Advanced Foreign Language Learners: Prosodic Transition from L1 to L3

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Abstract—**This study provides more data from more typologically distant languages and focusing on interrogative sentences. Thus, this research addresses a key gap from previous studies that have only studied prosodic transitions between more typologically close languages. Moreover, this study successfully controls for the background of participants in a more detailed way by setting limitations on participants' language proficiency and the recency of their language usage. These limitations are necessary since it is difficult to conduct research on prosodic transitions within 3 languages due to the limited number of trilingual participants. Finally, this paper finds that for people who speak second language (L2) and third language (L3) with high proficiency, the influence of phonological characters from L1 will be more prominent than that of L2 on L3 intonational status. This study can be improved, as the amount of data collected is limited. Besides this problem, intonational typology considered in this paper should be re-evaluated in further studies.**

Index Terms—**L3 acquisition, intonation, advanced language learners**

I. INTRODUCTION

It has long been believed that the acquisition of a new language entails a series of interactions between the prosody of a person's *first Language* (L1) and languages that he or she has studied. Previous studies (such as Rasier and Hiligsmann [1]) have mainly studied the phonological interactions between two languages. *Second language* (L2) is usually understood as the language that a learner acquires after infancy, and the *third language* (L3) is used in the sense of language acquisition order, that is, L3 is acquired after L1 and L2. However, the number of studies into the phonological interactions during the acquisition of a third language is still limited.

Some studies revealed the impact of previously learned foreign language(s), rather than only the mother tongue, on the phonetic performance in a third language (cf. Meisel 1983, Cenoz 2001 [2], Hammarberg 2001, Hammarberg & Hammarberg 2005 [3], Fernandes-Boëchat 2007, Wrembel [4] 2010). Other studies have provided evidence that in the area of phonology, L2 actually has a greater role to play comparing to L1 in comprehension and production of a L3 (see e.g Stedje, 1977; Chandrasekhar, 1978; Chumbow, 1981; Ringbom, 1987; Singleton,1987).

Several factors should be considered when analyzing the transfer during the acquisition process of a L3, including foreign language effect [1], proficiency level, recency of use or the context of interaction, typological distance (see e.g.,

Piske *et al.* [5] 2000, Cenoz [6] 2001, Jessner [7] 2006 for a detailed discussion thereof).

De Angelis and Selinker [8] claimed that there is some kind of "a potential talk foreign" or "foreign language cognitive mode" that facilitates the path of interlanguage transfer. Several psycho-affective factors are at play in the process. Among them, the attitude of the language learners was one of the most powerful factors. Hall and Ecke [9] concluded that there is a stronger transfer between L3 and L2 than L3 and L1, which could be attributed to stronger links between foreign languages in the speaker's mind.

The most recent studies based on participants' perceptual judgements maintain that although L2-accented speech prevails at the initial stages of third language acquisition, it diminishes with the increase of L3 proficiency and gradual approximation to the target norm [4]. In 2016, in Langages, Steien and Chantal [10] concluded that in the intonational system, the influence of the first language on the third language is stronger than the influence of second language, thus, the direction of language transition can be depicted as – "L1>L2 / L3".

Serving as a complement to studies on transitions between three languages, this research firstly, aims at answering the question of which language has a more powerful influence on the $f0^1$ characters acquisition [2]. Secondly, this paper seeks to provide a prosodic transition in L3 acquisition with a larger dataset while promoting the particular methods employed to investigate this question, as it will:

1. Provide data from languages that are more typologically distant, and the data also helps us to evaluate the importance of this fact for the phonological acquisition of foreign languages.
   Previous research investigated only the L3 phonological status of participants whose L1, L2, L3 are respectively Norwegian, English and French or Finnish, English and German. The typological distance between these three languages is closer than that in this study.
2. Investigate the source of influence on L3's prosodic features with only interrogative sentences. The previous studies only looked into intonation acquisition of declarative sentences or compared perceptual judgements of participants.
3. As participants in this study have the same study pattern because of the Chinese educational system, this study is able to restrict the participants' language level in a more precise way.
4. Control the recency of use or the context of interaction of participants.

