Cross-Linguistic Influence on Chinese Trilingual Speakers' Pronunciation: L2 Proficiency and Language Distance

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Abstract
This study investigated the cross-linguistic influence (CLI) of L2 proficiency on plosive production of Chinese trilingual speakers. Speech experiments were conducted to compare participants' verbal production of bilabial plosives in Chinese (L1), English (L2) and Italian (L3). The results showed that the closer the (actual) language distance is, the easier the specific phonemic inventory can be acquired. The proficiency level of L2 and language distance co-effected the transfer pattern. Advanced learners in L2 performed better on the acquisition of new phonetic categories in L3 due to their richer learning experience. When it comes to L2 & L3 shared phonetic categories, L2 intermediate group received stronger CLI from L1 than L2 advanced group. The L1&L2&L3 shared phonetic categories were easily picked up by all the L3 learners in L3 production.

Key words: Third language acquisition; L2 proficiency; Cross-linguistic influence

1. INTRODUCTION

The mechanism of third language acquisition (TLA) is more complex than that of second language acquisition (SLA) in the sense that more source languages and learning experiences are available for transferring (Wremble,2010). The main CLI factors examined in the literature are language distance, proficiency, exposure, L2 status, recency and so on (Cenoz, 2001). What's more, social environment and learners' individual factors, such as learning motivation, attitude and personality may also have an impact on individual's language acquisition. These factors are not isolated from each other, but intertwined and co-effect on the learners' output.

It is generally believed that with the improvement of the target language level, the cross-linguistic influence (CLI) of the source language is reduced, which is similar to SLA. On the contrary, there are only a handful of researches focusing on how the level of source languages, especially L2, affects the output of target language. As a result, the influence of L2 proficiency level on the output of L3 is underestimated in the scope of TLA. In this paper, we conducted speech production experiments on Chinese Trilingual speakers (L1 Chinese, L2 English, L3 Italian) with various L2 proficiency level in order to explore the potential CLI of L2 proficiency.

2. LITERATURE REVIEW

2.1 The Definition of Third Language Acquisition
The study of TLA began in Europe in the 1980s. Researchers found that the learning process of third language learners is different from that of second language learners. Therefore, TLA has gradually developed into an important research field independent of SLA (Hoffmann 2001). Fouser (2001, pp.150-151) proposed to use '≥ 3'to define the research category of SLA, which refers to one or more languages (L3) that learners are acquiring after learning L1 and L2. In this paper, L3 only refers to the third language that learners are learning recently.

2.2 CLI Factors in TLA

2.2.1 Language Distance

Language distance refers to the typological similarity between source language and target language, the more similar, the closer the language distance is. The closer the distance is, the more possible for linguistic knowledge to transfer (De Angelis, 2007). Ringbom & Jarvis (2009, p.106) pointed out that approximate comparison among language systems was not very practical and they pointed out that distinguishing the actual similarity at the specific language was more practical and it is helpful for learners compare from specific language phenomenon to approach target languages.

2.2.2 Language Distance of Chinese, English and Italian

Chinese belongs to Sino Tibetan language family, while English and Italian belong to Indo-European language family, among which English belongs to Germanic language family and Italian belongs to Roman language family. Here we only focus on the specific category of bilabial stops. At phonology level, both Chinese and English distinguish bilabial fortis and lenis by the feature of [Spread glottis], while Italian distinguish bilabial fortis and lenis by the feature of [voice] (Ladefoged, Peter & Ian Maddieson, 1996).

Although Chinese, English and Italian belong to different language families, they all contain voiceless bilabial stops [p]. For native Chinese speakers, the actual language similarity is helpful to the acquisition of this phonetic sound. The voiced stop [b] is missing in Chinese, but learners may expend their phonological inventory by learning English [b], and further transfer to L3. As for the geminate stops, they are new categories for Chinese trilingual speakers because it is missing in both L1 and L2, see Figure1.
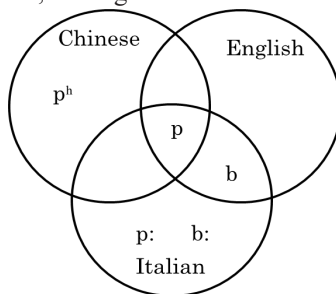

Figure 1

2.3 Language Proficiency

Trilingual speakers are not three monolinguals in one person, three languages compete with each other and output various mixed productions. Proficiency is a powerful factor that influences the productions of trilingual speakers. It can be divided into target language proficiency and source language proficiency. Target language is the language we are examining at and source languages are other languages that learners mastered.

