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Non-native listeners perceiving foreign accentedness of English speech: new evidence from Chinese and Spanish listeners

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Abstract. As an international language, English is an important tool for people of different native languages to communicate with each other. Many empirical studies, proving that foreign accents are prevalent in L2 learners' oral English, involved native speakers as raters of foreign accents. This study compared the rating patterns of listeners from Chinese, Spanish and English language backgrounds with different English proficiencies for foreign accents in English speech and investigated the acoustical cues used by these listeners. Results showed that Chinese listeners, sharing language backgrounds with talkers, tended to be more tolerant for the Chinese accent in English speech. Spanish listeners had a stricter criterion for mild Chinese accents, proving that the influence of listeners' L1 on their perception of foreign accents can be different for different degrees of accents. The effects of listeners' L2 proficiency was found for Chinese listeners' perception of accents and the number of acoustic predictors used by non-native English listeners. The study provides more evidence about the mechanism of native and non-native listeners' perception of foreign accent and offers implications for the recruitment of raters for the assessment of oral English.
Keywords: foreign accentedness; language background, L2 proficiency, acoustic features.

[ch] 非英语母语听者对英语语音外国口音的感知——来自汉语和西班牙语母语听者的新证据

摘要. 英语作为一门国际语言，是不同母语的人们相互交流的重要工具。许多实证研究证明，外语口音在二语学习者的英语口语中普遍存在。本研究比较了来自汉语、西班牙语和英语背景的不同英语水平的听者对英语外国口音的评价模式，并考察了这些听者所使用的声学线索。结果表明，与说话者有共同语言背景的汉语背景听者对英语语音中的中国口音更为宽容。西班牙语听者对中国口音持更为严格的标准。研究还发现，听者的二语水平会影响听者对外国口音的感知以及使用声学线索的数量。本研究揭示了母语和非母语听者对外国口音的感知机制，并为英语口语测试中评分员的采用提供了启示。
关键词: 外国口音、语言背景、二语水平、声学线索.

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1. Introduction

The existence of foreign accent in English speech produced by English learners has been proved by many studies (Flege, 1988; Anderson – Hsieh et al., 1992; Derwing et al., 1998; Magen, 1998; Trofimovich & Baker, 2007; Kang, 2010). Flege (1987) referred to foreign accent as the perceived effect of many discrete and general differences in pronunciation between native and non-native speakers. Although other definitions of foreign accent have been brought up by many other scholars, all agree with that foreign accent is a relative concept compared to native speech. Based on this, it is not hard to understand that English native speakers have been involved as the raters in the experiments exploring the perception of foreign accent (Magen, 1998; Meador et al., 2000; Piske et al., 2001; Trofimovich & Baker, 2007; Kang, 2010; Winters& O'Brien, 2013; Zhi & Li, 2021).

However, as the number of English users whose native languages are not English increases, this approach has been challenged by World Englishes proposed by Kachru (1985) and English as Lingua Franca by Jenkins (2000, 2002, 2009). Both advocate the importance of involving English non-native speakers in the research on the production and perception of English. As far as we are aware, few studies have tried to unscramble the mechanism used by non-native listeners when they are rating a foreign accent, including whether non-native listeners perceive a foreign accent in the same pattern as native listeners, and what cues non-native listeners use to rate foreign accents. Consequently, with the aim to learn more about the process and results of non-native listeners' perception of foreign accents, this current study compares the responses given by English native listeners, Spanish listeners and Chinese listeners to Chinese accented English speech.

The significance of studying the perception of foreign accents lies in that foreign accents can arouse positive or negative evaluative responses of listeners (Álvarez-Mosquera & Marín-Gutiérrez, 2021; Hendriks et al., 2017; Nejjari et al., 2019). Therefore, the comprehensibility of a speaker's speech and the attitude towards the speaker can be significantly impacted by accents.

This article displays an experiment with the intention to provide answers to the following to research questions: 1) Do English, Spanish, and Chinese listeners detect the foreign accentedness in Chinese accented English in the same pattern? 2) Do English, Spanish, and Chinese listeners use the same cues to detect foreign accentedness in Chinese accented English? The article is organized as follows. Section 2 discusses the history of the research on the confirmation of non-native listeners' ability to gauge foreign accent and the studies on the contribution of segmental and suprasegmental cues used by native listeners. Section 3 explains the methodology and the results of the present study. In section 4, a discussion about the results of the present study and those of previous studies is carried out. Section 5 exhibits the conclusions and provides some implications for future research based on the limitations of the present study.

2. Previous studies

2.1. The perception of foreign accent: beyond native speakers' judgments

Studies on foreign accents, which can be traced back to the beginning of 20th century, mainly focused on the factors affecting the foreign accent in L2 speech, as well as the discussion about the definition. Several factors attracted attention to be studied, such as age of learning (AOL), length of residence (LOR), gender, motivation and the amount of English usage. Many studies demonstrated the relationship between AOL and foreign accent, showing that the earlier learners started learning a second language, the weaker the foreign accent exists in the second language speech (Flege, 1988; Thompson, 1991; Flege & Fletcher, 1992; Flege et al., 1995; Flege et al., 1999; Munoz, 2010). The research focusing on the effect of LOR on foreign accent presented two opposite results that the studies done by Flege and Fletcher (1992) and Flege et al. (1995; 1999) supported the existence of the effects, while the other studies (Thompson, 1991; Elliott, 1995; Moyer, 1999) did not.