This study also tries to provide explanations for the

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[1] F0 refers to fundamental frequency defined as the lowest frequency of a periodic waveform.

phenomena that we have observed with participants' spectrograms. The influence of pitch characters of L1 has been found to be more prominent than that of L2 in L3 phonological status for advanced language learners

II. METHOD

The primary hypothesis of the study is that the influence of pitch characters of L1 is more prominent than that of L2 on L3 phonological status for advanced language learners (the levels of their L1, L2, L3 achieved B2 and above).

To test if this hypothesis:

I firstly collected audio recordings of sample sentences.

Upon completion of this stage, I compared the intonational differences across three languages with spectrograms collected from participants (Group B) as well as conclusions from previous studies of intonational features of interrogative sentences in Chinese, French and English.

The goal of this paper is not to build up intonational models of each of these three languages, but rather to determine the transfer capacity of L1 and L2 to L3. The paper does not investigate how these three languages vary in a detailed way. Nevertheless, this study is based on the phonological phenomena of interrogative sentences in three languages. Therefore, a comparison of intonational differences among the three languages is of necessary. However, due to the lack of analysis of French interrogative sentences due to limited work in this field, this study also collected audio of the declarative sentence: "Vous savez chanter."

Sample sentences:

The speech data consists of 2 French sentences, 1 declarative and 1 interrogative:

Vous savez chanter?

Vous savez chan Sample sentences:

The speech data consists of 2 French sentences, 1 declarative and 1 interrogative sentences:

Vous savez chanter?

Vous savez chanter.

(You   can sing?/.)

Prosodic focus is a phonetic means of highlighting part of an utterance against the rest of the constituents Bolinger [11]. While there is prosodic focus in English, prosodic focus does not exist in French, because French syllables are produced and perceived in rhythmic groups [12], while English is usually considered to be stress-timed.

The focus for this question lies in "can" – signifying the ability of singing

Participants:

1. Chinese participants

15 native Chinese speakers, whose L2 is English and L3 French.

All of the participants started learning English at the age of 7 and French at the age of 18. When they participate in this test, their English level has achieved C1 and French above B2. All these participants, when being tested, were still studying French as their major in university.

2. French participants

5 French native speakers were asked to read these two French sentences aloud.

All the subjects are females, because f0 is highly influenced by gender [13].

Recency of use or the context of interaction for participants of Group A, see the Table I below:

(The hour of recency of use or context of interaction per week)

TABLE I: RECENCY OF USE OR THE CONTEXT OF INTERACTION

Index of student	listening	speaking	reading	writing
1	2	10	1	20
2	5	5	5	5
3	4	0	3	3
4	2	Between 0 and 1	4	4
5	3	1/3	3	3
6	1	0	1	3
7	1.5	0	3	56
8	0	0	0	0
9	1	0	2	6
10	4	0	2	10
11	2.5	2.5	2.5	2.5
12	1	0	1	0
13	56	0	Between 2 and 3	between 4 and 5
14	3	2	8	8
15	4	1	5	I do not know

From the table above, it can be concluded that participants spend the most learning hours on writing, and the least learning hours on speaking regarding these four factors.

Task:

The speakers read the text aloud once. They were instructed to read the text with a natural, conversational intonation, and were asked to repeat any sentence when they misread it. The recordings took place in a quiet room, and each recording session lasted about 30 seconds. The audio signal was acquired digitally on a computer via PRAAT 44100kHz. The utterances were recorded with AKG GN30 microphones.

Comparing intonational differences in three languages:

The aim of this paper is to show that the character of the pitch of L1 is more prominent than that of L2. Therefore, we aim to determine whether:

First and foremost:

some prosodic characters do not exist in L3 French. Otherwise, it would be reinforced in learning (such as French liaison), and with this reinforced study, the results from such trained data would not be representative of students' speech.

With the variables such as language proficiency, recency of use or the context of interaction for participants controlled, the last factor that should be considered is the typological distance between the three languages.

Typology is usually explained in the following ways:

Firstly, Language similarity denotes languages that belong to the same language family, and which are closely related and highly similar to each other — for example, French, Italian, Portuguese and Spanish are all Romance languages.

