

An Experimental Study on English Majors Weak Form Productions of Prepositions

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Abstract—This study compares the acoustic cues Chinese English learners and American native English speakers used to realize the weak forms of prepositions. Six prepositions with the highest frequency of occurrence in COCA, “at, for, from, in, of and to”, were selected as target words, and each of them was collocated with 3 verb phrases (VP) which were further put into experimental sentences with a Subject+VP+Object+AP structure. Altogether 6 focus conditions were set for each experimental sentence in this research. The vowel formant, duration, pitch movement of prepositions were analyzed within and across two speaker groups, from which we concluded: learners only use pitch and duration as the phonetic cues to distinguish the reduced and the normal prepositions, and the deviation might be caused by their L1 transfer. Specifically, learners’ centralization is not as obvious as the native speakers in the process of vowel reduction, instead, they use the shortened Chinese vowels to realize the weak forms of prepositions. In addition, learners’ duration of reduced vowel in preposition is longer than that of the native speakers, as there is no lax vowel in their L1 system, so it is difficult for them to shorten the vowels as largely as the native speakers do. Besides, learners’ production of prepositions placed after the sentence nuclear is deviant from that of the native speakers in terms of pitch representation. Their pitch range is larger than the native speakers’, and the clear falling trend on their pitch contour is observed within the reduced vowel, which is supposed to be caused by the transference of neutral tone features in their L1 Chinese.

I. INTRODUCTION

Preposition is a type of frequently used word class in English, as almost 1 in 8 words is observed to fall in this class. This type of words is also categorized into functional words which are supposed to be shorter than notional words in duration [1], and usually take weak form which is different from the normal one in vowel quality [2]. “The appropriate use of weak form is essential to realize smooth and rhythmical speaking, to highlight prominent syllables, and to eliminate ambiguity in meaning” [3]. However, Chinese English learners find it difficult to weaken in the production of preposition due to the differences between their L1 and L2. Specifically, Chinese is a syllable-timed language with each syllable assigned almost the same duration [4], while in English, a stress-timed language, the stressed words are longer than those in weak form, by which rhythm and focus are achieved [5]. Having failed to notice the prosodic difference, learners are likely to produce a

speech with multiple stresses [6] [7] [8], which will probably lead to the ambiguity and incoherence of their expression.

Studies on Chinese learners’ unsatisfactory acquisition of weak form have been conducted both at home and abroad. Baker et al. [9] discovered that learners tended to produce more stressed syllables than the native speakers; in addition, he also found that functional words produced by learners were longer than those by their native counterparts, and a vowel reduction was observed in learners’ production. Wang [10] found that in comparison with weak forms of BBC broadcasting, Chinese learners were discovered to have a higher F1 and a lower F2; besides, the F1-F2 acoustic pattern of learners’ production further showed that no regular rules were followed by them in doing vowel reduction. Apart from duration and vowel quality, researchers have also explored the differences of weak form from the perspective of pitch representation. Sun [11] concluded that pitch prominence accounted for the least importance to learners’ L2 realization of prosodic pattern, by which an inference can be made that learners seldom use pitch variation to distinguish the weak form from the normal one. However, the L1 interference on the acquisition of the weak forms have scarcely been discussed. Therefore, an attempt is made in the present research to have the gap filled.

Deviant weak form production might be interfered by learners’ mother tongue. According to Lado [12], differences between learners’ L1 and L2 would give rise to the difficulty of acquisition, while the similarity between these two languages is conducive to their acquisition, as learners tend to produce the L2 sounds by following the same manners in their mother tongue, which is the alleged positive transfer and negative transfer respectively. But Speech Learning Model (SLM) [13] proposed a different view that that L2 sounds which are similar to learners’ L1 was harder to be acquired than those new phones, sounds which phonetically different or absent in learners’ phonological system.

It is known that functional words in Chinese are usually realized by neutral tone. Words with neutral tone is only half long to those with normal tones in terms of their duration; in addition, their pitch movement is determined by tones of their preceding words and is realized a falling tone except those preceding by words with falling-rising tone [14] [15] [16]. On this basis, learners’ acquisition of preposition weak forms will be analyzed by taking their L1 features into consideration.

II. METHODOLOGY

A. Participants

Two groups of participants were recruited with 4 native English speakers (2 males and 2 females) and 12 Chinese English learners (4 males and 8 females). All the native speakers were university students from America, aged 18-22, and the learners, aged 19-22, were English majors born and raised in Beijing. In addition, all the learners were reported to have passed the TEM-4 (Test for English Majors Band 4). But to make sure they were at the similar level in their oral proficiency, a further oral test was conducted on the learners by employing a cellphone APP, “English Fluent Speaking”, after which 4 participants were excluded due to their relatively high or low proficiency. Therefore, altogether 12 participants were investigated here without none of them reported to have sight or hearing impairment.