Regardless of the dispute about the influences of different factors on foreign accent, most studies above have a shared similarity when it comes to the identity of listeners or raters, who were all and always English native listeners. This does not mean that it is unnecessary to investigate non-native listeners' judgments of foreign accent. Here are two reasons that non-native listeners should be involved more in research. First, about 378 million people use English as their mother tongue, while 743 million use English as their second language. And the number of English users has been continually increasing to 1.5 billion in 2022 (Statista, 2023). Practically speaking, communication problems exist not only between English second language learners and native speakers, but also among non-native English learners. Second, more data about non-native listeners rating foreign accents is needed to understand the difference between the perception mechanism used in their first language compared to that used in their second language and to reveal more of the working pattern of interlanguage in processing accented speech which has been explored by some studies on speech intelligibility (Bent & Bradlow, 2003; Hayes-hard et al., 2008; Han et al., 2011).

Before moving on to ask non-native listeners to rate foreign accents, there is a question which should be addressed: Can non-native listeners perceive foreign accents? The answer is affirmative which had been proved by Flege (1988). Flege's study (1988) also verified that non-native listeners presented the same rating pattern as native listeners. Furthermore, the effect of non-native listeners' English proficiency on their accuracy of rating the foreign accent, if native listeners' ratings were considered accurate, also was demonstrated, attesting the prototype hypothesis brought by Samuel (1982) and Flege (1984). The prototype hypothesis assumes that non-native listeners, as

their experience develops, would acquire more information about how the phonetic segments of the target language "ought" to sound, namely phonetic category prototypes, resulting in a "tolerance region". The sounds which fall outside the region would be judged as foreign accented. The further the sounds are dispersed from the region, the heavier they perceived as foreign accented.

In Flege (1988)'s study, the more experienced learners tended to have a "tolerance region" similar to that of native listeners. However, all non-native listeners in Flege (1988)'s study shared the same language background with talkers, which was Taiwanese. How about non-native listeners who don't share the same language background with talkers? Even though they may know how the target phonetic segments "ought" to sound, do they use the same rubric when they measure the distance between the sounds with an unfamiliar foreign accent and their "tolerance region"? Elliott (1995) found that listeners with different language backgrounds and who were not familiar to the talkers' English accent rated the foreign accent in a similar pattern as native listeners. Nevertheless, non-native listeners in Elliot's study were all high proficient English learners, which is a common feature of other studies comparing native and non-native listeners' perception of foreign accent (Major, 2007; Munro, et al., 2006). On the whole, it is still not clear about the question in terms of how listeners from different L1 backgrounds with different L2 proficiency judge the foreign accent of L2 speech.

2.2. Segmental and suprasegmental cues in foreign accent detection

The studies of foreign accents involving English native speakers as raters have also been focusing on the cues used by native speakers to detect the degree of a foreign accent, including segmental cues and suprasegmental cues. Previous studies have devoted greatly to cope with two questions: 1) Do segmental and suprasegmental cues of stimuli separately help native listeners rate the foreign accent? 2) If two kinds of cues work together to influence the foreign accent rating, which one contributes more?

For the first question, research has achieved the consensus that both kinds of cues play roles in a perceived foreign accent. Anderson-Hsieh et al. (1992) proved that native speakers make use of inter-segment phoneme errors in determining the degree of foreign accent, including insertions, deletions and substitutions of segments, i.e., native speakers judge the degree of foreign accents according to the times and frequency of these segmental errors: the more frequent the errors, the stronger the foreign accent. This result has been supported by the studies of Brennan & Brennan (1981) and Munro and Derwing (1995). Anderson-Hsieh et al. (1992) also demonstrated the influence of deviance in prosody of non-native speakers' speech on the perceived foreign accent. The role of prosodic cues in foreign accent perception was also proved for other languages apart from English (van Maastricht et al., 2016).

Varonis and Gass (1982) firstly proposed a model to show the relationship among factors affecting the perception of speech concerning comprehensibility. Munro (2008) revised and extended the application of this model to the perception of intelligibility and foreign accentedness of speech. The revised version of this model is shown in Figure 1.

The model shows the accentedness score can be affected by stimulus properties, listener factors, contextual factors and other errors. Stimulus properties include properties in segments, those in prosody, those in grammar, those in fluency and other aspects with different influence weights shown by Greek letters. This leads to the second question: which factor contributes more?

$$SCORE = SP + LF + CF + \ldots + error$$

Where SCORE refers to one of acentedness, comprehensibility, or intelligibility

And

$$SP(\text{stimulus properties}) = \alpha Segment + \beta Prosody + \gamma Grammar + \delta Fluency + \cdots$$

$$LF(\text{Listener factors}) = \varepsilon Topic + \zeta Speaker + \nu Type\ of\ accent + \cdots$$

$$CF(\text{Contextual factors}) = \theta context$$

Figure 1. The reconceptualized model for accentedness provided by Munro (2008).

For the second question, a dispute exists. On the one hand, the dynamic that native speakers use segmental features more to perceive foreign accents than suprasegmental ones has been revealed by Tajima, Port and Dalby (1997), Ulbrich and Mennen (2015) and Sereno, Lammers and Jongman (2014). On the other hand, various experiments investigating the influence of suprasegmental cues on detecting foreign accents have shown that suprasegmental features of the stimuli can even influence native speakers' judgment of foreign accents more than segmental errors (Taniguchi, 2002; Trofimovich & Baker, 2007; Kang, 2010; Winters & O'Brien, 2013). van Maastricht et al. (2016) found out that native listeners could distinguish native and non-native speech solely based on suprasegmental cues. The range of pitch variation is one of the most important factors among suprasegmental cues. For example, Kang's (2010) study showed that, among various suprasegmental features, the overall range of pitch variation had the greatest impact on accent rating scores. This effect is manifested in native speakers' belief that the larger the range of pitch variation, the smaller the foreign accent. Speech rate (measured in syllables per second) has also been

focused on and proved to be more directly contributing to the foreign accent by Davis et al. (2019). Some studies, however, do not support this result since no significant correlations between speech rate and foreign accent was found (Anderson-Hsieh et al., 1992). Zhi and Li (2021) did not find a significant correlation between temporal information and native listeners' evaluation of Chinese speakers' English vowels.

