Second Language Phonology

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1.0 Introduction

The acquisition of a second language (L2) is a complex task which involves learning about many diverse phenomena. One component that must be acquired is the sound system of the target language; its *phonology*. It is important to recognize that the construct of phonology is much broader than the pedagogic notion of *pronunciation*. While pronunciation teachers are concerned with affecting the production and perception of L2 speech, here we are more concerned with the nature of the phonological competence of the learner.

This chapter is structured in the following way. I will begin by discussing some general issues from the field of second language acquisition (SLA) and show how the study of L2 phonology addresses these issues. Then, I will discuss the acquisition of (1) segments, (2) syllable structure, and (3) higher-level prosodic phenomena. By nature, such a survey is selective, and I have chosen to present works conducted within what we may call the generative tradition. For an overview of broader issues in second language phonology, see Archibald (1998), or Major (2001).

1.1 Phonological Knowledge and Skill

A basic insight from cognitive theory helps us to understand that SLA involves both *knowledge* and *skill*. The knowledge that we store in our heads is a relatively stable trait. You either know the word *cat* or you don't. You either know that the sentence, "They was inable to speaked French" is ungrammatical or you don't. Clearly, you have to acquire knowledge of your L2, but you also have to acquire skills. You have to be able to comprehend fast speech, or carry on a conversation. Proficiency in a second language is a complex construct that includes a range of knowledge (from grapheme to phoneme to sentence to text) and a range of abilities (from politeness routines to appropriate register).

The study of L2 phonology also involves both knowledge and skill. The learner must acquire the knowledge (in the form of the appropriate mental representaion for the target language) and the skills necessary to be able to accurately produce and perceive the relevant phonological contrasts. An obvious characteristic of L2 speech is that it is accented. Native speakers (NS) are able to recognize the characteristics of say French-accented English as being distinct from German-accented English. The first language (L1) of the speaker is one factor that can have quite a predictable influence on the L2 speech. At the sound level, L2 learners can sound non-nativelike for two reasons, Let's take an example from stress, Many languages mark certain syllables as prominent by stressing them. The second syllable in 'banána' is more prominent than the first or third syllables, Languages vary in where they put the stress, so it is something that has to be learned. This, then, is one possible source of error, and hence, one way in which people can sound non-nativelike; they can get the stress placement wrong and say “bánana’. This would be a phonological problem, They could, however put the stress on the right syllable but still not sound like a native speaker, Maybe in their L1, they indicate stress by loudness or vowel length, whereas in English the main means of indicating stress is by a pitch change. This would be an example of a phonetic marker of their accent.

1.2 What Is Acquired?

From a linguistic point of view, the first thing to consider in looking at the acquisition of phonology in a second language is the question of what exactly is being acquired. We must adopt a theory of phonological knowledge. The model in Figure 1 indicates some of the areas which will be addressed in this chapter. Second language learners must acquire features, segments, moras, syllables and feet.

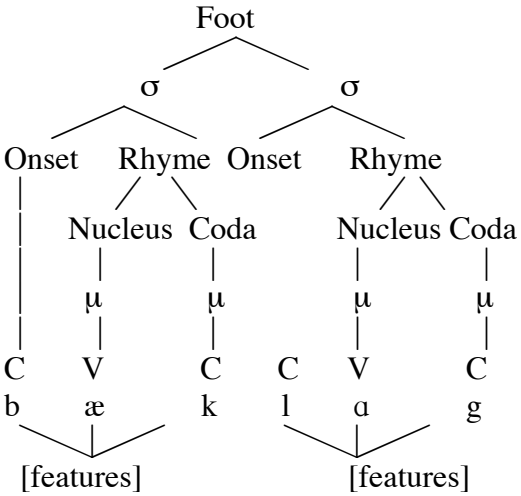


Figure 1. Phonological Structure.

This is the kind of mental representation that learners are trying to acquire. Much of the core of L2 phonology research attempts to see whether L2 learners are setting up targetlike representations. However, there is also much research which attempts to address the question of which extralinguistic factors (e.g., age, motivation, learning style) may be influencing the learner's proficiency. Due to space limitations, I will only consider one such factor here as it is known to affect L2 production.

1.3 Age Effects

Many in the SLA field (e.g., Birdsong 1999; Hyltenstam & Abrahamsson 2000) have investigated the question of whether adults can attain nativelike proficiency in a second language? Often this question is investigated under the rubric of the *critical period hypothesis* (see Singleton 1989). There are undeniably some age-related effects in second language learning. For example, people who start acquiring their L2 early are less likely to have a strong non-native accent than those who start learning later in life. However, we must always remind ourselves that pronunciation is a small part of L2 communicative competence (see Bachman, 1990). White and Genesee (1996) have demonstrated that some non-native speakers who started their L2 learning later in their

lives *can* evidence grammatical knowledge and performance that is statistically indistinguishable from native speakers when it comes to aspects of syntax. But what about L2 phonology? Bongaerts (1999) provides a summary of a number of projects which demonstrate that late L2 learners can attain nativelike performance in pronunciation as well. Bongaerts et al. (1997) showed that there were some instructed second language learners who were not significantly different from native spekers in terms of their production. Bongaerts et al. (2000) demonstrate that this is also true of uninstructed learners as well. Thus, we note that while there is still a definite connection between age of acquisition and degree of foreign accent, it is not the case that it becomes impossible for adults to acquire phonological ability that is indistinguishable from native speakers. However, the question that remains unanswered is this: if there are some people who are able to achieve this, what factors contribute to their success?

The givens of our field of study, then, appear to be the following:

(1) L2 learners of phonology are attempting to acquire a complex system of knowledge
(2) the L1 influences the interlanguage grammar considerably
(3) extralinguistic factors such as age also exert an influence on elements of the learner's grammar

Even accepting these facts, though, does not mean that all researchers agree on how best to explain these facts.

