Prosodic Analysis on English Mild Imperatives of Chinese EFL Learners

Xia Wang[1,2], Aijun Li[2], Jia Sun[1,2], Yun Mai[2]

[1] Nokia Research Center, Beijing
[2] Institute of Linguistics, Chinese Academy of Social Sciences
xia.s.wang@nokia.com, {liaj,maiyun}@cass.org.cn, sunnyj_abc@126.com

Abstract

The present study investigates the prosodic differences of English mild imperative sentences between native American English speakers and Chinese EFL (learning English as foreign language) learners within the framework of AM Theory. The study found out that prosodic native speakers and Chinese EFL learners exhibit the following prosodic differences: (i) phonological patterns of sentence-stress realization, specifically, number and location of the stress, and types of boundary tones. Comparatively speaking, for mild imperatives, native speakers apply two kinds of tones, low rising tone (L*H) as well as falling (H*L) tone to pronounce sentential stress while Chinese EFL learners apply high-level (H*) or rising-falling (H*L) tone; for Chinese EFL learners, the longer the sentence is, the more words are given prominences; (ii) patterns of boundary tones, according to different moods, mild imperatives can be uttered differently by native speakers, intonational phrase ending with H% or L%, however, for Chinese learners, only L% was adopted as boundary tone.

Index Terms: mild imperatives, tone, prosody, sentential stress, L1, L2, negative transfer

1. Introduction

With the improvement of phonetic technologies and the fast-growing need of communication, more attention has been given to language acquisition and language learning in a world-wide range.

At the beginning of language learning research, pronunciation problems were discussed, and many problems originated from ,negative transfer from the first language (L1). According to Zhang et al. [1], the lack of a sufficient similar vowel in the Mandarin system leading to particularly inaccurate productions in a manner consistent with the results of Flege et al. [2], who found that Mandarin speakers showed the least spectral accuracy when producing English vowels that are not found in Mandarin. For adult learners, it seems to be hard to speak the second language (L2) without accent. Moreover, except for different phoneme systems, intonational modes are also diversified [3], such as the PENTA model by Xu Yi, the Top-Bottom Line model by Shen Jiong, the STEM-ML model by Shih Chilin, etc. In addition the intonational model, based on the AM intonation theory, Lin Maocan [4] pointed out that there are two variables in Chinese intonation; the accents and the boundary tones.

Unlike previous studies, recent researchers shifted focus toward prosodic analysis of intonation pattern of Chinese EFL learners. Specifically, Cao Rensong [5] stated that Chinese EFL learners customarily read English words with Chinese four tones. He Shanfen [6] compared English word stress and Chinese neutral tones to get the conclusion that except for special cases, 'no word stress in Chinese' is the reason why Chinese students have problems on pronouncing stress correctly. And it has also been argued that this difficulty of producing English lexical and/or sentential stress may result in large part from the influence of native suprasegmental (tonal) categories (Archibald [7]; Chen et al., [8]). Also, research demonstrated that falling patterns are generally used to imply certainty and confirmation in statements, while rising patterns are used to indicate doubt and advice in questions. Xu & Liu [9] studied the phonetic realization of statements and declarative questions in American English with respect to focus and word stress, and compared it with Chinese intonation.

The whole picture of prosodic research is composed of different types of sentences. The present study focuses on the mild imperatives, trying to look for some prosodic regulations through comparative study within the framework of AM Theory.

In AM Theory, Pierrehumbert specifies three types of tonal events for the tonal inventory of English intonation [10], namely seven pitch accents (H*, L*, H*+L–, H–+L*, L*+H–, L–+H*, H*+H–), two phrase accents (H–, L–) and two boundary tones (H%, L%).

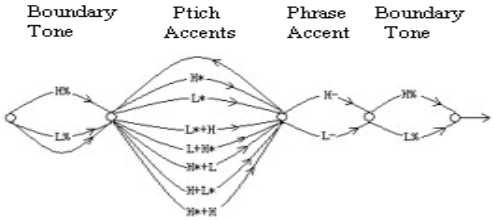

Figure 1: *The finite-state grammar of English intonation in Pierrehumbert*

Ladd proposed an improved grammar which can be used to generate all the legal tunes of English. [11]