Secondly, a less common approach is to consider typology from the perspective of geographical relevance. For example, although Albanian, Romanian and Bulgarian do not belong to the same language family, Albanian, Romanian and Bulgarian have some linguistic similarities due to their similar geographical location [14].

From evaluating either of the perspectives mentioned above, French should be typologically closer to English. Therefore, this study aims to find intonational features that both satisfy the following two conditions:

i. intonational features that do not exist in French.
ii. intonational features that only exist in Chinese but do not exist in English.

According to the various definitions of typological distance, French should be typologically closer to English. It would be difficult to explain what kind of role that typological distance plays if this study selected intonational features that only exist in English but do not exist in Chinese. In order to rule out the influence from typological distance, the features to be compared in the study should satisfy both conditions (i) and (ii), as these features could explain the transition capacity from L1 and L2 to L3. If L3 French speakers adopt these Chinese f0 characters, it will be shown that for advanced language learners, the phonological influence of L1 is more prominent than that of L2 for the phonological acquisition of L3.

III. RESULTS

By analyzing the spectrograms collected, we have found two intonational features that satisfy both conditions mentioned above.

A. Feature 1: "Rising Tone" Versus "Elevation of Pitch"

In Chinese, one of the intonational characters of interrogative sentences is that there will be a rising tone at the last syllable of a sentence to demonstrate the "interrogativity" (the intonation change which enables a declarative sentence to be interrogative) of the sentence (Lin 2004). In English, such rising tone exists in interrogative sentences as well. Unlike interrogative sentences in Chinese, this rising tone in English falls on the focus of the sentence, which lies in "can" in the sample sentence of the study.

In terms of French interrogative sentences, if this sentence has a question marker, such as "que", "quel", "où", etc. (meaning "what", "which" and "where"), a rising tone that demonstrates the interrogativity of a sentence will be optional.

The difference between French interrogative sentences and Chinese interrogative sentences should be best depicted as "rising tone" and "elevation of pitch". This study intends to distinguish the difference between "rising tone" and "elevation of pitch" in the first place.

i. rising tone

"Rising tone" happens inside of the last syllable of an interrogative sentence. If the "rising tone" exists in an interrogative sentence, it should take place inside of the last syllable of a whole sentence. For example, for the sentence "Vous savez chanter?", the rising tone falls on the capitalized part – "vous savez chanTER."

ii. elevation of pitch

"Elevation of pitch" happens between the first syllable of the last word and its previous syllable. As for the interrogative sentence "Vous savez chanter?" in the example sentences, this "elevation of pitch" takes place inside of the capitalized parts "vous saVEZ ~ CHANter.

1) Chinese native speakers: Elevation of pitch & rising tone

For a French sentence without any question marker, such as "que", "quel", "où", etc. (meaning "what", "which" and "where"), most Chinese participants expressed the interrogativity of such sentences with both an elevation of pitch and a rising tone.

Here is a spectrogram generated by a Chinese participant, and the sentence of utterance is: "Vous savez chanter?" See the Fig. 1 below:
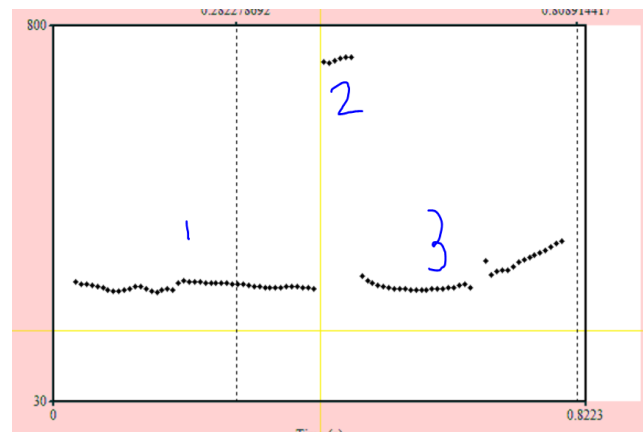

Fig. 1. "… vez chanter?" (Chinese L1 speaker).

In Fig. 1, here 1 is "vez", 2 is "chan" and 3 is "ter".

This elevation of pitch existed between 1 "vez" and 2 "chan".

Inside of the last syllable 3 was a rising tone.