1.4 Diverse Theoretical Approaches

Broadly speaking, in the field of second language acquisition, we are trying to answer the question: why do second language learners sound different than native speakers do? In the phonological domain, we might ask: why do some learners master some sounds but do not master others? Obviously, one could tackle these questions from a variety of theoretical perspectives (see Archibald (2002) for more discussion):

- accents are social constructs brought about by the fact that people use language in a social context (Schumann, 1976)
- accents are the result of universals reflected in language typology (Eckman and Iverson, 1993, 1994)

- accents are the result of phonetic phenomena either articulatory or perceptual (e.g. Flege, 1995)
- accents are the result of phonological phenomena

Oversimplifying slightly, in this chapter, I am going to explore the research program which suggests that the final approach has been the most productive. The stance I am going to take is that much of second language accent can be explained by linguistic theory.

1.5 The Deficit Hypothesis

Elsewhere in the field of SLA, we have witnessed a debate between those who argue that certain linguistic properties (e.g. some functional category features) may be unable to be acquired by adult speakers (e.g., Hawkins & Chan, 1997) and those (such as White 2003) who argue that adult learners *are* able to acquire these features. The first line of thought is what we can call the *Deficit Hypothesis*. The deficit hypothesis holds that if element *x* is not found in the first language then it will be unlearnable in adult second language acquisition. So, from a deficit perspective it would be argued if a speaker's L1 lacks a [tense] feature then it will be impossible for that learner to acquire the feature [tense] in an L2. The opposing view would hold that the lack of surface inflection in production does not entail the lack of the appropriate linguistic feature in the grammar. Lardiere (1998) argued that a Chinese L1 subject who was consistently omitting tense markers in her English L2 production also showed evidence of having acquired the abstract feature related to finiteness in her grammar.

Let us return to the field of L2 phonology. In many second language learning scenarios, we may find that someone from a given L1 is attempting to acquire an L2 which has some different phonological properties. Perhaps a feature may be lacking, or the onsets don't branch, or the codas don't project moras, or the feet are iambic rather than trochaic. The empirical question is: will second language learners be able to acquire structures which are not found in their first language? A classic treatment of this question

can be found in the work of Brown (1997, 2000). We will begin our look at L2 features by discussing Brown's model.

2.0 Phonological Features

Brown (2000) argues that if featural representations are lacking from the L1, that they will be unacquirable in the L2. She looked at the acquisition of English /l/ and /r/ by speakers of Japanese and Mandarin Chinese (neither of which contrasts /l/ and /r/ phonemically). The Japanese situation is diagrammed in Figure 2 where SV stands for Sonorant Voice:

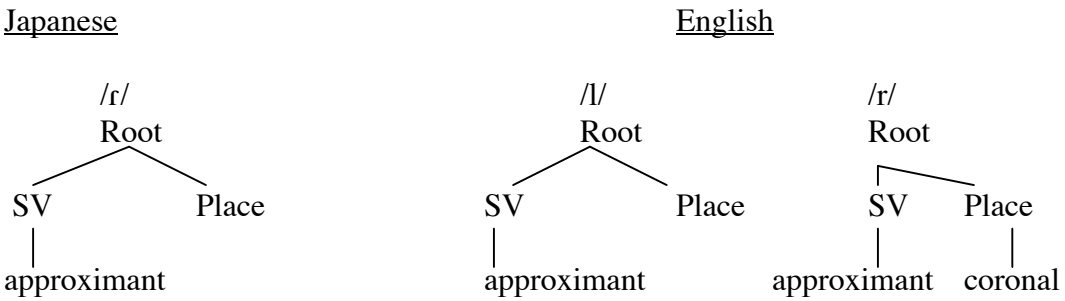


Figure 2. Feature geometry of liquids.

In Japanese, [l] and [À] are allophones of a single phoneme. This phoneme may appear only in a simple onset in Japanese. Mandarin Chinese also lacks the contrast (and hence the structure is the same as shown in Figure 2). If the *segment* is taken to be the level of explanation, then we might predict that both Mandarin and Japanese speakers should be unable to acoustically discriminate /l/ from /r/ (given their L1 feature geometries).

The graph in Figure 3 shows the overall performance of the subjects on an auditory discrimination task. Such a task demands that a listener hear two stimuli (e.g., "rip/lip" or "lip/lip") and judge whether they are the same or different (known as an AX discrimination task).

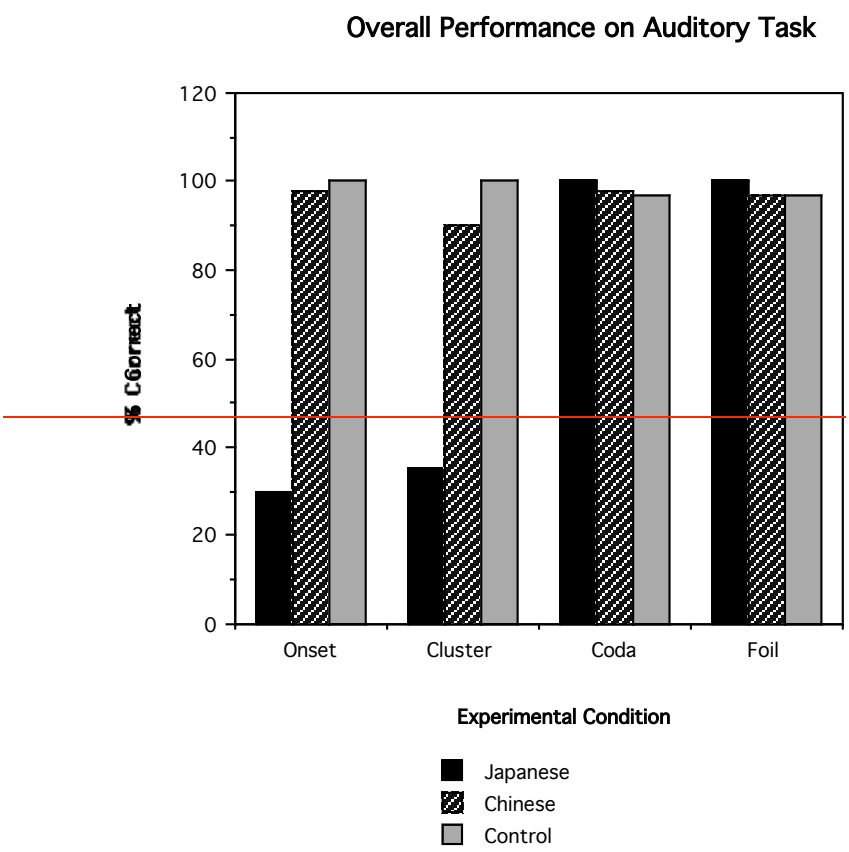


Figure 3. Performance on auditory discrimination task.