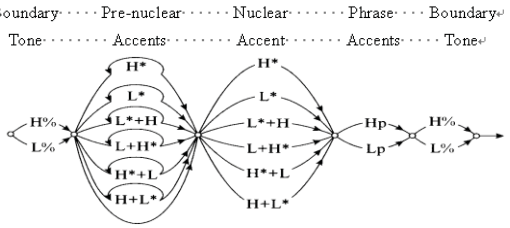

Figure 2: *The finite-state grammar of English intonation phrase in Ladd*

2. Research methodology

This study was carried out on the basis of "Chinese EFL (learn English as a foreign language) Learners' Speech Corpus with Multi-accents (CELSCOM [12]) which includes the speech sounds of 7 native American speakers and 12 Chinese EFL learners. The American speakers (6 male, 1 female) came from western America. The Chinese speakers (5 male, 7 female) came from international company in which English is one of the fundamental languages, and those speakers were Beijing

residents whose native language was standard Chinese. All of the Chinese speakers had no self-reported speech or hearing disorders. All mild imperative sentences in the corpus, which were digitized at 16 kHz sampling rate and 16 bit precision, were selected as the subjects to analyze. Altogether 190 (10/folder *19 speakers) sentences were processed with the following steps of annotation, perception experiment, data extraction, and picture drawing.

Table 1 is the original recording script with contextual environment. When doing current research, only the sentences starting with "Please" have been taken into account.

Table 1: *List of mild imperative sentences*

1	Please join our family for a picnic this weekend.
2	Please tape "American Idol" for me tonight. I'll be late.
3	Please say the name or phonebook index.
4	Please say one of the following names: Dennis or Smith. Or say "cancel" to start over.
5	Please tell Dad to call me when he gets home. I can't seem to reach him.
6	Please hurry home. I have a pile of dishes that needs washing.
7	I just ripped my pants trying to do the splits. Please pick up another pair of jeans for me.
8	Hi! How are you doing? Please give me that job. I will pay you a commission.
9	Please let me know if you need help with the baby.
10	Please wait while the information is retrieved from the web.

2.1. Annotations

The speech data was phonetically and phonologically annotated by a combination of both ToBI and IViE systems. ToBI (Tones Break Indices) [13] is the earliest system of English prosodic annotations, which is also the basis of IViE (Intonational Variation in English) [14], a system concentrating on intonational differences among dialects. The present study adopted the combined annotation system in order to give detailed phonetic and phonological analysis to both inter and intra structures. Applying only one system to give descriptions is not sufficient.

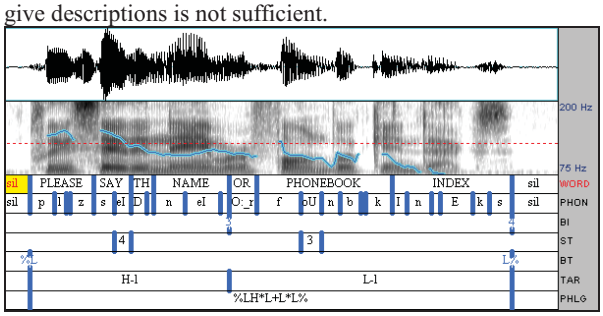

Figure 3: *Annotation for English uttered by a native speaker: "Please say the name or phonebook index."*

As shown in Figure 3, annotation tiers are:

- WORD: boundaries of each word;
- PHON: boundaries of phonemes. "*" indicates mis-pronunciations, and the phoneme in brackets is the standard one; "-" indicates phoneme missing phenomenon, and the phoneme in front of "-" is the missing one;
- BI: break index, including boundaries for minor phrase (3) and intonational phrase (4);
- ST: stress tier, the number 3 and 4 corresponding to different stress levels;
- BT: initial and final boundary tones, including H% and L%;
- TAR: target tier, a phonetic description toward tonal changes;
- PHLG: phonological tier, a linguistic description toward intonation pattern

2.2. Perceptual experiment

This study focuses on the prosodic differences between native American English speakers and Chinese EFL learners, one of which is the phonetic realization on the place of sentential stress. Therefore, a perceptual experiment was conducted. 8 native Americans were recruited as subjects. Their task was to mark out the prominent word(s) and pauses if there's any on paper through listening. All 190 sentences were randomly broadcasted as the stimuli for the perceptual experiment.

2.3. Data extraction

Data annotation was conducted using the program of Praat (http://www.fon.hum.uva.nl/praat/). Speech was first labeled by automatic segmentation software, and then the syllable boundaries were modified manually. Before extracting the data, the manual refinement of the pitch tier was conducted in order to ensure the accuracy of the data. The F_0 values were extracted by a Praat script with 10 sampling points for each phoneme. In order to neutralize the pitch differences due to gender and personal varieties, the F_0 values was transferred from Hz to semitone values and then normalized in 5 tone letter space. F_0 of each voiced phone was extracted in 10 points except those creaky voices.