3. The Present study

Considering the findings of previous studies, this present study intends to provide more evidence explaining how listeners from different L1 backgrounds with different L2 proficiency judge the foreign accent of L2 speech. Therefore, listeners from English, Chinese and Spanish language backgrounds at different English levels were involved in the foreign accent rating task.

The other aim of the current experiment is to deal with the existing inconsistencies in results in terms of the comparison between the roles of segmental and suprasegmental cues in the perceived foreign accent and in terms of comparison among the roles of the variables in segmental and suprasegmental cues in the perceived foreign accent. Furthermore, by involving listeners from different language backgrounds, we are also expecting to find out whether the cues which are important for native listeners to detect foreign accent would also be important for non-native listeners.

3.1. Methodology

3.1.1. Listeners

Five groups of listeners rated passage recordings for foreign accent. They differed in native language and English proficiency. The experiment had intended to recruit 57 participants as listener candidates, including 10 native English listeners, 25 native Chinese listeners and 22 native Spanish listeners. English listeners were professors working at a university in Seoul, with a mean age of 34.2 years (s.d.=1.9). Chinese listeners included graduate students and undergraduate students studying at the same university as English listeners. They had a mean age of 22 years (s.d.=0.79). None of them had been to an English-speaking country. Spanish listeners had a mean age of 26 years (s.d.=1).

Both TOEIC scores (Test of English for International Communication) and the pronunciation proficiency were considered to define non-native listeners' English proficiency. At first, the TOEIC scores of high proficient listeners were higher than 800 (approximately corresponds to or higher than B2 level) and those of low proficient listeners were lower than 500 (approximately corresponds to or lower than A2 level). Then, in order to decide the pronunciation proficiency of non-native English listeners, an accentedness rating task was carried out. All 47 non-native English listeners were asked to read an English passage. The foreign accent of their recordings was rated on a 9-point scale (1=native-like; 9=strong foreign accent) by 5 English native speakers who were not recruited as raters in the accentedness rating task. The inter-rater reliability was assessed through Spearman-Brown values and exhibited in Table 1.

	rater 1	**rater 2**	**rater 3**	**rater 4**	**rater 5**
rater 1	1	.959**	.902**	.871**	.921**
rater 2	.959**	1	.938**	.920**	.941**
rater 3	.902**	.938**	1	.926**	.932**
rater 4	.871**	.920**	.926**	1	.936**
rater 5	.921**	.941**	.932**	.936**	1

$p<0.05$.

Table 1 Spearman-Brown values of raters in the accentedness rating task to decide the pronunciation proficiency of non-native listeners

Listeners whose recordings were rated not higher than 3 were labeled as high proficient listeners; listeners whose recordings were rated not lower than 7 were labeled as low proficient listeners. The average rating result for each non-native listener is shown as in Figure 2. Five Chinese listeners and two Spanish listeners received their foreign accent ratings higher than 3 and lower than 7. These seven listeners were not asked to participate in the following perception experiment of foreign accent. Therefore, combining the TOEIC scores and the ratings of pronunciation, all listeners were divided into five groups, Chinese listener group with high proficiency (CHL), Chinese listener group with low proficiency (CLL), Spanish listener group with high proficiency (SHL) and Spanish listener group with low proficiency (SLL) and native English listener group (EL). Each group had 10 listeners.

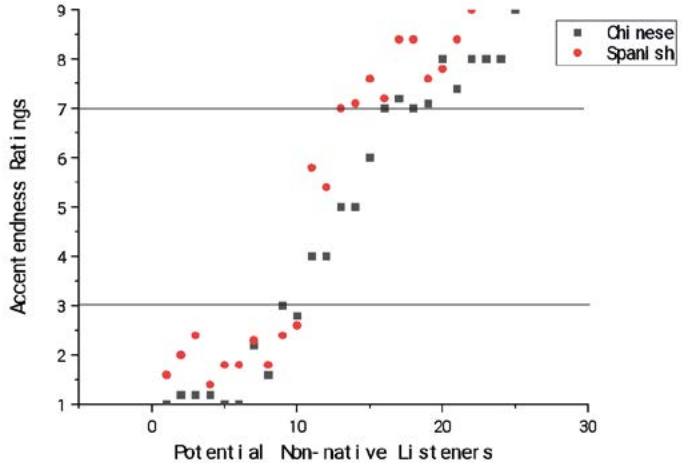

Figure 2. Average rating results of non-native listeners in the accentedness rating task.

3.1.2. Talkers

Twenty Chinese learners of English in this experiment were recruited as talkers. They were all female international students studying in a university in Seoul. Their ages ranged from 20-22 years with the mean age of 21 (s.d.=1). As listeners, the proficiency of talkers was determined by two aspects: Their scores of TOEIC and their pronunciation proficiency. The talkers whose scores were higher than 800 were labeled as high proficient talkers and lower than 500 as low proficient talkers. An accentedness rating task, the same as the one for listeners, was carried out and confirmed that ten of them had high pronunciation proficiency and the other ten had low pronunciation proficiency. Hence, they were divided into two groups, high proficiency group (HT) and low proficiency group (LT), with 10 speakers in each. They were asked to read an English passage.

3.1.3. Stimuli

The passage, including 5 sentences, was chosen from *New Concept English 2*, which is used as reference book for beginner learners of English in China. A vocabulary test involving the words in the passage and other filler words showed that no new words existed in the passage for these ten Chinese learners of English. Each passage recording was cut into 5 sentence recordings so that totally 100 sentence recordings, 50 from HT and 50 from LT, were provided to listeners in a random order.

