowels, Mandarin has two so-called apical vowels: the dental apical vowel, which only occurs after the dental sibilants [ts ts^h s], and the retroflex apical vowel, which only occurs after the retroflex sibilants [ʈʂ $ʈʂ^h$ ʂ] and [r]. In this thesis, the high back unrounded vowel [ɨ] is used to cover both types of apical vowels.

The status of the apical vowels is still a debated issue. In C. Cheng 1973, the apical vowels are viewed as deriving from some underlying vowels. Other scholars, on the other hand, suggest that the apical vowels should be treated as syllabic consonants [z] and [r], given that the properties the apical vowels possess usually belong to consonants — syllabic [z] is similar to voiced [s] and syllabic [r] is similar to pre-nuclear [r] (E. Pulleyblank 1984, Fu 1986). Whether the apical segments in question are real vowels or should be considered syllabic consonants is not the concern of this thesis. Based on the fact that the distributions of the apical vowels are limited and predictable, the claim made by Lin 1992 that they are not underlyingly present and can be regarded as epenthetic vowels is adopted. (13) shows that the two Mandarin morphemes 'four' and 'ten' lack vowels in their underlying representations, and it is at a later point in the derivation that nuclei are epenthesized and assimilate to the preceding consonants. (For more detail, see Lin 1992:236–241)

(13) (Lin 1992:238) (N denotes nucleus)

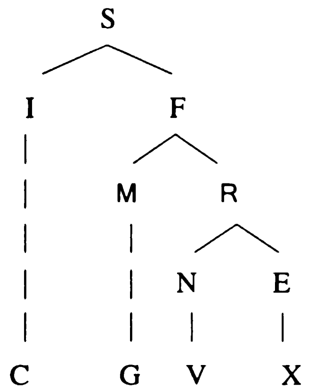
UR				SR	
/s/	→	sN	→	[sɨ]	'four'
/s̩/	→	s̩N	→	[s̩ɨ]	'ten'

1.5.3 Syllable Structure

In the traditional view, a Mandarin syllable is (C)(G)V(X), where C is a

consonant, G a glide, V a vowel and X a nasal or a glide. The length ranges from a maximum of four segments to a minimum of one segment. The diagram in (14) illustrates the structure of a Mandarin syllable in the traditional view:

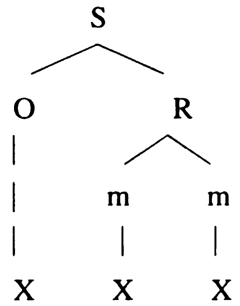
(14)



S: Syllable
I: Initial (Onset)
F: Final
M: Medial
R: Rime
N: Nucleus
E: Ending (Coda)

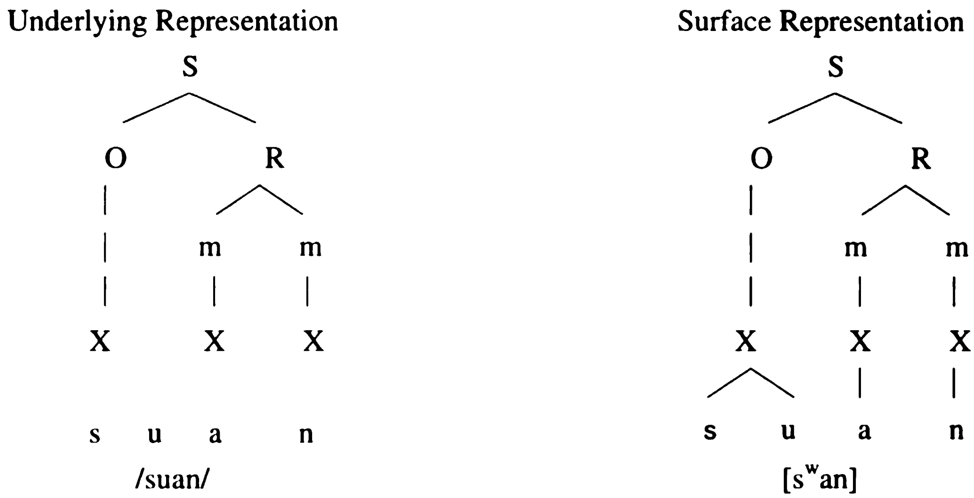
The major characteristic of this structure is the presence of the Final node, which dominates the pre-nuclear glide and the rime. Several proposals have been made with respect to how a Mandarin syllable should be represented. In Lin (1989), the traditional view of Initial/Final division is maintained while a post-nuclear glide is syllabified as the second half of the nucleus rather than as the coda. In Bao (1996), a pre-nuclear glide is considered to be part of the onset and thus the traditional Initial/Final division is not maintained. Duanmu (2000: §4) discards the traditional way of analyzing a Mandarin syllable and suggests that Mandarin has only two types of syllables — the full syllable and the weak syllable. The full syllable has three timing slots and is heavy, and the weak syllable has two timing slots and is light. In Mandarin, lexical words in most cases are full syllables, while grammatical words are always weak syllables. Since our data are all lexical words, only the full syllable is considered in this thesis. The structure of the full syllable is shown in (15):

(15) (p.79)



One of the main differences between the traditional representation as shown in (14) and Duanmu's analysis is regarding the status of the pre-nuclear glide. In the traditional representation, a pre-nuclear glide is always an independent segment, no matter whether or not it is preceded by another consonant. In Duanmu's analysis, a pre-nuclear glide is an independent sound only when it is syllable-initial. If a preceding consonant appears, the pre-nuclear glide palatalizes or adds a secondary articulation to the consonant, and the result is that both segments merge. Duanmu states that this is because a pre-nuclear glide is syllabified as part of the onset and there is only one timing slot for the onset. To illustrate this idea, Duanmu refers to an example originally pointed out by Chao (1934) in which /s/ and /w/ in the onset merge into a single segment at the surface level:

(16) (Duanmu 2000: p.86)



At the underlying level, this Mandarin morpheme contains four segments. Given that a pre-nuclear glide is syllabified to the onset and that there is only one timing slot available for the onset at the surface level, the syllable-initial segment /s/ and the following pre-nuclear glide /w/ have to share the slot and merge to [sʷ].

One of the arguments Duanmu provides for a syllable-initial consonant and a following pre-nuclear glide merging to a single sound at the surface level is the obvious phonetic difference between English *swan* [swan] and Mandarin *swan* [sʷan] 'sour' (Chao 1934: p.42, Duanmu 2000: p.28, 86). Both forms have four segments at the underlying level. However, the latter by no means sounds like the former, and the difference between the two apparently falls on the part of *sw*: it sounds like one segment followed by another in English but a single segment in Mandarin.

Duanmu's view (the structure shown in (15)) is supported by the data of this thesis. For example, when the English word [ʃo] 'show' enters Mandarin, the Mandarin output is transcribed as [çjow] in the traditional view but as [çow] in Duanmu's view. Because loanword adaptation must be minimal, Duanmu's view is confirmed given that it costs more for [ʃ] to be adapted to two segments ([çj]) than to one segment ([ç]). I will talk more about this issue in §3.2.2. In the following chapters, all the Mandarin forms will be transcribed based on Duanmu's view.

CHAPTER 2

DATA AND GENERALIZATION

2.1 Unchanged Loanwords

As the examples in (17) show, if the consonants and syllable structures involved in the incoming English forms satisfy the requirements imposed by Mandarin (the segmental inventory constraints and phonotactics), they surface without any adjustment. This confirms the idea that in loanword adaptation the output is matched to the input as closely as possible.

(17)

pie	→	[p^{h}aj]	*Lynn*	→	[lin]
muffin	→	[ma.fən]	*Colin*	→	[k^{h}ə.lin]
Simon	→	[saj.mən][3]	*Ian*	→	[i.ən]
Willy	→	[wej.li]	*Tina*	→	[t^{h}i.na]

2.2 Changed Loanwords

2.2.1 Feature Change in Licit Consonants

If the consonants in the English forms go through feature change, we naturally suspect that they are illicit from the perspective of Mandarin and therefore need to be

[3] It is possible that an English loanword has more than one Mandarin form. For example, an alternative Mandarin form for *Simon* is [saj.məŋ].

adjusted. In other words, given that the output is matched to the input as closely as possible, there seems to be no reason to adjust the consonants in the input that can surface. However, we find a small number of cases in which the input consonants undergo feature change even though they are licit segments in Mandarin. Consider the following examples:

(18) [pʰ tʰ kʰ] → [pʰ tʰ kʰ]

a.	*Peg*	→	[pʰej.kə]
b.	*Ted*	→	[tʰaj.tə]
c.	*Kevin*	→	[kʰaj.wən]

(19) [pʰ tʰ kʰ] → [p t k]

a.	*Paula*	→	[po.la]
b.	*Tony*	→	[toŋ.ni]
c.	*Kennedy*	→	[kan.naj.ti]

(20) [t k] → [t k]

a.	*Steven*	→	[ʂɨ.ti.fu]
b.	*Stanley*	→	[ʂɨ.tan.li]
c.	*Scotland*	→	[su.kə.lan]

(21) [t k] → [tʰ kʰ]

a.	*Steve*	→	[ʂɨ.tʰi.fu]
b.	*Stanley*	→	[ʂɨ.tʰan.li]
c.	*Scott*	→	[ʂɨ.kʰaw.tʰə]

In (18) and (19), the English forms begin with an aspirated voiceless stop. If we compare the Mandarin forms in (18) with those in (19), we find that only those in (18) keep the feature [+spread gl]. A similar situation is observed in the comparison of (20) and (21). In (20), [−spread gl] in the English voiceless stops occurring after [s] is retained in the adaptation, while in (21), this feature becomes [+spread gl].

Another example showing that a licit consonant undergoes feature change is the adaptation of English onset [r]. In (22), the English onset [r] surfaces without change, whereas in (23), it is adapted to [l]. Note that some English forms have two Mandarin equivalents.

(22) [r] → [r]

a.

Redford	→	[ɾ̠ʷej.fu]	*Shrek*	→	[ʂɨ.ɾ̠ʷej.kʰə]
Rachel	→	[ɾ̠ʷej.tçʰow]			

b.

Ricky	→	[ɾ̠ʷej.tçʰi]	*Jeffrey*	→	[tçej.fo.ɾ̠ʷej]
Rita	→	[ɾ̠ʷej.tʰa]	*Eric*	→	[aj.ɾ̠ʷej.kʰə]
Hillary	→	[çi.la.ɾ̠ʷej]			

(23) [r] → [l]

a.

Rachel	→	[lej.tɕ^{h}ow]	*Rex*	→	[lej.k^{h}ə.sɨ]
Raymond	→	[lej.məŋ]	*Reynolds*	→	[lej.n^{w}o.tsɨ]
Reagan	→	[lej.kən]	*Greg*	→	[kə.lej.kə]

b.

Richard	→	[li.ʈʂ^{h}a]	*Hillary*	→	[ɕi.la.li]
Ricky	→	[li.ɕ^{h}i]	*Jeffrey*	→	[tɕej.fo.li]
Rita	→	[li.t^{h}a]	*Eric*	→	[aj.li.k^{h}ə]

c.

Robin	→	[la.pin]	*Dora*	→	[t^{w}o.la]
Roy	→	[l^{w}o.i]	*Rudolf*	→	[lu.taw.fu]
Rice	→	[laj.si]	*Rose*	→	[l^{w}o.sɨ]

Several points are noted here. First, if [r] is not adapted to [l], it surfaces as [r^{w}]. Secondly, it seems that the English syllable [rɪ] can be adapted to either [r^{w}ej] or [li]. In the comparison of (22b) with (23b), we find that only *Richard* has one Mandarin equivalent. Thirdly, the English syllables [rej] and [rɛ] seem to have two Mandarin equivalents as well, one [r^{w}ej] and the other [lej] (22a, 23a). Finally, input [r] that is followed by a vowel other than [ɪ], [ɛ] or [ej] is always adapted to [l] (23c).

The adaptation of coda [n] to [ŋ] also shows that a licit consonant may undergo feature change. Compare (24) with (25):

(24) [n] → [n] (in the coda position)

Robin	→	[la.pin]	*Vincent*	→	[wən.sən]
Vivian	→	[wej.wej.an]	*Susan*	→	[su.ʂan]
Simon	→	[saj.mən]	*Jonathan*	→	[tɕ^{h}aŋ.na.sən]

(25) [n] → [ŋ] (in the coda position)

Raymond	→	[lej.məŋ]	*Vincent*	→	[wən.ʂəŋ]
Jonathan	→	[tɕʰaŋ.na.ʂəŋ]	*Damon*	→	[taj.məŋ]

Take *Simon* from (24) and *Damon* from (25) for example. In the adaptation of *Simon*, all the segments in the second syllable surface intact. In contrast, exactly the same syllable in *Damon* surfaces with the coda [n] changed to [ŋ]. This seems to show that [n] and [ŋ] are interchangeable in the coda position.

The last example is the adaptation of [s] to [ʂ]. Consider (26) and (27):

(26) [s] → [s]

Simon	→	[saj.mən]	*Sophie*	→	[su.fej]
Susan	→	[su.ʂan]	*Bess*	→	[pej.sɨ]
Sandy	→	[saŋ.ti]	*Max*	→	[maj.kʰə.sɨ]
Sandra	→	[saŋ.tə.la]	*Pierce*	→	[pʰi.ər.sɨ]

(27) [s] → [ʂ]

Smith	→	[ʂɨ.mi.sɨ]	*Stanley*	→	[ʂɨ.tʰan.li]/[ʂɨ.tan.li]
Stone	→	[ʂɨ.toŋ]	*Scott*	→	[ʂɨ.kʰaw.tʰə]
Stanford	→	[ʂɨ.tan.fu]	*Lisa*	→	[li.ʂa]
Stuart	→	[ʂɨ.tu.xʷa]	*Sarah*	→	[ʂa.la]
Starr	→	[ʂɨ.tʰa]	*Vanessa*	→	[wən.ni.ʂa]
Steve	→	[ʂɨ.tʰi.fu]/[ʂɨ.ti.fu]			

We can see in the comparison of (26) with (27) that the adaptation [s] → [ʂ] occurs as long as [s] is word-initial and followed by another consonant. In addition, the examples of *Lisa*, *Sarah* and *Vanessa* show that this feature change may occur if the resulting syllable is [ʂa].

2.2.2 Feature Change in Illicit Consonants

(28) [v] → [w] or [f]

a.

