| **RESEARCH ARTICLE**

An Analysis of Prosodic Features of Chinese EFL Majors' English Questions

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| **ABSTRACT**

Drawing on the Auto-segmental Metrical theory in intonational phonology, this paper reveals the phonological structure of English interrogatives between Chinese EFL majors and native speakers from a syntactic pragmatic perspective, based on reading documents of eight English majors with Praat being its research tool. Findings show that the prosodic characteristics of interrogatives of English majors are obviously different from those of native speakers, which are mainly reflected in the segmentation of tone groups, boundary tone, intonation nucleus, and stress distribution. It purports to help English majors clarify the important pragmatic functions of intonation in information transmission and interpersonal communication, and foster strengths and circumvent weaknesses so as to better develop "Chinglish pronunciation" with Chinese characteristics; meanwhile, to bring enlightenment to English intonation teaching.

1. Introduction

Intonation can convey syntactic, pragmatic, and emotional information. In order to better understand how intonation conveys information, it is not enough to focus only on the acoustic variables that represent this information, but also necessary to combine the specific intonation variables (such as rising and falling boundary tones) reflected in the pitch curve diagram of intonation with the linguistic characteristics of utterance (such as syntactic characteristics; interrogative types) (Ladd, 2008:213). Therefore, the study of syntactic, pragmatic, and prosodic features has become an important field of prosodic research (Ladd, 1983; Selkirk, 1986; Steedman, 2000). Interrogatives are utterances in which the speaker tries to ask or confirm information. The intonation of the speaker is different in the two situations (Haan, 2002). Previous research has been conducted on three categories: one is the study on the intonation characteristics of single English interrogatives (Chen, 2006; Yuan, 2010); one is the contrastive study of interrogative intonation between English and Chinese (Lu, 2004; Guo & Shi, 2011) or interrogative intonation characteristics based on dialect (You, 2009; Erde & Wang, 2013); the other is the study of the function and meaning of English interrogative intonation (Yu, 2004; Hong, 2008; Chen, 2010). It can be seen that there are few empirical studies on the prosodic structure of English interrogatives of Chinese learners, and most of them only involve one sentence pattern of interrogative sentences, let alone comprehensive analysis from the perspectives of syntax, pragmatics, and intonation function. Therefore, this paper drawing on the Intonational phonology framework, uses the Praat acoustic software and combines syntactic and pragmatic functions of interrogatives to analyze prosodic features of English questions for college English majors, and reveal features and differences in phonological structure of English interrogatives between Chinese English majors and native speakers, so as to help English majors foster strengths and circumvent weaknesses in the aspect of intonation, which means not only carries forward "Chinese-English pronunciation" with Chinese characteristics but also avoids some problems caused by weak intonation awareness.

2. Literature Review

Auto-segmental Metrical theory (AM theory for short) emerged in the 1980s with the shift to nonlinear structures in modern generative phonology. The theory is a phonological analysis of English intonation summarized by Pierrehumbert in 1980. It is the compositional theory of intonation patterns. That is, intonation is described as a linear sequence combination that reflects the

change of pitch. The sequence combination consists of two variables, pitch accent, and edge tone. Pitch stress includes two monotone stresses (H*, L*) and four double-tone stresses (L*+H, L+H*, H*+L, H+L*). The edge tone consists of Phrase accent (H-, L-) and boundary tone (H%, L%). Ladd (2008) combined AM theory with traditional English intonation theory and proposed a new intonation pattern, which retained phrase accents and boundary tones but divided pitch accents into nuclear accents and pre-nuclear accents (See Figure 1).