In SLA, Major (2001) proposed Ontogeny and Phylogeny Model (OPM) which assumes that learners with low L2 proficiency receive more CLI from L1. As L2 proficiency level improves, CLI from L2 weakens. Similar pattern is found in TLA for target language. CLI is more significant at L3 elementary levels rather than advanced levels (Wrembel, 2010, 2015). For example, Wremble (2010) conducted a cross-sectional study on L3 proficiency. Participants' (L1 polish, L2 English, L3 Germany) L3 productions were evaluated through subjective accent rating by English and Germany native speakers. He found that L2-accented speeches were prevailed in low proficiency L3 learners and it diminished as the L3 proficiency increased.

However, there are some researches concluding the source languages as factors instead of examining the target language solely. Gracia's (2013) study showed that the development of L3 learners' phonemic production is more like a "U" curve in TLA. Ten subjects (L1 English) with different L2 (Spanish) proficiency and the same L3 (Portuguese) proficiency were tested on their oral production of trill [R]. However, it is found that when L2 learners with intermediate L2 proficiency level are more likely to transfer L2 phonetic knowledge and the accuracy of L3 verbal outputs are the lowest comparing to elementary and advanced learners. She thinks the possible reason is that trilingual speakers with higher proficiency level in L2 also have better metalinguistic competence so that it facilitates the acquisition of L3. However, for the L2 intermediate group, they have more competitive segments in their phonemic inventory comparing to L2 elementary learners. Cal and Zuzanna (2020) claimed that the higher proficient language is always the dominant source language of CLI. They examined the interaction of L2 and L3 proficiency level in TLA, her participants were trilingual speakers (L1 Polish, L2 English, L3 Spanish) who varied in their L2 and L3 proficiency. She found that If the L2 proficiency is high and L3 proficiency is low, then L2 → L3 CLI is significant, if L3 proficiency is high, L2 proficiency is low, the output will be closer to L3. Whether the source language need to reach a threshold of proficiency to have an impact on target language remains controversial. De Angelis (2007) pointed out that any non-native languages of learners can be a potential source domain irrespective of how proficient the learners are. While Fernandes-Boëchat (2007) proposed that the activation of the source language must reach a threshold of proficiency level to have an impact on the target language.

These studies indicated that L3 proficiency level should not be regarded as an absolute level, but a relative level which relative to multilingual learners' proficiency level of other source languages. Most claims above are based on observational data or intuition about trilingual speakers' productions and the language distance among the examined languages is usually close (limited in Indo-European family). The methodology of examining the

speech sounds need to be more sophisticated and scientific and the more non-Indo-European languages shall be explored. In this paper we used speech experiment to collect Chinese trilingual speakers' production and analyzed them with plosive patterns, which will be illustrated in next part, to provide objective data. Besides, the language distance is evaluated by two phonetic parameters rather than general knowledge of language family.

3. EXPERIMENT

3.1 Hypothesis

• According to language distance hypothesis, the difficulty of learning Italian bilabial stops is ranked as [p]<[b]<[p:]<[b:].

• Both groups are heavily influenced by source languages (L1 and L2) because of their low proficient language in their target language.

• The mother tongue provides the major CLI for all participants because it is the highest proficiency among source languages. The CLI from L2 is more significant for L2 intermediate groups comparing to L2 advanced group.

3.2 Participants

In the experimental group, four college students from a university in China, two of them major in chemistry, have not obtained any English proficiency certificate; The Other two participants major in English and have passed CET-6. Four subjects with an average age of 21 have studied English for 8-11 years, with an average of 9.5 years. They have taken Italian courses and have studied for four months without any experience of studying abroad. Two native English speakers from the United States and two native Italian speakers from Italy consisted

of the control group. The ratio of male to female in the experimental group and the control group was 1:1.

3.3 Stimuli

The stimuli includes Chinese bilabial stops [p] and [pʰ], English bilabial stops [p], [b], and Italian bilabial stops [p], [b], [p:], [b:] (from the participants' textbook: *Progetto Italiano 1*). The word contains disyllabic or polysyllabic words with bilabial stops, which is convenient to measure GAP value from the following words. The order of relevant words is disturbed and irrelevant words are inserted to prevent the subjects from understanding the purpose of the experiment, thus affecting the experimental results (see appendix 1).

Two parameters are considered to evaluate participants' output: voice onset time (VOT) refers to the relative time from removing block to vocal cord vibration. The GAP value can only be measured from the following words. The larger the GAP value is, the tenser the muscles are when the stops are pronounced.