3.1.4. Procedures

The current accentedness rating experiment was carried out using the software program Superlab, along with noise cancellation headphones. Listeners were told that they would hear sentence recordings. Listeners were not told the language background of the speakers. They were instructed to judge the degree of a foreign accent in each sentence by pressing the corresponding keys on the key board. More specifically, each listener would hear one sentence in its entirety and saw the numbers from one to nine on the screen (1=no foreign accent; 9=very strong foreign accent). The results were recorded automatically in Superlab. The next sentence would not play until the listener gives a score. Listeners took part in the experiment separately. It took each listener 30-40 minutes to finish the experiment, with an interval of 5 minutes after every 30 sentences.

3.1.5. Data Analysis

(1) To answer the first research question

Inter-rater reliability, representing agreement among listeners in each group, was first assessed after all listeners had finished experiments, to see if the ten listeners were consistent in their ratings within each group, which is shown in Table 2. The stronger agreement among listeners is found, the less subjectivity exists in listeners' judgments. From Table 2, we can see that the Spearman-Brown values of five groups are all high and significant, ranging from .89 to .964 ($p<0.05$). This means that listeners in each group tended to agree with one another on determining English foreign accent.

Listener group	EL	CHL	CLL	SHL	SLL
Spearman-Brown values (α)	.964	.932	.901	.89	.911

$p<0.05$.

Table 2. Spearman-Brown values for each listener group (n=10 per group).

In order to get the answer to the first research question, the mean rating score given by each listener group to HT and LT were calculated separately. And the scores given by listeners to each talker were submitted in an ANOVA in which listeners' language background and English proficiency served as between-subjects factors, and talkers' proficiency served as within-subjects factors. The statistical software used in this study was SPSS.

(2) To answer the second research question

Segmental features were phonologically defined by counting the numbers of segment deletion, insertion and substitution of each sentence recording, as Anderson-Hsieh et al. (1992) did. Three steps were carried out. At first, to establish the correct norms for the reading passage. One female native speaker of American English and one female native speaker of British English were asked to read the same passage as mentioned in section 3.1.3. If the changes in Chinese talkers' recordings were also identified in these native speakers' recordings, they were not counted as segmental errors in this study. For instance, the deletion of /r/ in *year* was not labeled as an error since it is common in British English. Secondly, to transcribe the passage recordings. Two linguists who had been received professional training in phonetic research and were familiar with Chinese accented English were recruited as phonetic transcribers. It turned out that some differences between two transcribers' transcriptions especially relating with vowels occurred, and then the spectrograms of the sounds were checked (as shown in Figure 3) and resolved by the first author, who teaches English phonetics and phonology in Yangzhou University. At last, to analyze and count the phonemic errors. The deletion errors included consonant deletion (e.g., in *small,* /l/→Ø) and vowel deletion (e.g., in word *success*, /ə/→Ø). The insertion errors also included consonant insertion (e.g., in *Frank*, /k/→/ks/) and vowel insertion (e.g., in *people*, /l/→/lə/). The substitution errors consisted of consonant substitution involving the changing of voicing, place or manner (e.g., in *his,* /z/→/s/, in *saved*, /v/→/w/) and vowel substitution (e.g., in *his*, /I/→/i/).

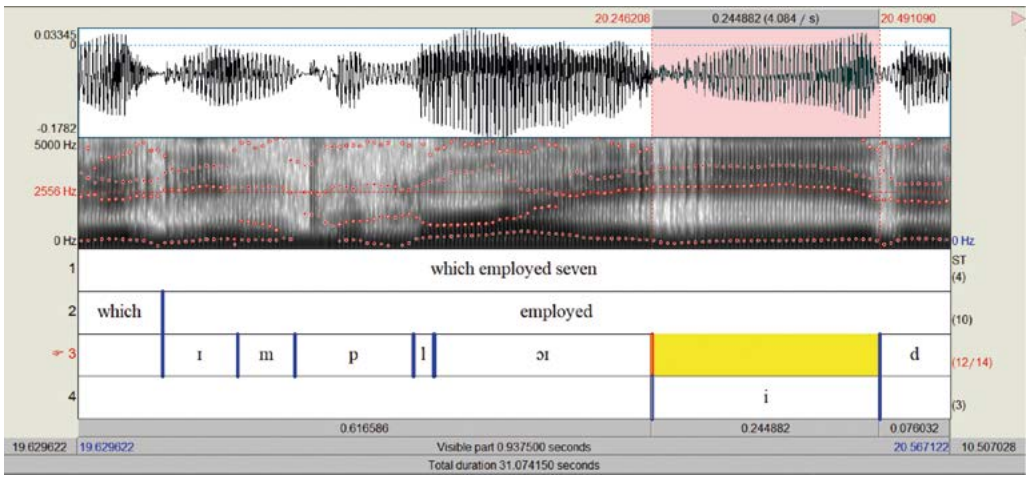

Figure 3. An example of the spectrogram of an insertion of vowel /i/ in the word *employed*

Suprasegmental features in this study include overall pitch range and speech rate. Overall pitch range was the result of maximum F_0 minus minimum F_0 in each sentence. Only pitch on prominent syllables, which were determined by the F_0 peaks and the features of prominence, were taken into consideration. The F_0 was measured in Hz at the midpoint of the vowels in the prominent syllables. F_0 measurements were accomplished by watching the sound wave and narrow-band spectrogram and correcting the errors in F_0 extraction in PRAAT. In the study, most of errors were octave jumps or drops at initial or final stage of a continuous pitch contour. These errors were corrected by adjusting the pitch settings, including setting the pitch range to a reasonable range and changing the value of octave jump cost.