Thus, Chinese speakers expresses the interrogativity of a French sentence with both "elevation of pitch" and "rising tone".

2) French native speakers: Only elevation of pitch

For a French sentence without any question marker, most French native speakers expressed the interrogativity with an elevation of pitch. No rising tone was found in any of the participants' spectrogram.

Here is a spectrogram generated by a French native speaker. The sentence of utterance is: "Vous savez chanter?" See the Fig. 2 below.

In Fig. 2, the part marked by 1 is "vez", by 2 is "chan" and by 3 is "ter".

While between 1 and 2, an elevation of pitch was found, there was no rising tone inside of the last syllable 3 – as we can see the pitch contour of the last syllable "ter" in this spectrogram is flat.
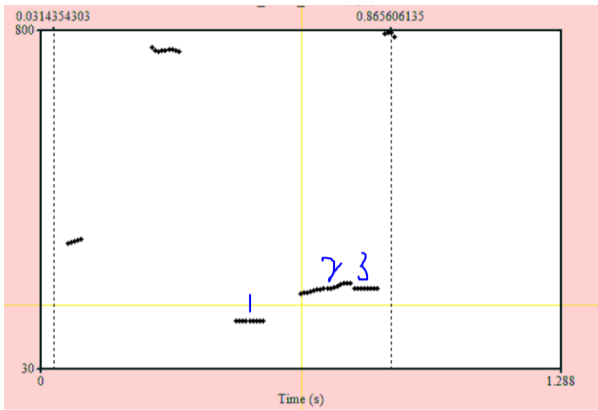
Fig. 2. "… vez chanter?" (French L1 speaker).

3) The experiment result of Chinese participants

Among 15 Chinese participants, 14 of them uttered the French interrogative sentence: "Vous savez chanter?" with both an elevation of pitch and a rising tone, so the transition rate of L1 to L3 is 93.75%. This suggests a strong influence from L1 on L3.

B. Feature 2: Only in Chinese: The Highest f0 and the Lowest f0 Inside of the Last Syllable of an Interrogative Sentence are Respectively Higher Than These of a Declarative Sentence

In Chinese, the highest f0 and the lowest f0 inside of the last syllable of an interrogative sentence should be higher than its counterparts of its parallel declarative sentence (parallel declarative sentence means that the content of the sentences are the same. They only differentiate in their intonations). This feature in Chinese interrogative sentences can be seen in the Fig. 3 below.
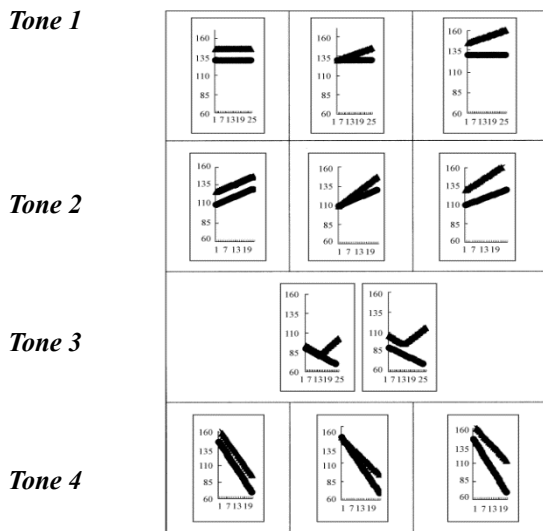

Fig. 3. The pitch of the last syllable of interrogative sentences and their declarative counterparts in Chinese, varied by four tones in mandarin Chinese.

Spectrograms generated by most Chinese students demonstrated the same feature: the highest f0 and the lowest f0 of the last syllable in an interrogative sentence are higher than those of its counterpart in the parallel declarative sentence.

