

Acquisition of English onset clusters by Chinese learners in Taiwan

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MSc in Developmental Linguistics

0. Introduction

In the studies of second language phonology, it is found that L2 learners' pronunciation deviates from that of native speakers and is deeply influenced by their L1 language. Thus, the role of L1 transfer seems to play a very crucial role in L2 phonological acquisition. As indicated in Rochet (1995), L2 learners tend to perceive L2 sounds in terms of their L1 category; misperception may lead to misproduction, which accounts for the phenomenon of "foreign accent."

How can we predict the difficulty that L2 learners may encounter when acquiring a second language? Traditionally, Contrastive Analysis Hypothesis (CAH) was regarded as a good way to identify the aspects that L2 learners may have problems with. It was also suggested that by comparing the L1 and the target language, similar aspects should be easier to acquire than new or different aspects. However, it was proved less than efficient to predict the difficulty because similar sounds, in a contrary fashion, create more problems. When two phonological elements are seen by L2 learners as nearly the same, they will be settled for the L1-based version for that phoneme rather than create a new one. Although CAH failed to predict accurately the errors that L2 learners may make, it does not follow that CAH is completely useless. Eckman (1977) believed that CAH can be maintained as a viable principle of L2 acquisition if it can be modified to incorporate certain principles of universal grammar. Thus, an improvement on CAH is to contain the idea of markedness. The Markedness Differential Hypothesis (MDH) claimed that the more marked the differences between the L1 and the L2, the greater the difficulty there would be for acquisition.

In this paper, we attempt to test the Interlanguage Structural Conformity Hypothesis (ISCH) which predicts that implicational universals also influence the structuring of interlanguage phonology. In addition to examining the influence of Universal Grammar, we also employ Contrastive Analysis to predict the "areas" of difficulty that L2 learners may have, because it helps to examine the effect of L1 transfer. The primary purpose of this study is to investigate the development of interlanguage phonology of Chinese ESL learners. How do Chinese ESL learners deal with tri- and bi-consonant onset clusters? This paper is in four sections. The first section outlines a contrastive analysis of syllables structures in English and Chinese. Interlanguage prediction is made according to ISCH and MDH. Some reviews of related studies are also summarized. The second section presents the methodology of the data collection. The third discusses different reasons of mispronunciation by L2

speakers. Finally, the last section draws some general conclusions.

1. Literature Review

1.1 Chinese onset structure and phonotactics

Traditional Chinese syllable models allow variable templates, ranging from a minimum of V to a maximum of CGVX. (C=initial consonant, G=onglide, V=nucleus, X=ending [nasal or offglide]). The syllable structure is (C)(G)V(X), with two onset constraints: (1) C can not be [ŋ] (2) G can only be [j], [w]. The only possible onset cluster in Chinese is CG. In some literature¹, G is regarded as a secondary articulation rather than another consonant. Some researchers also analyzed the glides as being in the construction with the following vowel rather than the preceding consonant, as a branching structure within the syllabic nucleus rather than in the onset.

1.2 English onset structure

Onset and coda clusters are both allowed in English. English syllable structure is (C)(C)(C)V(C)(C)(C)(C). It has a number of 3-member onsets that are completely resolvable into their component parts. In other words, given an onset such as ABC, both AB and BC will be well-formed 2-member onsets, and A, B, and C will be permissible 1-member onsets. In English 3-member onsets, the first 2-members consist of /s/ followed by a voiceless stop: /st/, /sp/, and /sk/, the last 2-members of a voiceless stop followed by an oral sonorant. In this study, we will focus on the tri-consonant cluster: s + voiceless stop + r.

1.3 Contrastive Analysis of Chinese and English syllable structure

As mentioned above, English onset position allows clusters up to three consonants while Chinese at most allows one consonant occurring with glide, [j] or [w]. Most of the time, no consonant clusters will be licensed in the onset position. Thus, we can foresee that L2 learners may encounter problems when acquiring onset clusters. Knowing the “area” of the problem is not enough to accurately pinpoint out the degree of difficulty and the development of L2 acquisition. Combining with markedness theories is necessary to complete the picture. Having outlined the differences between English and Chinese, we are able to make certain prediction according to Interlanguage Structure Conformity Hypothesis and Markedness Differential Hypothesis.