Speech rate was calculated in line with the method suggested by Riggenbach (1991), Kormos and De´nes (2004) and Kang (2010). That is to say that the speech rate (syllables per minute) was obtained by dividing the number of syllables by the amount of total time of the sentence recording in seconds and then multiplying by 60.

In order to get the answer to the second question, Pearson correlations among all variables for each listener group were inspected first. Knowing that none of the correlations exceeded 0.8, multiple linear regression analyses for five listener groups were proceeded separately by taking each listener group's rating scores as the dependent variable and the five acoustic features as independent variables or predictors.

3.2. Results

3.2.1. Accentedness ratings

From Figure 4, it is not difficult to notice that every listener group presented higher scores to low proficient talkers than to high proficient talkers, proving the criteria for organizing the talkers' groups. Note that the higher rating

scores, the less foreign-accented the stimuli was perceived. The ANOVA yielded a significant effect of talker group [F (1,245) =25.24, p<0.05]. Hence, the accentedness ratings of two groups of talkers are analyzed separately as follows.

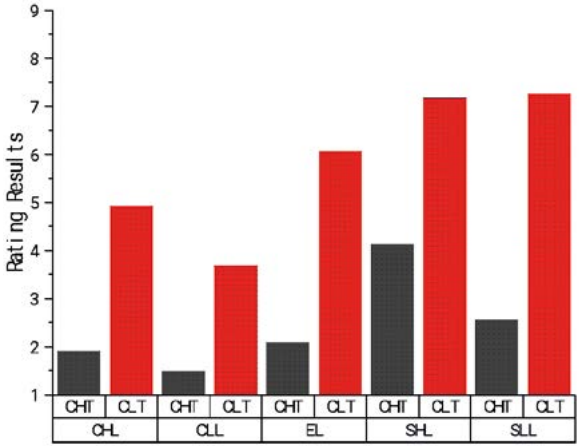

Figure 4. The mean accent ratings given by listeners in five groups to English sentences spoken by native speakers of Chinese

The bars in black represent mean rating scores for high proficient talkers given by all five listener groups. The mean ratings given by Chinese listeners, with high proficiency and low proficiency respectively, are 1.9 and 1.48, neither of which shows a significant difference from the mean rating by English listeners, 2.08 [F (4,245) =37.38, p=0.939 for EL vs. CHL; F (4,245) =37.38, p=0.121 for EL vs. CLL]. This indicates that Chinese listeners perceived similar degrees of foreign accents of English speech spoken by high proficient talkers as English listeners. Spanish listeners gave significantly higher scores to high proficient talkers' sentences than English listeners [F (4,245) =37.38, p<0.05], signifying high proficient talkers' sentences sounded more accented to Spanish listeners than to English listeners. In addition, Spanish listeners rated high proficient talkers' sentences with higher scores than Chinese listeners did [F (4,245) =37.38, p<0.05], no matter the proficiency of listeners, demonstrating that these sentences sounded more accented for Spanish listeners than for Chinese listeners. Hence, the effect of listeners' language backgrounds, which was proved to be significant in the ANOVA [F (1, 245) =96.8, p<0.05], only occurred for comparing the results of Spanish listeners with those of English listeners or Chinese listeners. Among non-native listener groups, Chinese low proficient listeners did not show any significant difference from Chinese high proficient listeners in terms of perceiving the foreign accents of sentences recorded by Chinese speakers [F (4,245) =37.38, p=0.485]. However, it is not the case for Spanish listeners in the way that low proficient listeners presented lower accentedness score than high proficient listeners [F (4,245) =37.38, p<0.05], suggesting less foreign accents were perceived by low proficient listeners. The effect of listeners' proficiency revealed by the ANOVA [F (1, 245) =34.28, p<0.05] occurred for Spanish listeners.

The bars in red show the mean rating scores for low proficient talkers by all five listener groups. Two groups of Chinese listeners (CHL and CLL) rated low proficient talkers' sentences as 4.92 and 3.68, being significantly lower than English listeners' average rating score of 7.1 [F (4,245) =116.3, p<0.05]. This result reveals that Chinese listeners, sharing the same language background with the talkers, did not regard the talkers' English as strongly accented even though English native listeners did. This phenomenon also emerged when we compare the scores given by Chinese listeners and Spanish listeners, regardless the proficiency of the involved non-native listeners, since Chinese listeners rated the speech with lower scores than Spanish listeners did. Spanish listeners (SHL and SLL) rated the sentences as 7.16 and 7.26, having no significant difference from the mean rating of English listeners [F (4,245) =116.3, p<0.05]. This suggests that Spanish listeners responded to the foreign accents of Chinese low proficient talkers in the same way as English listeners. Therefore, the effect of listeners' language backgrounds, which was proved to be significant [F (1, 245) =368.63, p<0.05], only can be found when we compare the results of Chinese listeners and English listeners or Spanish listeners. The effect of listeners' English proficiency was found significantly for Chinese listeners [F (1, 245) =16.25, p<0.05], for CHL rated the speech with significantly high scores than CLL did.

The effect of listeners' language backgrounds × English proficiency interaction was confirmed for the ratings of high proficient talkers [F (1, 245) =12.68, p<0.05] and low proficient talkers [F (1, 245) =19.54, p<0.05].

3.2.2. Regression between accentedness ratings and acoustic features

In order to explore the contributions of acoustic features to accentedness ratings given by listeners with different language backgrounds and different English proficiency, five listener group's rating scores (dependent variables) and acoustic measurements (independent variables or predictors) were submitted to correlation and regression anal-

yses. First, Table 3 shows that none of the absolute correlations exceeds 0.8 (the highest correlation is -.654), allowing to proceed with the actual regression analyses.