B. Materials

Altogether 6 prepositions were elaborated in the research, including “to”, “of”, “in”, “for”, “at”, “from”, as these words were the most frequently occurred prepositions in COCA (Corpus of Contemporary American English). Among them, “to” and “in” resembled learners’ mother tongue in syllable structure, while the rest four were different from the latter in this respect. The distribution of prepositions in this research enabled the exploration of the influence generated by crosslinguistic similarity of syllables construction on learners’ realization of weak form. Each preposition was collocated with 3 phrases, sentences with which were made to do the elicitation. S (subject)+V (verb)+O (object)+A(adverbial) structure is employed to compile the experimental sentences as follows.

Fig. 1. Table 1: List of Experiment Sentences

preposition	collocation	Experiment sentence
to	Be going to	Lily is going to watch a movie tonight.
	Have to	Billy has to do housework tomorrow.
	Want to	Bruce wants to drink apple juice today.
in	Be interested in	Scott was interested in reading books before.
	Be involved in	Clark is involved in making artwork recently.
	Live in	Pandas live in the mountains every day.
for	Pay for	Tony paid for the phone bill yesterday.
	Vote for	People voted for that leader last month.
	Live for	Eddie waited for his meal this morning.
of	Aware of	Woman are aware of their rights now.
	Think of	They think of buying a car recently.
	Proud of	Sue was proud of her writing skills before.
at	Look at	Peter looked at the job market last week.
	Aim to	Dad aims at increasing income this year.
	Good at	Bert is good at playing games all the time.
from	Hear from	Tim hears from her mother every month.
	Come from	Articles come from the journal monthly.
	Different from	Bill is different from his friends sometimes.

To investigate whether and how different focus conditions influence the phonetic representation of the six prepositions’ weak form, each sentence is reconstructed with its focus assigned to different grammatical component. Presented in table 2 is an example of “be going to”.

Table 2: Sentences of Different Focuses with “be Going to”

collocation	focus	question	answer
Be going to	broad	What did you say?	Lily is going to watch a movie tonight.
	subject	Who is going to watch a movie tonight?	LILY is going to watch a movie tonight.
	verb	Is Lily coming to watch a movie tonight?	Lily is GOING to watch a movie tonight.
	object	What is Lily going to watch tonight?	Lily is going to watch a MOVIE tonight.
	adverbial	When is Lily going to watch a movie?	Lily is going to watch a movie TONIGHT.

Altogether 108 target sentences and 30 fill sentences were presented to participants. Note that both questions and answers in the above table were required to be read by participants.

C. Speech Recording and Data Extraction

Speech productions made by learners were recorded in the sound-proof booth of Chinese Academy of Social Sciences (CASS), and those of the native speakers in Peking University by a portable device. Cool Edit Pro in the research was used to do the recording at a sampling rate of 16Hz with a 16-bit resolution in mono stereo.

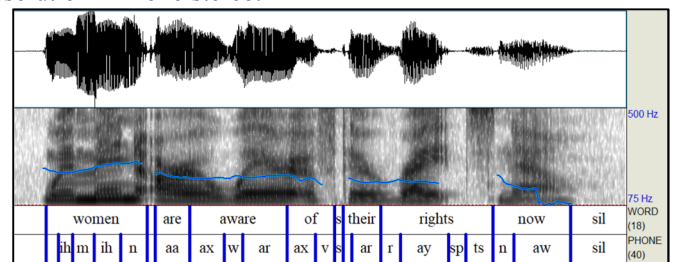


Figure 1: Example of Annotation

As is shown on the figure, words and phones were segmented respectively in different tiers. The blue curve presented on the spectrogram was the pitch contour which was trimmed in Praat for further analysis.

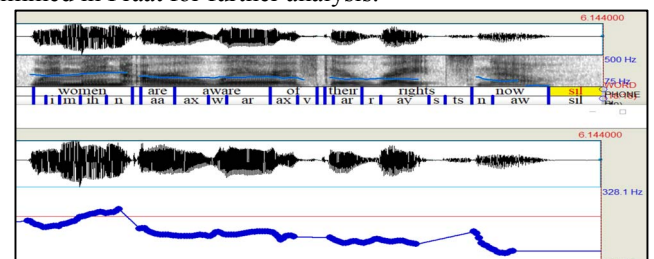


Figure 2: Example of Pitch Curve Trimming

As is presented in the above figure, pitch generated by consonants and silence were removed to get a smooth curve. In addition, points around the sharp spikes and the nasal-vowel junctions were adjusted. The trimming helped to reduce the random variation of the pitch contour, conducive to obtain a more accurate locations and values of both F0 peak and valley.

Parameters used to describe and analyze features of prepositions' weak forms were the following three: pitch, duration, and formant.

In order to eliminate the gender difference and personal characteristics, normalizations were conducted by transforming Hertz into semitone through the equation (1) and by Z-score in equation (2) respectively.

$$F(st) = 12 * \log_2 (F0 - Fmin) \tag{1}$$

$$Z1 = \frac{y1 - my}{sy} \tag{2}$$

Altogether F0 values of 10 points in the pitch contour were extracted, with Fmin in equation (1) representing the minimal value of F0 among the 10, and y_1 , m_y , and s_y , the logarithm of the lowest F0 value among the 10, the mean value and the standard deviation of the logarithm respectively.