This graph demonstrates that the Japanese speakers were unable to discriminate /l/ from /r/ in an acoustic task whereas the Chinese speakers discriminated the contrast in successfully. The same results were obtained in a task which demanded that the subjects access lexical representations (i.e., they saw a picture of a 'rake' and of a 'lake' and, when hearing a single word, had to point out the picture of the word that they heard.

The initial hypothesis that speakers of both languages would be unable to perceive the /l-r/ distinction because one of the members of the contrast is an L1 *phoneme* is not supported by the Chinese subjects. So, what aspect of the L1 could be accounting for this difference? Brown suggests that a speaker may be able to perceive a non-native contrast if the *feature* that distinguishes the two segments is present in the L1 feature geometry (even if the feature is not utilized for the contrast in question). Under her analysis, it is the feature [coronal] that distinguishes /l/ from /r/. Chinese requires the coronal node for some features but Japanese does not. The inventories are given in Figure 4.

(a) Japanese Inventory

p	t	k	ʔ
b	d	g	
	s		h
m	n	ŋ	
	ɾ		
w	y		

(b) Mandarin Chinese Inventory

p	t	k	
	ts	ʈs	
	s	ʂ	h
		ʐ	
m	n	ŋ	
	l		
w	y		

Figure 4. Chinese and Japanese Inventories.

Regardless, then, of the L1 liquid inventory, the Chinese speaker will have a representation for the feature [coronal] somewhere in the phonological inventory (i.e., to contrast alveolar from post-alveolar segments shown in the box). The Japanese inventory, on the other hand, does not contrast any coronal phonemes and will, therefore lack a coronal node. Thus, Brown concludes that L2 speakers cannot build representations for segments which require features not present in their L1. They can, however, combine the features of their L1 in new ways to yield new segments.

2.1 A non-deficit stance

There may be reason to believe, however, that this deficit model is too strong. There are a number of studies which suggest that circumstances exist where adult second language learners can acquire phonological contrasts even when the relevant feature is inactive in their L1.

Larson-Hall (2004) is one such study. She looks at the perceptual abilities of Japanese speakers learning Russian. Remember that Brown argued that the Japanese subjects were unable to acquire the English [l]/[r] contrast in onsets because they lacked the relevant phonological feature in their L1. The graph in Figure 5 clearly shows that the Japanese learners of Russian were able to perceive the contrast successfully.

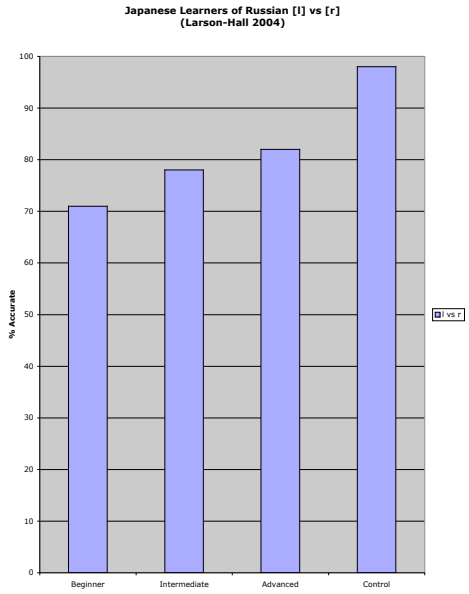


Figure 5. Japanese acquisition of Russian [r]

Even the beginners were accurate more than 70% of the time (contrasted with the 30% accuracy of Brown's learners of English [ɹ]). One possible explanation for this is that the Russian [r] is a trilled sound which makes it very salient in the input to the L2 learners. When the phonetic cues are robust, it is possible to override the effects of the L1 filter (see Wright 2004 for a discussion or robust cues).

Additional complexities are revealed in work by Curtin, Goad and Pater (1998).They document a case study where English speakers learning Thai are able to acquire a feature that is not present in their L1. The property in question is aspiration which is most likely represented by the feature [spread glottis]. English does not make use of the phonetic feature of aspiration contrastively in its lexical items. Ignoring some complexities, suffice it to say that English has aspirated stops at the beginning of stressed

syllables (e.g. 'top' [t^hɑp]) but lacks aspiration after an [s] (e.g. 'stop' [stɑp]). Aspiration, then, in English is predicatable from the phonetic context and does not have to be memorized as part of the word. Thai, on the other hand, utilizes aspiration contrastively. For example, the word [pet] means 'duck' and the word [p^het] means 'spicy'. English speakers learning Thai, then, would have to learn how to store the feature of aspiration as part of the lexical entry. Curtin et al. (1998) argued that English speakers *did* show the ability over time to lexicalize this phonological feature. That is to say that while their initial structures were transferred from the L1, they *were* able to trigger new knowledge.

Gonzalez (in progress) also provides evidence of a situation where L2 learners are able to acquire a contrast based on a feature absent from their L1. He looks at the acquisition of Yucatec Maya ejectives by Spanish speakers. Spanish lacks the [constricted glottis] feature required for the phonological structure of ejectives. He conducted both an auditory discrimination task and a force-choice picture selection task. The results of the auditory discrimination task are shown in Figure 6.