Vicky	→	[wej.tɕ^{h}i]	*Las Vegas*	→	[la.sɨ.wej.tɕa.sɨ]
Vincent	→	[wən.sən]	*Olivia*	→	[aw.li.wej.ja]
Vivian	→	[wej.wej.an]	*Kevin*	→	[k^{h}aj.wən]
Vanessa	→	[wən.ni.ʂa]	*David*	→	[da.wej]

b.

Steven	→	[ʂɨ.ti.wən]/[ʂɨ.ti.fən]	*Oliver*	→	[aw.li.fo]
Ivan	→	[aj.wən]/[aj.fan]	*Yvonne*	→	[i.fan]

c.

Steve	→	[ʂɨ.ti.fu]	*Eve*	→	[i.fu]
Dave	→	[taj.fu]	*Olive*	→	[aw.li.fu]

[v] in the onset position is adapted to [w] in most cases. As seen in (28b), when onset [v] is contained in a syllable such as [vən], [vər] or [van], it could be adapted to [f]. In the coda position, [v] is always adapted to [f] with the epenthetic [u] following.

As mentioned in §1.4.1, Mandarin obstruents are all voiceless. Therefore, it is not surprising that English voiced obstruents simply get devoiced in the loanword adaptation. However, we have found an exception in (28), where onset [v] may be adapted to [w]. The other exception is [z], which sometimes is adapted to [ʂ] rather than expected [s].

Now consider the adaptation of English voiced obstruents as shown in (29):

(29)

Barry	→	[pa.li]	*Missouri*	→	[mi.su.li]
Greg	→	[kə.lej.kə]	*Louise*	→	[lu.i.sɨ]
Adam	→	[ja.taŋ]	*Chas*	→	[tʂʰa.ʂɨ]
Derek	→	[tə.li.kʰə]	*Jazz*	→	[tçʷe.ʂɨ]
Gary	→	[kaj.li]			

(29) shows that English voiced obstruents all surface as unaspirated voiceless obstruents. Following Silverman and Yip, I assume that Mandarin speakers, like Cantonese speakers, are not able to detect the contrast between the two.

Examples of the adaptation of the interdental fricative [θ] are given in (30):

(30) [θ] → [s], [ʂ] or [ç]

Keith	→	[tçʰi.sɨ]	*Matthew*	→	[maj.çow]
Kenneth	→	[kʰən.ni.sɨ]/[kʰən.ni.ʂɨ]	*Theo*	→	[çi.ow]
Arthur	→	[ja.sə]	*Timothy*	→	[tʰi.mo.çi]
Heather	→	[xaj.sə]	*Jonathan*	→	[tçʰaŋ.na.ʂəŋ]
Catherine	→	[kʰaj.sə.lin]	*Samantha*	→	[ʂa.man.ʂa]

[θ] is mostly adapted to [s]. If it is preceded by a front high vowel or glide, [s] goes through palatalization and becomes [ç]. We find that the [θ] in *Jonathan* and *Samantha* is adapted to [ʂ] instead of [s].

Now let us turn to the adaptation of [ʃ], [tʃ] and [dʒ].

(31) [ʃ] → [ɕ] or [ʂ]

show	→	[ɕow]	*Bush*	→	[pu.ɕi]/[pu.ʂɨ]
Charlotte	→	[ɕa.l^{w}o.t^{h}ə]	*Sharon*	→	[ɕ^{w}e.l^{w}ən]/[ʂa.l^{w}ən]
Sheila	→	[ɕi.la]	*Sean*	→	[ʂ^{w}o.ən]/[ɕi.ən]/[ʂɨ.ən]
Michelle	→	[mi. ɕ^{w}e.ər]	*Shrek*	→	[ʂɨ.r^{w}ej.k^{h}ə]
Cash	→	[k^{h}aj.ɕy]	*Joshua*	→	[tʂ^{w}o.ʂu.wa]
Nash	→	[naj.ɕy]	*Cashmere*	→	[k^{h}ə.ʂɨ.mi.ər]

(31) shows that [ʃ] is adapted to [ɕ] or [ʂ]. Careful readers may observe that the feature [labial] may appear in the output either by adding a secondary articulation or by appearing in the following epenthetic vowel. To illustrate the latter case, compare the adaptation of *Cash* with that of *Bush*. In the adaptation of *Cash*, [ʃ] surfaces as [ɕ] with the rounded front vowel [y] epenthesized after it. In the adaptation of *Bush*, [ʃ] surfaces as [ɕ] or [ʂ] with an unrounded epenthetic vowel [i] and [ɨ], respectively.

It is not surprising that [ʃ], [tʃ] and [dʒ] are adapted in a similar way. Consider the examples given in (32) and (33):

(32) [tʃ] → [tɕ] or [tʂ]

Chip	→	[tɕ^{h}i.p^{h}u]	*Churchill*	→	[tɕ^{h}ow.tɕi.ər]
Chas	→	[tʂ^{h}a.ʂɨ]	*Rachel*	→	[r^{w}ej.tɕ^{h}ow]
Chad	→	[tʂ^{h}a.tə]	*Hitchcock*	→	[ɕi.tɕ^{h}y.k^{h}aw.k^{h}ə]
Chile	→	[tʂɨ.li]	*Lynch*	→	[lin.tɕ^{h}i]/[lin.tɕ^{h}y]
Richard	→	[li.tʂ^{h}a]			

(33) [dʒ] → [tɕ] or [tʂ]

Jack	→	[tɕe.k^{h}ə]	*Jerry*	→	[tʂə.li]/[tɕe.li]
Jeff	→	[tɕe.fu]	*Joshua*	→	[tʂ^{w}o.ʂu.wa]
Jazz	→	[tɕ^{w}e.ʂi]	*Page*	→	[p^{h}ej.tɕi]

(32) and (33) show that [tʃ] and [dʒ] are both adapted to [tɕ] or [tʂ]. Two things are worth mentioning here. First, like the adaptation of [ʃ], [labial] sometimes appears in the output. Second, the Mandarin consonants corresponding to [tʃ] vary in terms of aspiration, but those corresponding to [dʒ] are always unaspirated.

Finally, we see in (34) that [h] is adapted to [x]; if [h] is followed by a front high vowel, then [x] goes through palatalization and becomes [ɕ].

(34) [h] → [x] or [ɕ]

Hilary	→	[ɕi.la.r^{w}ej]/[ɕi.la.li]	*Herb*	→	[xə.po]
Hilda	→	[ɕi.ər.ta]	*Harvey*	→	[xa.wej]
Hitler	→	[ɕi.t^{h}ə.lə]	*Hannah*	→	[xan.na]
Hitchcock	→	[ɕi.tɕ^{h}y.k^{h}aw.k^{h}ə]	*Henry*	→	[xəŋ.li]

2.2.3 Adaptation of Illicit Syllable Structures

While English allows complex onset, Mandarin does not. As a result, when English forms with complex onset enter Mandarin, this structure has to be fixed. There are two strategies Mandarin can use — vowel epenthesis and consonant deletion. However, Mandarin takes the vowel epenthesis strategy in a majority of cases.

Mandarin does not allow consonant clusters in the coda position either. In fact, only the two nasals [n] and [ŋ] can serve as coda in Mandarin. Consequently, any coda consonant other than [n] and [ŋ] in the English forms has to be fixed. Our data show that an obstruent coda is always fixed by vowel epenthesis. Consider the examples given in (35):

(35)

Steven	→	[sɨ.ti.wən]/[sɨ.ti.fən]	*Chad*	→	[ʈʂ^{h}a.tə]
Scott	→	[sɨ.k^{h}aw.t^{h}ə]	*Jeff*	→	[tçe.fu]
Smith	→	[sɨ.mi.sɨ]	*Bush*	→	[pu.çi]/[pu.ʂɨ]
Greg	→	[kə.lej.kə]	*Page*	→	[p^{h}ej.tçi]
Frank	→	[fu.lan.k^{h}ə]	*Cash*	→	[k^{h}aj.çy]
Shrek	→	[sɨ.r^{w}ej.k^{h}ə]	*Nash*	→	[naj.çy]
Chip	→	[tç^{h}i.p^{h}u]	*Ernest*	→	[ə.ni.sɨ.t^{h}ə]
Herb	→	[xə.po]	*Max*	→	[maj.k^{h}ə.sɨ]

It can be seen in (35) that the epenthetic vowels occurring after [s] and [ʂ] are always [ɨ]; those after [t]/[t^h] and [k]/[k^h] are always [ə]; those after [p]/[p^h] and [f] are always round vowels; and those after [ç] and [tç] are [i] or [y].

If the English form possesses [m] in the coda position, this problematic structure is fixed by adapting [m] to [n] or [ŋ] or by epenthesizing the vowel [u] after [m]. Some examples are given in (36) and (37):

(36) [m] → [n] or [ŋ]

William	→	[wej.lʲan]	*modem*	→	[mo.tʲan]
Miriam	→	[mi.rʷej.an]	*Adam*	→	[ja.taŋ]
Malcolm	→	[maj.ər.kʰən]			

(37) [m] → [mu]

Tim	[tʰi.mu]	Tom	[tʰaŋ.mu]
Jim	[tçi.mu]	Hume	[çow.mu]
Sam	[ʂan.mu]		

It is interesting how Mandarin treats the two liquids [r] and [l] if they occur in the coda position. Our data show that (i) [l] either vocalizes or is adapted to [r] with a schwa epenthesized before it, and (ii) [r] is either preserved by epnthesizing a schwa before it or simply deleted. Examples are given below:

(38) [l] vocalizes

Rachel	→	[rʷej.tçʰow]	*bagel*	→	[pej.kʷo]
Hazel	→	[xaj.row]			

(39) [r]/[l] → [ər]

Pierce	→	[pʰi.ər.sɨ]	*Nobel*	→	[nʷo.pej.ər]
Clare	→	[kʰə.laj.ər]	*Miles*	→	[maj.ər.sɨ]
Blair	→	[pu.laj.ər]	*e-mail*	→	[i.mej.ər]
Sears	→	[çi.ər.sɨ]	*Hillman*	→	[çi.ər.man]
Malcolm	→	[maj.ər.kʰən]	*Neilson*	→	[ni.ər.sən]

(40) [r]/[l] → ∅

Ann Arbor	→	[an.na.paw]	*Orson*	→	[o.sən]
Mark	→	[ma.k^{h}ə]	*Gordon*	→	[kə.təŋ]
Barbara	→	[pa.pa.la]	*Goldberg*	→	[kə.po]
Starr	→	[ʂɨ.t^{h}a]	*Harold*	→	[xa.l^{w}o.tə]
Mort	→	[mo.t^{h}ə]			

The occurrence of [r] in the coda position seems to contradict what has been mentioned in §1.4.3 that only [n] and [ŋ] can serve as the coda. The issue of coda [r] in Mandarin will be discussed in §3.5.3. With respect to what causes the preservation-deletion asymmetry found in the English coda liquids, I will argue in §3.5.3 that it is attributed to the difference in salience between those preceded by front vowels and those preceded by back vowels.

CHAPTER 3

ANALYSES

3.1 The Nature of Loanword Input

In Silverman (1992), the input to loanword adaptation is viewed as superficial non-linguistic acoustic signals, and this view results in an analysis in which loanword adaptation proceeds at two separate, ordered levels: the Perceptual Level and the Operative Level. Paradis & Lacharité (1997), in contrast, claim that loanwords enter the borrowing language with structures (i.e., segments and sequences). This view eliminates the motivation for the existence of the Perceptual Level proposed by Silverman. Any work on loanwords must deal with the nature of the input. In this chapter, I will first provide evidence arguing that when English forms enter Mandarin, the input is best viewed as acoustic signals.

Stating that loanword input consists of acoustic signals entails that it contains information corresponding to features that are non-contrastive in the lending language. We therefore wonder if we are able to find those features in the ultimate output. Our data show that some English non-contrastive features are indeed present in composing segments of the Mandarin forms.

The existence of English non-contrastive features in the Mandarin forms does

not in itself prove the acoustic-signal nature of English loanword input to Mandarin, because one can claim that the input is a representation at the postlexical level of English. What we need is to find evidence showing that the input does not involve structures (e.g., segmental sequences). Our data actually provide such evidence. It is observed that a sequence of a stop plus a fricative or of a stop plus [r] in the English form may surface as an affricate, e.g., *Reynol<u>ds</u>* → [lej.n^{w}o.<u>ts</u>ɨ], <u>*Tr*</u>*acy* → [<u>ts^{hw}</u>ej.çi]. We have seen in Chapter 2 that vowel epenthesis is the strategy most frequently used to repair structures such as complex onsets or illicit codas. If English loanwords enter Mandarin with their phonological representations (i.e., structures), it is hard to explain why the vowel epenthesis strategy is abandoned in these cases. In contrast, an acoustic-signal view to loanword input gives us a straightforward explanation: the acoustic signals for those sequences are simply interpreted as single segments at the Perceptual Level.

In §3.1.1 — §3.1.5, I point to those English non-contrastive features that are found in the Mandarin output. The 'segment-merging' phenomenon is investigated in more detail in §3.1.6.

3.1.1 Aspiration in English Stops and Affricates

Let us begin with English voiceless stops and affricates. English voiceless stops are unspecified for [spread gl] at the lexical level (thus non-contrastive) (Kenstowicz 1994: p.506). At the postlexical level, they are assigned [+spread gl] in the syllable-initial position but [−spread gl] elsewhere. It is observed in our data that English syllable-initial voiceless stops in most cases surface as aspirated, e.g., ***K**evin* → [kʰaj.wən], ***T**ed* → [tʰaj.tə], ***P**eg* → [pʰej.kə], *Mi**ch**ael* → [maj.kʰə]. In addition, in the appendix of *A New English-Chinese Dictionary* (1987), where a total of 238 common English names with form-initial voiceless stops are found, 193 of them correspond to a Mandarin form that begins with an aspirated voiceless stop, making up more than eighty percent of the instances (81.1%). This high degree of match between the syllable-initial position of the English voiceless stops and the aspiration of their correspondents in the Mandarin forms provides evidence that English loanword input to Mandarin does contain non-contrastive features.