With reference to duration, it was extracted by a Praat script, and on this basis, the data was also normalized by the Z-score equation presented above so that influence generated by different speakers' habits could be minimized.

Formant was extracted to describe the vowel quality. According to Odlin [17], F1 was inversely proportional to the height of the tongue's tightening point, and F2 proportional to the backwardness of the tongue's highest point. In this research, the F1 and F2 values of 10 points with equal intervals were extracted, after which the average value from the third to the eighth point were calculated to obtain the representative value. Likewise, normalization was also conducted here to eliminate the personal characteristics in the production by the following Lobanvo equation.

$$F_{n[V]}^N = (F_{n[V]} - MEAN_n) / S_n \tag{3}$$

$F_{n[V]}$ represents formant n of the vowel V , and the $MEAN_n$ the mean value of formant n . S_n is the standard deviation of formant n , and $F_{n[V]}^N$ the normalized value of formant n of the vowel V .

III. RESULTS

Altogether 1728 experimental sentences were collected in this research. Presented in the following table is the distribution of these sentences.

Table 3: Distribution of the Experimental Sentences

focus	Number		preposition	number	
	broad	288		at	288
	S	288		for	288
	V	288		from	288
	P	288		of	288
	O	288		in	288
	A	288		to	288

We described the productions of the six prepositions made by both learners and native speakers. On this basis, comparisons were made between the two group speakers from the perspectives of vowel duration, vowel quality, and pitch representation of the prepositions.

A. Vowel Duration

In this part, weak forms of prepositions produced by native speakers and learners were compared in terms of the vowel duration. A weakened preposition was observed to be shorter in duration compared with the normal form. We used ANOVA analysis to compare the reduction ratios between the two group speakers.

Table 4: Results of ANOVA Analysis on Vowel Reduction Ratios (%) between Native Speakers and Learners

	broad	S	V	O	A
to	*	*	*	*	*
in	*	*	*	*	*
for	*		*	*	*
of	*			*	
at	*	*	*		*
from	*	*	*	*	*

It is known from the results that learners were significantly different from their native speakers in terms of the normal-weak reduction ratios, which went true for nearly all the six prepositions produced in different focus conditions. To further explore the specific difference between the two group speakers, the reduction ratios of each preposition in sentences of varied focus conditions were listed in the following table for comparison.

Table 5: Comparisons of Vowel Reduction Ratios (%) between Native Speakers and Learners

	at		for		from	
	C	A	C	A	C	A
broad	70.2%	53.1%	45.1%	42.6%	53.9%	52.1%
S	69.3%	51.3%	44.9%	43.1%	51.2%	58.2%
V	72.8%	63.9%	48.5%	42.2%	51.5%	60.1%
O	69.3%	58.3%	51.2%	42.6%	54.8%	62.2%
A	64.3%	44.4%	45.1%	38.7%	46.9%	55.4%
	in		of		to	
	C	A	C	A	C	A
broad	51.4%	47.5%	51.0%	56.6%	36.7%	41.4%
S	53.6%	49.1%	48.9%	44.1%	36.5%	44.2%
V	60.4%	56.2%	53.1%	53.7%	53.0%	55.3%
O	53.5%	54.1%	52.2%	58.9%	35.3%	41.1%
A	55.7%	55.2%	50.0%	46.7%	39.0%	44.9%

We noticed from the table that the reduction ratios of learners were larger than the those of the native speakers in most cases which are marked in bold. To account for the above phenomena, the original durations of these prepositions produced in sentences of different focuses conditions were compared below.

Table 6: Comparison of Vowel Duration of Weakly Produced Prepositions between Native Speakers and Learners (ms)

	broad		S		V		O		A	
	A	C	A	C	A	C	A	C	A	C
to	0.04	0.07	0.05	0.07	0.06	0.10	0.04	0.07	0.05	0.07
in	0.05	0.09	0.05	0.09	0.06	0.10	0.05	0.09	0.06	0.09
for	0.06	0.10	0.06	0.10	0.06	0.11	0.06	0.11	0.06	0.10
of	0.07	0.10	0.05	0.09	0.06	0.10	0.07	0.10	0.06	0.10
at	0.08	0.14	0.08	0.14	0.10	0.15	0.09	0.14	0.07	0.13
from	0.03	0.07	0.04	0.07	0.04	0.07	0.04	0.07	0.03	0.06

We observed that weak forms of all the six prepositions produced by the learners were longer than native speakers no matter where the focuses of the sentences were. Presented

Table 11: Comparison of Vowel Quality between Stressed and Unstressed “for”

		P-Broad	P-S	P-V	P-O	P-A
Chinese	F1	0.703	0.089	0.726	0.670	0.468
	F2	0.000	0.000	0.000	0.000	0.000
American	F1	0.620	0.667	0.661	0.414	0.474
	F2	0.014	0.008	0.037	0.031	0.001

We noticed from the table that the F2 values, or the backwardness of the tongue was mainly used to distinguish the weakened “for” from the normal one. For this reason, in the following table, F2 was used to test whether the weak form of this preposition produced by learners was deviant from the native speakers through an independent sample T-test.