3.4 Procedure

The speech experiments were conducted in a quiet classroom, and the recording was conducted using Cool Edit pro2.0. The sampling rate was 22050 Hz, 16 bits, mono. The participants were required to read the word list at normal speed, and read them three times each. The control group read English word list or Italian vocabulary only. 792 speech samples were collected and analyzed by Praat. SPSS 22.0 was used to make statistics and analysis.

3.5 Data Analysis

The data of Chinese stops [pʰ] and [p] are quoted from Ran Qibin and Shi Feng (2007). English and Italian stops' data of control group are shown in Table 1.

Table 1
Reference bilabial stops' value   Unit: ms

	Chinese				English			
Stops	**[pʰ]**		**[p]**		**[p]**		**[b]/[b]***	
Parameters	VOT	GAP	VOT	GAP	VOT	GAP	VOT	GAP
M.	87	60	11	79	18	104	-62/9	73/83
Std.	18.3	22.1	6.9	24.9	5	11.6	-14.4/2.9	12.9/23.8
	Italian							
Stops	**[p]**		**[b]**		**[p:]**		**[b:]**	
Parameters	VOT	GAP	VOT	GAP	VOT	GAP	VOT	GAP
M.	17	94	-89	91	20	149	-153	192
Std.	4.7	10	7.8	8	6	22	22.8	20.4

Note: * indicates voiceless trait.

According to the data in Table 1, draw the average sample points into the two-dimensional coordinate map with VOT value as the horizontal axis and GAP value as the vertical axis, and get the pattern of Chinese, English and Italian bilabial stops, as shown in Figure 2.

With the vertical axis as the boundary, the right side is the main picture (voiced area), and the left side is the

secondary picture (voiceless area). Chinese voiceless stops [pʰ], [p] are located in the middle of the main picture, with large horizontal axis span and small vertical axis span. The position of Chinese bilabial aspirated plosives [pʰ] is the most right and the lowest, which is obviously different from other plosives. Comparing with English and Italian, bilabial stops in Chinese are more relaxed, without voiced stops, and characterized by aspiration.
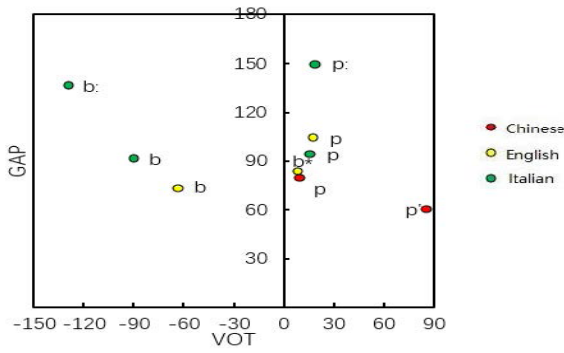
Figure 2
Reference bilabial stop pattern

The English phoneme /b/ has two allophones, [b]* is a voiceless variation. The GAP value of double lip stops [b:] and [p:] in Italian is about 140ms, which is significantly higher than that of singleton stop [b] and [p]. The analysis of variance shows that there is no significant difference in VOT values among Chinese, English and Italian [p], which have actual cross-linguistic similarity. It is easy for learners to acquire (P (Chinese-English) = 0.066 > 0.05, P (Chinese-Italian) = 0.174 > 0.05, P (English-Italian) = 0.621 > 0.05). Through independent sample t-test, it is found that there is a significant difference in VOT between English [b] and Italian [b] (P = 0.000 < 0.05), so it is difficult for learners to acquire theoretically.

The average acoustic data of four participants were calculated (see Table 2), and the analysis of variance was carried out, and the plosive pattern was constructed for comparison (see Figure 3)

1）Although the [p] of the three languages has actual linguistic similarity, the voiceless stop [p] of L2 intermediate proficiency level group's L3 outputs are close to that of native Italian speakers (P = 0.362 > 0.05). L2 intermediate proficiency level group's acquisition for [p] is poor and has significant differences compare to reference group (P = 0.02 < 0.05).

2）The GAP values of [b:] and [p:] are closer to those of Italian native speakers. In the R diagram, the geminate stops are in the upper part of the pattern diagram, which is obviously different from the geminate stops. In the L diagram, there is no distinction of geminate and singleton stops.