Our data also show that English syllable-initial voiceless affricates are matched to Mandarin aspirated affricates, e.g., *Chad* → [tʂʰa.tə], *Rachel* → [rʷej.tɕʰow] (the only exceptions are *Chile* → [tʂɨ.li] and *Churchill* → [tɕʰow.tɕi.ər]). It is certain that voiceless affricates in English are unspecified for [spread gl] at the lexical level (there is no contrast between [tʃ] and [tʃʰ] in English), but whether they are at the postlexical level assigned [+spread gl] or [−spread gl] in terms of their position is not clear. Based on my own observation (also personal communication with Dennis Preston) and the fact that English syllable-initial voiceless affricates are regularly matched to Mandarin aspirated affricates, I propose that at the postlexical level, English voiceless affricates are assigned [+spread gl] syllable-initially and [−spread gl] elsewhere. If this is correct, then the data can be accounted for the same way as English syllable-initial voiceless stops: [+spread gl] comes into the input and is preserved in the adaptation process, resulting in aspirated affricates in the output.

Let us now consider English voiced stops/affricates. Like their voiceless counterparts, English voiced stops/affricates are unspecified for [spread gl] at the lexical level. At the postlexical level, however, they are assigned [−spread gl] by default, regardless of where they occur in a syllable. Our data show that English voiced stops/affricates are matched to Mandarin unaspirated voiceless stops/affricates (e.g., *Gary* → [kaj.li], *Ted* → [t^{h}aj.tə], *Jeff* → [tçe.fu], *Page* → [p^{h}ej.tçi]). This once again shows what is assigned at the postlexical level of English is found in Mandarin output.

English voiceless stops/affricates in the coda position are unspecified at the lexical level and assigned [−spread gl] at the postlexical level. We thus expect their Mandarin correspondents to be unaspirated. Surprisingly, our data show that English voiceless stops/affricates in this particular position are matched to Mandarin aspirated stops/affricates (e.g., *Hitchcock* → [çi.tç^{h}y.k^{h}aw.k^{h}ə], *Matt* → [maj.t^{h}ə]). I suggest this is attributed to the fact that English voiceless stops/affricates in the coda position are released (personal communication with Eric Zee). Though the release of air is much weaker and shorter than the aspiration of syllable-initial voiceless stops/affricates, Mandarin speakers still perceive it as aspiration. In fact, there are some cases in our data in which English voiceless stops in the coda position are deleted. For example, *Raymond* surfaces as [lej.məŋ] and *cast* as [k^ha.sɨ]. In most of these cases, the deleted stops are in a consonant cluster. I assume that these deleted stops are unreleased and therefore not perceived by Mandarin speakers at all. The result is that they are not included in the input to the loanword adaptation.

Note that whether we assume [spread gl] to be a binary or a monovalent feature does not affect our analysis. In a system where [spread gl] is viewed as monovalent, English voiced stops/affricates are assigned 'nothing' instead of [−spread gl] at the postlexical level. Their Mandarin corresponds are unaspirated simply because 'nothing' is in the input.

3.1.2 Lip Rounding in English [ʃ]

The English fricative [ʃ] is strongly labialized (Ladefoged 2001: p.53). Our data show that the feature [labial] sometimes appears in a Mandarin syllable or segment that is matched to [ʃ]. Some examples are given in (41):

(41)

Input		Output
Ca<u>sh</u>	→	[kʰaj.<u>ɕy</u>]
Na<u>sh</u>	→	[naj.<u>ɕy</u>]
<u>Sh</u>aron	→	[<u>ɕ</u>ʷe.lʷən]
<u>Sh</u>irley	→	[<u>ɕ</u>ʷe.li]
Mi<u>ch</u>elle	→	[mi.<u>ɕ</u>ʷe.ər]

(41) shows that [ʃ] is matched to [ɕy] or [ɕʷ]. In both cases, the feature [labial] is observed. Since [labial] does not contrast [ʃ] from other segments, it is assigned to [ʃ] at the postlexical level, probably by a language-specific rule. The presence of [labial] in the Mandarin syllables/segments indicates that the English input contains this feature as well.

3.1.3 Syllabicity in English [l]

The next English non-contrastive feature to consider is syllabicity in [l]. There is an English allophonic rule which says that [l] is syllabic (thus [+syllabic]) at the end of a word when immediately preceded by a consonant (e.g., *padd<u>l</u>e* [pʰædl̩], *whist<u>l</u>e* [wɪsl̩], *kenne<u>l</u>* [kʰɛnl̩]) (Ladefoged 2001: p.58). Our data show that English [l]s in this particular context are matched to [ow] or [o], but those occurring elsewhere are not. Some examples are given below:

(42)

	Input		Output
a.	*Rachel*	→	[r^{w}ej.tç^{h}ow]
	Hazel	→	[xaj.row]
	bagel	→	[pej.k^{w}o]
b.	*Lisa*	→	[li.ʂa]
	Clare	→	[k^{h}ə.laj.ər]
c.	*Miles*	→	[maj.ər.sɨ]
	Nobel	→	[n^{w}o.pej.ər]
d.	*Goldberg*	→	[kə.po]
	Albright	→	[ow.pu.laj.t^{h}ə]

In (42a), the English [l]s, which occur at the end of a word and immediately follow a consonant, are adapted to [ow] or [o]. The examples in (42b) — (42d) show that English [l]s which occur in other contexts either surface intact (42b), are adapted to [ər] (42c), or get deleted (42d). Following Yip (1993: p.273), who observes a similar phenomenon in English loanwords in Cantonese, [ow] and [o] in (42a) are not epenthetic; instead, they are realized by vocalization of the English [l]s[4]. The reason is simple: epenthetic vowels triggered by unsyllabified [tç^{h}], [r] and [k] are never found to be [ow] or [o] in Mandarin loanword adaptation. Given that [+syllabic] in English [l]s is assigned at the postlexical level, its presence in the Mandarin output (contained in the vowels) argues for the involvement of English non-contrastive features in the input.

[4] Alan Munn (personal communication) points out that coda [l] vocalization is common in some varieties of English, especially in closed syllables such as [wɔlf] 'wolf'. It is not unlikely that the English input is actually a vowel rather than [l] in certain words.

3.1.4 Velarization of English Coda [l]

It is known that English [l] is velarized when it occurs in the coda position[5] (e.g., *file* [fajɫ], *field* [fiɫd]) and that the relevant feature, [dorsal], is assigned by a context-sensitive rule at the postlexical level. Our data show that if English coda [l] is preceded by a back vowel, the [l] is deleted in the adaptation; whereas, if it is a front vowel that precedes the coda [l], then the [l] is preserved and adapted to [ər]. Consider the following examples:

(43)

	Input		Output
a.	*Goldberg*	→	[kə.po]
	Harold	→	[xa.l^{w}o.tə]
	Albright	→	[ow.pu.laj.t^{h}ə]
b.	*Miles*	→	[maj.ər.sɨ]
	Neilson	→	[ni.ər.sən]
	Nobel	→	[n^{w}o.pej.ər]
	Hillman	→	[çi.ər.man]
	Malcolm	→	[maj.ər.k^{h}ən]

In (43a), the [l]s in the English forms are preceded by a back vowel and have no correspondents in the Mandarin forms. (43b) shows that if the preceding vowel is a front one, [l] is retained instead of being deleted. It has been widely stated in the

---

5 Alan Munn (personal communication) claims that English [l] preceded by a front vowel is not velarized or is only slightly velarized. According to Ladefoged (2001: 84), however, a front vowel in a word such as [hil] 'heel' or [hæl] is retracted. This suggests that English coda [l] is velarized regardless of the quality of the preceding vowel.

literature that liquids are unsalient and thus sometimes not parsed. For example, Fay and Culter (1977) claim that liquids possess vowel-like formants so that they fail to saliently stand out from the surrounding vowels. Now assume that the English [l]s in (43a) come into the input with the feature [dorsal]. Since the preceding back vowels possess the feature [dorsal] as well, it follows naturally that it is even harder for those [l]s to saliently stand out (they share more properties with the preceding vowels). When the adaptation process arrives at the Operative Level, where the Mandarin phonotactic constraints hold, Mandarin chooses to delete them instead of preserving them. In contrast, the [l]s in (43b) are more salient than those in (43a) for two reasons: (i) the preceding vowel is not a dorsal but a coronal, and (ii) a schwa might be inserted between the [l] and the preceding vowel. As a result, the [l]s in (43b) are more likely to be preserved through the adaptation. The examples in (43) indicate that whether English coda [l] is preserved or deleted in the loanword adaptation is related to the quality of the preceding vowel. That is, a velarized [l] is deleted only if the preceding vowel contains the feature [dorsal]; otherwise, it is preserved. Since English [l] obtains [dorsal] at the postlexical level, this close relation argues for the claim that the loanword input contains English non-contrastive features.

3.1.5 Nasalization of English Vowels Before Nasals

In English, vowels are nasalized if followed by a nasal consonant (e.g., *can* [k^{h}æ̃n], *sing* [sĩŋ]). Since the feature [nasal] is predictable in such vowels, it is regarded as non-contrastive. Our data show that this particular feature may appear in the output. First of all, consider the examples given in (44):

(44)

Input		Output	Input		Output
Ben	→	[pən]/[pən.ən]	*King*	→	[tɕin]/[tɕin.ən]
Dan	→	[tan]/[tan.ən]	*Lynn*	→	[lin]/[lin.ən]
Ken	→	[k^{h}ən]/[k^{h}ən.ən]			

We see in (44) that the English forms are all monosyllabic and each has two Mandarin equivalents, one monosyllabic and the other bisyllabic. I will argue in §3.5.4.2 that if the English form is monosyllabic, it may be augmented by vowel epenthesis and surfaces as bisyllabic. Assume this is correct for the moment. Now compare the two Mandarin forms for each English input in (44). It is certain that the epenthetic vowel is a schwa. A question then arises: Is the syllable [ən] as a whole added at the end of the monosyllabic form, or is a schwa inserted between the vowel and the coda [n] with another [n] appearing right after the vowel? There is evidence supporting the latter suggestion. Consider the following examples:

(45)

Input		Output	Input		Output
Main	→	[mej.ən]	*Jean*	→	[tɕʰin]/[tɕi.ən]
Wayne	→	[wej.ən]	*Boone*	→	[pu.ən]

All the English forms in (45) contain a tense vowel and are augmented in the loanword adaptation. We can clearly see that the augmentation is realized by epenthesis of a schwa and the location of the epenthesis is between the vowel and the coda [n]. An assumption where the syllable [ən] is added at the end of the form has to explain the deletion of the [n], but [n] deletion (or more generally, deletion of nasal segments) is never found in English loanwords in Mandarin.

Having identified the location where the schwa is epenthesized, the question now is the status of the [n] that occupies the coda position of the first syllable. Put differently, where does it come from? An epenthetic status of the [n] is not supported. Take the adaptation *Lynn* → [lin.ən] as an example. We all know that loanwords are adapted minimally. Given that [li] is a well-formed Mandarin syllable, epenthesizing an [n] at the end of the syllable does not seem to be motivated (i.e., Why does *Lynn* not surface as [li.ən]?).

If we adopt the assumption that English loanword input to Mandarin contains non-contrastive features, this question has an answer: the observed [n] is derived from the feature [nasal] involved in the English vowel. I argue that this 'unpacking' process[6] is triggered by the two-mora requirement in Mandarin (see §1.4.3). We know that in English a tense vowel/diphthong possesses two moras while a lax vowel possesses one. When English forms such as those in (44) enter Mandarin and undergo augmentation by schwa epenthesis, the first syllable is judged as ill-formed by Mandarin because its rhyme only possesses one mora. To fix this ill-formed syllable, the most economical way seems to unpack the nasalized vowel, letting the feature [nasal] involved in the vowel surface as [n]. By doing so, the resulting syllable has two moras and meets this particular requirement imposed by Mandarin.

As for the examples in (45), I suggest that the feature [nasal] is deleted during the adaptation. When English forms such as those in (45) enter Mandarin and are augmented to bisyllabicity by schwa epenthesis, the first syllable possesses two moras and satisfies the two-mora requirement. Since Mandarin does not allow nasalized vowels and no extra slot is available for the feature [nasal] to surface as [n], it has to undergo deletion.

3.1.6 Segment Merger

I have shown in §3.1.1 — §3.1.5 that English loanword input to Mandarin contains features that are non-contrastive in English. In this subsection, I will provide

---

[6] This term is given by Paradis & Prunet (2000), who argue that 'contrastiveness in the source language determines the presence or absence of unpacking in the borrowing language.' The adaptations in (44) seem to be counterexamples to their claim.

additional evidence to argue that the input enters Mandarin without structures (i.e., the input consists of acoustic signals).

Compare the underlined segments in the English forms with their Mandarin correspondents:

(46)

a.			b.		
Input		Output	Input		Output
Reynolds	→	[lej.nʷo.tsɨ]	*Tracy*	→	[tsʰʷej.çi]
Schultz	→	[ʂu.tsɨ]	*Patrick*	→	[pʰaj.tçʰy.kʰə]
Roberts	→	[lʷo.po.tsɨ]	*Sandra*	→	[ʂan.tʂʷo]
Betsy	→	[pej.tçʰi]	*Alexandra*	→	[ja.li.ʂan.tʂʷo]
			Sinatra	→	[çin.na.tçʰy]
			Streep	→	[ʂɨ.tʂʰʷej.pʰu]
			Truman	→	[tʂʰu.mən]
			Streisand	→	[ʂɨ.tʂʰʷej.ʂan]

(46a) shows that a stop and an immediately following fricative in the English forms are matched to a Mandarin affricate. We observe a similar situation in (46b): a stop and an immediately following [r] correspond to a single Mandarin affricate. There is no doubt that in (46a) the two English segments merge to [ts]/[tçʰ] in the adaptation. For (46b), however, it is not that obvious. I would say that they merge as well, since if the liquid [r] were deleted, the preceding stop would surface as [t] rather than as an affricate. Paradis & Lacharité's view that loanwords enter the borrowing language with structures fails to account for this fact. By their view, the input is immediately interpreted as a phonological representation by the borrowing language (p.380). Since the input contains segments that are in a sequence, we would expect a vowel (a schwa) to be epenthesized between the stop and the fricative/[r] in (46). However, this is not what we have seen. (47) illustrates their view using the adaptation of *Roberts* and *Tracy*:

(47)

Input (with structures)		Loanword adaptation[7]		Output
[ra.bərts] *Roberts*	→	Epenthesize [ə] between [t] and [s]	→	*[lʷo.po.tə.sɨ]
[tʰrej.si] *Tracy*	→	Epenthesize [ə] between [tʰ] and [r]	→	*[tʰə.rʷej.çi]

An acoustic-signal view to the nature of loanword input is able to account for the merger of the two English segments in the adaptation. In this view, the acoustic signals for the stop and the following fricative/[r] are represented as an affricate at the Perceptual Level. At the Operative Level, a vowel is epenthesized if the affricate is assigned a syllable node. This view is exemplified in (48):

[7] Only the schwa epenthesis in question is shown here. Other types of epentheses and processes of segmental adaptation are ignored.