Table 12: Comparison of Reduced “for” Produced by Native Speakers and Learners

focus	Broad	S	V	O	A
F2	0.000	0.009	0.001	0.000	0.000

The results showed that the reduced production of “for” were significantly different between the two speaker groups in sentences of all the five focus conditions. The following figure presents the distribution of “for” produced in sentences of different focus conditions, by which we could see how learners were deviant from the native speakers in vowel quality.

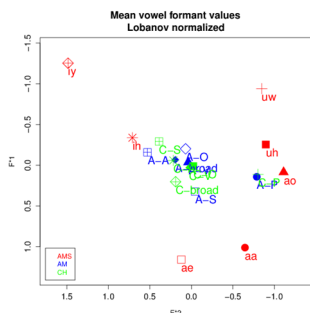


Figure 4: Graphic Comparison of the Productions of “at” between Learners and Native Speakers

Both native speakers and learners, as shown on the figure and tables, could distinguish the weakened form of /ɔ/ in [fɔ] from the normal one by reducing it to /ə/ through centralization. In addition, as to weak forms of “for” produced in sentences of different non-focused conditions, learners were observed to produce them at a more backward place in the vocal tract compared with their native counterparts.

FROM

To explore the differences of the weakened production of “from” between learners and native speakers, the same procedures gone through above will be followed here again. Presented next are the results gained from independent sample T-tests, indicating whether speakers in both groups could distinguish the weak form from the stressed one.

Table 13: Comparison of Vowel Quality between Stressed and Unstressed “from”

		P-Broad	P-S	P-V	P-O	P-A
Chinese	F1	0.007	0.008	0.020	0.002	0.000
	F2	0.000	0.001	0.007	0.000	0.000
American	F1	0.017	0.004	0.015	0.006	0.013
	F2	0.027	0.007	0.029	0.023	0.024

We noticed from the table that different from the above two prepositions, “from” produced in normal form was different from the other five weak ones in terms of both F1 and F2, or the height and backwardness of tongue position. Henceforth, both parameters were used to find out the difference between vowel quality of unstressed productions made by learners and that of native speakers.

Table 14: Comparison of Reduced “from” Produced by Native Speakers and Learners

focus	Broad	S	V	O	A
F1	0.026	0.010	0.055	0.091	0.088
F2	0.060	0.079	0.087	0.110	0.092

Weak forms produced in sentences of broad focus and subject focus by learners were significantly different from the native speakers only in their F1, namely, the height of tongue position. The following figure would graphically demonstrate the specific differences between the two speaker groups.

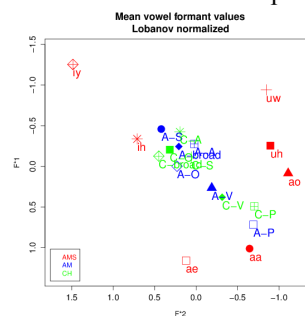


Figure 5: Graphic Comparison of the Productions of “from” between Learners and Native Speakers

Centralization could be observed in the process from the normal to weak forms in both speaker groups. This was because both were able to distinguish the normal and the weakened “from”. However, learners’ weak form of this preposition was not realized in the same way as that native speakers did. Specifically, native speakers had the vowel /ɒ/ reduced much closely to /ə/, while learners, according to the normal productions distributed on the figure, was much higher in their F1, indicating that learners were inclined to have a lower tongue position and larger mouth openness than their native counterparts.

IN

The weak form of “in” produced by learners were elaborated here through comparison with that of their native counterparts and the normal form produced by their own. Presented next were comparisons of the normal and weakened productions of “in” through independent sample T-tests.

Table 15: Comparison of Vowel Quality between Stressed and Unstressed “in”

		P-Broad	P-S	P-V	P-O	P-A
Chinese	F1	0.000	0.000	0.000	0.000	0.000
	F2	0.000	0.000	0.000	0.000	0.000
American	F1	0.014	0.034	0.011	0.011	0.035
	F2	0.001	0.000	0.024	0.000	0.001

Both F1 and F2, as we observed, could be used to distinguish the normal from the weak produced by the two group speakers. Therefore, the two parameters were used to see if there was a

significant difference between weakened “in” produced by learners and that by native speakers. Presented in the following table were results obtained from independent sample T-tests.

Table 16: Comparison of Reduced “in” Produced by Native Speakers and Learners

focus	Broad	S	V	O	A
F1	0.000	0.008	0.000	0.000	0.043
F2	0.021	0.016	0.000	0.000	0.043

We observed from the table that learners differed from native speakers in their weak forms of “in” in terms of both height and backwardness of the tongue positions, and all the five weakened productions of them were deviant from their native counterparts in the above two aspects. To explore the specific difference of the weakened “in” productions between them, the distribution of vowel in these prepositions produced at sentences with different focus positions were demonstrate below.