Different types of interrogatives have different intonation patterns (such as boundary tone) and different meanings, for example,L*H-H% (low rise) is a typical intonation pattern of yes-or-no questions, L* indicates that the speaker is asking the listener to make a judgment or prediction, rather than confirming whether the listener has reached an agreement with the speaker because both parties already know the background information; the boundary tone H% indicates that the speaker expects the listener to pay special attention to the succeeding utterance so as to explain the utterance (Pierrehumbert & Hirschberg, 1990). The typical intonation pattern of wh-questions H*L-L% (high fall) indicates that the speaker is trying to get more information or initiate a sub-topic (Hedberg et al., 2009). For this special sentence form of interrogatives, it is very important to use appropriate phonological structure to convey information in speech expression; otherwise, misunderstanding or interruption of speech will occur.

Based on AM theory or intonational phonology theory, there are few empirical studies on prosodic features of interrogatives from the perspective of syntax and pragmatics, mainly including interrogatives of native English speakers (Bartels, 1999; Hedberg, Sosa & Fadden, 2004) and the study of interrogatives of native Dutch speakers (Haan, 2002). There is a lack of empirical research on prosodic features of English interrogatives of Chinese learners. Therefore, this study applies the theory of intonational phonology to analyze the prosodic features of English interrogatives of Chinese learners in combination with syntax
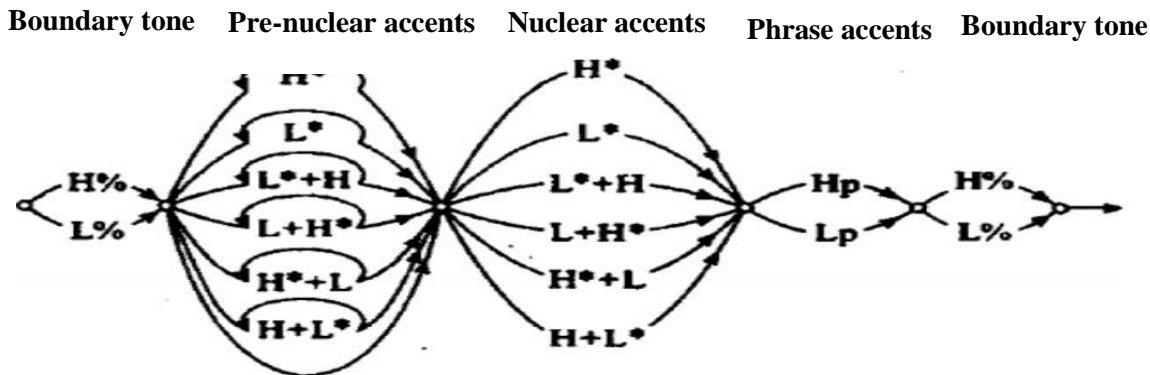
Boundary tone **Pre-nuclear accents** **Nuclear accents** **Phrase accents** **Boundary tone**

Figure 1: Finite-state grammar to generate tunes of English intonation proposed by Ladd (2008) according to Pierrehumbert's original analysis

3. Research Design
3.1 Research questions
This paper analyzes the prosodic structure of yes-or-no questions, wh-questions, and alternative questions of English majors from the combination of pitch stress, boundary tone, and tone group in AM theory. Specifically, this paper examines the following three issues:

1) Is there any difference between English majors and native speakers in the prosody of three types of interrogatives? If so, in what prosodic features?
2) What are the effects of these differences in prosodic features on pragmatic functions of discourse?
3) What implications does this study bring to intonation teaching for English majors?

3.2 Research tool and research data
The research tool of this study is Praat, an acoustic software. The corpus for this study comes from the real TOEFL listening test materials, which are parts of the large real corpus established by ETS, mainly covering the academic content of real lectures given by university professors and the daily campus dialogues between teachers or staff and students in and out of class. In this experiment, part of the phonetic data in the real listening test was selected as the model, and the characteristics of intonation processing were summarized. The audio was transcribed as the reading corpus for Chinese English learners.

3.3 Subjects
Eight English majors, including 6 girls and 2 boys, were selected from Jinan University. None of them had any travel history in Britain or America, and all of them had passed College English Test 6.