(48)

Input (acoustic signals)		The Perceptual Level		The Operative Level		Output
Roberts	→	[ra.pər.ts]	→	Epenthesize [ɨ] after [ts]	→	[l^{w}o.po.<u>tsɨ</u>]
Tracy	→	[ts^{hw}ej.si]	→	N/A	→	[ts^{hw}ej.çi]

3.1.7 Summary

We have seen that English non-contrastive features such as [+spread gl] in stops/affricates, [labial] in [ʃ], [+syllabic] or [dorsal] in [l] and [nasal] in vowels may appear in the Mandarin output. We have also seen that two English segments of certain types may merge to an affricate in the adaptation. These facts are in conformity with an acoustic-signal view to the nature of loanword input. Paradis & Lacharité's view fails to account for the segment merging phenomenon shown in the last subsection, since it assumes that loanwords enter the borrowing language with structures, including segments and sequences.

3.2 At the Perceptual Level

3.2.1 Licit Consonants

I have argued above that English loanword input to Mandarin is best viewed as acoustic signals. Following Silverman (1992), the acoustic signals are divided into segment-sized chunks for which the closest feature matrices from the Mandarin inventory are provided. Our data show that if the English consonants exist in Mandarin, they usually surface intact. For example, most English aspirated voiceless stops surface without any change. Nevertheless, some exceptions are found. For example, although both English and Mandarin have the labial nasal [m], it is mapped to [n] or [ŋ] when it is assigned to the coda position. A few examples show that a vowel is epenthesized to the right of it (e.g., *To<u>m</u>* → [t^haŋ.<u>mu</u>]). These examples will be discussed in §3.3. Clearly, coda [m] surfaces differently because Mandarin only allows [n] and [ŋ] in the coda position. Following Silverman (p.297), I assume that the acoustic signal of every English [m] is represented as [m] at the Perceptual Level; when the loanword adaptation process arrives at the Operative Level, where the Mandarin phonotactic constraints hold, those assigned to the coda position undergo feature change and turn into [n] or [ŋ]. (49) shows that no matter in what position the English [m] occurs, its acoustic signal is always represented as [m] at the Perceptual Level.

(49)

Input		The Perceptual Level[8]		The Operative Level
a.				
Smith	→	[s.mi.s]	→	[ʂɨ.mi.sɨ]
Mary	→	[me.ri]	→	[ma.li]
b.				
Adam	→	[e.təm]	→	[ja.taŋ]
William	→	[wi.liəm]	→	[wej.lʲan]

In (49a), the acoustic signal of the input [m] is represented as [m] and assigned to the onset position; in (49b), the acoustic signal of the input [m] is also represented as [m] although it is assigned to the coda position.

The phonemes [r], [s] and [n], which also exist in Mandarin, sometimes undergo feature change as well. Our data show that [r] and [s] in onset position and [n] in coda position sometimes surface as [l], [ʂ] and [ŋ], respectively. For example, *Mary* → [ma.li], *Lisa* → [li.ʂa] and *Damon* → [taj.məŋ]. It is puzzling that the adaptations take place because in Mandarin [r] and [s] are allowed in the onset position and [n] is allowed in the coda position. Just like English [m], I assume that at the Perceptual Level, the acoustic signals of English [r], [s] and [n] are represented as such irrespective of their position, and it is during the Operative Level that they may undergo feature change. Nevertheless, [r], [s] and [n] are adapted for different reasons. I suggest that the following two factors trigger the adaptation: (i) the choice of

[8] According to Silverman (1992), post-vocalic [s] is assigned a syllable node at the Perceptual Level (see §1.2.1).

Chinese characters; and (ii) some syllables simply cannot surface in Mandarin because they lack corresponding Chinese characters. These two factors are also able to account for many exceptions, including those in which English aspirated stops/affricates surface as unaspirated. In §3.4, I will show evidence to argue for my claim.

(50)

Input		The Perceptual Level		The Operative Level
a.				
Redford	→	[r^{w}ej.for]	→	[r^{w}ej.fu]
Simon	→	[saj.mən]	→	[saj.mən]
Ted	→	[t^{h}et]	→	[t^{h}aj.tə]
b.				
Mary	→	[me.ri]	→	[ma.li]
Lisa	→	[li.sa]	→	[li.ʂa]
Damon	→	[tej.mən]	→	[taj.məŋ]
Tony	→	[t^{h}o.ni]	→	[toŋ.ni]

3.2.2 Illicit Consonants

Our data also show that if the English consonants do not exist in Mandarin, they are mapped to the closest Mandarin segments. For example, although English obstruents contrast in voicing, Mandarin obstruents do not. Following Silverman (1992) and Yip (1993), I assume that Mandarin speakers do not even detect the contrast. Therefore, the acoustic signals of English voiced obstruents are represented as voiceless obstruents at the Perceptual Level. Two things are noted here. First, English voiced stops and affricates all surface as unaspirated in spite of the fact that Mandarin voiceless stops and affricates contrast in aspiration, as we have seen in §3.1.1. Second, the voiced labio-dental fricative [v] is mapped to [w] or [f].

The interdental fricative [θ] and the glottal fricative [h] are mapped to [s] and [x], respectively. If they are followed by the high front vowel [i], they surface as [ç]. Similar to [s], [θ] sometimes surfaces as [ʂ] due to selection of the character.

Let us now consider [ʃ], [tʃ] and [dʒ]. Since [ʃ] differs from [tʃ] in presence/absence of the [t] and [tʃ] differs from [dʒ] in voicing, only [ʃ] is discussed here. Our data show that [ʃ] surfaces as [ç] or [ʂ]. However, the feature [labial] sometimes is observed in the output, e.g., Mi<u>ch</u>elle → [mi.$ç^w$e.ər]. Based on the fact that English [ʃ] has the non-contrastive feature [labial], I assume that the acoustic signal of [ʃ] is represented as [$ç^w$] or [$ʂ^w$]. This raises a question: Why is the feature [labial] deleted in some cases (e.g., <u>*Sh*</u>*eila* → [çi.la], <u>*Sh*</u>*rek* → [ʂi.r^wej.k^hə])? Again, like onset [s] and [r] may surface as [ʂ] and [l] or coda [n] may surface as [ŋ], I suggest that it is character selection that triggers the deletion.

(51)

a. Voiced obstruents

Input		The Perceptual Level		The Operative Level
Barry	→	[pe.ri]	→	[pa.li]
Adam	→	[e.təm]	→	[ja.taŋ]
Gary	→	[ke.ri]	→	[kaj.li]
Missouri	→	[mə.su.ri]	→	[mi.su.li]
Steven	→	[sti.fən]/[sti.wən]	→	[ʂɨ.ti.fən]/[ʂɨ.ti.wən]

b. [θ]

Arthur	→	[ar.sər]	→	[ja.sə]

c. [h]

Herb	→	[xərp]	→	[xə.po]

d. [ʃ], [tʃ], [dʒ]

Sharon	→	[ɕ^{w}e.rən]/[ʂ^{w}e.rən]	→	[ɕ^{w}e.l^{w}ən]/[ʂa.l^{w}ən]
Chip	→	[tɕ^{hw}ip^{h}]/[tʂ^{hw}ip^{h}]	→	[tɕ^{h}i.p^{h}u]
Chas	→	[tɕ^{hw}es]/[tʂ^{hw}es]	→	[tʂ^{h}a.ʂɨ]
Jerry	→	[tɕ^{w}e.ri]/[tʂ^{w}e.ri]	→	[tɕe.li]/[tʂə.li]

3.3 Mandarin Palatals

As we have seen in §1.4.1, the palatals [tɕ], [tɕ^{h}] and [ɕ] are allophones in Mandarin. In many studies, they surface by the phonemes assimilating to a following high front vowel or glide. Duanmu (2000: p.28, 81), however, claims that the phonemes and a following glide merge into a single segment. (52) and (53) show the difference using the dental sibilants [ts ts^{h} s]:

(52) **Others**

Underlying Representation				Surface Representation		
/ts ts^h s/	+	/j/	→	[tç $tç^h$ ç]	+	[j]
/ts ts^h s/	+	/ɥ/	→	[tç $tç^h$ ç]	+	[ɥ]

(53) **Duanmu**

Underlying Representation				Surface Representation
/ts ts^h s/	+	/j/	→	[tç $tç^h$ ç]
/ts ts^h s/	+	/ɥ/	→	[$tç^w$ $tç^{hw}$ $ç^w$]

In (52), the palatals and the following glide are independent segments in the surface representation, but in (53), the phonemes and the following glide merge into a single segment. In this section, I will draw evidence from our data to argue for Duanmu's view. First of all, consider the adaptations in (54) where the output forms are transcribed in both ways (For the sake of convenience, I discuss [$ç^w$] only).

(54)

Input		Output	
		Others	Duanmu
show	→	[çjow]	[çow]
Shirley	→	[çɥe.li]/[çje.li]	[$ç^w$e.li]/[çe.li]
Charlotte	→	[çja.lwo.t^hə]	[ça.l^wo.t^hə]
Michelle	→	[mi.çɥe.ər]	[mi.$ç^w$e.ər]
Sharon	→	[çɥe.lwən]	[$ç^w$e.l^wən]

In (54), English [ʃ] is mapped to [ç]/[$ç^w$] in Duanmu's transcription but to [çj]/[çɥ] in other people's. As suggested by Silverman (1992), the acoustic signals are parsed into segment-sized chunks for which the closest native segments are provided. Intuitively, the acoustic signal of [ʃ] should be parsed into one chunk rather than two, and therefore only one segment from the borrowing language can be provided. I have assumed that when English [ʃ] enters Mandarin, [ç^{w}] is one of the segments that fill the chunk. Duanmu's view has no problem with this assumption: The acoustic signal of [ʃ] is represented as [ç^{w}] at the Perceptual Level, and then it surfaces with no change or as [ç] due to selection of the character. According to the views of others, however, the occurrence of the glide [j]/[ɥ] in the output cannot be explained. Assuming an epenthetic status of [j]/[ɥ] also fails, in the sense that loanword adaptation is minimal and therefore there is no reason to epenthesize them.

(55)[9]

Input		The Perceptual Level		Output	
show	→	[ç^{w}o]	→	[çow]	*[çjow]
Shirley	→	[ç^{w}ər.li]	→	[ç^{w}e.li]/[çe.li]	*[çɥe.li]/[çje.li]
Charlotte	→	[ç^{w}ar.lət^{h}]	→	[ça.l^{w}o.t^{h}ə]	*[çja.l^{w}o.t^{h}ə]
Michelle	→	[mi.ç^{w}el]	→	[mi.ç^{w}e.ər]	*[mi.çɥe.ər]
Sharon	→	[ç^{w}e.rən]	→	[ç^{w}e.l^{w}ən]	*[çɥe.l^{w}ən]

Let us now consider English [ʃ] that is assigned to the coda position. Some

[9] The processes at the Operative Level are omitted in this chart.

examples are given in (56):

(56)

Input		Output	
		Others	Duanmu
Bu<u>sh</u>	→	[pu.<u>çi</u>]	[pu.<u>çi</u>]
Ca<u>sh</u>	→	[k^haj.<u>çy</u>]	[k^haj.<u>çy</u>]
Na<u>sh</u>	→	[naj.<u>çy</u>]	[naj.<u>çy</u>]

Although Duanmu and other people have the same transcription for the output forms, only Duanmu's view can explain the realization of [çy]. As mentioned above, the acoustic signal of [ʃ] is represented by [$ç^w$] at the Perceptual Level. When the loanword adaptation arrives at the Operative Level, a nucleus is epenthesized after [$ç^w$] because [$ç^w$] has been assigned to the coda position and Mandarin does not allow this structure. The [$ç^w$]+nucleus sequence then surfaces as [çy] through assimilation. Note that the epenthetic nucleus may be realized as [i], as in *Bu<u>sh</u>* → [pu.<u>çi</u>], which I assume is due to selection of the character.

In theories other than Duanmu's, [$ç^w$] cannot be used to fill the chunk because it is not a legal segment. The segment that is chosen for the chunk might be [ç], [s] or [ʂ]. At the Operative Level, a nucleus is epenthesized since none of them is a legal coda consonant. A problem now emerges: the epenthetic nucleus is realized as [i] after [ç], as a dental apical vowel after [s] and as a retroflex apical vowel after [ʂ]. The consequence is that the attested output [çy] would never surface.

(57) ('N' denotes an epenthetic nucleus)

		Others	
Input	*Cash*	*Cash*	*Cash*
	↓	↓	↓
The Perceptual Level	k^he.s	k^he.ş	k^he.ç
	↓	↓	↓
The Operative Level	k^haj.sN	k^haj.sN	k^haj.çN
	↓	↓	↓
Output	*k^haj.sɨ	*k^haj.şɨ	k^haj.çi

		Others	
Input	*Nash*	*Nash*	*Nash*
	↓	↓	↓
The Perceptual Level	ne.s	ne.ş	ne.ç
	↓	↓	↓
The Operative Level	naj.sN	naj.şN	naj.çN
	↓	↓	↓
Output	*naj.sɨ	*naj.şɨ	*naj.çi

Duanmu

Input	*Cash*	*Nash*
	↓	↓
The Perceptual Level	k^he.ç^w	ne.ç^w
	↓	↓
The Operative Level	k^haj.ç^{w}N	naj.ç^{w}N
	↓	↓
Output	k^haj.çy	naj.çy

In order for the syllable [çy] to surface, one has to assume that the acoustic signal of English [ʃ] is represented as [ç^w] at the Perceptual Level. Since [ç^w] is the outcome of the phoneme [s], [ʂ] or [x] merging with the glide [ɥ], Duanmu's proposal is supported.