Results of the regression for English listeners (in Table 4) indicates that all five acoustic features played significant roles in gauging the foreign accentedness. The b-coefficients demonstrates that three segmental features of English speech recorded by Chinese speakers affected native listeners' accentedness ratings in a positive way and two suprasegmental features influenced the ratings in a negative way, meaning that a speech sample with more deletions, insertions and substitutions of segments, narrower pitch range and slower speech rate tends to be rated as a stronger foreign accent. The relative strengths of five predictors are shown by Beta coefficients. Therefore, for native listeners, the strongest predictor is pitch range (β= -.555), followed by segmental insertion, speech rate, deletion and substitution.

IV	1	2	3	4	5	EL ratings	CHL ratings	CLL ratings	SHL ratings	SLL rating
1.	-	.100	-.534**	-.586**	-.394**	-.654**	-.563**	-.512**	-.107	-.102
2.		-	-.009	.130	-.205*	-.564**	-.342**	.209	-.433*	-.521*
3.			-	.487**	.275**	-.443*	.487**	.342*	.535**	.606*
4.				-	.394**	-.411*	.231	.211	.220	.231
5.					-	-.481*	.387**	.242*	.259**	.167

* p<0.05, * p<0.01.
Note: IV = independent variables; 1 = pitch range; 2 = speech rate; 3 = deletion; 4 = insertion; 5 = substitution.

Table 3. Summary of correlation analyses among independent variables and each dependent variable

Variables	B	95% CI	β	t	p
Pitch range	-.029	[-.035, -.023]	-.555	-16.171	.000
Speech rate	-.012	[-.015, .011]	-.248	-3.357	.006
Deletion	.581	[.269, .904]	.188	4.536	.000
Insertion	.491	[.282, .700]	.265	5.313	.000
Substitution	.408	[.034, .782]	.104	2.170	.030

Note. R^2_{adj}=.827, (N=100, p=.000). CI=confidence interval for B.

Table 4. Regression coefficients for predicting English native listeners' accentedness ratings

From Table 5, it can be noticed that for Chinese listeners with high proficiency, all features, except the insertion of segments, are significantly associated with accentedness ratings, suggesting that they could make use of deletion and substitution of segments and suprasegmental features to judge the foreign accents. Like native listeners, pitch range is the strongest predictor (β= -.49). For Chinese listeners with low proficiency, among five features, only two of them, pitch range and substitution, are significantly associated with accentedness ratings as shown in Table 6, and pitch range is still the stronger predictor (β= -.413).

The regression results for Spanish listeners with high proficiency (in Table 7) shows a significant positive relationship between segmental features (deletion and substitution) and the ratings and a significant negative relationship between speech rate and the ratings. Speech rate is the strongest predictor (β= -.426), followed by deletion (β=.274) and substitution (β=.231). According to the p values shown in Table 8, it can be seen that, for Spanish listeners with low proficiency, only deletion of segments and speech rate were significantly related to the ratings, demonstrating that these two features were used as predictors while rating the foreign accents. And deletion worked as a relatively stronger predictor (β= -.526).

Variables	B	95% CI	β	t	p
Pitch range	-.017	[-.022, -.011]	-.490	-5.969	.000
Speech rate	-.015	[-.027, .002]	-.152	-2.368	.020
Deletion	.432	[.136, .728]	.214	2.897	.005
Insertion	.047	[.282, .700]	.019	.269	.789
Substitution	.260	[.065, .454]	.217	2.897	.005

Note. R^2_{adj}=.640, (N=100, p=.000). CI=confidence interval for B.

Table 5. Regression coefficients for predicting Chinese high proficient listeners' accentedness ratings

Variables	B	95% CI	β	t	p
Pitch range	-.010	[-.014, -.006]	-.413	-4.673	.000
Speech rate	-.000	[-.010, .009]	-.005	-.068	.946
Deletion	.494	[.264, .725]	.337	4.252	.173
Insertion	-.188	[-.459, .084]	-.102	-1.373	.789
Substitution	.195	[.043, .347]	.224	2.548	.012

Note. R^2_{adj}=.584, (N=100, p=.000). CI=confidence interval for B.

Table 6. Regression coefficients for predicting Chinese low proficient listeners' accentedness ratings

Variables	B	95% CI	β	t	p
Pitch range	-.007	[-.026, .012]	-.063	-.766	.446
Speech rate	-.018	[-.026, -.009]	-.426	-4.068	.000
Deletion	.681	[.218, 1.145]	.274	2.919	.004
Insertion	.125	[-.180, .430]	.085	.813	.418
Substitution	.095	[.066, .543]	.231	2.332	.037

Note. R^2_{adj}=.596, (N=100, p=.000). CI=confidence interval for B.

Table 7. Regression coefficients for predicting Spanish high proficient listeners' accentedness ratings

Variables	B	95% CI	β	t	p
Pitch range	-.012	[-.032, .007]	-.085	-1.265	.212
Speech rate	.854	[.381, 1.327]	-.280	3.585	.001
Deletion	.027	[.036, 1.018]	.526	6.047	.000
Insertion	.263	[-.048, .574]	.145	1.678	.097
Substitution	-.360	[-.917, .197]	-.094	-1.284	.202

Note. R^2_{adj}=.415, (N=100, p=.000). CI=confidence interval for B.