Here are the results of participants' spectrogram analysis, see the Table II below:

TABLE II: THE RESULTS

Index of audios	Interrogative sentence		Declarative sentence		Did feature 2 exist?
Unity Hz	Min	Max	Min	Max	Yes or no
1	289	355	220	262	Yes
2	**211**	**274**	**216**	**240**	**no**
3	218	283	208	236	Yes
4	196	284	173	201	Yes
5	**239**	**265**	**324**	**221**	**no**
6	298	368	186	217	Yes
7	**217**	**231**	**155**	**251**	**no**
8	246	278	225	261	Yes
9	140	198	94	102	Yes
10	255	305	202	232	Yes
11	353	388	179	194	Yes
12	265	288	223	236	Yes
13	226	292	213	228	Yes
14	284	332	224	234	Yes
15	255	360	206	231	Yes

Among 15 Chinese participants, 12 of them uttered the French interrogative sentence: "Vous savez chanter?" with feature 2. The transition rate of L1 to L3 is 80%, which can again support a strong influence of L1 on L3.

IV. DISCUSSION AND CONCLUSION

This study provides more data for phonological interactions between multiple languages, and it has expanded the studies on prosodic transition between three languages with two languages that more typologically distant – Chinese and French. This study has a good control of participants' language proficiency and their recency of language usage. This research also studied the phonology transition to L3 from an interesting point of view, as researchers before did not study the language transition from the perspective of fundamental frequency. Besides that, previous research did not investigate the question about intonational transition with interrogative sentences either.

Since we do not know whether a shorter typological distance can influence the prosodic transition between multiple languages, when comparing features of French interrogative sentences with Chinese and English interrogative sentences, by selecting the intonational features that neither exists in French nor in English, this study ruled out the potential impact of typology distance of languages. This study has found two features that only exist in Chinese, and they are (1) the rising tone and (2) the pitch span of the last syllable (more precisely, in Chinese, the highest f0 and the lowest f0 of the last syllable in an interrogative sentence should be higher than its counterparts in the parallel declarative sentence). In terms of the first feature, 14 out of 15 Chinese participants uttered the interrogative French sentence with both an elevation of pitch and a rising tone, and this is different from French participants, as French participants expressed the "interrogativity" of the same

sentence only with an elevation of the pitch. In terms of the second feature, 12 out of 15 Chinese participants uttered the interrogative French sentence with this feature, that is the highest f0 and the lowest f0 of the last syllable in an interrogative sentence were higher than their counterparts in the parallel declarative sentence.

With the outcomes of the experiment, this paper found that the influence of prosodic characters of L1 is more prominent than that of L2 in L3 phonological status for advanced language learners (advanced learner means that the levels of participants' L1, L2, L3 achieved B2 and above).

Why did Chinese participants utter French interrogative sentences with a rising tone? The assumption is that Chinese is the only tone language among the three languages (Chinese, English and French). Therefore, the variation of f0 inside Chinese syllable is more obvious than languages that have no tones.

What can serve as the explanation to the second feature in this paper? It can be assumed from a syntactic point of view, question markers inside an interrogative sentence in Chinese is usually not at the beginning, and this lessens the attention drawn on the syntactic ground. As a consequence, interrogative sentence in Chinese asks for the license from the prosodic environment, and this might be a reason to explain why the highest f0 and the lowest f0 of the last syllable in a Chinese interrogative sentence are higher than its counterparts in the parallel declarative sentence.

Some people might question that whether the non-discussed phonological features in L2 are acquired by participants, and if they are acquired, will they influence the prosodic transition in multi-language acquisition. However, this question can be solved with the following reasoning: if the features of L2 are more influential than those of L1, then the non-discussed features of L2 will outpower the features of L1. The results of the paper rejected the idea that L2 outpowers L1 in multi-language acquisition, as they showed that the L1 feature is applied to L3. It is to be concluded that, for advanced language learners, the prosodic transition from L1 to L3 is more prominent than the prosodic transition from L2 to L3, which confirms the hypothesis of this study.

Nevertheless, this study can be improved, as the amount of data collected is limited. Besides this problem, typology should be re-evaluated in further studies: typology studies on non-discrete phonological features should be of vital importance for this paper. By that I mean questions such as how to calculate the similarities between languages by measuring non-discrete phonological features of tones and of intonations, since previous studies have only tried to calculate similarities between languages by analyzing their segmental features. Studies on prosodic transition need more theoretical support from studies on the non-discrete phonological features. The question whether the typological distance between English and French is closer than the distance between Chinese and French in phonological system remains dubious. The discussion of the paper only limits itself to assumptions without further studies on language typology. Whether these assumptions in this paper are right or not can be discussed in further studies.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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