Interlanguage Structural Conformity Hypothesis (ISCH)

¹ Duanmu (2000) had a very different view about Chinese syllable structure. He argued that there are only two fixed types of syllable structures in Chinese: one is the heavy syllable, CVX, and the other is the light syllable, CV. Duanmu maintains that all Chinese syllables have an obligatory onset slot and the prenuclear G is in the onset; that is, he moved G into the onset as a secondary articulation of the initial consonant C, creating a complex onset which occupies only one time slot. Therefore, Chinese syllable structure at most allow one consonant onset with a secondary articulation glide.

“Interlanguage Structural Conformity Hypothesis: The universal generalizations that hold for the primary languages hold also for interlanguages.” (Eckman, 1991:24)

ISCH is used to examine the influence of the implicational universals on the acquisition of second language phonology. Under one interpretation, it suggests that L2 learners will modify more marked structures more frequently than less marked structures.

Markness Differential Hypothesis (MDH)

The only difference between ISCH and MDH is that MDH makes predictions on the basis of implicational universals and the differences between the NL and TL whereas ISCH makes predictions only on the basis of implicational universals. As noted in Eckman (1977: 321),

The area of difficulty that a language learner will have can be predicted on the basis of a systematic comparison of the grammars of the native language, the target language and the markedness relation is stated in universal grammar, such that:

1. Those areas of the target language which differ from the native language and are more marked than the native language will be difficult.
2. The relative degree of difficulty of the areas of the target language which are more marked than the native language will correspond to the relative degree of markedness.
3. Those areas of the target language which are different from the native language, but are not more marked than the native language will not be difficult.

In fact, MDH already imply ISCH. According to the first item above, we can predict that Chinese ESL learners will have difficulty with onset clusters because one singleton onset is the least marked structure. The more number of the onset cluster, the more marked it is. The following hypothesis is made according to the second item in MDH.

- a. Taiwanese ESL learners will modify tri-consonant onsets more frequently than bi-consonant onset: The sequence of modification should be as follows:

$s + p, t, k + r$ (more marked) $\rightarrow s + p, t, k / p, t, k + r$ (less marked)

- b. Resolvability Principle: If a language has a consonantal sequence of length m in either initial or final position, it also has at least one continuous subsequence of length $m-1$ in this same position. (Eckman, 1991: 25)

$C_1C_2C_3 \rightarrow C_1C_2 / C_2C_3$

To sum up, L2 learners must acquire C_1C_2 or C_2C_3 before acquiring $C_1C_2C_3$ structure. In order to predict the sequence between C_1C_2 and C_2C_3 , another parameter is used.

Minimal Sonority Distance (MSD; Broselow & Finer, 1991)

MSD is the required degree of difference in sonority value between two adjacent segments in the onset or coda; the smaller the MSD, the more marked. Therefore, the acquisition order of English onset consonant clusters will be:

$p, t, k + r (C_2C_3) \rightarrow s + p, t, k (C_1C_2) \rightarrow s + p, t, k + r (C_1C_2C_3)$

The sequence of modifications should be in the contrary order:

$C_1C_2C_3 \rightarrow C_1C_2 \rightarrow C_2C_3$

1.4 Cross-linguistic reviews on onset clusters

Many studies have been done to test the ISCH, and some of them also focus on the syllable structure. To name but a few, Carlisle (1997) found that Native Spanish speakers modified three-member onsets more frequently than 2-member ones. Eckman and Iverson (1993) also examined the role of typological markedness in English onset clusters. They first reviewed the study of Broselow and Finer (1991) about the MSD parameter and then conducted their own study to investigate subjects of different linguistic background, including Japanese, Korean, and Cantonese. They argued that MSD was inadequate empirically and conceptually. Nevertheless, markedness should be the relevant construct in characterizing the L2 subjects' knowledge. In this paper, both ISCH and MSD were used as criteria to predict the acquisition sequence of onset clusters: (s + p, t, k + r), (s + p, t, k,) and (p, t, k + r). On the one hand, we intend to test the implicational universals of ISCH; on the other hand, we also attempt to check if MSD is really inappropriate in predicting interlanguage grammar.