3. Results and Discussion

This part explores the intonational differences between native American English speakers and Chinese EFL learners from several aspects, number of prominent words, phonetic and phonological realization on the stressed word and types of boundary tones. F_0 was employed as the parameter and it mainly concerned with the acoustic manifestations and phonological explanation.

3.1. Number of prominent words

When analyzing the result of perceptual experiment, it was found out that the number of words with prominence of Chinese EFL learners was far more than that of the native American English speakers. 10 sentences, totaling 84 words for one speaker were taken into account. After counting, the ratio pictures of stressed words versus unstressed words of both American speakers and Chinese EFL learners were calculated (see Figure 4 listed below).

American speakers Chinese EFL learners

Figure 4: *Ratio pictures of stressed and unstressed words for both native American English speakers and Chinese EFL Learners*

An astonishing distinction can be observed from the above pictures. The number of stressed words of Chinese EFL learners is more than twice as large as that of American speakers. Figure 4 shows the statistics of words with prominence of one example sentence "Please join our family for a picnic this weekend." From the example, it is clearly shown that the number of words with prominence of Chinese EFL learners is far more than that of native American English speakers.

As for the stressed words, in English, content words usually bear the sentential stress (Liang Huaxiang, 1996) [15]. Pike (1945) [16] defined content words and function words in detail. Content words are words that have meanings that can be defined in a dictionary and probably have straight forward translation equivalent in other language; these include nouns, adjectives, most verbs and most adverbs. Function words, on the other hand, are verbs whose meaning may need to be explained in a grammar rather than a dictionary, and which may not have exact equivalents in other languages; these include articles, pronouns, prepositions, articles, auxiliary verbs, and modal verbs.

According to the results of perceptual experiment, for native English speakers, 77% (84 out of 109 stressed words) were content word, i.e. 21% were functional words. However, for Chinese learners, 39.3% (164 out of 417 stressed words) were assigned to functional words, such as pronouns and prepositions. Most linguists agree that English sentences, except for some questions, follow a step-down pattern, especially the part after the stressed word/focus. According to this consensus, it is understandable that why there are more peaks in the learners' production, which can be better observed in Figure 5.

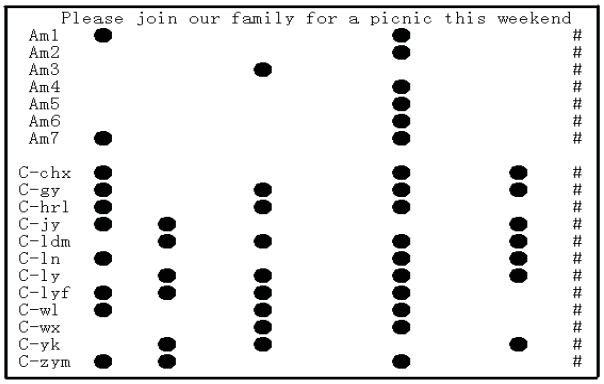

Figure 5: *Statistics of words with prominence of the sentence "Please join us for a picnic this weekend.", in which "●"refers to the word with prominence*

3.2. Phonetic realization

The phonetic realization of English mild imperative sentences was investigated with fundamental frequency (F_0) as a parameter. Specifically, this part examined the manner of the effect, specifically taken to mean rising or lowering of F_0. The longitudinal coordinates of all figures are represented in transformed 5-grade system. Following Figures showed the pitch contours of the sentence "Please say the name or phonebook index." of both native English speakers and Chinese learners. As shown in the following figure, according to the location differences of prominent words, the sentences can be categorized into several groups. Obviously, more peaks can be observed in the learners' production.

According to the results of perceptual experiment, this group of sentences can be divided into three parts by the location differences of the prominent words, stressed PLEASE, stressed SAY and stressed NAME.

Terken and Hirschberg [17] once concluded that sentential stress usually locates on the word/phrase with new information. Normally, the word "PLEASE" indicates more polite expression, so it is acceptable that "PLEASE" in the sentence bears sentential stress in order to raise its prominence.

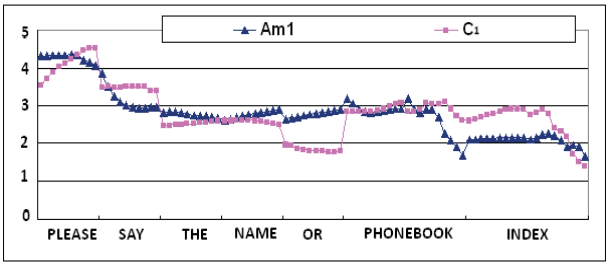

Figure 6: *Time-normalized F_0 contours of "Please say the name or phonebook index." with "Please" as stressed word*

Figure 6 is the F_0 contours of "Please say the name or phonebook index." with the sentential stress on PLEASE. Both American speakers and Chinese learners adopt a falling tone (H*L). It seems to be similar, but when we go to the target tier, differences can be observed, with H-l for American speakers and mH-l for Chinese learners.