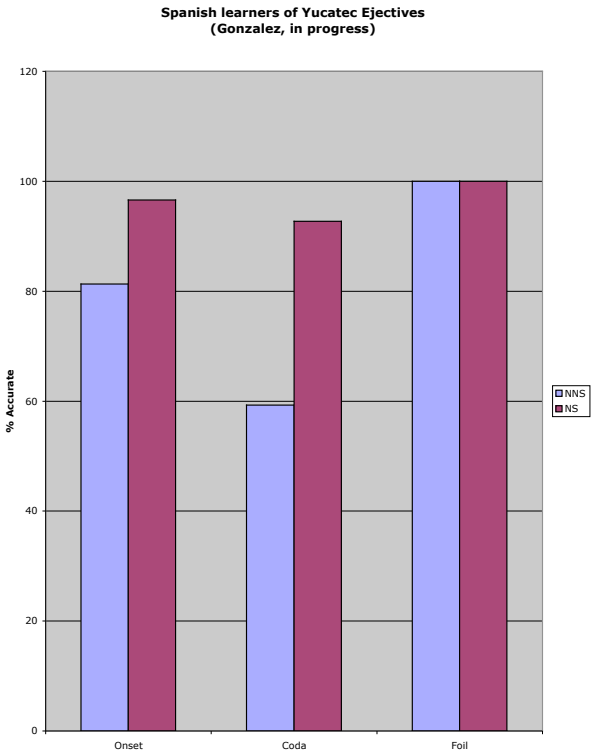


Figure 6. Spanish acquisition of Yucatec Maya ejectives.

In onset position, the Spanish speakers were not performing significantly differently from the native Yucatec Maya speakers; they were able to acquire the contrast. In the coda position, however, they were not behaving in a nativelike range. One explanation for this goes back to the notion of robust phonetic cues. The transitional cue from the ejective in onset position to the vowel is much more robust that the phonetic cue found when an ejective is at the end of a word. Learners appear to be sensitive to such distinctions. Gonzalez found the same basic results in his picture-selection task but there are added complications that prevent me from explicating fully. Suffice it to say that there were confounds with word familiarity in the subjects. For words that they new quite well, they were very good at detecting the contrast. However, in less familiar lexical items, they were not as accurate.

LaCharité & Prévost (1999) proposed a refinement of Brown's model. In looking at French speakers acquiring English, they proposed a hierarchy of difficulty for new sounds. Whereas Brown argued that if a feature was lacking from the L1 then any contrast dependent on that feature could not be acquired, LaCharité & Prévost argued that a missing Articulator node would be more difficult to acquire than a missing terminal node. French learners of English have to acquire the sounds [h] and [θ]. They propose the representations of Figure 7 for these sounds:

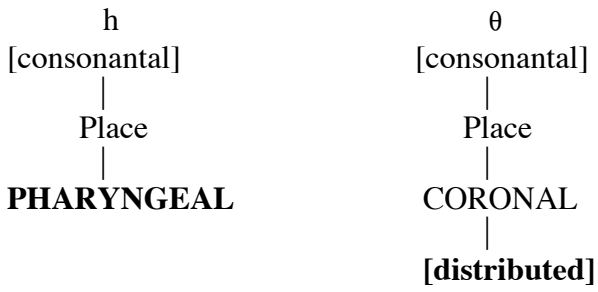


Figure 7. Articulator versus terminal nodes in English.

The features in boldface are the ones which are absent from the French inventory. They predict that the acquisition of [h] will be more difficult than the acquisition of [θ] because [h] requires the learner to trigger a new articulator node. On a discrimination task, the

learners were significantly less accurate identifying [h] than identifying [θ], however, on a word identification task (involving lexical access) there was no significant difference between the performance on [h] versus [θ]. Mah (2003) conducted an ERP (Event-Related Potential) study which looked at English speakers acquiring French and Spanish 'r' sounds. Under her analysis, English lacks a Pharyngeal node ([h] being Laryngeal) while French [R] is analyzed as Pharyngeal. Spanish [r], on the other hand, is Coronal. The acquisition of both French and Spanish 'r' will require English speakers to activate a new terminal node which Mah defines as [vibrant]. In her analysis of the processing of these two 'r' sounds, Mah did not find any differences between the perception of a French 'r' as opposed to the Spanish 'r'. This is an argument against the LaCharité & Prévost position.

2.2 The Speech Learning Model

No discussion of second language phonology would be complete without even a brief mention of the Speech Learning Model of Flege . Flege is a very prolific researcher but his (1995) chapter provides a good overview of the model. He is primarily concerned with phonetic aspects of L2 speech. Many of his empirical studies have attempted to answer the question *why are some sounds harder to learn than others?* His explanation centres on the comparison between L1 and L2 sounds. There are three possible relationships between these sounds: (1) the L2 sound is *identical* to the L1 sounds, (2) the L2 sound is *similar* to the L1 sound, and (3) the L2 sound is *new*. He predicts that (1) will be a case of ease of learning as the L2 sound is mapped directly onto the L1 category. A case might be the [m] of English and the [m] of German. These sounds are virtually identical and appear to propose no difficulty for second language learners. Cases such as (3) are also predicted to result in ease of learning because the new L2 sound is so different from any existing L1 category that a new category can be set up. An example of this might be the learning of Yucatec Maya ejectives ([p'], [t'] and [k']). However, the case of (2) is predicted to cause learning difficulty. An English alveolar [t] is quite similar to a French dental [t̪] and this similarity may block the formation of a new phonetic

category. The interested reader is recommend to consult the original works of Flege many of which are available online at: http://www.jimflege.com/.

3.0 Syllables

Let us turn now to another example of hierarchical structure at a higher level: the syllable. A common model of syllable structure is shown in Figure 8.

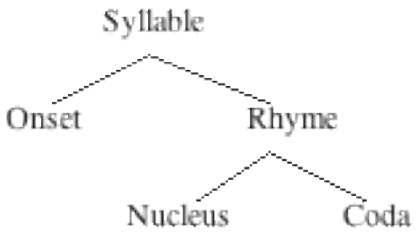


Figure 8. Syllable structure.

The languages of the world vary according to such things as whether syllabic nodes can branch. Some languages (e.g. Japanese) do not allow branching onsets or codas. A common phenomenon in second language learning involves modifying an L2 word so that it fits the L1 syllable structure. Consider the words given in (1) spoken by someone whose L1 is Arabic (these examples come from Broselow, 1988):

(1)	English Target	Non-native Speaker's Version
	plant	pilanti
	Fred	Fired
	translate	tiransilet

Arabic does not allow branching onsets or codas, so an English word like *plant* cannot be mapped onto a single Arabic syllable.

As this example helps show, we can explain why Arabic speakers pronounce English words in the way that they do by investigating the principles of syllabification in the L1. Especially at the beginning levels of proficiency, the structure of the IL is influenced by the structure of the L1. This would suggest that learners are clearly transferring the L1 principles of syllabification.