Table 8. Regression coefficients for predicting Spanish low proficient listeners' accentedness ratings

4. Discussion

The main part of the present study included an accentedness rating task and an acoustic analysis, with the aims of looking for the influence of listeners' language backgrounds and English proficiency on accentedness ratings and exploring the acoustic cues used by listeners with different language backgrounds at different levels of English. The discussion is presented in the order of answering two research questions:1) Do English, Spanish, and Chinese listeners detect foreign accent in Chinese accented English in the same pattern? 2) Do English, Spanish, and Chinese listeners use the same cues to detect foreign accent in Chinese accented English?

4.1. Do English, Spanish, and Chinese listeners detect the foreign accentedness in Chinese accented English in the same pattern?

The answer to this question is partially affirmative. The same patterns were found between non-native listeners and native listeners for talkers with specific L2 proficiency, while non-native listeners with two different language backgrounds did not show any similar patterns in terms of their rating scores.

Chinese listeners showed the same pattern as English listeners when they rated the foreign accent of Chinese high proficient talkers' speech. However, they, compared with English listeners' ratings, rated low proficient talkers' speech as less accented, which agrees with the result of Jiang & Yuan (2012) indicating that non-native listeners rated non-native speech as less accented when they shared language background with the talkers. Jiang & Yuan (2012) had not considered the influence of the proficiency of the non-native speech which was taken into account and confirmed by the current study. When listeners shared the same language background with the talkers, they used the same criteria as native listeners do for the speech having a mild accent and more tolerant criteria than native listeners for the speech having a strong accent. This can be interpreted in the way that listeners, sharing the same language background with the talkers, knew how the standard English sounds like, but were not sure to what degree the speech deviated from the standard. There are two possible explanations for this phenomenon: 1) Chinese learners of English have received the standard English speech as input from school teaching, movies, news and other

media. This training has equipped them with the ability to gauge the cues of good English speech. Previous studies also confirmed that training can draw L2 learners' attention to linguistic cues (Francis & Nusbaum, 2002). 2) Chinese learners of English are familiar with the Chinese accented English, which impedes their judgement of Chinese accents of the speech objectively.

On the contrary, Spanish listeners showed the same pattern as English listeners when they rated the foreign accent of Chinese low proficient talkers' speech. However, they, comparing with English listeners' ratings, rated high proficient talkers' speech as more accented. This indicates that Spanish listeners used the same criteria as native listeners for rating the speech with a strong foreign accent and have a stricter criterion when applied to the ratings of mild accents. This finding is in line with some earlier research (Kang, 2012) discovering that non-native listeners were more stringent than native listeners in rating the foreign accent. Kang (2012) even proposed possible reasons for this phenomenon, First, non-native listeners' difficult learning experience of English impels them to be more sensitive to non-native talkers' mistakes whereas native listeners would not be bothered as long as non-native talkers' foreign accent is not strong enough to impede communication. Second, non-native listeners (not sharing the language background with talkers) don't share pronunciation features with non-native talkers, which caused their lower comprehension compared to native listeners' perception of non-native speech. These may be the reasons for why Spanish listeners were stricter with mild Chinese accents, however, this is not the case for Spanish listeners' ratings of Chinese talkers with low proficiency. It seems a ceiling effect was exhibited for Spanish listeners' evaluation of Chinese accented speech, which needs to be verified by further studies. These different patterns shown by the ratings by Spanish listeners to talkers with different proficiency confirmed the conclusion given by Jiang & Yuan (2012) that the influence of listeners' L1 on their perception of a foreign accent is complicated by showing different patterns at different accent levels.

Spanish and Chinese listeners did not display any similar patterns for evaluating the foreign accent of English speech spoken by Chinese speakers. Spanish listeners tended to be more stringent for Chinese accent than Chinese listeners. This result provides proof for the proposed explanations mentioned above: Chinese listeners might be familiar with the Chinese accented English and Spanish listeners might experience lower comprehension when they perceive Chinese accented English. Overall, compared with listeners not sharing language backgrounds with Chinese talkers, no matter English or Spanish, Chinese listeners, sharing language backgrounds with talkers, showed a tendency to be more tolerant for the Chinese accent in the English speech, which is in line with findings of previous research. For example, Kang et al. (2016) found that Vietnamese accented English sounded more accented for U.S. listeners than for Vietnamese listeners.

When L2 proficiency is taken into consideration for non-native listeners, Chinese listeners with high proficiency tended to more stringent than Chinese listeners with low proficiency, especially in ratings of Chinese talkers with low proficiency. This tendency shown in Figure 2. also indicates that ratings given by Chinese listeners with high proficiency resembled more with native listeners than those with low proficiency, which is coherent with Schoonmaker-Gates (2012) and also provides proof for the prototype hypothesis brought by Samuel (1982) and Flege (1984), demonstrating high proficient learners, compared to low proficient learners, have a "tolerance region" more similar to native speakers when perceiving the foreign accent. What was not expected, however, was that a different "tolerance region" was found for Spanish listeners with high proficiency from native listeners. In this study, Spanish listeners with high proficiency were stricter to CHT's speech than those with low proficiency, causing their ratings more significantly different from native listeners. It seems that the prototype hypothesis only works for listeners rating the foreign accent of speech given by speakers sharing the same language background. Listeners, not sharing language background with speakers, with high proficiency of L2, may know how the L2 "ought" to sound like, but they use different scales to measure the distance between the sounds with an unfamiliar foreign accent and their "tolerance region". Yet, this conclusion should be considered with caution since more experiments involving listeners with different language backgrounds are in need to confirm. What can be concluded is that EFL learners' pronunciation proficiency does not necessarily match with their proficiency of perceiving the foreign accent which can be affected by other factors, such as the degree of foreign accent in the stimuli and the familiarity to the foreign accent.