3.4 Data analysis

This study analyzes three typical interrogatives of yes-or-no question, wh-question, and alternative question (see Table 1). Each type contains two groups of sentences, which are divided into long sentences and short sentences according to their number of syllables. These representative sentence patterns are all selected from the situational dialogues in the TOEFL listening test materials.

Table 1: Examples of English interrogatives analyzed in this study

Type	Structure	Examples
Yes-or-no question	Auxiliary verb + subject + predicate verb + (object) + (adverbial)	*Can you explain it?* *Was there any particular dorm you were interested in?*
Wh-question	Wh-words + auxiliary verb + subject + (notional verb) + (object)	*What do you need?* *Why does the professor mention the solar wind?*
Alternative question	Element 1＋or＋element 2	*Did you say mellow or yellow?* *Does it have to be a book, or could you use a journal article?*

The data analysis of this study mainly includes the following steps: 1) Yes-or-no question: focus on the difference between learners' and native speakers's boundary tones. In this study, only the cases conforming to the specification are analyzed. 2) wh-question: The key nucleus of a wh-question is usually the non-final key nucleus, which usually moves forward to the auxiliary verb. Although the wh-word is not the key nucleus, it can be stressed. This paper analyzes the characteristics of tone group, intonation nucleus, stress distribution, and boundary tone. 3)Alternative question: Alternative questions are mainly composed of two or more phrases or sentences connected by the conjunction word "or." In view of the complexity of sentence patterns, this paper mainly examines the typical tone group segmentation and the characteristics of boundary tone.

4. Results and Discussion

4.1 The prosodic features of yes-or-no questions

In the sentence pattern of "auxiliary verb + subject + predicate verb + object," prosodic characteristics of tone group and boundary tone are basically the same as those of native speakers; that is, there is one tone group. In terms of tone type, the final boundary tone was mainly rise tone (75%), and a small number of students treated the final boundary tone as a flat tone or falling tone (12.5%). In the long general interrogative sentences led by "be +there," there is a significant difference in prosodic characteristics between English students and native speakers, mainly in tone group segmentation. Native speakers treat the main clause "was there any particular dorm" and the attributive clause "you were interested in" as a tone group, and the final boundary tone is rise tone. However, English majors mostly processed the main sentences and clauses into two or three tone groups (two-tone groups accounted for 50%, three-tone groups accounted for 12.5%), and only 37.5% of the students processed into one tone group. The end boundary tone of the flat tone was used by 12.5% of English majors (see Table 2).

Table 2: Prosodic features of yes-or-no questions of native speakers and Chinese students

Sentence pattern	Features	Type	Native speakers	Chinese students
I	Tone group	1	√	100%
	Boundary tone	Rise	√	75%
		Fall		12.5%
		Flat		12.5%
II	Tone group	1	√	37.5%
		2		50%
		3		12.5%
	Boundary tone	Rise	√	87.5%
		Fall		0
		Flat		12.5%

Note: I ="auxiliary verb + subject + predicate verb + object" short yes-or-no question; II = "be verb +there" long yes-or-no question; 1, 2, and 3 represent one tone group, two tone groups, and three tone groups.