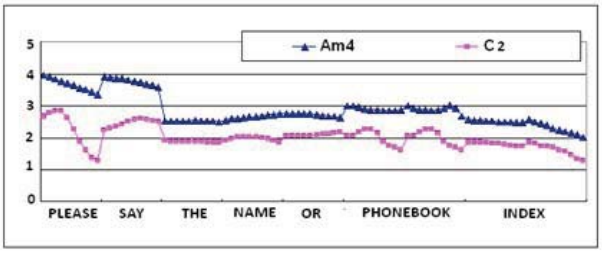

Figure 7: *Time-normalized F_0 contours of "Please say the name or phonebook index." with "SAY" as stressed word*

For native speakers, lowering or flat pattern were frequently applied, while for most learners, raising-falling patterns were favored. The same phenomenon can be observed in Figure 7. In Figure 7, the word "SAY" bears sentential stress. When giving phonological representation, "H*L" was adopted for both native English speakers and Chinese EFL learners. However, applying detailed observation, before falling, the tone of Chinese EFL learners first rises a little.

Figure 8 is the F_0 contours of "Please say the name or phonebook index." with the sentential stress on NAME. When American speakers applied a low-rising (L*H) on the stressed word, Chinese EFL learners adopted a falling tone (H*L).

As being mentioned in the previous discussion, most native English statements follow a step-down pattern, especially the part after the stressed word/focus. However, it is hard to draw a conclusion on the learners' production.

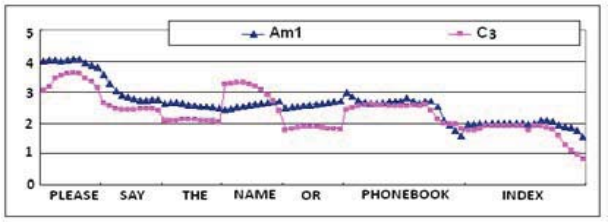

Figure 8: *Time-normalized F_0 contours of "Please say the name or phonebook index." with "Name" as stressed word*

It has been summarized that, for negative imperatives, native speakers usually apply lowering or flat pattern to make sentential stress prominent while Chinese learners prefer adopting rising pattern (Wang Xia 2009) [18]. For Yes-No questions, Ji Xiaoli showed that American speakers apply a low rising tone (L*H) on nuclear word, while Chinese EFL learners always apply high-level tone (H*) or falling tone (H*L) on nuclear accent [19].

As mentioned in previous chapters, negative transfer from L1 has always been judged as the reason for improper expression. One former study, which focuses on Chinese strong imperatives, could provide support fro this conclusion [20]. Figure 9 shows the pitch contour of "Ben4 (HL) dong1 (HH) bian_r0 <Go eastwards>" in both mild and strong imperative sentences, with sentential stress on DONG. From Figure 9, it is clearly shown that, a falling tone (H*L) was adopted for both mild and strong imperatives.

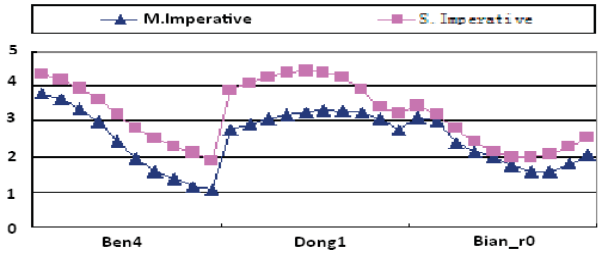

Figure 9: *F_0 means of Chinese mild and strong imperatives of "Ben4Dong1Bian_r0" (Go eastwards!)*

3.3. Boundary tone

English mild imperative sentences usually indicate two moods, one is request and the other is polite order. According to different moods, sentences may end differently (Zhao Yongxin, 1988) [21]. In most cases, a falling tone is a common pattern for statements, wh-questions, echo questions, imperatives and exclamations (Tench 1996:88) [21]. In the 70 mild imperatives of American speakers, 11 ended with rising boundary. However, Chinese learners only adopted falling tones in the expressions. From this aspect, it can be concluded that native speakers are flexible on the choices of boundary tones, while Chinese learners usually strictly follow the rules in textbook.