(58)

/s ʂ x/ + /ɥ/

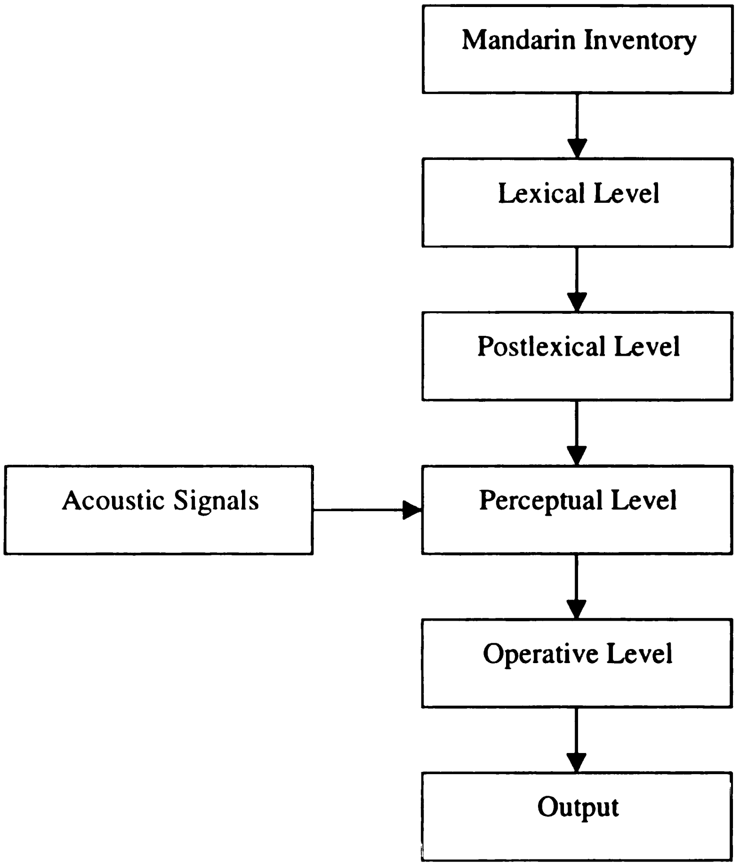
↓

[ʃ] → Acoustic Signal → [ç^w]

I will also argue in this thesis that the loanword adaptation not only operates on the output of the postlexical level of English, but also operates on the output of the postlexical level of Mandarin. I will show that the acoustic signals are interpreted as phonological representations using Mandarin allophones, rather than its phonemes.

The above analysis implies that the loanword adaptation operates on the output of the Mandarin postlexical level (that is, allophones), which is in contradiction with Paradis & Lacharité's view that loanword input enters into the borrowing language's lexicon. I agree with Yip (1993), who argues that loanword adaptation does not constitute a separate grammar from the native phonology. As I will show in §3.5, the Operative Level of the loanword adaptation has the same function as the lexical level of the native phonology. At both levels, the Mandarin phonotactic constraints exert the influence. However, the above analysis suggests that the segments that are used to make up the inputs of the two levels are different. For the Operative Level of the loanword adaptation, the input is the output of the Perceptual Level, which is made up of Mandarin allophones that most closely approximate the acoustic signals. For the postlexical level of the native phonology, the input is made up of the phonemes. The following diagram illustrates the relation of the loanword adaptation to the native phonology:

(59)



3.4 Character Selection

We have seen that English non-contrastive features may appear in the output and that this fact can be explained only if the input to the loanword adaptation is assumed to contain these features. Now the question is how to explain the examples where these features do not show up in the output. In this section, I will argue that these features may be deleted during the adaptation. To account for these 'exceptions', consider the examples given in (60) and (61):

(60)

	Input		Output	
a.	*Paula*	→	[po.la]	
	Tony	→	[toŋ.ni]	c.f. [tʰaŋ.ni]
	Kennedy	→	[kan.naj.ti]	
b.	*Chile*	→	[tʂi.li]	
	Churchill	→	[tɕʰow.tɕi.ər]	
c.	*Steve*	→	[ʂi.tʰi.fu]	c.f. [ʂi.ti.fu]
	Stanley	→	[ʂi.tʰan.li]	c.f. [ʂi.tan.li]
	Scott	→	[ʂi.kʰaw.tʰə]	

(61)

Input		Output	
Sheila	→	[ɕi.la]	
Sharon	→	[ʂa.lʷən]	c.f. [ɕʷe.lʷən]
Shrek	→	[ʂi.rʷej.kʰə]	
Sean	→	[ɕi.ən]/[ʂi.ən]	c.f. [ʂʷo.ən]
Bush	→	[pu.ɕi]/[pu.ʂi]	
Cashmere	→	[kʰə.ʂi.mi.ər]	

(60a) and (60b) show that English syllable-initial voiceless stops and affricates are de-aspirated. In (60c), English voiceless stops which are preceded by [s] are matched to Mandarin aspirated stops. (61) shows that English [ʃ], which has been assumed to contain the non-contrastive feature [labial], surfaces as [ɕ] or [ʂ]. In both cases, [labial] are absent. To account for these exceptions, I propose that selection of Chinese characters is involved in the loanword adaptation. In the Chinese language, a character corresponds to a syllable. In addition, each character possesses a certain meaning. It makes sense that when an English name enters Mandarin, Mandarin speakers prefer a Mandarin equivalent that is composed of proper characters even if the equivalent is not so close to the input. Take *Tony* → [t̲oŋ.ni] as an example. Although the word-initial voiceless stop is de-aspirated, when assigned the first tone, [toŋ] may correspond to the character '东', which means 'east' and is quite common for male names in China. [tʰaŋ.ni] is another Mandarin equivalent to *Tony*. In this case, the feature [+spread gl] in the word-initial voiceless stop is kept. However, we can see that instead of having the closest vowel [o], the first syllable has the vowel [a]. The reason that [o] is replaced with [a] is because when assigned the first tone, [tʰaŋ] may correspond to the character '汤', a Chinese surname (In a Chinese name, the surname goes before the given name). The choice between [toŋ.ni] or [tʰaŋ.ni] as *Tony*'s Mandarin equivalent is really personal preference, but no matter which one is chosen, it reveals that the composing characters are taken into account.

Let us consider another example. I have assumed that the acoustic signal of English [ʃ] is represented as [çʷ] or [ʂʷ] at the Perceptual Level. Our data show that *Sharon* surfaces as [ç̲ʷe.ɹʷən] or [ʂa.ɹʷən]. The fact that the feature [labial] is absent in the latter case may be attributed to consideration of Chinese characters as well. For the syllable [ʂʷa], the most common character has the meaning 'to brush' when assigned the first tone ('刷') and 'to play with' when assigned the third tone ('耍')

(there are no characters for this syllable with the second or fourth tone), and neither is appropriate for names. In contrast, when assigned the first tone, [ʂa] may correspond to the character '莎', which is commonly used for female names. Once again, this example shows the involvement of character selection in the loanword adaptation.

Consideration of Chinese characters also accounts for cases in which licit consonants undergo feature change. Consider the following examples in which [n] is adapted to [ŋ] and [s] is adapted to [ʂ]:

(62)

Input		Output	Input		Output
a.			b.		
Raymond	→	[lej.məŋ]	*Stone*	→	[ʂɨ.toŋ]
Damon	→	[taj.məŋ]	*Stanford*	→	[ʂɨ.tan.fu]
Jonathan	→	[tɕ^{h}aŋ.na.ʂəŋ]	*Stuart*	→	[ʂɨ.tu.x^{w}a]
Vincent	→	[wən.ʂəŋ]	*Sam*	→	[ʂan.mu]
			Vanessa	→	[wən.ni.ʂa]
			Lisa	→	[li.ʂa]

At first glance, the adaptations are puzzling because Mandarin has both [n] and [s] and allows [n] in the coda position and [s] in the onset position. As suggested above, it is consideration of Chinese characters that triggers the adaptations. For example, in *Stanford* → [ʂɨ.tan.fu], the word-initial [s] surfaces as [ʂ] instead of [s] simply because, when assigned the third tone, [ʂɨ] may correspond to the character '史', a Chinese surname. This 'surname' reason explains many other cases in which word-initial [s] followed by another consonant surfaces as [ʂ]. In addition, masculinity or femininity of the characters sometimes becomes an influence as well. For example, *Raymond* surfaces as [lej.məŋ] rather than [lej.mən] and *Lisa* surfaces as [li.ʂa] rather than [li.sa] because the characters corresponding to [məŋ] ('蒙') and [ʂa] ('莎') look masculine and feminine, respectively.

In addition, a licit consonant may get adapted because the syllable where it occurs simply cannot surface.[10] Consider the following examples where English onset [r] surfaces as [l] or [r^w].

(63)

Input		Output	Input		Output
a.			c.		
Rachel	→	[lej.tç^{h}ow]/[r^{w}ej.tç^{h}ow]	*Richard*	→	[li.tʂ^{h}a]
Redford	→	[r^{w}ej.fu]	*Ricky*	→	[li.tç^{h}i]/[r^{w}ej.tç^{h}i]
Shrek	→	[ʂi.r^{w}ej.k^{h}ə]	*Rita*	→	[li.t^{h}a]/[r^{w}ej.t^{h}a]
			Hilary	→	[çi.la.li]/[çi.la.r^{w}ej]
b.			*Jeffrey*	→	[tçej.fo.li]/[tçej.fo.r^{w}ej]
Robin	→	[la.pin]	*Eric*	→	[aj.li.k^{h}ə]/[aj.r^{w}ej.k^{h}ə]
Rice	→	[laj.si]			
Brian	→	[pu.laj.ən]			

The phoneme [r] exists in Mandarin and is allowed in the onset position. However, (63) shows that the input [r], which is assigned to the onset position at the

10 According to Duanmu 2000:§3, the majority of expected Mandarin syllables are missing. Some missing forms are systematic gaps. For example, a Mandarin syllable cannot have two segments that are both [+round]. Some missing forms are accidental gaps. For example, while [m^{j}e] 'wipe out' and [p^{hj}e] 'skim' are well-formed Mandarin syllables, *[f^{j}e] is is not. Thus, *[f^{j}e] is probably an accidental gap.

Perceptual Level, surfaces as [l] or [r^w]. Consider the English syllables that contain [r]. We find that the [r] is followed by [ej], [ɛ] (63a), [a], [aj] (63b) and [ɪ] (63c). If we further assume that the acoustic signals of these vowels most closely approximate Mandarin [ej], [e], [a], [aj] and [i], respectively, then at the Perceptual Level, the syllables in question are represented as [rej], [re], [ra], [raj] and [ri]. Because these syllables cannot surface, the easiest way for Mandarin to fix them seems to be to turn the onset [r] into [l], meaning that only the value for [lateral] changes. In many examples in (63), especially in (63c), the English [r] surfaces as [r^w]. I assume that this is due to consideration of characters. Careful readers may have found that in (63c), if the English [r] surfaces as [r^w], the following vowel is always [ej]. Given that English [ri]/[rɪ] surfacing as [r^wej] instead of [li] violates the 'minimal change' principle, only selection of character is able to account for it.

Some scholars claim that English onset [r] involves lip rounding (e.g., Duanmu (2000: p.26) and many others). If this is true, then the syllables in question should be represented as [r^wej], [r^we] (63a), [r^wa], [r^waj] (63b) and [r^wi] (63c) at the Perceptual Level. Note that, according to Duanmu's proposal, [r^w] is a legal Mandarin segment, which is derived from the merger of [r] with a following glide [w]. However, except for [r^wej], none of those syllables has a corresponding Chinese character. As shown in (63), only the first syllable of *Rachel* surfaces intact (*<u>Ra</u>chel* → [<u>r^wej</u>.$tç^h$ow]); other syllables all surface with featural change made either to [r^w] or to the vowel. This supports my claim that a licit consonant gets adapted because the syllable where it occurs corresponds to no character and cannot surface.

To sum up, I have argued that character selection is able to account for some of the examples that are considered exceptions, and the reason is that Mandarin speakers would like an output form that is composed of proper characters even if they deviate from the input. In addition, some syllables simply cannot surface in Mandarin because they lack a corresponding character. The consequence is that either the consonant or the vowel has to be adapted. It should be noted here that although the output may deviate from the input due to character selection, there seems to be a limit in terms of how different they can be. The main principle in loanword adaptation is to keep the output as close to the input as possible. When it comes to Mandarin loanword adaptation, this principle is not followed strictly because of the influence of character selection. However, as I have shown, this principle is not totally overridden; otherwise we would have seen adaptations where the input and the output are entirely different. Our data show that only a few types of feature changes are made when the character selection factor exerts its influence. They are listed in (64):

(64)

	Type	Example
a.	[+spread gl] ↔ [−spread gl]	*Tony* → [t̲oŋ.ni], *St̲eve* → [ʂɨ.t̲ʰi.fu]
b.	[labial] as a secondary articulation ↔ ∅	*Sh̲eila* → [çi.la], *Hilar̲y* → [çi.la.r̲ʷej]
c.	Coronal → Dorsal (nasals)	*Raymon̲d* → [lej.məŋ]
d.	[−retroflex] → [+retroflex]	*Lis̲a* → [li.ʂa]
e.	[−lateral] → [+lateral]	*R̲obin* → [l̲a.pin]

A question arises: Why are only these types of feature changes tolerated? Given that loanword adaptation is minimal, it seems like some types of feature changes make more difference in perception than others. For example, we never find feature changes such as [+continuant] ↔ [−continuant] occurring when character selection comes into force. This issue is left open here and it deserves further research in the future.

3.5 At the Operative Level

After the acoustic signals turn into native segments at the Perceptual Level, the loanword adaptation process arrives at the Operative Level, where true phonological operations apply in order for the segment strings produced at the Perceptual Level to surface in conformity with the native phonotactic constraints. In this section, I will discuss those phonological operations and give an analysis within the framework of Optimality Theory.

3.5.1 Mandarin Syllable Structure Constraints

Syllable structure constraints are a set of constraints about the well-formedness of syllables in a given language. For Mandarin, they include the following four constraints:

a. *COMPLEX: Complex onset or coda is not allowed.

b. NUCLEUS: Syllables always have nuclei. Nuclei are always vocalic.

c. CODA CONDITION: In the coda position, only [n] or [ŋ] is allowed.

d. MINSYLL: A full syllable has two moras.

These constraints are undominated, since a well-formed Mandarin syllable has to satisfy all of them. In addition, these four constraints cannot be ranked with each other.