In brief, Chinese listeners are more tolerant to strong Chinese accent in English speech than native listeners; Spanish listeners are more stringent to mild Chinese accent in English speech than native listeners. This proved that the influence of listeners' L1 on their perception of foreign accent can be different for different levels of accents. Furthermore, the influence of Chinese listeners' L2 proficiency on their foreign accent ratings supported the prototype hypothesis, while this hypothesis was not verified for Spanish listeners, leaving us to wonder about the conditions of the prototype hypothesis.

4.2. Do English, Spanish, and Chinese listeners use the same cues to detect foreign accentedness in Chinese accented English?

The answer to this question is also partially affirmative. There were some similarities among different listener groups concerning cues used by them to judge the foreign accent, for example, every listener group used both segmental and suprasegmental features to rate a foreign accent, while differences are more prominent in terms of the number of cues and the weight of each cue for different listener groups.

With regard to the number of cues used by listeners, native listeners were revealed to use all five features, segmental and suprasegmental, as predictors to perceive the foreign accent, which is in line with the study of Anderson-Hsieh et al. (1992) also demonstrating that both segmental and prosodic variables significantly influence the pronunciation ratings. For non-native listeners in the current study, the number of cues was reduced as the L2 pro-

ficiency dropped. High proficient listeners from Chinese and Spanish language backgrounds were found to use four and three features out of five, respectively, and ratings given by two low proficient listener groups were both significantly influenced by two features out of five. This may be interpreted as that the ability of perceiving features as predictors could be affected by their English proficiency. High proficient English learners could be more sensitive to the acoustic features which cause foreign accent than low proficient learners. This also offers the explanation to the result about the difference in ratings between Chinese listeners with high proficiency and those with low proficiency. CHL tended to rate the foreign accent in a more similar pattern as native listeners than CLL did, which might be caused by that CHL were able to notice the deviance between the acoustic features of target stimuli and those of native speech and to rate the accentedness based on the deviance. This result also can be explained by that listeners' foreign accentedness ratings are affected by factors other than the five acoustic features, and low proficient listeners' ratings could be influenced more by other factors. This speculation can be proved by the values of adjusted R^2, showing the proportion of variance in the rating scores accounted for by the regression models. Adjusted R^2 for native listeners is the highest (.827), followed by CHL (.64), SHL (.596), CLL (.584) and SLL (.415).

As for the weight of each cue for each listener group, one interesting phenomenon needs more attention. When comparing the relative strengths of the predictors, beta coefficients show that overall pitch range is the strongest one both for English native listeners and Chinese listeners. This suggests that pitch range played a crucial role in these listeners' perception of non-native listeners' speech. Kang (2010) has already proved that pitch range can best predict native listeners' accent ratings. The monotonous speech spoken by non-native listeners could affect native listeners' feelings toward the speech. Unlike native listeners and Chinese listeners, pitch range did not significantly influence Spanish listeners' ratings. Instead, Spanish listeners applied speech rate in the perception of foreign accent in the current study. Speech rate worked as the strongest predictor among the five acoustic features for Spanish listeners with high proficiency and one of the predictors for Spanish listeners with low proficiency. This seems to be different from Busto (2020)'s study, claiming that the foreign accentedness in Spanish rated by Spanish listeners was strongly related to the pronunciation of vowels and consonants, followed by intonation and rhythm, while the variable "tempo", relating with speech rate, was not found significantly related with the accentedness ratings. However, Schoonmaker-Gates (2012) once found the evidence showing that Spanish listeners would rate native Spanish speech which was slowed by 25% as more accented, suggesting that Spanish listeners use speech rate to gauge the foreign accent in Spanish, which is consistent with the results of this current study. This disagreement on the role of speech rate in accent ratings for Spanish listeners might be caused by different ways of measuring speech rate. Therefore, more evidence about this problem is needed to make a conclusion.

To put it concisely, both segmental and suprasegmental features of speech were found to play important roles for native and non-native listeners to perceive the foreign accent in the present study. Non-native listeners' L2 proficiency may have an impact on the number of variables they are able to use as predictors for foreign accent. Moreover, native listeners and Chinese listeners were more sensitive to the change of pitch range to detect accent than to other features.

5. Conclusions and implications for future research

The study aimed to explore the rating patterns of native English, Chinese and Spanish listeners for a foreign accent in Chinese accented English speech and the acoustic cues used by different listeners. Based on this, the results are two-fold. First, Chinese listeners, sharing language backgrounds with talkers, tended to be more tolerant for Chinese accents in English speech, and the influence of listeners' L1 on their perception of foreign accents can be different when different levels of accents are perceived. In light of these findings, this study offers implications for the recruitment of raters for the assessment of oral English.

Second, both segmental and suprasegmental features of speech were found to play important roles for native and non-native listeners to perceive foreign accents in the present study. Non-native listeners' L2 proficiency may have an impact on the number of variables they are able to use as predictors for a foreign accent. Moreover, native listeners and Chinese listeners were more sensitive to the change of pitch range to detect accent. Although Spanish listeners' ratings were found to be affected by speech rate in this study, more evidence is needed to come to a conclusion considering the disagreement between the present study and other previous ones.

It is important to note the limitations which remain for future studies to amend. First of all, the speech samples were all reading passages. Even though there was no intervention while the talkers were reading the passage, it is still not as natural as spontaneous speech, which may better reveal the rating patterns of listeners in real communication context. Secondly, from the adjust R^2 value of each regression model in section 3.2.2, we can know that about half of the variance in rating scores given by non-native listeners accounted for by other factors which were not involved in this study. Hence, future research is recommended to use different types of speech samples and involving more variables, such as linking across word boundaries or tone choice.

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Xiaojiao Xue: Conceptualization, Data curation, Fundraising, Research, Methodology, Visualization, Writing-original draft, Writing-review & editing
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