Now let us look more closely at the acquisition of consonant clusters. Most of the consonant clusters in the worlds' languages obey what is known as the Sonority Sequencing Generalization (diagrammed in Figure 9) which captures the fact that the Nucleus of a syllable is the most sonorous element, and sonority diminishes towards the edges:

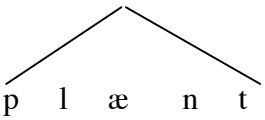


Figure 9. The Sonority Sequencing Generalization.

There are, however, sequences of consonants that violate this generalization, and they tend to involve the phoneme /s/.

In English some s-clusters violate Sonority Sequencing (e.g. 'st' since the fricative [s] is more sonorous than the stop [t]) while some do not (e.g. 'sn' where the fricative [s] is less sonorous than the nasal [n]).

The analysis of the structure of s-clusters is a complex and problematic area of phonological theory and I will not go into the details here. Many researchers argue that [s] is what is known as *extrasyllabic*. In other words, it is not really part of the syllable, but somehow outside it. The interesting fact, bringing all this back to second language acquisition, is that L2 learners are aware of this.

Carlisle (1997) looked at how Spanish speakers deal with English onset clusters. He notes that three-consonant clusters are changed significantly more often than two-consonant clusters. Carlisle (1991) in a study on two-segment onsets, found that Spanish speakers modified onsets that violated the Sonority Sequencing Generalization (e.g. st-) significantly more often than they did those that did not (e.g. sn-).

Broselow (1992) shows that Arabic speakers treat s-clusters that violate the sonority sequencing generalization differently than those that do not as shown in (2):

(2) sweater -> [siwɛtar] study -> [istadi]
slide -> [silayd] ski -> [iski]

Singh (1985) demonstrates the same pattern for Hindi speakers shown in (3):

(3) fruit -> [fɪrut] school -> [ɪskul]
please -> [pɪlɪz] spelling -> [ɪspɛliŋ]

Samarajiwa and Abeysekera (1964) show the same pattern by native speakers of Sinhalese speaking Sanskrit, given in (4).

(4)

Sanskrit	Sinhalese	
tyage ->	[tiyage]	'gift'
sriyavə ->	[siriyavə]	'grace'
stri ->	[istiri]	'woman'

These data suggest that L2 learners have full access to the principles of Sonority Sequencing regardless of their L1 experience. A recent paper by Cardoso (2007) also addresses this issue. He looks at Portuguese learners of English (Portuguese lacks onset clusters) and investigates two hypotheses as to the developmental path that the learners will follow. Hypothesis A is that the learners will acquire the less marked clusters (e.g. [sl]) before the more marked clusters (e.g. [st]). Hypothesis B is that the learners will acquire the clusters which are most frequent in the input ([st]) before the clusters which are less frequent ([sl]). In analyzing the production of his subjects demonstrated that the Portuguese learners followed the path predicted by markedness . Even though the [st] clusters were *much* more frequent in the input to the learners, they still acquired the [sl] cluster before the [st] cluster.

The work of Eckman and Iverson (1993, 1994) also clearly demonstrate that syllable structure can be changed in L2 learning. People can learn to pronounce new clusters that are not found in their L1.

Abrahamsson (2003) provides one of the best overviews of the studies into the second language acquisition of syllable structure. He focuses on the patterns of acquisition in coda position. Abrahamsson looks at the different types of repair strategies that are available to an learner whose L1 does not sanction coda consonants. Two strategies that are covered are epenthesis and deletion. Consider the examples in (5):

(5)

Target Word	Deleted Form	Epenthesized Form
when	[wɛ]	[wɛnə]
wet	[wɛ]	[wɛtə]
went	[wɛ]	[wɛntə]

As the above example illustrates, the *deleted* forms are much more difficult to recover for the listener than are the *epenthesized* forms. Abrahamsson hypothesizes that the proportion of epenthesis to deletion repairs will increase as a subjects overall proficiency increases.

He looks at speakers of Chinese (who allow at most one consonant in the coda) learning Swedish (which allows, or as Abrahamsson puts it, has a 'pain threshold of', five consonants at the end of a word). Subjects were recorded nine times with three to five weeks between recordings. The first recording took place ten to twenty-four days after their arrival in Sweden. The tenth recording took place one year after the ninth. For all three subjects, the proportion of epenthesis to deletion increased over time.

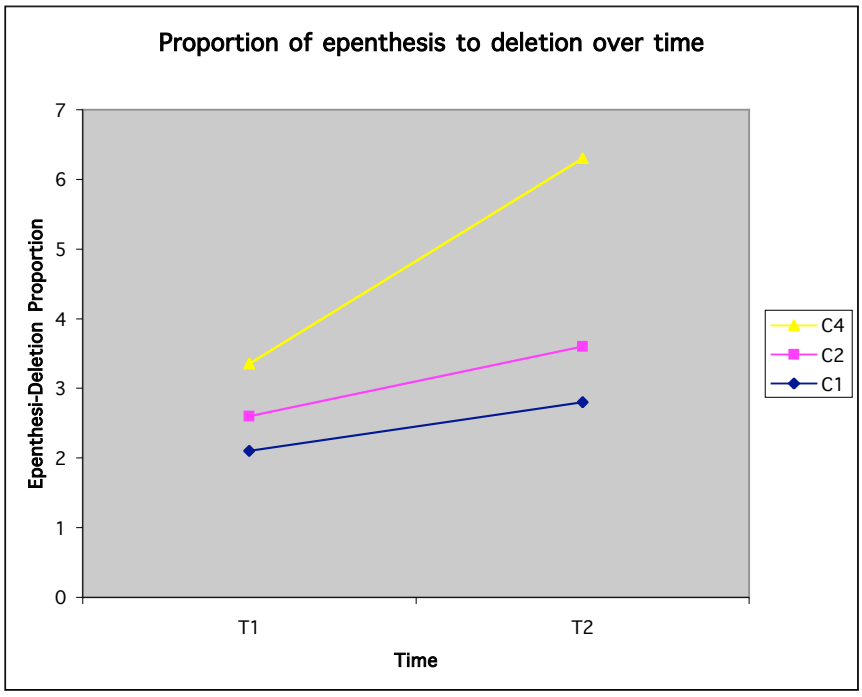


Figure 10. Modification strategies.