3.5.2 Vowel Epenthesis

As shown in §2.2.3, when English forms enter Mandarin, consonant clusters assigned to the onset position and any obstruents assigned to the coda position are fixed by means of vowel epenthesis. Some examples are given in (65):

(65)

Input		The Perceptual Level		The Operative Level
Eric	→	[e.rik^h]	→	[aj.li.k^{h}ə]/[aj.r^{w}ej.k^{h}ə]
Glen	→	[klen]	→	[kə.lan]
Ernest	→	[ər.ni.st]	→	[ə.ni.sɨ.t^{h}ə]
Frank	→	[frenk^h]	→	[fu.lan.k^{h}ə]

Since consonant deletion is not used as a strategy to fix these ill-formed structures, MAX-C-IO outranks DEP-V-IO. The tableau in (68) shows that for the input[11] [klen], which possesses two consonants in the onset position, the candidate [kə.lan] is selected as optimal:

(66) MAX-C-IO: Input consonants must have output correspondents.

(67) DEP-V-IO: Output vowels must have input correspondents (No epenthesis of vowels).

[11] It means the input to the Operative Level.

(68)

[klan] 'Glen'	*COMPLEX	CODA CONDITION	MAX-C-IO	DEP-V-IO
☞ [kə.lan]				*(ə)
[klan]	*(kl)!			
[lan]			*(k)!	
[kan]			*(l)!	

Lin (1992) observes the following three types of epenthetic vowels in Mandarin loanword adaptation: the apical vowel [ɨ], the rounded vowel [u] and the schwa. Some examples found in our data are given in (69):

(69)

	Input		The Perceptual Level		The Operative Level
a.	*Keith*	→	[k^{h}ːi.s]	→	[tç^{h}ːi.sɨ]
	Gates	→	[kej.ts^{h}]	→	[kaj.tsɨ]
b.	*Ernest*	→	[ər.ni.st^{h}]	→	[ə.ni.sɨ.t^{h}ə]
	Max	→	[mek^{h}.s]	→	[maj.k^{h}ə.sɨ]
c.	*Jeff*	→	[tçef]	→	[tçe.fu]
	Chip	→	[tç^{h}ːip^{h}]	→	[tç^{h}ːi.p^{h}u]

According to Lin, the epenthetic nucleus is realized as [ɨ] through coronal assimilation if preceded by a coronal sibilant, as [u] through labial assimilation if preceded by a labial consonant, and as [ə] by a default rule if preceded by another non-labial consonant. As I have shown in §3.3, if the acoustic signal of English [ʃ] is represented as [ç^w] and it is assigned to the coda position, then the following epenthetic nucleus is realized as [y]. Note that the non-contrastive feature [labial] may be deleted during the Operative Level for the 'character selection' reason, and the result is that the epenthetic nucleus surfaces as [i]. Some examples are shown in (70):

(70)

	Input		The Perceptual Level		The Operative Level
a.	*Cash*	→	[k^{h}eç^w]	→	[k^{h}aj.çy]
	Nash	→	[neç^w]	→	[naj.çy]
b.	*Bush*	→	[puç^w]	→	[pu.çi]
	Page	→	[p^{h}ejtç^w]	→	[p^{h}ej.tçi]

3.5.3 Liquids in the Coda Position

Liquids are not legal coda consonants in Mandarin. When English forms enter Mandarin, the liquids that are assigned to the coda position are either preserved by vowel epenthesis or simply deleted. In this section, I will (i) discuss what causes this asymmetry and (ii) find out the relevant constraints and give a plausible analysis. Before we reconsider the data, there is one question that we need to answer. What is the reason that in the loanword adaptation liquids may be deleted while obstruents are always preserved? Following Yip (1993), I suggest that this asymmetry be attributed to the difference in salience between liquids and obstruents. First of all, compare the

English form-initial obstruents with the immediately following liquids in the Cantonese examples given in (71):

(71) Cantonese loanword adaptation (Silverman 1992: p.290, Yip 1993: p.267, 270)

a. Input		Output	b. Input		Output
brake	→	[pik.lik]	*broker*	→	[puk.ka]
cream	→	[kej.lim]	*freezer*	→	[fi.sa]
plum	→	[pow.lam]	*place*	→	[p^hej.si]
fluke	→	[fu.luk]	*floorshow*	→	[fo.sow]

We see that the obstruents are all preserved but the liquids are either preserved (71a) or deleted (71b). Silverman (1992: p.290) suggests that the liquids in (71a) are preserved in order for the output to be bisyllabic; otherwise, the liquids are deleted. Following Silverman's idea, Yip (1993: p.268) further explains why the liquids are deleted while the obstruents are not. She suggests 'that the liquids are less salient than the preceding obstruents and that this lack of salience renders them relatively vulnerable to deletion.' To summarize, since liquids are unsalient by nature, which in turn leads to their vulnerability to deletion, whenever the output forms are guaranteed to be at least bisyllabic, the liquids undergo deletion (e.g., the output forms in (71b) would satisfy this constraint even though the liquids are deleted).

In addition, it has been widely stated in the literature that liquids are vowel-like and thus sometimes not parsed. For example, Fay & Culter (1977) claim that liquids possess vowel-like formants so that they fail to saliently stand out from surrounding vowels. Zue (1985: p.141) also suggests that liquids are similar to vowels in terms of formant position. Since liquids are unsalient and have difficulties in standing out from neighboring vowels, it makes sense that they tend to be deleted in loanword adaptation.

Nevertheless, our data show that the liquids assigned to the onset position are almost always preserved[12]; only those assigned to the coda position may be deleted. This might be because our data basically comprise adaptations of proper names. It is reasonable that when it comes to proper names, people tend to preserve more segments, even if they are not that salient. Therefore, though liquids are unsalient in general, in proper name transliteration, onset liquids are still considered salient enough to be preserved; only some coda liquids that are really unsalient must go. This issue, however, needs further research and I leave it open here.

Let us now move on to our data. Consider the examples given in (72) and (73):

---

[12] The only case I have found where an onset liquid is deleted is *Fraser* → [fej.ç^{w}ej].

(72)

Input		Output	Input		Output
Pierce	→	[pʰi.ər.sɨ]	*Malcolm*	→	[maj.ər.kʰən]
Clare	→	[kʰə.laj.ər]	*Nobel*	→	[nʷo.pej.ər]
Blair	→	[pu.laj.ər]	*Miles*	→	[maj.ər.sɨ]
Sears	→	[çi.ər.sɨ]	*Neilson*	→	[ni.ər.sən]
e-mail	→	[i.mej.ər]	*Hillman*	→	[çi.ər.man]

(73)

Input		Output	Input		Output
Ann Arbor	→	[an.na.paw]	*Orson*	→	[o.sən]
Mark	→	[ma.kʰə]	*Gordon*	→	[kə.təŋ]
Barbara	→	[pa.pa.la]	*Goldberg*	→	[kə.po]
Starr	→	[ʂɨ.tʰa]	*Nicole*	→	[ni.kʰə]
Mort	→	[mo.tʰə]	*Harold*	→	[xa.lʷo.tə]

In (72), the English coda liquid is preserved with a schwa epenthesized between it and the preceding vowel, while in (73) the English coda liquid is deleted. As mentioned in §1.4.3, Mandarin only allows [n] and [ŋ] in the coda position. However, the examples in (72) show that [r] is able to occur in this particular position as well. In fact, there are two circumstances in Mandarin native phonology in which [r] can serve as the coda: the special syllable [ər] and [r]-suffixed words. Some examples for each type are given in (74):

(74) Two types of Mandarin native words with [r] in the coda position (the numbers denote the tones)

(a) The underlying type		(b) The derived type						
[ər]2	'son'	[xʷa]1	+	[r]	→	[xʷar]1	'flower'
[ər]3	'ear'	[pu]4	+	[r]	→	[pur]4	'cloth'
[ər]4	'two'	[wo]1	+	[r]	→	[wor]1	'nest'
		[kə]1	+	[r]	→	[kər]1	'song'

The reason I call [ər] a 'special' syllable is because it is the only Mandarin syllable with [r] in the coda position. Given the fact that [ər] is well formed, I assume that [r] is a legal coda consonant as long as it occurs in the syllable [ər]. Derived syllables such as those in (74b) are considered ill-formed in Mandarin loanword adaptation for two reasons. First, while [r]-suffixed words are extensively found in Beijing Mandarin, they are not common in Standard Chinese (Duanmu 2000: §6), which is the target language in this thesis and referred to as Mandarin simply for convenience. Second, the suffix [r] may add the meaning of 'smallness' to the word to which it attaches (Duanmu 2000: p.195), but we have never found any English loanwords in Mandarin that semantically involve 'smallness'.

It is therefore necessary to modify the definition of the constraint CODA CONDITION. The modified version is given in (75):

(75) CODA CONDITION: Only [n] or [ŋ] is allowed in the coda position. [r] is allowed in this position only if it occurs in the syllable [ər].

We now turn to the central question of this section: What is the reason that in (72) the English coda liquids are preserved while in (73) they are deleted? To answer this question, we need to consider the contexts in which they occur. We find that in (72) the English coda liquids are preceded by [i]/[j], [ɛ], [æ] or [ɪ]. In (73), however, we do not find any of these vowels preceding the liquids; instead, they are preceded by [a], [ɔ] or [ə]. If we further consider the qualities of these two groups of vowels, we find that only front/non-front can distinguish one group from the other. It therefore seems reasonable to assume that the preservation-deletion asymmetry in the English coda liquids is attributed to whether the preceding vowel is front or not. I suggest that if the English coda liquid is preceded by a front vowel, it becomes salient and must be preserved; on the other hand, if it is preceded by a back vowel, it is very unsalient and must go.[13]

Whether a segment is salient or not sometimes depends on the context in which it occurs. The reason a liquid is usually less salient than an obstruent is that it is vowel-like and thus not able to saliently stand out from its neighboring vowel(s). However, we do find a context in which a liquid is perceived as salient. In English, a sequence such as a front tense vowel plus a liquid within a syllable results in the perception of an intervening schwa; for example, *eel* is perceived as [iᵊl] and *air* as

---

[13] A few exceptions are found. For example, *Darwin* surfaces as [ta.ər.wən] rather than as *[ta.wən]. This might be because of the influence of the spelling. In general, English coda liquids preceded by back vowels are deleted in the adaptation.

[ej^{ə}r]. The reason for perceiving an intervening schwa in such a context is simple: To pass from a front tense vowel to post-alveolar/retroflexed [r] or velarized [l] requires considerable movement of the tongue; if this is somewhat slowed, an epenthetic schwa develops as the tongue moves through schwa space (Gick & Wilson 2001: p.1). Because an intervening schwa is perceived and considered part of the liquid, the liquid becomes quite salient.

This phonetic phenomenon is found in [r]-suffixed words in Beijing Mandarin as well. It is observed that if the suffix [r] directly attaches to the vowel [i] or [y], an intervening schwa is perceived. Some examples are given in (76):

(76)

[ti]4	+	[r]	→	[tjər]4	'younger brother'
[y]2	+	[r]	→	[ɥər]2	'fish'
[p^{h}i]2	+	[r]	→	[p^{h}jər]2	'skin'

Because [i] and [y] are incompatible with retroflexion in articulation, when an open syllable with one of these vowels is suffixed by [r], a schwa is epenthesized between the vowel and the [r] in order to separate one from the other (Chao 1968: p.46, C. Cheng 1973: p.25 and Lin 1989: p.102).

The fact that an English sequence of a front tense vowel plus a coda liquid requires considerable movement of the tongue actually implies the incompatibility of the two segments. Since they are incompatible with each other, the liquid, though believed to be unsalient by nature, is easily noticed and thus must be salient.

Because a front tense vowel-liquid sequence in English results in the perception of an intervening schwa, the schwas observed in [p^{h}i.ər.sɨ] 'Pierce', [çi.ər.sɨ] 'Sears', [i.mej.ər] 'e-mail', [maj.ər.sɨ] 'Miles' and [ni.ər.sən] 'Neilson' in (72) should not be treated as epenthetic. Instead, they should be thought of as appearing at the Perceptual Level and being preserved at the Operative Level of the adaptation. Those schwas observed in the remaining examples are truly epenthetic, given that the preceding vowels in the English forms are lax rather than tense.[14] For the sake of clarity, compare the adaptations in (77a) with those in (77b):

(77a)

Input		The Perceptual Level		The Operative Level
Clare	→	[k^{h}ler]	→	[k^{h}ə.laj.ə̲r]
Malcolm	→	[mel.k^{h}əm]	→	[maj.ə̲r.k^{h}ən]
Nobel	→	[no.pel]	→	[n^{w}o.pej.ə̲r]
Hillman	→	[xil.mən]	→	[çi.ə̲r.man]

[14] I assume that an English coda liquid preceded by a front lax vowel is salient as well because the tongue still has to move quite a distance.

(77b)

Input		The Perceptual Level		The Operative Level
Pierce	→	[pʰi.ər.s]	→	[pʰi.ər.sɨ]
Blair	→	[pu.le.ər]	→	[pu.laj.ər]
Sears	→	[si.ər.s]	→	[çi.ər.sɨ]
e-mail	→	[i.mej.əl]	→	[i.mej.ər]
Miles	→	[maj.əl.s]	→	[maj.ər.sɨ]
Neilson	→	[ni.əl.sən]	→	[ni.ər.sən]

In (77a), the underlined schwas at the Operative Level are epenthetic because they lack a correspondent at the Perceptual Level. In (77b), the input forms all possess a front tense vowel-liquid sequence. As a result, a schwa is perceived and appears at the Perceptual Level, which subsequently shows up at the Operative Level.

A question now arises: If the schwa is epenthetic, why is it always epenthesized before the liquid? Put differently, why do we never find a case where a schwa is epenthesized after the liquid (both [rə] and [lə] are well-formed Mandarin syllables), just like the way an obstruent coda is fixed (e.g., *Matt* → [maj.tʰə])? I suggest that the faithfulness constraint SROLE plays a role here:

(78) SROLE-IO (Gafos 1998: p.227): A segment in the input and its correspondent in the output have identical syllabic roles.

To illustrate how this constraint works, compare the forms at the Perceptual Level with those at the Operative Level in (79):

(79)

Input		The Perceptual Level		The Operative Level
Clare	→	[k^hler]	→	[k^hə.laj.ər] *[k^hə.laj.rə]
Nobel	→	[no.pel]	→	[n^wo.pej.ər] *[n^wo.pej.lə]

At the Perceptual Level, the liquids in question are in the rime. If a schwa is epenthesized before them, the liquids stay in the rime at the Operative Level, satisfying SROLE-IO. In contrast, if a schwa is epenthesized after the liquids, the liquids are reassigned to the onset position at the Operative Level, violating SROLE-IO. Since [ər] is a well-formed Mandarin syllable, fixing a problematic liquid coda by epenthesizing a schwa before it simultaneously satisfies both CODA CONDITION and SROLE-IO. On the other hand, if a schwa is epenthesized after the liquid coda, as shown in the starred forms, only CODA CONDITION is satisfied.