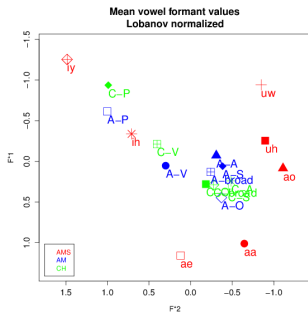


Figure 6: Graphic Comparison of the Productions of “in” between Learners and Native Speakers

When it comes to the normal production of this preposition, learners tended to realize the vowel /ɪ/ in [ɪn] as /i:/, different from the native speakers in a lower and backward manner. This might be caused by the absence of short vowel /ɪ/ in Chinese. As to the weak form, native speakers tended to produce them at more central places in the vocal tract, while learners demonstrated a higher and more advanced manner when doing the unstressed production with smaller mouth openness.

OF

Presented in the following table are results of the comparisons of the vowel quality between the normal and the weakened “at” in different focus conditions.

Table 17: Comparison of Vowel Quality between Stressed and Unstressed “of”

		P-Broad	P-S	P-V	P-O	P-A
Chinese	F1	0.661	0.308	0.901	0.665	0.211
	F2	0.000	0.000	0.002	0.000	0.000
American	F1	0.430	0.959	0.947	0.827	0.674
	F2	0.000	0.002	0.039	0.004	0.001

We observed from the table that F2 values in the vowel of “of” were mainly used by both learners and native speakers to distinguish the weak form from the normal one. Therefore, only F2 values here were employed to see whether there was a significant difference between reduced “of” produced by learners and native speakers through independent sample T-test.

Table 18: Comparison of Reduced “of” Produced by Native Speakers and Learners

focus	Broad	S	V	O	A
F2	0.108	0.095	0.350	0.253	0.210

We could see from the table that weak forms in sentences of different focuses conditions were well acquired by learners due to insignificant difference between the F2 values of the two groups. The specific distributions of this preposition produced in each focus condition by the two groups are demonstrated as follows.

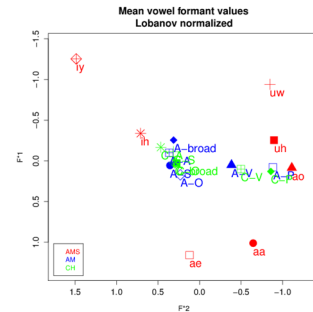


Figure 7: Graphic Comparison of the Productions of “of” between Learners and Native Speakers

We noticed that weak forms of vowels in “of” was more advanced than its normal one and closer to the central position of the vowel quality. Although learners, according to the vowel distribution in the figure, tended to produce the weak form of this preposition in a more backward place, but no significant difference could be observed between them, which indicated that learners had a good acquisition of “of” production in terms of its weak form.

TO

Similarly, the normal and weakened production of this preposition by the two speaker groups were compared through independent sample T-tests to see if how the weak form was realized by both.

Table 19: Comparison of Vowel Quality between Stressed and Unstressed “to”

		P-Broad	P-S	P-V	P-O	P-A
Chinese	F1	0.000	0.000	0.005	0.000	0.000
	F2	0.000	0.000	0.007	0.000	0.000
American	F1	0.027	0.016	0.004	0.026	0.020
	F2	0.023	0.039	0.030	0.037	0.021

We noticed from the table that the F1 values, or the height of the tongue was the main factor used to distinguish the stressed “to” from the unstressed one. For this reason, in the following table, F1 was used to test whether the weak form of this preposition produced by learners was deviant from the native speakers through an independent sample T-test.

Table 20: Comparison of Reduced “to” Produced by Native Speakers and Learners

focus	Broad	S	V	O	A
F1	0.013	0.018	0.007	0.011	0.034

The results showed that the reduced production of “for” were significantly different between the two speaker groups in sentences of all the five focus conditions. The following figure presents the distribution of “to” produced in sentences of

different focus conditions, by which we could know how learners were deviant from the native speakers in vowel quality.

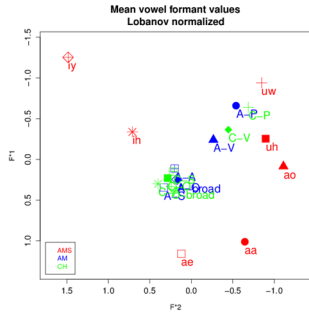


Figure 8: Graphic Comparison of the Productions of “to” between Learners and Native Speakers

We noticed from the figure that learners tended to produce the normal “to” at a lower position with larger mouth openness, while native speakers were used to realize the its weak form by centralization.

A conclusion could be drawn that only the weak form of “of” was well acquired by learners in terms of their vowel quality. The rest five prepositions, although were weakened by learners through centralization as the native speakers did, yet were still different from the latter. Most of the weakened vowels produced by native speakers were realized by the central vowel /ə/, and those produced by learners were either more backward (“for”), or more advanced (“in”) than the former. The mouth openness was also different between learners and the native speakers, with the former being larger (“at”, “from”, “to”) or smaller than the latter (“in”).

C. Pitch

Different weak form realization might influence the pitch representations of prepositions in the following two aspects, pitch range and its movement within durations of the prepositions which were discussed separately in this part.