Since the sentence pattern I is relatively short, both native speakers and learners process the sentence as a tone group. At the end of the boundary tone, native speakers use the rising tone. The difference lies in the boundary tone type. Native speakers use a fall-rise tone in boundary tone, while English majors mostly use a basic rising tone, as well as a falling tone and flat tone. The rising tone is usually used in yes-or-no questions, whether in the positive or negative form (Halliday, 2000:302). Combined with the context of the conversation, "can you explain it" is the assertion that the speaker requests the listener to give related information. Therefore, if the rising tone is used in the end boundary tone, pragmatically, it indicates that the speaker expects the listener to pay special attention to the succeeding utterance and give an explanation, which is consistent with the semantic transmission. Flat tone can be used as a question in the discourse function, but it indicates mentioning (known information) or insisting or strengthening; falling tone means that the current discourse does not need to be explained by subsequent discourse and is often used to indicate the completion and affirmation of information. According to the context of the conversation, the speaker is expecting further explanation about it from the listener, so it is most appropriate to use a rising tone at the end.
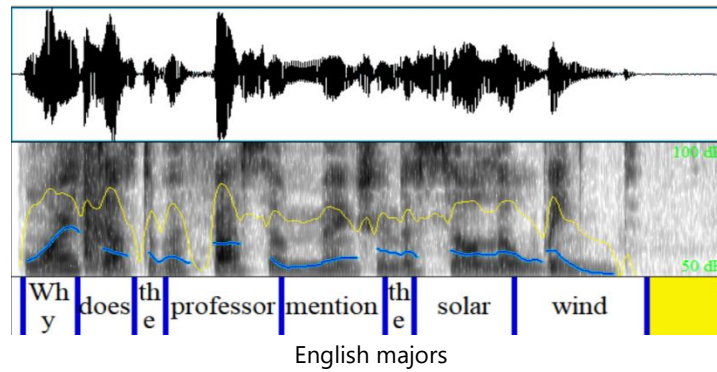
In the long yes-or-no question "Was there any particular dorm you were interested in," native speakers treat the main clause "was there any particular dorm," and the attributive clause "you were interested in" as one tone group, while English majors treat the main clause and attributive clause as two or even three-tone groups (Figure 2). Since the attributive clause, "you were interested in," modifies the object of the main clause, the object "dorm" is the important information that the speaker wants to convey. If the sentence is divided into multiple tone groups, the complete semantic transmission will be destroyed, and the attention of the listener will be distracted. The listener should grasp the main information in the main sentence rather than the clause or other components. In terms of boundary tone type, the final boundary tone of rising tone conforms to the pragmatic meaning of asking the listener to make a judgment and provide an answer to the question "whether there is a dormitory in which he is interested," so it is appropriate. A flat tone appears constrained, serious, not natural.

Figure 2: Screenshot of the spectrum of tune group segmentation at the end of the "be verb +there" long yes-or-no question

Native speaker

English majors

4.2 The prosodic features of wh-questions
The context of interrogatives of "wh-word + auxiliary verb + subject + notional verb " and "wh-word + auxiliary verb + subject + notional verb + object" are shown in Example 1 and Example 2 respectively.
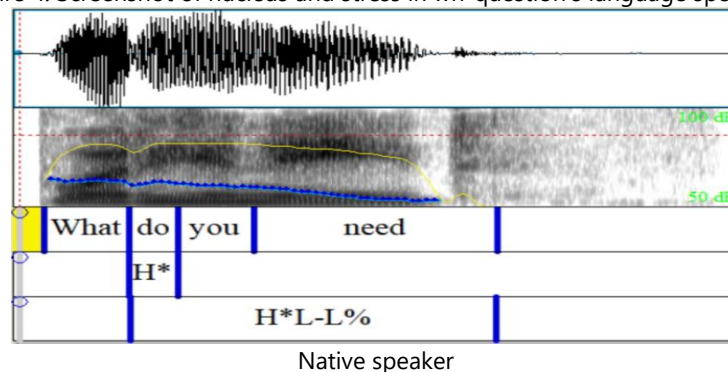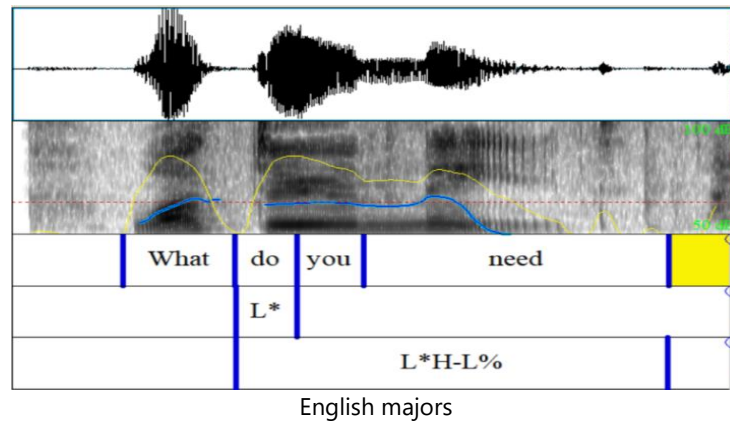
Example 1 :

    S: Excuse me. Can you help me with something?