As for the ranking of SROLE-IO, I claim that it be ranked below CODA CONDITION.

(80) CODA CONDITION >> SROLE-IO

(81)

k^hler 'Clare'	CODA CONDITION	SROLE-IO	DEP-V-IO
a. k^hə.lajr	*(r)!		*(ə)
☞b. k^hə.laj.ər			*(ə)*(ə)
c. k^hə.laj.rə		*(r)!	*(ə)*(ə)

Candidate (a) is ruled out first because it violates the undominated constraint CODA CONDITION. Candidate (c) later loses to Candidate (b) because Candidate (b) is faithful to the input in terms of the syllabic role of the liquid [r] while Candidate (c) is not. Note that in all the three candidates, neither [k^h] nor [l] violates SROLE-IO in spite the fact that a schwa is epenthesized between them.

The motivation for ranking SROLE-IO below CODA CONDITION comes from the cases in which the coda is an obstruent. Consider the tableau in (82):

(82)

met^h 'Matt'	CODA CONDITION	SROLE-IO	DEP-V-IO
☞a. maj.t^hə		*	*(ə)
b. majt^h	*(t^h)!		
c. maj.ət^h	*(t^h)!		*(ə)

Although Candidate (a) violates SROLE-IO, it is still selected over the other candidates because it is the only one that satisfies CODA CONDITION. This tableau shows that whenever the input has an obstruent coda, the optimal candidate must violate SROLE-IO because an obstruent coda is always fixed by epenthesizing a vowel after it.

Two things are worth mentioning here. First, SROLE-IO does not seem to interact with other constraints and thus cannot be ranked with them. For example, SROLE-IO and DEP-V-IO cannot be ranked with respect to each other because a vowel is never epenthesized in order to satisfy SROLE-IO, or vice versa. Second, the effect of SROLE-IO is usually masked by the undominated constraint CODA CONDITION. For example, an obstruent coda is always fixed by epenthesizing a vowel after it (thus violating SROLE-IO) since an obstruent is never allowed in the coda position. The only situation in which SROLE-IO takes effect is when the input possesses a problematic liquid coda. In such a situation, the liquid coda can be fixed by epenthesizing a schwa either before or after it. Since adding a schwa before the liquid does not change the liquid's syllabic role while adding a schwa after the liquid does, the former is favored.

Let us now turn to the claim that English coda liquids preceded by a back vowel are unsalient and must be deleted in the loanword adaptation. As I have stated above, whether a segment is salient or not may depend on the context in which it occurs. In an English syllable where a coda liquid follows a front vowel, the liquid is salient because the articulation of such a sequence requires considerable movement of the tongue (that is, the two segments are incompatible with each other in terms of articulation). We can therefore assume that an English coda liquid preceded by a back vowel should be unsalient given that to pass from a back vowel to post-alveolar/retroflexed [r] or velarized [l] does not involve too much movement of the tongue (they already have a similar tongue body position). Indirect evidence for this assumption is available from the speech errors made by Chinese speakers who are learning English. Gui (1985) reports that when Chinese speakers learn English, they tend to delete the coda [l] that is preceded by [o], [ɔ] or [ɜ̆]. Gui's data also show that coda [r] may be deleted if it is preceded by [a] and followed by [n]. Note that [o], [ɔ], [ɜ̆] and [a] are all back vowels. The close match between what is deleted in Mandarin loanword adaptation and what tends to be deleted by Chinese speakers in their speech errors seems to suggest that the two processes are triggered by the same mechanism. If we further assume that Chinese speakers choose to delete the most unsalient segments when they are under pressure and forced to simplify the syllable structure of the English form (as opposed to obstruents in onset clusters, where vowel epenthesis is found), then the claim that unsalient segments undergo deletion in Mandarin loanword adaptation is plausible.

Steriade (2001) proposes that the ability of speakers to adapt a non-native string to the closest equivalent in their native inventory has a perceptual basis. This idea is formulated as in (83):

(83) Perceptual similarity to input (Steriade 2001: p.222)
The likelihood that a lexical representation R will be realized as modified R' is a function of the perceived similarity between R and R'.

She states that 'certain contrasts are more discriminable than others, and that the same contrast is more salient in some positions than in others (p.236).' To illustrate this idea, compare the adaptation of *tips* with that of *post* when they enter Cantonese, *tips* → [t^hip.si] and *post* → [p^ho.si]. We observe that the sibilant [s] is preserved in the coda position while the stop [t] is not. This asymmetry is of course attributed to the nature of the two segments. In other words, in the coda position, the contrast of [s] → ∅ is more discriminable than that of [t] → ∅ because [s] is by nature more salient than [t]. We also observe that the stop [t] is not deleted in all contexts. It is deleted only if it is syllable-final and preceded by another consonant. In the onset position, it is preserved. The preservation-deletion asymmetry of [t] is obviously dependent on the context in which it occurs; namely, the contrast of [t] → ∅ is more easily noticed in the onset position than in the coda position.

In an OT analysis, we can explain it by treating MAX-C(strident) as undominated (e.g., [s] is never deleted in any position) but ranking MAX-C(stop)/C_# below DEP-V (e.g., in *post* → [p^ho.si], the problematic form-final [t] is deleted rather than being preserved by vowel epenthesis). The different rankings of various MAX-C constraints indicates that the contrast of sibilant → ∅ and that of stop → ∅/C_# have different similarity values. The different similarity values in turn reflect the difference in auditory salience among the various C → ∅ contrasts for Cantonese speakers.

The idea that various C $\rightarrow \varnothing$ contrasts have different similarity values can help us explain the fact that in the loanword adaptation, coda liquids are either preserved or deleted, and obstruents are always preserved. Based on the observation that the only consonants found to be deleted in the adaptation are those coda liquids preceded by back vowels, I suggest that for Mandarin speakers the contrast of liquid $\rightarrow \varnothing / V_{[+back]}\_C_0]$ has a greater similarity value than the contrasts of obstruent $\rightarrow \varnothing$ and liquid $\rightarrow \varnothing / V_{[-back]}\_C_0]$ have. Similar to the Cantonese example, the MAX-C-IO constraint corresponding to the contrast of liquid $\rightarrow \varnothing / V_{[+back]}\_C_0]$ is ranked below DEP-C-IO while the MAX-C-IO constraints corresponding to the contrasts of obstruent $\rightarrow \varnothing$ and liquid $\rightarrow \varnothing / V_{[-back]}\_C_0]$ are ranked undominated. Consider the tableau given in (87), where [mark^h] 'Mark' serves as the input:

(84) MAX-C-IO(obstruent): Input obstruents must have output correspondents.

(85) MAX-C-IO(liquid/$V_{[-back]}\_C_0$): Input liquids that are preceded by front vowels must have output correspondents.

(86) MAX-C-IO(liquid/$V_{[+back]}\_C_0$): Input liquids that are preceded by back vowels must have output correspondents.

(87)

$mark^h$ 'Mark'	CODACOND	MAX-C-IO (obstruent)	MAX-C-IO (liquid/ $V_{[-back]}\_C_0]$)	DEP-V-IO	MAX-C-IO (liquid/ $V_{[+back]}\_C_0]$)
☞a. $ma.k^hə$				*(ə)	*(r)
b. $ma.ər.k^hə$				*(ə)*(ə)!	
c. $mar.k^hə$	*(r)!			*(ə)	
d. ma		*(k^h)!			*(r)

Candidate (c) and Candidate (d) are ruled out in the very beginning because they violate the undominated constraints CODACONDITION and MAX-C-IO(obstruent), respectively. Candidate (b) later loses to Candidate (a) because Candidate (b) chooses schwa epenthesis as the strategy to fix the problematic coda [r] and violates the more serious constraint DEP-V-IO while Candidate (a) simply deletes the [r], violating the least significant constraint MAX-C-IO(liquid/$V_{[+back]}\_C_0]$).

Now consider another tableau, where the input possesses a sequence of a front vowel plus a coda liquid:

(88)

k^hler 'Clare'	CODACOND	MAX-C-IO (obstruent)	MAX-C-IO (liquid/ $V_{[-back]}\_C_0]$)	DEP-V-IO	MAX-C-IO (liquid/ $V_{[+back]}\_C_0]$)
☞a. $k^hə.laj.ər$				*(ə)*(ə)	
b. $k^hə.laj$			*(r)!	*(ə)	
c. $k^hə.lajr$	*(r)!			*(ə)	

Since the problematic coda [r] is preceded by a front vowel, it is perceived as salient and therefore cannot be deleted. The only way of fixing it is by schwa epenthesis. Candidate (a) wins over its competitors because it is the only one that adopts this strategy. The other two candidates either delete the [r] (Candidate (b)) or simply leave it alone (Candidate (c)), violating the undominated constraints MAX-C-IO(liquid/$V_{[-back]}$_C_0]) and CODACONDITION.

3.5.4 [m] in the Coda Position

3.5.4.1 Polysyllabic Input

Though Mandarin has the bilabial nasal [m], it is observed in our data that English coda [m] surfaces as [n] or [ŋ] in a vast majority of cases. It is apparent why this happens: Mandarin does not allow [m] in the coda position. Following Silverman (1992: p.297), I assume that the acoustic signal of English [m] is perceived by Mandarin speakers as [m] no matter in what position in the input it occurs, and once the adaptation arrives at the Operative Level, where Mandarin syllable structure constraints hold, those that are assigned to the coda position are fixed. It is interesting that Mandarin fixes coda [m] by turning it into [n] or [ŋ] instead of vowel epenthesis, which, as we have seen in the previous sections, is used to fix coda obstruents and liquids that are preceded by front vowels. This indicates that DEP-V-IO outranks

IDENT-IO(place). The tableau in (91) shows that for the input [mi.ri.əm] 'Miriam', this ranking surfaces [mi.r^{w}ej.an] instead of [mi.r^{w}ej.a.mu].

(89) MAX-C-IO(nasal): Input nasals must have output correspondents.

(90) IDENT-IO(place): The specification for place of articulation of an input segment must be preserved in its output correspondents.

(91)

miriəm 'Miriam'	CODACOND	MAX-C-IO(nasal)	DEP-V-IO	IDENT-IO(place)
☞a. mi.r^{w}ej.an				*(Lab → Cor)
b. mi.r^{w}ej.am	*(m)!			
c. mi.r^{w}ej.a		*(m)!		
d. mi.r^{w}ej.a.mu			*(u)!	

Candidate (b) and Candidate (c) are ruled out because the former keeps the [m] in the coda position, violating CODA CONDITION, and the latter deletes the [m], violating MAX-C-IO(nasal). The remaining candidates then move on for the evaluation of DEP-V-IO and IDENT-IO(place). Candidate (a) is selected over Candidate (d) as the output because Candidate (a) violates the lower-ranked constraint IDENT-IO(place) by turning the coda [m] into [n] while Candidate (d) fixes this ill-formed structure by vowel epenthesis, violating the more significant constraint DEP-V-IO.

The above analysis seems to imply that to fix an illicit coda, a feature change costs less than vowel epenthesis and thus should be preferred. However, we have never found an example in our data where a perceived obstruent or liquid assigned to the coda position undergoes a feature change and turns into a nasal. I suggest that this can be explained by ranking IDENT-C-IO(nasal) above DEP-V-IO. Consider the tableau in (93), where for the input [sikrit] 'Sigrid', [çi.kə.li.tə] is selected over [çi.kə.lin] as the output:

(92) IDENT-IO(nasal): Correspondent segments in input and output have identical values for the feature [nasal].

(93)

sikrit 'Sigrid'	CODACOND	MAX-C-IO(obstruent)	IDENT-C-IO(nas)	DEP-V-IO
a. çi.kə.lit	*(t)!			*(ə)
☞b. çi.kə.li.tə				*(ə)*(ə)
c. çi.kə.lin			*(t → n)!	*(ə)
d. çi.kə.li		*(t)!		*(ə)

Candidate (a) and Candidate (d) are ruled out because Candidate (a) violates CODA CONDITION by keeping the [t] in the coda position and Candidate violates MAX-C-IO(obstruent) by deleting it. Candidate (c) loses to Candidate (b) because Candidate (c) turns the [t] into [n] in response to the requirement of CODA CONDITION and the accompanying violation of IDENT-IO(nas) is more serious than the violation of DEP-V-IO incurred by Candidate (b).

It should be noted here that IDENT-C-IO(nas) is ranked undominated. The reason is that we find no case in the data where an oral consonant has turned into a nasal, or vice versa. In other words, IDENT-C-IO(nas) is ranked undominated because changes of the values for [nasal] in consonants never happen.

Here is another example showing that IDENT-C-IO(nas) is undominated. In this example, the coda [r] is not fixed by being turned into [n].