Furthermore, a. showed that subjects modified (epenthesis and deletion) inflected forms significantly more often that monomorphemic lexical forms. In addition, subjects used epenthesis as a repair strategy more on monomorphemic lexical items than they did on inflected items, as shown in the graph in Figure 11.

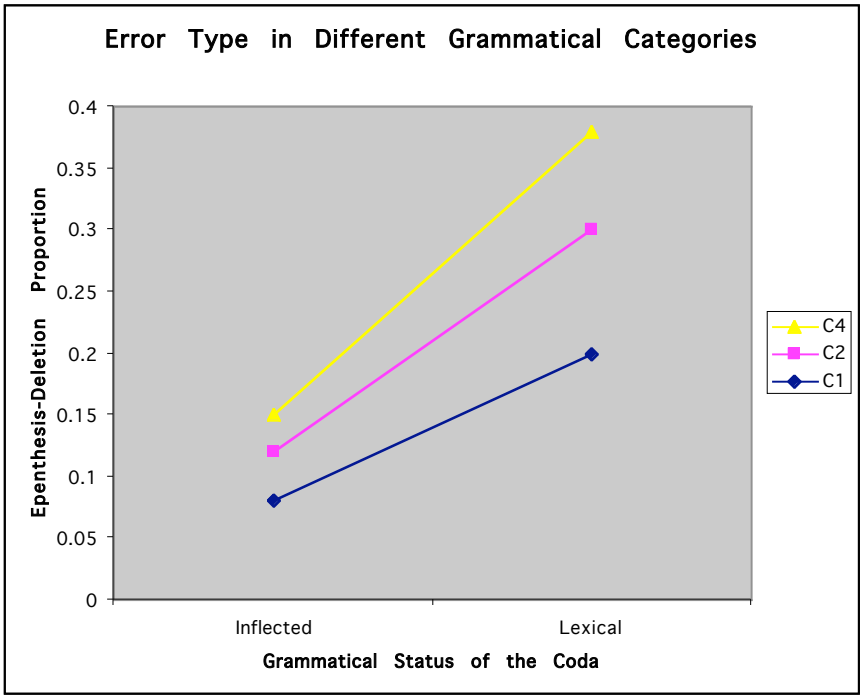


Figure 11. Effect of grammatical category.

They also used inflection more often on open class lexical items than closed class lexical items. A. proposes a functional explanation for this: that there is a greater possibility for ambiguity in open class words than closed class words and therefore recoverability will be enhanced for the listener by epenthesizing the open class words. As there are fewer lexical competitors for closed class words, the subjects are freer to delete sounds from them and the message will still be conveyed.

Lin (2001) presents another take on the syllable simplification strategies used by second language learners. Lin looks at the effects of different tasks, or different register as stimulated by a given task, on the accuracy of consonant cluster production. S/he argues that more formal registers do not lead to greater accuracy, as had been suggested in other studies (e.g., Tarone, 1983), but rather that the formality of the register correlates

with the *type* of repair strategy used. S/he suggests that epenthesis is used relatively more often in more formal contexts (where focus is on the form of the utterance, rather than on the content). Conversely, deletion and substitution will be used relatively more often in less formal contexts.

In this study, s/he looked at 20 Chinese speakers producing a variety of two-consonant onset clusters (e.g., [pj], [dr], [fl], [sn]) in English monosyllables. Subjects were taught the meanings of a variety of words (and pseudowords) and were given fifteen minutes to learn them and practice pronouncing them. The four tasks were: (1) reading minimal pairs with normal orthography *and* phonetic transcription, (2) reading randomized list of target words in normal orthography, (3) reading two sentences out loud in a grammaticality judgment task, and (4) controlled conversation, or structured interview. Task number one was assumed to be the most formal moving down the scale to task four which was assumed to be the most casual.

There were no significant differences in overall error *rates* between the four tasks, as shown in Figure 12.

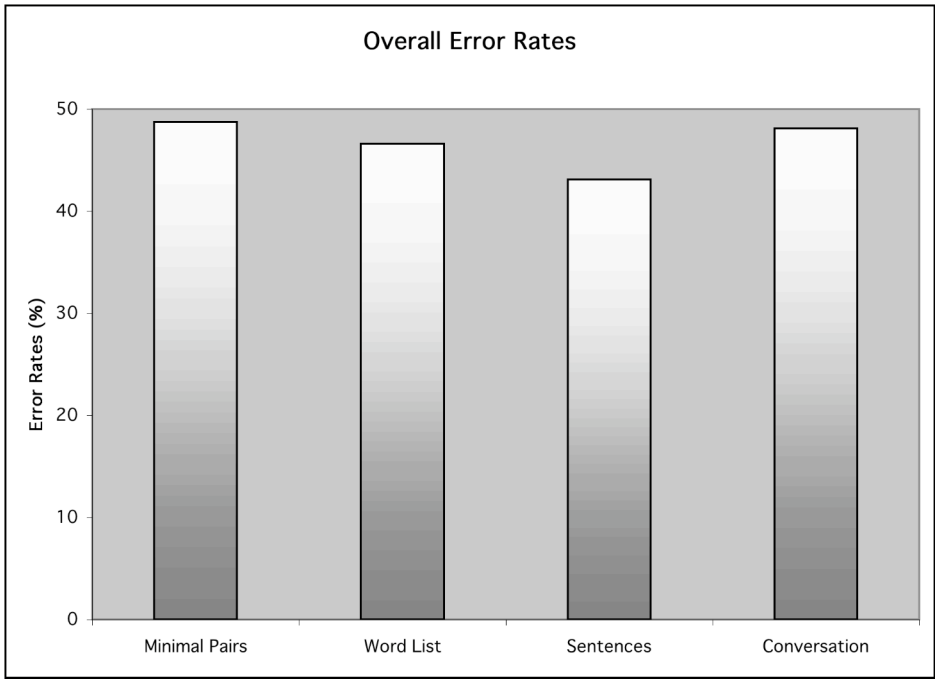


Figure 12. Error rates.