    H: I'll do my best. [$_S$[$_{Spec}$ **What**] [$_{Aux}$ **do**] [$_{NP}$ **you**] [$_{VP}$ **need**]]
                                        H*   L- L%

Example 2 :

    S: **Why does the professor mention the solar wind**?
    H: He suggests a reason for early climate differences between Earth and Mars.

As for the short wh-question, there are significant differences between Chinese English majors and native speakers in accent, intonation nucleus, and boundary tone. Among them, native speakers mainly place stress and nucleus on the auxiliary verb "do"; however, Chinese students mainly placed the nucleus on notional verb (50%), the stress on wh-words (50%) and notional verbs (50%), and only a few students (12.5%) placed the stress on auxiliary verbs. In terms of boundary tone, the final boundary tone of native speakers is falling tone. In contrast, the final boundary tone of Chinese students is fall (62.5%), flat (25%), and rise (12.5%) (Table 3). As far as the long wh-question is concerned, there are differences between English majors and native speakers in tone group, intonation nucleus, and boundary tone. Native speakers treat it as one tone group; the intonation nucleus lies on the wh-word "why," and the final boundary tone is fall. English majors mainly treated it as one tone group (75%), while a few students divided it into two tone groups (25%). The nucleus was mainly placed on the wh-word "why" (87.5%), and a small part on the subject "The professor" (25%) and the object "the solar wind" (12.5%). 62.5% of the students treated the boundary tone as a falling tone and 32.5% as a rising tone. In terms of stress, due to the length of sentence pattern, differences between the stress patterns of English majors and native speakers are not obvious and complicated (see Figure 3), so it will not be discussed.

Table 3: Prosodic features of wh-questions of native speakers and Chinese students

Sentence pattern	Features	Type	Native speakers	Chinese students
I	Tone group	1	√	100%
	Stress	Wh-word(What)		50%
		Auxiliary verb	√	12.5%
		Subject(you)		12.5%
		Notional verb(need)		50%
	Nucleus	Wh-word(What)		25%
		Auxiliary verb(do)	√	12.5%
		Subject(you)		12.5%
		Notional verb(need)		50%
	Boundary tone	Rise		12.5%
		Fall	√	62.5%
		Flat		25%
II	Tone group	1	√	75%
		2		25%
	Nucleus	Wh-word(Why)	√	87.5%
		Subject(the professor)		25%
		Object (the solar wind)		12.5%
	Boundary tone	Rise		38.5%
		Fall	√	62.5%

Note: I = "wh-word + auxiliary verb + subject + notional verb" short wh-question; II = "wh-word + auxiliary verb + subject + notional verb + object" long wh-question.

Figure 3: Screenshot of stress pattern in wh-question's language spectrum

Native speaker

English majors

In terms of tone group, sentence pattern Ⅰ is shorter, so both native speakers and English students treat it as a tone group. Sentence pattern ⅠⅠ is long, and native speakers and most English majors treat it as one tone group, but some English majors divide it into two tone groups, that is, the professor*// mention the solar wind (" *// "means boundary of a tone group inserted mistakenly), which destroys the complete semantic transmission. A tone group has one and only one nucleus, which carries information the focused speaker wants to convey. The nucleus is the most prominent syllable of all stressed syllables, usually accompanied by a sharp rise or fall in pitch. Halliday (2000:305) pointed out that the nucleus of a wh-question is usually the non-final nucleus, which usually moves forward to the auxiliary verb. Although the wh-word does not have the tone nucleus, it can be stressed. As can be seen from Table 3, native speakers in this study put the nucleus of the short sentence on the auxiliary verb "do." However, Chinese students mostly put the nucleus on the verb "need" at the end of the sentence, which is significantly different from native speakers (Figure 4). The main function of wh-questions is to ask for or obtain information, while the nucleus carries the most important core information in a sentence. A different nucleus means different highlighted information, which may cause the hearer to give information that does not meet the speaker's expectations. Therefore, nuclear errors in wh-questions are worth the attention of English majors.