(94)

k^hler 'Clare'	CODACOND	MAX-C-IO (liquid/$V_{[-back]}$_C_0])	IDENT-C-IO(nas)	DEP-V-IO
a. k^hə.lajr	*(r)!			*(ə)
☞b. k^hə.laj.ər				*(ə)*(ə)
c. k^hə.lan			*(r → n)!	*(ə)
d. k^hə.laj		*(r)!		*(ə)

3.5.4.2 Monosyllabic Input

Not every perceived [m] assigned to the coda position turns into [n] or [ŋ], though. We have found in our data that coda [m] sometimes does not undergo a feature change but is retained with a vowel epenthesized after it, just like the way an obstruent coda is fixed. Some examples are given in (95):

(95)

Input		The Perceptual Level		The Operative Level
Ti<u>m</u>	→	[tʰi<u>m</u>]	→	[tʰi.<u>mu</u>]
Ji<u>m</u>	→	[tɕi<u>m</u>]	→	[tɕi.<u>mu</u>]
To<u>m</u>	→	[tʰa<u>m</u>]	→	[tʰaŋ.<u>mu</u>]
Sa<u>m</u>	→	[se<u>m</u>]	→	[ʂan.<u>mu</u>]

In (95), the perceived [m]s are assigned to the coda position. However, unlike what we have just discussed, they surface intact with the vowel [u] epenthesized after them and occupy the onset positions of the newly formed syllables. If we look at the number of the syllables in both the perceived and surface forms, we find that all the perceived forms are monosyllabic and all the surface forms are bisyllabic. It therefore seems that whether or not coda [m] is fixed by vowel epenthesis is related to whether or not the input is monosyllabic. Broselow, Chen & Wang (1998) analyze the simplification of English forms with obstruent coda by Mandarin speakers learning English as a second language and discover that they tend to add an extra vowel at the end of a monosyllabic word but delete the obstruent coda if the word is bisyllabic. For example, /vɪg/ → [vɪ.gə] while /filɪg/ → [fi.lɪ]. They claim that the preference for bisyllabic words is playing a role here and that it represents a case of the emergence of the unmarked, which means that this preference, though not obviously motivated, exists in the grammar of Mandarin. I agree with them in that in Mandarin native phonology, this preference is masked by higher ranked faithfulness constraints such as MAX-C-IO and DEP-V-IO and thus has no effect (for example, the underlying form /kʰan/ 'to see' surfaces as [kʰan] rather than *[kʰa.nə]); nevertheless, this preference exposes itself whenever forms with forbidden coda serve as the input, e.g., foreign forms. In such circumstances, since the faithfulness constraints must be violated in order to satisfy Mandarin phonotactics, the preference for bisyllabic words comes into force. The tableau in (97) illustrates their idea:

(96) WD BIN: Word should consist of two syllables (Broselow, Chen & Wang (1998: p.272)).

(97) (p.273)

/vɪg/	CODA CONDITION	DEP-V-IO, MAX-C-IO	WD BIN
a. vɪg	*!		*
☞b. vɪ.gə		*	
c. vɪ		*	*!

Candidate (a) is ruled out because it violates the undominated constraint CODA CONDITION by possessing [g] in the coda position. The other two candidates, which both satisfy CODA CONDITION, then move into the second round where they are evaluated by the faithfulness constraints banning vowel epenthesis and consonant deletion. Since they tie in this round, the decision is up to the lowest ranked constraint WD BIN. Candidate (b) finally wins out because it possesses two syllables.

In addition to Broselow, Chen & Wang, Duanmu (2000: §7) claims that the majority of commonly used vocabulary words in Mandarin are bisyllabic and there is evidence that bisyllabic words are still increasing even today. Li & Thompson (1981) also claim that 'although classical Chinese appears to have been a monosyllabic language, modern Mandarin is no longer monosyllabic; instead, Mandarin has a very large number of polysyllabic words (p.14).' Yip (1993) observes a similar tendency in Cantonese – 'kinship names and hypocoristics are subject to a bisyllabic minimum, and since most names are monosyllabic, they are augmented by the addition of the prefix [a], e.g., /jip/ → [a jip] (p.276)' – and suggests the constraint Minimal Word, which requires each word to consist of at least two syllables. Following Broselow, Chen & Wang, I assume that the vowel epentheses in (95) are triggered by the preference for bisyllabic words and will use the constraint WD BIN in the subsequent analysis.

Nevertheless, our case is more complicated than the one analyzed by Broselow, Chen & Wang. Recall that in their analysis, the two faithfulness constraints MAX-C-IO and DEP-V-IO are ranked above WD BIN but not ranked with respect to each other. This ranking entails that consonant deletion and vowel epenthesis cost the same, and since input forms ending in obstruents cannot surface faithfully anyway (in other words, the obstruent coda must be fixed by either vowel epenthesis or deletion), the alteration proceeds in the direction of satisfying WD BIN. In our case, the trouble-making coda is not an obstruent but [m], which presumably may undergo deletion, vowel epenthesis or feature change to satisfy CODA CONDITION. However, we cannot simply rank WD BIN below MAX-C-IO, DEP-V-IO and IDENT-IO(place), since by doing so, we would get an unwanted output. Consider the tableau in (98), where [t^{h}im] 'Tim' serves as the input:

(98)

t^{h}im 'Tim'	CODACOND	MAX-C-IO(nasal)	DEP-V-IO	IDENT-IO(place)	WD BIN
a. t^{h}im	*!				*
☹ b. t^{h}i.mu			*(u)!		
☞c. t^{h}iŋ				*(m → ŋ)	*
d. t^{h}i		*!			*

Candidate (a) is ruled out because of its fatal violation of CODA CONDITION. The other three candidates, which all have done something to the coda and thus satisfy CODA CONDITION, stay in the contest competing for being the output. Candidate (c) finally surfaces as the output because the constraint it violates by fixing the coda (IDENT-IO(place)) is less serious than those Candidate (b) and Candidate (d) violate (DEP-IO and MAX-IO(nasal), respectively). The attested output, however, is Candidate (b) rather than Candidate (c), as indicated by the sad face.

The problem with this ranking is that the effect of WD BIN is still masked. This is because we can determine the output simply by the different rankings of MAX-C-IO(nasal), DEP-V-IO and IDENT-IO(place) without considering WD BIN, as indicated by the entire shading of the WD BIN column in (95). To put it differently, the output is always the candidate that changes the [m]'s place of articulation in response to the requirement of CODA CONDITION. By promoting WD BIN to a higher position in the constraint hierarchy, WD BIN can be activated. I claim that WD BIN be ranked below MAX-C-IO(nasal) but above DEP-V-IO.

(99) MAX-C-IO(nasal) >> WD BIN >> DEP-V-IO

Consider the tableau in (100), where the rankings of the constraints have been rearranged:

(100)

t^him 'Tim'	CODACOND	MAX-C-IO(nasal)	WD BIN	DEP-V-IO	IDENT-IO(place)
a. t^him	*(m)!		*		
☞b. t^hi.mu				*(u)	
c. t^hiŋ			*!		*(m → ŋ)
d. t^hi		*(m)!	*		

After promoting WD BIN from the bottom to the current position, we see that Candidate (b) is selected as the output. Candidate (a) and Candidate (d) are still the worst candidates, since they violate the undominated constraint CODA CONDITION and

MAX-C-IO(nasal), respectively. Candidate (c) loses to Candidate (b) due to its more serious violation of WD BIN.

3.5.4.3 An Attempt to Account for Cases such as *Lynn*

I have argued in the previous section that the preference for bisyllabic words triggers the vowel epentheses observed in (92) and that the corresponding constraint WD BIN should be ranked above DEP-V-IO. However, we have found some counterexamples indicating that WD BIN has to be ranked below DEP-V-IO. Consider the adaptations given in (101):

(101)

Input		Output	Input		Output
Ben	→	[pən]/[pən.ən]	*King*	→	[tɕin]/[tɕin.ən]
Dan	→	[tan]/[tan.ən]	*Lynn*	→	[lin]/[lin.ən]
Ken	→	[kʰən]/[kʰən.ən]			

In (101), each English form has two Mandarin equivalents, one monosyllabic and the other bisyllabic. I have argued in §3.1.1 that for the perceived forms to surface as bisyllabic, [ə] is epenthesized right before the [n], and the feature [nasal] involved in the vowels surfaces as [n] due to the requirement that a full Mandarin syllable is bimoraic. The constraint ranking I have just argued for has no trouble surfacing the bisyllabic forms. Take a look at the tableau in (102), where for the input [lin], the bisyllabic candidate [lin.ən] is selected as the output over the monosyllabic one [lin]:

(102)

lin 'Lynn'	CODA COND	MAX-C-IO	WD BIN	DEP-V-IO	IDENT-IO(place)
a. lin			*!		
☞b. lin.ən				*(ə)	

The problem we are faced with now is that, based on this particular ranking, there is no way in which the English forms in (101) can surface as monosyllabic: since WD BIN is ranked above DEP-V-IO, whenever a monosyllabic form serves as the input, it must be augmented to bisyllabicity at the expense of violating DEP-V-IO.

This problem forces us to reconsider the constraint ranking. The fact that in (101) the output forms may be monosyllabic seems to imply that at least for some Mandarin speakers, satisfying WD BIN is not really that important. As a result, WD BIN should be demoted in the constraint hierarchy. I suggest that for the examples in (101), DEP-V-IO and WD BIN are not ranked with respect to each other.

(103) WD BIN >> DEP-V-IO; DEP-V-IO >> WD BIN

In (104), the constraint ranking is the same as that in (102) except that WD BIN is not ranked with respect to DEP-V-IO, and we can see that both the monosyllabic candidate [lin] and the bisyllabic candidate [lin.ən] surface as the outputs:

(104)

lin 'Lynn'	CODA COND	MAX-C-IO	DEP-V-IO	WD BIN	IDENT-IO(place)
☞a. lin				*(ə)	
☞b. lin.ən			*		

It should be noted here that this change does not affect the analysis done above. Take a look at the following tableau, which is the same as the one given in (104) except for the relevant rankings of DEP-V-IO and WD BIN:

(105)

t^him 'Tim'	CODA COND	MAX-C-IO	WD BIN	DEP-V-IO	IDENT-IO(place)
a. t^him	*!		*		
☞b. t^hi.mu				*	
c. t^hiN			*		*(m → N)!
d. t^hi		*!	*		

We see that Candidate (b) is still selected as the output after the change to the ranking is made.

CHAPTER 3

CONCLUSION

In this thesis, I argue that English loanword input to Mandarin is best viewed as consisting of superficial acoustic signals. My argument is based on the observation that English non-contrastive features may appear in the output of the loanword adaptation and that two English segments in an onset cluster may merge into one. Paradis & Lacharité's (1997) claim that loanwords enter the borrowing language with structures cannot account for the second observation, since it is unable to explain why the complex onset is not repaired by vowel epenthesis.

I also argue in this thesis that when English forms enter Mandarin, the acoustic signals are interpreted using the allophones of Mandarin. This is also in contradiction with Paradis and Lacharité's claim that loanword input enters into the borrowing language's lexicon. This fact suggests that although the Operative Level of the loanword adaptation and the lexical level of Mandarin have the same function, their inputs are composed of segments from different sources.

Finally, I argue that the preservation-deletion asymmetry found in the coda liquids is attributed to the difference in salience. I suggest that though liquids are unsalient in nature, English coda liquids that are preceded by front vowels are perceived as salient and thus must be preserved in Mandarin loanword adaptation.

Some issues are left open in this thesis and deserve attention in the future. One is regarding the fact that some types of feature changes never occur in the loanword adaptation. For example, we do not find the feature change [+continuant] ↔ [−continuant]. This seems to suggest that these feature changes make greater difference in perception than others and therefore are not tolerated in the loanword adaptation. The other issue has to do with the observation that only the liquids assigned to the coda position may be deleted while those assigned to the onset position are almost always preserved. Although this might be attributed to the nature of our data, the syllabic position to which they are assigned is probably playing a role as well.

REFERENCES

Bao, Zhiming. 1996. The Syllable in Chinese. *Journal of Chinese Linguistics* 24: 312-354.

Broselow, Ellen, Chen, Su-I and Wang, Chilin. 1998. The Emergence of the Unmarked in Second Language Phonology. *Studies in Second Language Acquisition* 20: 261-280.

Chao, Yuen-ren. 1968. *A Grammar of Spoken Chinese, Berkeley and Los Angeles,* University of California Press.

Cheng, Chin-chuan. 1973. *A Synchronic Phonology of Mandarin Chinese.* Mouton, The Hague.

Duanmu, San. 2000. *The Phonology of Standard Chinese.* Oxford, New York: Oxford University Press.

Fay, David and Culter, Anne. 1977. Malapropisms and the Structure of the Mental Lexicon. *Linguistic Inquiry* 8: 505 – 520.

Gafos, Diamandis. 1998. Eliminating Long-Distance Consonantal Spreading. *Natural Language & Linguistic Theory* 17: 223 – 278.

Gick, B. and Wilson, I. 2001. Pre-liquid Excrescent Schwa: What Happens When Vocalic Targets Conflict. In P. Dalsgaard, B. Lindberg and H. Benner (eds.) *Proceedings of the 7th European Conference on Speech Communication and Technology* 273-276. Aalborg, Denmark: Center for Personkommunikation.

Gui, C. K. 1985. *Applied American English Phonetics.* Shanghai Foreign Language Education Press.

Guo, Hugo Ling-Yu. 2001. A Constraint-based Analysis to Mandarin Loanwords: Evidence from Transliterated American State Names and Typhoon Names. *Precedings of the 7^{th} International and the 19^{th} National Conferences on Chinese Phonology* 442-462.

Harris, John. 1994. *English Sound Structure.* Massachusetts: Blackwell.

Kager, Rene. 1999. *Optimality Theory*. New York: Cambridge University Press.

Kenstowicz, Michael. 1994. *Phonology in Generative Grammar*. Cambridge: Blackwell.

Ladefoged, Peter. 1982. *A course in Phonetics*. New York: Harcourt Brace Jovanovich.

Li, Charles N. and Thompson, Sandra A. (1981). *Mandarin Chinese: A Functional Reference Grammar*. Berkeley: University of California Press.

Lin, Yen-Hwei. 1989. *Autosegmental Treatment of Segmental Processes in Chinese Phonology*. PhD dissertation, The University of Texas at Austin.

Lin, Yen-Hwei. 1992. Vocalic Underspecification in Two Mandarin Dialects: A Case Against Radical Underspecification. *Journal of East Asian Lingustics* 1: 219-253.

Paradis, Carole and Lacharite, Darlene. 1997. Preservation and Minimality in Loanword Adaptation. *Journal of Linguistics* 33: 379-430.

Paradis, Carole and Prunet, Jean-François. 2000. Nasal Vowels as Two Segments: Evidence from Borrowings. *Language* 76: 324-357.

Prince, Alan and Smolensky, Paul. 1993. *Optimality Theory: Constraint Interaction in Generative Grammar*. MA: MIT Press.

Roca, Iggy and Johnson, Wyn. 1999. *A Course in Phonology*. Oxford, UK; Malden, Mass.: Blackwell Publishers.

Silverman, Daniel. 1992. Multiple Scansions in Loanword Phonology: Evidence from Cantonese. *Phonology* 9: 289-328.

Steriade, Donca. 2001. Directional Asymmetries in Place Assimilation, a Perceptual Account. *The Role of Speech Perception in Phonology* 219-249.

Yip, Moira. 1993. Cantonese Loanword Phonology and Optimality Theory. *Journal of East Asian Linguistics* 2: 261-291.

Zue, Victor W. 1985. *Notes on Spectrogram Reading*. Cambridge: MIT Press.