4. Conclusion

Comparing the productions from both native American English speakers and Chinese EFL learners, we observed that native speakers applied 2 kinds of tones, low rising tone (L*H) as well as falling (H*L) tone to make sentence-stress prominent while Chinese learners applied high-level (H*) or rising-falling (H*L) tone. For Chinese learners, longer sentences exhibited more words with prominence. Mild imperatives usually indicated two moods: according to different usages, native speakers were flexible on the choices of boundary tones, while Chinese learners usually strictly followed the rules of textbook. Once the prosodic regulations of learned English are found, it can hopefully expected to do contribute to the improvement of Chinese EFL learners in speaking English,, and enhance current speech technologies as well as Computer Aided Language Learning (CALL) systems.

5. References

[1] Yanhong Zhang, Shawn L. Nissen, and Alexander L. Francis, "Acoustic characteristics of English lexical stress produced by native Mandarin speakers", Journal of the Acoustical Society of America, 2008, 4498.

[2] Flege, J.E., Bohn, O.S., and Jang, S., "Effects of experience on non-native speakers' production and perception of English vowels", Phonectics, 1997, 437-470.

[3] Li,A., Lin, M. "Studies on Chinese Prosody-Professor WU Zongji's thoughts on prosody and their far-reaching implications", Proc. of PCC 2008, Beijing, China, 2008.

[4] Lin, M., "Interrogative Mood and Boundary Tone in Chinese", Report of Phonetic Research, Beijing, 2006, pp. 5-15.

[5] Cao Rensong, "Negative Transfer of features of Chinese tones to English intonation learning", Journal of Dalian Maritime University, Dalian Maritime University Press, Dalian, 2008.

[6] He Shanfen, Comparative Study of English and Chinese, Shanghai Waiyu Jiaoyu Press, Shanghai, 2002.

[7] Archibald, J. "The acquisition of English stress by speakers of non-accentual languages: Lexical storage versus computation of stress", Linguistics, 1997, 167-181.

[8] Chen, Y., Robb. M.P., Gillbert. H.R., and Lerman, J. W., "A study of sentence stress production in Mandarin speakers of American English", Acoust. Soc. Am. 4, 2001, 1681-1690.

[9] Liu, F. and Xu, Y., "Question Intonation as Affected by Word Stress and Focus in English", 16th International Congress of Phonetic Sciences, Saarbrucken,Germany, 2007.

[10] Pierrehumbert, J. The Phonology and Phonetics of English Intonation, MIT, 1980.

[11] Ladd, D. R, Intonational phonology, Cambridge University Press, Cambridge.1996.

[12] JI Xiaoli, SUN Jia, WANG Xia, LI Aijun. Chinese EFL<learn English as a foreign language>Learners' Speech Corpus with Multi-accents, Proc. Of NCMMSC2009, Lanzhou.

[13] Silverman, K.E.A., Beckman, J. F., Pitrelli, M. Ostendorf, C. Wightman, P. Price, J. Pierrehumbert, and J. Hirschberg. ToBI: A Standard for Labeling English Prosody. Proc. Of the 1992 International Conference on Spoken Language Processing, Canada, 1992

[14] Jia, Y. and L,i A., "An Introduction to IViE English Labeling System", Report of Phonetic Research, Beijing, 2005, pp.76-80.

[15] Liang Huaxiang, "Study of English sentential stress", Journal of Guangxi University, Guangxi University Press, 1996.

[16] Pike, Kenneth L., The intonation of American English, University of Michigan publications, Ann Arbor, 1945.

[17] Terken, J. and Hirschberg Jones, "Deaccentuation of words representing 'given' information effects of persistence of grammatical function and surface position", Language and Speech, 1994, 125-145.

[18] WANG Xia, SUN Jia, LI Aijun. A Comparative Study on Prosody of English Negative Imperatives for Chinese EFL Learners, Proc. Of O-COCOSDA2009, Beijing.

[19] JI Xiaoli, WANG Xia, LI Aijun. Intonation Patterns of Yes-No Questions for Chinese EFL Learners, Proc. Of O-COCOSDA2009, Beijing.

[20] Zhao Yongxin, Comparative study on imperative sentences of Chinese and English, Yuyan Jiaoxu Yu Yanjiu, 1988.

[21] Tench. P., The Intonation System of English, Cassell, 1996.

[22] JI Xiaoli, SUN Jia, WANG Xia, LI Aijun. Chinese EFL<learn English as a foreign language>Learners' Speech Corpus with Multi-accents, Proc. Of NCMMSC2009, Lanzhou.

[This paper was published in Speech Prosody 2010]