2. Methodology

2.1 Subject:

Ten subjects were asked to do the experiment, but one of them did not complete the second section. So, there were nine subjects (three females and six males) counted in this study. Seven of them were high school students (mean age is 17) and have learned English for at least four years. Their native language is Chinese and most of them can also speak some Taiwanese. The other two subjects (one is 23, the other is 55 years old) were adults who had received English training only at school. They speak both Chinese and Taiwanese.

2.2 Technique:

Instrumentation

The data-gathering instrument consisted of two parts: The first half were ten sentences containing 9 words with tri-consonant onset and 11 words with bi-consonant onsets; the second half was a wordlist of 15 tri-consonant onsets (There are five tokens in spr, str, skr respectively.) and 30 bi-consonant onsets. All the words in the data were mono-syllabic words. Fifteen fillers were interspersed in the list. The context of each group of clusters was also controlled in the wordlist. The complete wordlist is in the

Appendix and the total token list is as follows:

NUMBER OF TOKENS IN THE DATA

tokens	spr	sp	Pr	skr	sk	kr	str	st	tr
sentences	3	3	1	3	3	2	3	0	2
words	5	5	5	5	5	5	5	5	5
Total	8	8	6	8	8	7	8	5	7

There are 65 tokens in total for each subject.

Procedure

Each subject was shown the lists ahead of time in a familiarization session and was asked to look over the list to point out any words that were unfamiliar. Sentences were recorded one by one, but word list were recorded one line by another.

Transcribing

The collecting data were transcribed phonetically by two native speakers with training in linguistics. One of them had rich experience in phonetic transcription. Where they did not have agreement was listened again by a third person.

2.3 Result & Analysis:

Note that we counted only epenthesis and deletion as modifications of target language syllable structures. As for the substitution part, we leave it in the discussion of L1 transfer. As indicated in table 1, tri-consonant clusters were modified more frequently than the other two bi-consonant clusters. 23.7 % of tri-consonant clusters were modified, including 9.3% of epenthesis and 14.4% of deletion. As for bi-consonant groups, only 3.9% were altered through epenthesis in C₁C₂, and totally 9.5% in C₂C₃ structure, 4.2 % of epenthesis and 5.3% of deletion respectively.

TABLE 1. Summary of the modifications in different onset clusters

C₁ = s C₂ = voiceless stop (p, t, k) C₃ = r

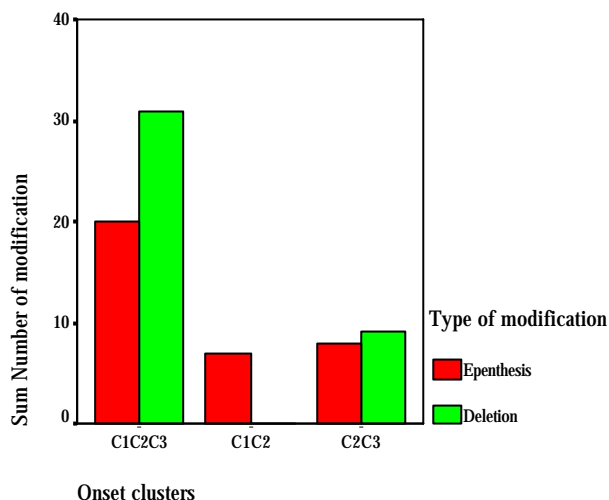
Clusters \ Modification	C ₁ C ₂ C ₃ 24*9= 216	C ₁ C ₂ 20*9=180	C ₂ C ₃ 21*9=189
Epenthesis	20/216 (9.3%)	7/180 (3.9%)	8/189 (4.2%)
Deletion	31/216 (14.4%)	0	10/189 (5.3%)
Total	51/216 (23.7%)	7/180 (3.9%)	18/189 (9.5%)
Substitution	26/216 (12%)	0	41/189 (21.7%)

Note: Substitution is not counted as modification of syllable structure here.