3）There was no significant difference in the VOT value of L3 voiced stops [b] among the four learners (P = 0.682 > 0.05), but there was significant difference between them and native Italian speakers (P = 0.000 < 0.05). In R-map, L3 voiced stops [b] are distributed in the main map and the auxiliary map at the same time, and some voiced stops are not actually voiced, showing the pronunciation characteristics of L2 phoneme /b/, and the frequency of voiced stops is only 9%. There was no accessory image in L-map, and no voiced trait was found.
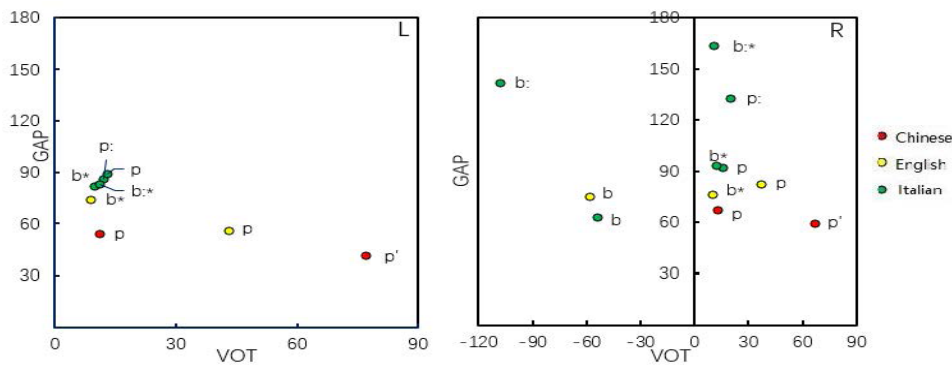

Figure 3
Plosive pattern of control group
Note: L-map is L2 intermediate group, R-map is L2 advanced group.

Table 2
Bilabial stops' value of experimental group   Unit: ms

	Chinese				English			
	[pʰ]		[p]		[p]		[b]	
Stops								
Parameters	VOT	GAP	VOT	GAP	VOT	GAP	VOT	GAP
Int	77	41	11	54	43	56	9	74
High	67	59	13	67	37	82	-58/10	75/76

	Italian							
	[p]		[b]		[p:]		[b:]	
Stops								
Parameters	VOT	GAP	VOT	GAP	VOT	GAP	VOT	GAP
Int	12	86	10	82	13	89	11	83
High	16	92	-54/13	93	20	133	-143/11	142

4. DISCUSSION

Hypothesis 1 is valid. Due to the shared phonetic features of L1, L2, L3, [p] is the easiest for Chinese trilingual speakers. [b] is not acquired by L2 intermediate group,

both of their L2 and L3 output is influenced by L1 feature of [-voice]. [b] is partially acquired by L2 advanced learners, the percentage of voiced sounds are quiet limited and do not have significance in statistics, but still they did better than L2 intermediate group and transfer this semi-finished pattern to L3 [b]. As for the geminate stops in L3, it is the most difficult category for learners to acquire, however, L2 advanced groups did better than L2 intermediate group, probably because they have more language learning experience and lead to a better metalinguistic awareness. More studies can be carried out to explore the relationship between metalinguistic awareness and multilingual speakers' production.

Hypothesis 2 is valid, all the participants' output in L3 were significantly different from native speakers of English and Italian. Through their plosive patterns, we found that L1 and L2 had mixed influence on L3 productions. However, we do not have contrastive high proficiency L3 learners in our experiment, whether the CLI would decrease as the L3 proficiency improves remains unclear.

Hypothesis 3 is not valid. Due to the L2 intermediate group did not acquired the quality of [voiced] in their L2, both L2 and L3 output are significantly influenced by L1, thus they were not able to transfer L2 phonetic inventory to L3. On the contrary, L2 advanced group receive a mixed L1 and L2 influence, the semi-acquired pattern exists in both L2 and L3 production. It is worth noting that the evaluations of proficiency are quite different across studies and languages. This may be the reason that our results are not consisted with Gracia's (2013). More importantly, the proficiency is a very general terms which covers many language abilities which may not be suitable for evaluating a specific aspect of multilingual learners (e.g. Plosive patterns).

5. CONCLUSION

Our experiment results aligned with previous studies that the closer the language distance is the better output that learners can achieve. We found that even for the non-existed geminate stops in L1 and L2, learners with more language learning experience can better acquire this category in L3. This might be due to their higher L2 proficiency level. Our study indicated that L1 provided the dominant CLI for learners with intermediate L2 proficiency while advanced L2 learners received a mixed CLI form L1 and L2. Language distance and L2 proficiency co-influenced the output of trilingual speakers.

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APPENDIX

Chinese		
琵琶	旗袍	充沛
铅笔	清白	拥抱
English		
Paper	People	couple
Cabin	Rabbit	tibet
Italian		
Papa	Tempo	tipico
Tabacco	Libero	tubo
Cappuccino	Cappello	coppa
Abbaiare	Babbo	fibbia