PITCH RANGE

Presented in the following table were the T-test results by which the pitch ranges of prepositions produced by learners and native speakers were compared.

Table 21: Comparisons of Pitch Ranges of Prepositions Produced by Learners and Native Speakers

	Broad	S	V	O	A	P
at						*
for		*				*
from	*	*	*			*
in		*	*			*
of	*	*	*		*	*
to	*	*	*	*	*	*

We observed from the results that learners’ pitch ranges were significantly different from the native speakers when prepositions were not weakened or situated in the post-nuclear positions (sentences with broad focus, subject focus, verb focus), while a similarity was found between their pitch ranges when prepositions were after the nuclear in the sentences. Pitch contours presented in the following figure could help to

observe the different pitch range of prepositions between the two groups.

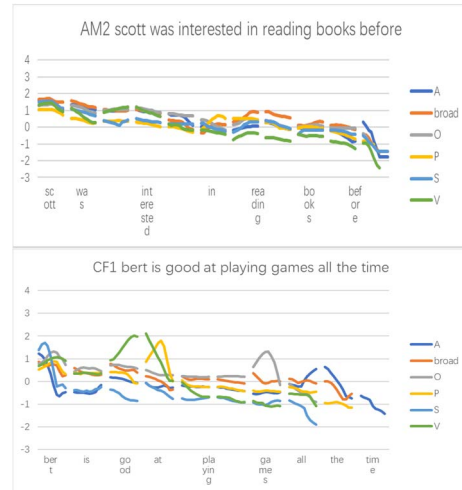


Figure 9: Comparison of Preposition Pitch Range between Learners and Native Speakers

We could see that learners demonstrated a larger pitch range when prepositions were placed after the nuclear of the sentences, which indicated that learners do not weaken the reduced vowels in prepositions properly. This might be because learners’ mother tongue Chinese was originally larger in pitch range than English, which could be proved by their larger pitch range in preposition focused sentences where these words were produced in their normal forms.

PITCH MOVEMENT

Focus condition of a sentence is correlated with the its pitch movement. Therefore, productions of weak form of the prepositions between the two group speakers were compared from the perspective of pitch movement. Since syllable constructions of the six English prepositions are either similar to those of Chinese, such as “in”, “to”, or different from them like “from”, “at”, “of”, and “for”, which could also be a factor leading to different pitch realization of learners. Therefore, prepositions with different syllable construction were also discussed separately in this part.

A. Broad Focus

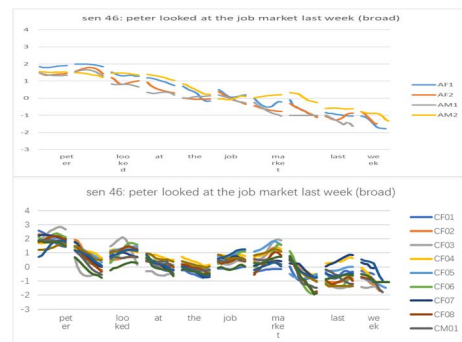


Figure 10: Comparison of Pitch Movement between Native and Learners in Broad Focus Productions (“at”)

We noticed from the Fig. 10 that native speakers had sentences of this type realized in two different ways by placing focuses on the both subject and object, or only by stressing the object. However, learners demonstrated a totally different pitch contour. Specifically, multiple accents were observed on learners' productions. Except the peak occurring within the subject duration, the productions of the verb, object, and adverbial were characterized by a clear peak or valley on their pitch contours. The multiple accent here was the reason leading to the deviant pitch realization of learners. In detail, non-weakened syllable in the subject position was realized by the H* pattern in productions of both speaker groups. However, native speakers had the immediate post-nuclear syllable coarticulated with its preceding one, and their entire sentence productions were featured by a slightly continuous falling trend, with the pitch onset of preposition following the ending of its preceding syllable. Comparatively, learners' pitch contours demonstrated a slight fluctuation after the second syllable, the immediate post-nuclear one showing a sharply downward trend, which was due to the multiple-accent realization of the sentence. As to the pitch representation of the preposition, a new reset was discovered as well, from which we could see that learners did not produce it as weakly as the native speakers did.

Another word "to" here was employed to exemplify the pitch movements of learners and native speakers in prepositions with a similar syllable construction to Chinese.

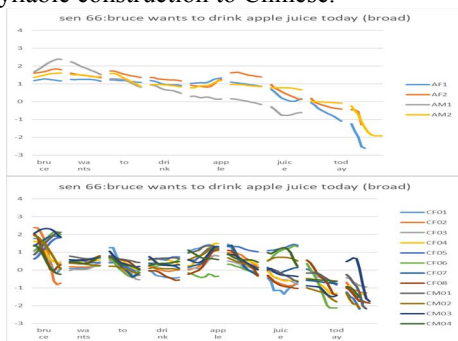


Figure 11: Comparison of Pitch Movement between Native and Learners in Broad Focus Sentences ("to")

Similar to the pitch contours of "at", a clear pitch reset and a falling trend could be observed within durations of this preposition, which showed that syllable construction did not act as an influencing factor to the difference between learners' and native speakers' pitch movements in broad focus condition.