Figure 1 illustrated clearly the number and types of modifications in three different clusters. In general, the result supported the ISCH that L2 learners make more modifications in more marked structures. However, within the two bi-consonant clusters, we found that C₂C₃ (voiceless stop + r) were modified more frequently than

C₁C₂ (s + voiceless stop), which is contradictory to our prediction according to MSD. This indicates that MSD may not be a qualified predictor for interlanguage grammar. We have a detailed discussion on this point in next section.

FIGURE 1. Number of modifications in different types of clusters



As displayed in the figure 2, it showed that eight out of nine subjects modified tri-consonant clusters more frequently than bi-consonant clusters. The other one subject modified bi-consonant clusters only one time more than the tri-consonant ones. Besides, according to the implication scale in table 2, we can infer that L2 learners acquire bi-consonant clusters before they acquire more marked tri-consonant clusters, because subject 2 and subject 3 did not make any modifications on bi-consonant clusters, which showed that they have fully acquired the bi-consonant clusters but still have not mastered tri-consonant ones. This again proves typological markedness is a very powerful predictor for interlanguage grammars.

FIGURE 2. Number of modification by different subjects

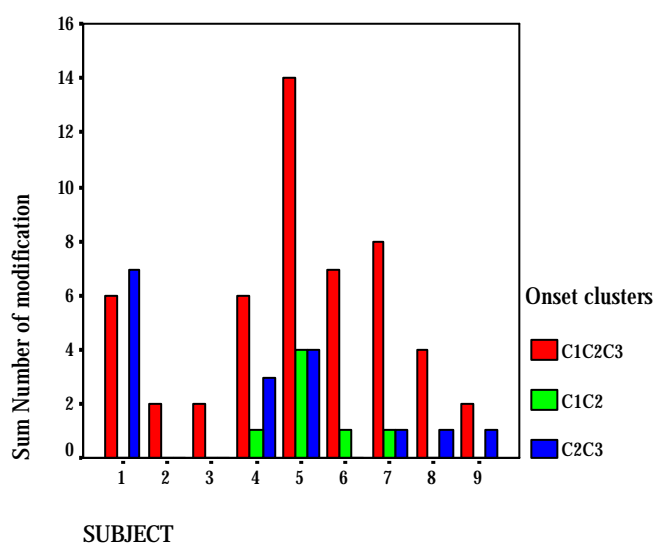


TABLE 2. Implicational scale : Modifications of onset clusters by nine subjects.

Cluster Subject	C ₁ C ₂ C ₃			C ₁ C ₂			C ₂ C ₃		
	E	D	S	E	D	S	E	D	S
1	6	0	4	0	0	0	7	0	6
2	0	2	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0
4	2	4	12	1	0	0	0	3	13
5	4	10	4	4	0	0	1	3	9
6	0	7	4	1	0	0	0	0	8
7	7	1	0	1	0	0	0	2	2
8	0	4	0	0	0	0	0	1	0
9	0	2	2	0	0	0	0	1	3

E represents epenthesis ; D represents deletion; S represents substitution.

3. Discussion

In this study, we also found that Chinese native speakers use many substitutions for certain segments in English. They did not pronounce all the segments accurately but rather they chose a segment in their native language to replace the similar sound in target language. We can examine the influence of L1 transfer in doing the contrastive analysis of Chinese and English consonant inventories. Three issues will be included in this section: (1) the choice of substitutions on onset segment, (2) the analysis of two bi-consonant clusters, (3) the role of L1 transfer and UG in L2 acquisition.

3.1. The choice of substitutions on onset segments

The Chinese phonological system differs from English not only on a segmental but also on a suprasegmental level. Here we examine solely fricatives, voiceless stops, and approximants in both languages. Below are the Chinese and English consonant inventories:

The consonant inventory of Standard Chinese

Place Manner	labial	labial- dental	dental	Alveolar	Alveolar- palatal	(retroflex)	palatal	velar	labial- velar
Stop	p p ^h			t t ^h				k k ^h	
Nasal	m			n				ŋ	
Fricative		f		s		ʂ ʐ	ç	x	
Affricate				ts ts ^h		tʂ tʂ ^h	tç tç ^h		
Approximant							j		w
Lateral				l					