However, as predicted, there was a significant decrease in the amount of epenthesis as the task formality decreased, as shown in Figure 13.

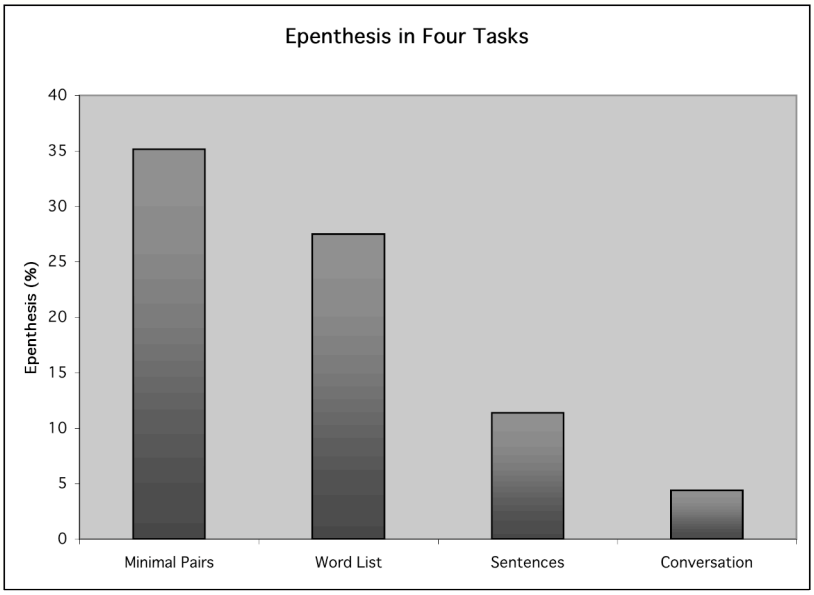


Figure 13. Epenthesis in different tasks.

3.1 Moras

At another level of phonological structure, the moraic level, we also see that learners are transferring their L1 phonological structures as shown by Broselow and Park in their paper on mora conservation in L2 phonology.

Broselow and Park (1995) began by presenting the data given in (6) from native speakers of Korean who were learning English:

(6)	a.			b.		
		bit$^{h.}$ɨ	"beat"		bit	"bit"
		čip$^{h.}$ɨ	"cheap"		t$^{h.}$ip	"tip"
		p^{h}ik$^{h.}$ɨ	"peak"		p^{h}ik	"pick"
		ruthɨ	"route"		gut	"good"
		khothɨ	"coat"		buk	"book"

Note that the Korean speakers insert an epenthetic [ɨ] at the end of the words in column (a), but not at the end of the words in column (b). Each of the words in the two columns

ends in the same consonants, so it cannot be triggered by the final consonant in the English word. Broselow and Park suggested that it is the quality of the vowel in the English root that determines whether epenthesis takes place. The epenthetic vowel is added to words that have long (bimoraic) vowels and not to words that have short (monomoraic) vowels. What would cause this difference in behavior?

Broselow and Park (1995) assumed coda obstruents are nonmoraic in Korean. Syllabic nuclei must be monomoraic in Korean (contrasted with English, in which they may be either mono- or bimoraic). In their view, the L2 learner begins by perceiving the L2 English input of a word like "beat," and setting up a representation that includes a bimoraic vowel, as shown in (7):

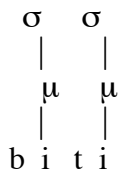
(7)

Because this is an illicit structure in Korean, the second mora is delinked from the vowel as in (8):

(8)

This triggers epenthesis, which fills the empty mora, and then onset formation occurs as in (9):

(9)



They argue, then, that what the Korean learners are doing is attempting to preserve the mora count of the original English word (which has two moras attached to the vowel). Because this is an illicit structure in Korean, they set up a new syllable that allows the bimoraic structure to be preserved.

Work by Summerell (2007) also looks at the acquisition of moraic structures. She looked at the acquisition of Japanese length contrasts (in both consonants and vowels) by native speakers of English. Japanese has minimal pairs based on length shown in (10).

(10) *kite* (wear)
kiite (listen)
kitte (stamp)

English has a contrast between tense vowels (which are bimoraic) and lax vowels (which are monomoraic) but the difference is manifested as quality (e.g., [i] vs. [ɪ]) not length (e.g., [ii] vs. [i]). English does not have a phonemic length distinction when it comes to consonants. Will English speakers be able to acquire Japanese length? Summerell (2007 conducted both an auditory discrimination task and a forced-choice picture selection task. The results of the auditory discrimination task are shown in Table 1.

Contrast	Group	% Correct	Mann-Whitney U	Probability
V vs. VV	L1 English	95.58	187.00	.290
	L1 Japanese	96.88		
C vs. CC	L1 English	95.08	223.50	.677
	L1 Japanese	94.63		

Table 1. Results from Discrimination Task

The non-native speakers were not performing significantly differently than the native speaker control group. This is true for the groups with beginner, intermediate and advanced levels of proficiency. The results from the picture selection task are given in Table 2.

Contrast	Group	% Correct	Mann Whitney U	Probability
V vs. VV	L1 English	94.96	137.50	.011*
	L1 Japanese	100		
C vs. CC	L1 English	89.23	114.50	.005*
	L1 Japanese	99.13		

Table 2. Results from Picture-Selection task.

Here we note that there is a significant difference between the native speakers and the non-native speakers. However, this difference is due to differential performance between groups. The beginners were significantly different from the control group, but both the intermediate and advanced groups were performing at nativelike levels of accuracy. Under one interpretation then, English speakers (who lack consonantal length) are able to acquire this feature in their second language. See Summerell (2007) for a more extended discussion on how the English speakers are redeploying their L1 property of weight-by-position (where coda consonants are moraic) to acquire Japanase geminate consonants (which are also moraic).

4.0 Stress

A number of papers have addressed the question of L2 learners acquiring stress. Table 3 below illustrates how languages may differ in their parameter settings. When the parameter settings are different in the first and the second language, we have the potential for transfer. Often, the L1 parameter settings transfer into the L2.