B. Focus on Subject

Presented next are figures showing the pitch movement of sentences with the subjects being focused and preposition at the post-nuclear position.

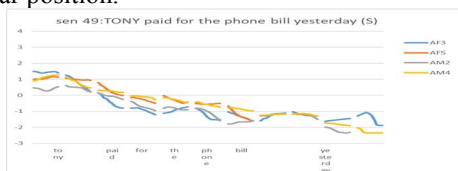


Figure 12: Comparison of Pitch Movement between Native and Learners in Subject-Focused Sentences (for)

Likewise, preposition similar to Chinese in syllable constructions were discussed as well in the following.

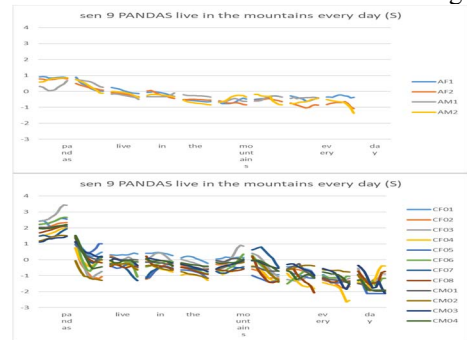


Figure 13: Comparison of Pitch Movement between Native and Learners in Subject-Focused Sentences ("in")

Although a clear pitch range compression was observed within the duration of the preposition produced by learners, yet an obvious pitch reset could be seen on their pitch contour, which implied that this syllable was not combined into the same prosodic word as the native speakers did, and was not produced as weakly as the latter either.

C. Focus on Verb

It is noteworthy that the prepositions are the immediate post-nuclear place if the verb here is a monosyllabic one, but this is not true if the stressed syllable verb is a polysyllabic one with its stress on the first syllable. Therefore, monosyllabic and polysyllabic stressed verbs are discussed separately.

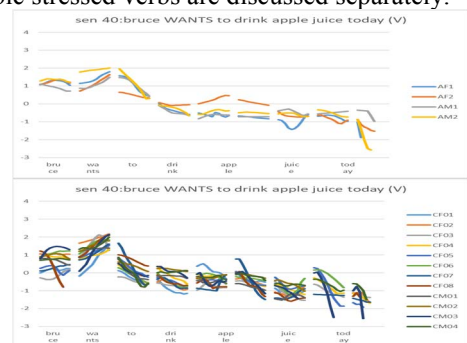


Figure 14: Comparison of Pitch Movement between Native and Learners in Verb-Focused Sentences (Monosyllabic-"to")

Prepositions in sentences of this focus condition was immediately follow the nuclear, which was supposed to be used by coarticulation as the native speakers do. However, learners did not highlight the nuclear by compressing the pitch range of the post-nuclear syllable, instead, a falling tone was employed by them in this process, by which an inference could be made

that learners might transfer features of the Chinese neutral tone to realize the weak form of the preposition.

Sentences with polysyllabic verbs stressed only differed from their monosyllabic counterparts in the amplitude variation within the duration of prepositions, therefore, it was discussed graphically in this part.

With reference to the pitch realization of prepositions different from Chinese in syllable constructions, the pitch contours of “at” are taken as an example to see whether learners have well acquired their weak forms in pitch.

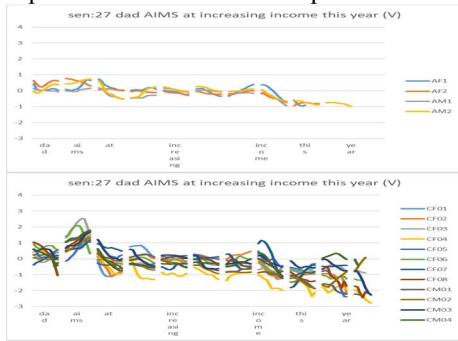


Figure 15: Comparison of Pitch Movement between Native and Learners in Verb-Focused Sentences (Monosyllabic-“at”)

The clear reset within the duration of preposition on learners’ pitch contour showed that they did not combine this syllable with the nuclear into the same prosodic word and failed to produce it as weakly as the native speakers did.

D. Focus on Object

The preposition in object focused sentences was placed at the pre-nuclear position. The pitch movements of the preposition, as was observed on the pitch contour, was well realized by learners. Although the immediate post-nuclear syllable was realized by as a sharply falling trend by following the pattern of Chinese neutral tone, yet the preposition, which positioned before the nuclear, was properly weakened due to the continuous pitch movement before the nuclear. This might be influenced by the absence of multiple accents in their production of this sentence. Additionally, in this focus condition, pitch movement was immune to the syllable construction of the prepositions.

E. Focus on Adverbial

Like sentences focused on their object, only one pitch accent was observed on learners’ pitch contour, the preposition in adverbial focused sentences was also correctly realized by them in its pitch movement by following the H-L pattern as the native speaker did, and no obvious pitch reset was observed on its pitch contour.

F. Focus on Preposition

Pitch representations of stressed prepositions were elaborated in order to find out whether an L1 transfer was occurred during their acquisition of the weak forms.