The consonant inventory of English

Place manner	labial	labial- dental	dental	alveolar	Alveolar- palatal	retroflex	palatal	Velar	labial- velar	glottal
Stop	p b			t d				k g		
Nasal	m			n				ŋ		
Fricative		f v	θ ð	s z	ʃ ʒ					h
Affricate					tʃ tʒ					
Approximant				ɹ			j		w	
Lateral				l						

The phenomenon of /r/ substitution

When investigating the three types of clusters: (s + p, t, k + r), (s + p, t, k), and (p, t, k + r), we assume that Chinese ESL learners may have more problems on the groups which involve the approximant [ɹ], because Mandarin does not have the [ɹ]. From the perspective of L1 transfer, L2 learners may identify the [ɹ] in terms of their native language categories. L1 elements are most likely to be transferred into a target language, which is perceived to be linguistically similar to L1. Thus, among all the approximants in Chinese, the closest approximation would be either [l] (same place of articulation, invariant voicing and similar degree of aperture) or [w] (same lip rounding feature, invariant voicing and similar degree of aperture). However, in Mandarin, /pl/, /kl/, and /tl/, are not legitimate onset sequences. Thus, when L2 learners encounter the clusters (voiceless stop + r) in the target language, they will tend to choose /tw/, /kw/ and /pw/ rather than illegal clusters /pl/, /kl/, tl/.²

In this data, English /ɹ/ was replaced by /w/ when occurring after all English voiceless stops and in some cases replaced by /tʃ/ when occurring after /t/. Among 585 (65 *9 subjects) tokens of all three types of clusters, 67 of them (11.4%) have been substituted for certain segments. As indicated in table 3, among all the substitutions, 74.6% of the [ɹ] sound has been replaced by [w] in the (C₁) C₂C₃ template, and one-fourth of the /tr/ has been replaced by /tʃ/. In some English speakers, in the cluster /tr/, the first segment is not a stop /t/, but an affricate -- and since there is some degree of assimilation to the following /ɹ/, very often the first segment is a retroflex affricate, very similar to Chinese /tʃ/. If this is the case, then it would be natural for Chinese subjects to replace it with a retroflex or alveopalatal affricate.³

² Note that /pw/ is not a legitimate onset cluster in Chinese, but because these two segments share the same place of articulation, it will be easier than /pl/.

³ Chinese subjects replaced it with an alveopalatal in this data because the Chinese speakers were speakers of Taiwan Mandarin, who don't use retroflex initials.

TABLE 3. Substitution of English [r] in clusters: (s) + voiceless stop + r

[r]	1	2	3	4	5	6	7	8	9	Total
/w/	0	0	0	21	9	9	1	0	4	50 (74.6%)
/tr/→/tw/	0	0	0	3	3	0	0	0	0	
/tr/→/tʃ/	10	0	0	1	1	3	1	0	1	17 (25.4%)

3.2 The analysis of two bi-consonant clusters

As for the two bi-consonant onset clusters: **s + p, t, k** (C_1C_2) and **p, t, k + r** (C_2C_3), we predicted that C_1C_2 will be more marked than C_2C_3 because according to MSD, the distance between fricative and stop is smaller than that between stop and liquid. However, our result showed that the prediction was not accurate because the modification percentage of C_2C_3 was 5.6% higher than that of C_1C_2 . Does it mean that sonority is not a valid predictor for interlanguage phonological grammar or maybe there are other factors influencing the acquisition sequence such as the effect of L1 transfer? In the cluster of fricative and stop, it actually violated Sonority Sequencing Principle (SSP) and was regarded as a very marked form due to the short distance of two adjacent sounds. However, it did not receive more modifications. As presented in table 2, most subjects were able to produce this cluster.