	Spanish	Polish	Hungarian	English
P1 (word tree)	right	right	left	right
P2 (foot type)	binary	binary	binary	binary
P3 (strong on)	right	right	left	right
P4 (built from)	left	left	left	left
P5 (Quantity-sensitive)	yes	no	yes	no
P6 (sensitive to)	rhyme	NA	nucleus	rhyme
P8 (extrametrical)	yes	no	no	yes
P8A (extrametrical on)	right	NA	NA	right

Table 3. Metrical parameters.

Archibald 1993 showed that L2 learners were able to reset their existing parameters to new values. (see Van der Pas and Zonneveld (2004) for counter-arguments.) In other words, if your L1 is quantity-sensitive to the nucleus (i.e., a long vowel attracts stress) you will be able to acquire the English setting of having your stress system sensitive to the rhyme (where a closed syllable can also attract stress). What this study revealed was that a simplistic view of stress assignment is not supported. A simple proposal would follow these lines: Hungarian has a rule of initial stress assignment which will transfer into English; Polish has a rule of penultimate stress assignment which will transfer into English. The adoption of this parameter-setting analysis reveals that both what transfers into the interlanguage grammar, and the nature of the interlanguage grammar is much subtler. Our representations must include constructs like quantity-sensitivity, extrametricality and the like.

Pater (1997) examined the acquisition of English stress by French speakers. Under his analysis, Quebec French is a quantity-insensitive language with unbounded feet (unlike English's trochaic binary feet). He had subjects produce nonce forms in English which were designed to reveal whether the French speakers had acquired English foot structure and quantity sensitivity. Pater argued that they had. Once again, it seems that the acquisition of stress shows that learners can reset their L1 grammatical settings.

However, we must also ask the question of whether subjects whose first languages did not have stress but rather had tone or pitch accent were able to trigger these metrical representations. Archibald (1997a) argued that Chinese and Japanese subjects learning English did not compute metrical representations but rather stored stress placement for each lexical item. Ou and Ota (2004) argue that Chinese learners of English show sensitivity to syllable weight in a perception test of English words and hence that these subjects are able to engage in a computational process to generate stress placement. This would be further evidence that second language learners are able to create new representations that are not found in their L1. Similarly, Kawagoe (2003) argues that Japanese learners of English *are* able to acquire a computational system for English metrical properties building on their L1 system of loanword phonology adaptation. This would be another example of how L1 knowledge in one phonological domain can be redeployed to acquire new knowledge in an L2.

5.0 Rhythm

While pedagogic treatments of L2 rhythm abound (primarily focusing on the differences between so-called stress-timed and syllable-timed languages), there have been relatively few empirical studies of this phenomenon. Guilbault (2002) investigates the acquisition of French rhythm by English L2 learners. French has been argued to be a language where there is much more equal duration of syllables (syllable-timed) than in English (stress-timed). He argues that advanced L2 learners of French have modified the temporal properties of their speech to approximate its rhythmic patterns. See also Archibald (1997b) for an investigation of the L2 acquisition of phrasal stress.

6.0 Intonation

There are very few studies on the acquisition of L2 intonation carried out within a generative framework. To understand why this would be the case, we need merely go back to the question posed at the beginning of this chapter: what is being acquired? In order to understand how syllable structure is acquired, we need to have a model of what syllable structure *is*. In order to understand how people arrive at knowledge of intonation in a second language, we need to have a model of what exactly native speakers of a language know when they can produce and perceive intonation patterns in their first language. And this is where we find relatively little agreement in the generative literature (see Ladd, 1996 for a discussion).

One exception is the work of Jilka (2000). Working within the ToBI system, Jilka demonstrates that a non-native intonation pattern is a robust cue to non-nativelike phonology. Native speakers of English were recorded speaking German, and native speakers of German were recorded speaking English. All subjects were assessed as having high levels of proficiency and high levels of segmental accuracy. For all subjects, the non-native utterances were 'corrected' by an automated program. Both raw and corrected versions of the sentences were played (non-sequentially) to native speaker

judges. A significant number of the native-speaking judges judged the corrected versions to be more nativelike than the raw versions.

7.0 Work Within Optimality Theory

The advent of Optimality Theory has spawned much work in the fields of both first and second language acquisition of phonology. Escudero's (2005) thesis provides a good overview of many of the current issues within this framework. However, I will focus on a discussion of the work of Broselow (1998, 2004) as I believe it is accessible without getting caught up in too many details of theoretical machinery. Optimality Theory (Prince & Smolensky 1993) is a theory of phonological competence which invokes a ranked set of violable constraints which guide the output of the speaker. Constraints which are highly ranked are violated at great cost while lower-ranked constraints can be violated quite easily. Constraint rankings are specific to each language and, therefore, the goal in learning a second language is to acquire the appropriate constraint rankings.

Broselow et al. (1998) look at the acquisition of English coda consonants by native speakers of Mandarin. Mandarin allows only glides and nasals in coda position while English allows a range of sonorants *and* both voiced and voiceless obstruents. The data presented show that the Mandarin speakers tended to devoice their final voice obstruents in English. The question which immediately arises is "where does this pattern come from?" There is nothing in the L1 grammar which says to devoice obstruents (since no coda obstruents are allowed. There is nothing in the L2 input to reveal this pattern either as English speakers produce both voiced and unvoiced obstruents. Broselow et al. note that universally voiceless codas are less marked than voiced codas. Therefore, a markedness constraint would exist which would favour voicelss codas and disfavour voiced codas. This constraint is part of the universal constraint set found in universal grammar. The L1 grammar does not allow us to see the evidence for this constraint but as we chart the developmental path of the interlanguage grammar we can see the emergence of the unmarked coda pattern. The behaviour of these L2 learners, then, provides an example of what is called in the OT literature *the emergence of the unmarked*. Studies such as these show us that linguistic theory can help to explain learner behaviour but also

that studies in second language acquisition can also be very useful for the construction and testing of new linguistic theories.

8.0 Summary

When we probe the construct of second language accent, we can demonstrate the complexity of the phonological grammars of language learners. Linguistic theory and the field of second language acquisition combine to explain the nature of the mental representations that underlie second language speech.

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