Native speakers put pitch stress on the auxiliary verb "do," while English majors mainly put pitch stress on the wh-word "what," the notional verb "need," and the subject "you" (Figure 4). The notional verb "need" refers to the speaker's response to the listener's request. The subject "you" is known information, so it is not stressed. In addition, the stress on wh-words is appropriate or not is also worth further study. Bolinger (1989:106-111) proposed that the sentence-initial wh-word in wh-questions have typical pitch stress. Hedberg et al. (2004) studied the phonological structure of interrogative questions and showed that 48% of native speakers put pitch stress on specific wh-word "what." Steedman (2000) proposed wh-words as the "theme" of wh-questions because it arises from the backup choices. Therefore, wh-words can be given stress.

In terms of boundary tone, Wells (2006:42-43) points out that wh-questions are mainly in the falling tone, and sometimes the rising tone is encouraged, with a softer, friendly, encouraging, sympathetic, and respectful mood. From the perspective of pragmatic function, the falling boundary tone is appropriately used in wh-questions to seek or guide information or initiate subtopic, while the rising tone in wh-questions indicates supplementary information, positive politeness strategy, speaker's dominant position in the conversation, or asking the listener to narrow the context. In combination with the context of the conversation, the short and long wh-questions "What do you need?" and "Why does the professor mention the solar wind?" are repeated inquiries after the speaker has answered what he said before, which not only elicit the information but also initiate the subtopic, so falling tone is more consistent with pragmatic expression than rising tone.

Figure 4: Screenshot of nucleus and stress in wh-question's language spectrum

Native speaker

English majors

4.3 The prosodic features of alternative question
Alternative questions connect two components with the conjunction "or," which can be a phrase or clause, as in examples 3 and 4.

Examples 3 :
    Did you say mellow or yellow?
Examples 4 :
    Does it have to be a book, or could you use a journal article?

There was a significant difference in tone group segmentation between the two groups. Native speakers treated the two phrases connected by "or" as an object component, and the whole sentence was treated as a tone group; "or" and clause 2 are processed into one component, so the whole sentence is divided into two tone groups. But 50 percent of English majors saw "or+ phrase two" as a single tone group, meaning there are two tones in the whole sentence. 25% of English majors regarded "or" clause 1 and clause 2 as three independent tone groups, and the whole sentence was processed into three tone groups, breaking the complete semantic transmission (see Table 4). In the boundary tone, 50% of English majors in sentence pattern i treated the final boundary tone as rising tone, which was consistent with native speakers. In sentence pattern ii, 75% of the English majors' clause 1 ends in a rising tone, which is consistent with the native speakers. However, the final boundary tone of the second clause of native speakers is falling tone, while 62.5% of English majors use rising final boundary tone.

Table 4: Prosodic features of alternative questions of native speakers and Chinese students

Sentence pattern	Features	Type	Native speakers	Chinese students
Ⅰ	Tone group	1	√	50%
		2		50%
	Boundary tone	Rise		50%
		Fall	√	50%
Ⅱ	Tone group	2	√	75%
		3		25%
	Boundary tone			
	Clause 1	Rise	√	75%
		Fall		25%
	Clause 2	Rise		62.5%
		Fall	√	37.5%

Note: Ⅰ = "phrase 1 +or+ phrase 2" short alternative question; ⅠⅠ = "clause 1 +or+ clause 2" short alternative question.