Like sentences focused on their subjects and verbs, those in this focus condition was realized by learners with multiple accents. Specifically, pitch move downward continuously

before the nuclear, yet it started to rise sharply on the nuclear and dropped immediately after it, which was similar to the features of Chinese neutral tone. Prepositions with syllable construction different from Chinese was also realized in this manner.

In summary, pitch ranges in learner productions of both normal and weakened prepositions are larger than that of native speakers. However, focus condition might influence their pitch realization. Specifically, prepositions positioned after the sentence nuclear is usually not well realized by learners in pitch, as multiple accents would appear in sentences of these focus conditions, which might further lead to the superfluous pitch reset in their productions. In addition, pitch movement of prepositions in these sentences are realized by employing features of Chinese neutral tone. On the contrary, prepositions placed before the sentence nuclear is acquired in both pitch range and pitch movement. But it should be noted that the similarity in syllable construction between learners’ L1 and L2 does not influence the pitch realization of prepositions.

IV. DISCUSSIONS

To explore reasons contributing to learners’ deviation of preposition weak form production, their L1 features were discussed in this part, by which the L1 influence on learners’ acquisition of the weak forms is supposed to be discovered.

As is mentioned above, functional words in learners’ mother tongue Chinese is usually realized by neutral tone, which might be employed in the production of functional words in their target language English.

According to Li [18], neutral tone of the latter syllable in a dissyllabic Chinese word is usually realized by a falling tone with an obvious pitch reset, which is similar to learners’ production of weak forms of prepositions located in the post-nuclear position. This phenomenon indicates that learners’ L1 feature of neutral realization is transferred into the production of English weak form, which is in line with the negative transfer proposed by Lado [12]. But it is noteworthy that weak forms of prepositions positioned before the sentence nuclear is the relatively well acquired. This might be due to the fact the neutral tone usually occurs on the latter syllable of dissyllabic words. A reduced vowel positioned before the nuclear might be taken as the new phone by learners who would then notice the difference between their L1 and L2, and further gain a relatively well acquisition, conforming to the statement of SLM [13].

It should be noted that the similarity between learners’ L1 and L2 syllable construction do not influence the realization of the preposition weak forms.

With reference to the vowel quality and duration of the unstressed prepositions, it is known that except the preposition “of”, learners have an unsatisfactory acquisition of all the prepositions due to their bad vowel centralization. This might be caused by the absence of lax-tense contrast in their mother tongue Chinese, which is another evidence of negative transfer in L2 acquisition. Specifically, weak forms in English is usually realized as /ɪ/ and /ə/, both of which are lax vowels. However, Chinese learners do not have phonetic experience of

vowels in this type as their L1 vowel system does not contain lax vowels which are shorter than their English tense counterparts [16]. These might be the possible reasons leading to the relatively longer duration of learners' weak forms.

But it should be noted that learners have noticed the difference between the weak and the normal forms of prepositions as the duration of weak forms they produce is obviously reduced, by which it is inferred that reduction in duration is the main phonetic cue they use to distinguish the weak forms from their normal counterparts, with seldom attention paid to the variation of vowel quality. Features of the vowels they used to represent the weak forms might be borrowed from their L1 system. This hypothesis can be proved by the statistical analyses on learners' production of stressed syllables. Specifically, /æ/ in [æt] is usually realized as /a:/, a Chinese sound articulated at a lower position compared with the former, by learners in its normal form, and this sound is shortened when a weak form is needed. Although a vowel quality is change during this process according to the above data, still it is different from what is realized by the native speakers. Likewise, /ɔ/ in "from" [frɒm] and /ɔ:/ in "for" [fɔ:] are realized by them as the Chinese /o/ due to their closeness in the vowel acoustic space, which leads to the more backward position in the L2 productions of the stressed "from" and "for", and only reducing the duration does not make weak forms of vowels in these two words similar to those produced by the native speakers. Similarly, similarity in acoustic space also lead to learners' transference of the Chinese sounds /i/ and /u/ into their L2 productions of the stressed "in" [ɪn] and "to" [tu:] respectively, and only have duration of the two sounds reduced in the unstressed context, which contributes to the deviant productions of them. The preposition "of" is well acquired as /ə/ is present in their L1 system and can be borrowed without doing any change.

V. CONCLUSIONS

From the above discussions, it could be concluded that learners do not have a good acquisition of weak forms of prepositions. Although differences between weak forms and the normal ones are noticed by them, still, they cannot have the weak forms realized by using the same acoustic cues as the native speakers do. In detail, it is hypothesized that only pitch and durations are employed by them to distinguish the unstressed from the stressed. However, they have transferred pitch features in neutral tone into the production of weak forms, and have only shortened the vowel duration of the prepositions to highlight the prominence of other syllables in the sentences. In addition, it is probably because that learners have no awareness that centralization should be done in doing vowel reduction, so they use shortened Chinese vowel to do represent the weak forms of each vowel prepositions. But due to the absence of lax vowels in their mother tongue, their weak forms, the shortened L1 vowels are still longer than those of the native speakers.

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