In 1999, Morelli has provided a universal typology of onset clusters based on a survey of about 25 languages. Among the six possible language types⁴, Fricative + Stop is the least marked one. For most of the languages of this type, such a sequence is restricted to the segment “s” followed by a stop. Morelli (1999) also argued that the principle of SSP is not relevant to obstruent clusters since it fails to account for both the markedness relations and the implicational universals observed for onset obstruent clusters. SSP necessitates onsets to rise in sonority and codas to fall in sonority. Given this principle, it would predict the well-formedness of SF (Stop + Fricative) and the ill-formedness of FS (Fricative + stop), since stops are less sonorous than fricatives. In this case, we would expect to see the type of FS sequence is more marked than SF clusters. According to their markedness relation, an implication occurs: if a language has FS clusters, then it has SF clusters. However, this is contradictory to Morelli’s typology of obstruent clusters. She claimed that FS but not SF can be found in isolation and SF always implies the presence of FS. Thus, the above implication is false. FS is the unmarked cluster type and in particular, the type of “s + stop” is extremely common across language. Our result seemed to correspond to this claim.

With regard to C_2C_3 , as noted in section 3.1, the higher modification percentage might be due to the approximant [r], which is absent in Chinese speakers’ L1. In

⁴ All four possible clusters (FS, FF, SS, and SF) were attested and only six ways were attested to occur across languages. Please refer to Morelli (1999: 3) for further details.

Young-Scholten & Archibald (2000), it was suggested that a language with a single liquid such as Chinese and Japanese will not allow obstruent +liquid clusters due to some typological evidences⁵. Another reason for the wrong prediction might be that MSD is actually not a valid predictor as stated in Eckman and Iverson (1993). Therefore, the acquisition sequence between C_1C_2 and C_2C_3 is difficult to predict, since two many factors such as consonant inventories (L1 transfer) and typological markedness (implicational universals) are involved in.

3.3 The role of L1 transfer and UG in L2 acquisition.

Full transfer / Full access (White, 2000)

The result in this study seemed to imply the full transfer/full access perspective. According to what we examined in the data, subjects have no problem pronouncing the consonant [s], [p], [t], and [k], since these can be found in their L1 inventory. However, as for the [ɹ] which is not in their L1 category, L2 learners may have some degree of difficulty. Assume that L1 phonological inventory is the initial state of L2 phonological grammar, then we would expect to see that ESL learners will not have any problem with L2 sounds which can be found in their L1 inventory. The same rule is applicable to L1 syllable structure, in which L2 learners try to modify the onset clusters because they have different structure in their native language. They modify the clusters in such a way that it conforms to implicational universals. This indicates that properties of UG (e.g. implicational universals) not instantiated in the L1 grammar (onset clusters) are still available to L2 learners at intermediate stages. In other words, “UG aids acquisition”, which upholds the idea that L2 learners have full access to UG rather than partial access.

4. Conclusion

This study has further tested the Interlanguage Structural Conformity Hypothesis or Markedness Differential Hypothesis, and like all other studies testing the ISCH, has failed to falsify it. Chinese subjects tended to alter the more marked, tri-consonant clusters, more frequently than the less marked, bi-consonant clusters. Between the two bi-consonant clusters, we also further proved that Minimal Sonority Distance may be inadequate to be a viable construct for determining the markedness of consonant clusters in the onset of a syllable. Special attention was paid to the cluster (s + voiceless stop), which were regarded as more marked by MSD but this

⁵ Archibald (1998) claims that the acquisition of new syllabic structure (at least in the onset) is not possible until the acquisition of new segmental structure takes place. This involves an implicational hierarchy in which the presence of onset clusters involving an obstruent and liquid in a language implies the presence of an /l/~r/ contrast. Please refer to Young-Scholten & Archibald (2000: p.83) for details.

claim was refuted by Morelli's examination of typology of onset obstruent clusters. Contrastive analyses of syllable structures and segment inventories were also offered to examine the differences between English and Chinese, which enabled us to predict the area of difficulty that L2 learners may encounter. Furthermore, the role of L1 transfer and access of UG were also discussed; the idea of full transfer/ full access was suggested in this paper. Nevertheless, the clusters we collected in the data were restricted to (s + voiceless stop + r). It would be much better if we were able to examine all the possible onset clusters. But the main problem we may encounter is the time-consuming session of data collection and data transcription. Furthermore, we did not control the proficiency or age of subjects in this study. Probably we can try to control the subjects' proficiency levels or ages so as to see if other factors have effects on the acquisition development.

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