Alternative questions are syntactically composed of two selection components with the conjunction "or." When "or" connects two phrases, English majors ignore that the selection component of "or" connects belongs to the object category, so they over-segment the tone group, which eventually leads to the misplacement of the nucleus and misleading information transmission. When "or" is connected with two clauses, each clause conveys complete information. Moreover, the sentence pattern is long, so English majors need more time to process sentences when they are faced with long English sentences, resulting in the arbitrariness of broken sentences, thus breaking complete information transmission. This shows that Chinese students have a poor command of syntactic segmentation of alternative questions and relatively weak awareness of how to divide tone groups according to semantic syntax to convey complete semantic information.

In terms of boundary tone, the rising tone expresses the meaning of "to be continued" or "polite request," while the falling tone implies the meaning of "end" or "affirmation." In the context of the two alternative questions analyzed in this study, sentence pattern ⅰ is where the speaker is trying to determine whether the listener mentioned above is "mellow" or "yellow," and sentence pattern ⅱ is that the speaker is trying to offer the listener two choices, "book" or "journal article." The boundary tone after "book" of the clause should use a rise or flat tone to remind the listener that there is a choice; a falling tone indicates a "not very polite" or "very cold" question (Wells, 2006). The boundary tone at the end of clause 2 is mainly a falling tone, indicating exhaustion and completion of enumerations, which is a positive mood, but the proportion of English majors using rising tone is as high as 62.5%. Bartels (1999:84-92) points out that rise or flat final boundary tone is rarely used at the end of the last option in an alternative question and can be used when the choice is two opposing choices to refute the listener's expected answer.

5. Conclusion

This study empirically analyzes the prosodic characteristics of Chinese EFL majors' interrogatives. The results show that the prosodic characteristics of interrogatives of Chinese EFL majors are obviously different from those of native speakers, which are mainly reflected in the segmentation of tone groups, boundary tone, intonation nucleus, and stress distribution.

In regard to the division of tone groups, English majors and native speakers are basically identical in yes-or-no questions, wh-questions, and long alternative questions ("or" connected independent clauses), that is, wh-questions and yes-or-no questions processed into one tone group, long alternative questions processing into two groups. The main difference between English majors and native speakers is that the former process the attributive clauses into a single tone group, which breaks the whole semantic transmission. It's also found in shorter alternative questions (or questions that connect two phrases). Due to lack of proficiency of the discourse and grammar, sense-group is divided incorrectly, and "or+ phrase 2" is processed into one tone group alone, which destroys sentence structure and affects information transmission

In terms of boundary tone, the final boundary tone of yes-or-no questions and wh-questions of English majors is basically the same as that of native speakers; that is, yes-or-no questions are rise and wh-questions are fall. The difference is mainly reflected in the fact that most English majors treat the final boundary tone of alternative questions as a rising tone instead of a falling tone commonly used by native speakers.

There are obvious differences between English majors and native speakers in intonation nucleus and stress distribution. Native speakers tend to place stress and nucleus on auxiliary verbs, but many English majors place them on wh-words and notional verbs. Misplacement of the nucleus will lead to veil important information, which is not conducive to the transmission of information. However, stress on specific wh-words and notional verbs have no obvious negative effect on information transmission. English majors can deal with stress in interrogatives according to context.

These findings have put forward higher requirements for English pronunciation teaching for English majors: 1) Given the differences in phonological structure between learners and native speakers, phonological teaching materials should integrate syntactic, pragmatic, and phonological knowledge; 2) When conducting phonetic teaching, English teachers should attach importance to tone group division, take into account nucleus position and its important role of information communication, changes traditional grammar-oriented teaching methods, combine syntax, pragmatics, and phonetics and explain and drill more such knowledge, so as to help students effectively express their thoughts through intonation. 3) English majors should clarify the important pragmatic functions of intonation in information transmission and interpersonal communication, through classroom training and daily accumulation effectively adjust the wrong intonation habit, at the same time carry forward the prosodic features such as stress and boundary tone, beneficial to information transmission and interpersonal relationship, so as to improve "Chinglish" with Chinese Characteristics while avoiding its weaknesses.

Conflict of Interest: The authors declare no conflict of interest.

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