THE PRODUCTION OF PERSIAN RHOTICS BY NATIVE MANDARIN SPEAKERS

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ABSTRACT

This study investigates the non-native production of rhotics by Mandarin speakers learning Persian as L3 and it compares the results with that of native speakers. In the light of the findings, one of the predictions made by the Speech Learning Model was tested. According to this model, speech acquisition happens at a position-sensitive allophonic level. A series of informal /casual interviews were conducted to collect the data. This resulted in 1252 tokens used for the analysis. The results showed that all speakers produce the allophonic variant trill which exists in Persian but is absent in both Mandarin and English as their L1 and L2. However, their contextual distribution did not show the same pattern as the native speakers. It is suggested that extra-linguistic factors should be also taken into account in order to get a fuller picture of non-native allophonic production.

Keywords: L2/L3 speech acquisition, rhotics, trills, Persian, Mandarin.

1. INTRODUCTION

The class of sounds labelled rhotics or "r-sounds" consists of segments with variable phonological and phonetic behaviours. From a phonological perspective, rhotics tend to occupy a slot closest to the syllable nucleus (Lindau [7]). It is possible that rhotics could have syllabic variants, or they could merge with other vowels. In American English, for example, the rhotic approximant /ɹ/ has syllabic variant as in the word "herd". These segments could also behave as non-syllabic consonants. Both rhotics and coronal stops show similar behaviour in Persian. Word-final rhotics, similar to coronal stops, are optionally deleted when they are preceded by obstruents (Falahati [3]). For example, the final clusters in the words /fekr/ "thought", /sæbr/ "wait", /sefr/ "zero", and /estæχr/ "swimming pool" are optionally simplified in fast/casual speech, resulting in: [fek], [sæb], [sef], and [estæχ], respectively.

According to Ladefoged and Maddieson [5], the class of rhotics could have a wide range of segments such as taps, flaps, trills, fricatives, and approximants. Obviously, this classification is neither based on the manner nor the place of articulation. These segments may be considered categorically alike in light of their representations within their respective orthography systems. For example, English and Persian use graphemes <r> and <ر> representing all the "r-sound" variants in the two languages. Another reason for regarding these segments as one group could be the phonetic affinity extant among these segments. This similarity could be either acoustic, auditory, or both.

The main objective of this research is to investigate whether the allophonic variants of rhotics are learned by non-native speakers who lack such variations in their L1 and L2. In order to follow this goal, the Mandarin speakers learning Persian as L3 are studied. The following section provides a brief introduction to rhotics in Persian and Mandarin.

2. RHOTICS IN PERSIAN AND MANDARIN

Persian rhotics have received different accounts in the literature. According to Carr [1], the phoneme /r/ in Persian has three allophonic variations: voiced alveolar taps, voiceless alveolar trills, and voiced alveolar trill. The voiced alveolar tap is realized inter-vocalically, the voiceless alveolar trill appears word-finally, and a voiced alveolar trill elsewhere. Ladefoged and Maddieson [5] also echo Carr's viewpoint regarding the positional distribution of rhotic allophones in Persian. Samareh [10] considers both the vocalic environment and the position in his description of Persian rhotics. He states taps, trills, fricatives, and approximants as different variants of the rhotics in the language. According to him, rhotics could be realized as either trills or fricatives word-finally, depending on the preceding vocalic environment, and as taps or approximants intervocalically. These studies are mainly based on phonological data and the acoustic analysis of Persian rhotics is quite limited. In one of the few acoustic studies, Rafat [9] found that fricative is the prominent variant used by the native speakers in word-initial, intervocalic, and word-final positions.

Her results also showed that the production of trills as a singleton exists only word-finally.

Trills are consonants produced by vibrations between the active articulator and passive articulator. From this perspective, trills are very different from taps where a specific gesture is used to strike an active articulator against a passive articulator. Cross-linguistically, word-initial and post-vocalic positions are the primary locations favoured by the trill due to aerodynamic and mechanical reasons (Lewis [6]). In addition to the trill as a singleton and allophonic rhotic variant shown by single grapheme <ر> in orthography, Persian also has a geminate trill cued by the single grapheme <ر> and a diacritic which happens only in an intervocalic position. It is only the former trill as an allophonic variant of rhotics which is the main focus of this study.

According to Duanmu [2], Mandarin has one rhotic consonant which is a voiced approximant/fricative. There are also voiced alveolar stops and voiced dental laterals in Mandarin which are quite similar to the Persian tap from both auditory and articulatory perspectives. Therefore, for the Mandarin speakers the trill, as one of the allophonic variants of Persian rhotics, which happens word finally is considered to be a new sound. The models of speech learning propose different predictions regarding the acquisition of a new sound. The following section introduces one of these models and its predictions as it relates to the current study.

3. NON-NATIVE ACQUISTION OF SOUNDS

Different models have been proposed to account for the acquisition of non-native sounds. According to the Speech Learning Model (SLM) proposed by Flege [4], sounds in the L1 and L2 are related perceptually to one another at a position-sensitive allophonic level, rather than at a more abstract phonemic level. According to this model, a new phonetic category can be established for an L2 sound that differs phonetically from the closest L1 sound. This is conditioned by the fact that bilinguals detect at least some of the phonetic differences between L1 and L2 sounds. Therefore, this model predicts that Mandarin speakers learning Persian as a non-native language should be able to acquire this allophone and show the production of trills in word-final position, should they detect the acoustic/auditory cues present in the native production. Since geminate trills also happen in Persian, It could be also interesting to investigate whether language learners show the same distributional pattern as native speakers in using the allophonic singleton trill. The following section introduces the methodology of this study.

4. METHODOLOGY

4.1. Subjects

Fifteen Mandarin speakers (eight female, seven male) aged 20-37 participated in this study. Eight of them were in an immersion program at the International University of Qazvin, located in Iran. They were all at the 3rd year of their studies learning Persian language and literature as their field of study at the University of Shanghai, their home university. The rest of the subjects were regular students at the Iranian universities. In this paper, the results of seven speakers (four female, three male) are only presented.

All of the subjects knew English as L2. Since their L2 does not have the targeted allophone in this study (i.e., trills), that does not affect the predictions made earlier.

4.2. Data collection and acoustic analysis

The subjects received three tasks for data collection. The first task was an interview which was conducted in a very informal and casual way. Each interview was recorded using digital tape recorder Marantz PMD 660 which lasted 30-60 minutes. Interviews usually started with some demographic questions followed by some topics of potential interest for international students in Iran. In addition to the free interview, a translation task as well as word list reading task were used for data collection. Here only the data taken from the oral interviews will be reported. This resulted in 1252 tokens from seven subjects.

Praat was used for the segmentation, annotation, and acoustic measurements. By looking at the spectrograms, any short closure with the presence of auditory discontinuity and lack of formant structure and dip amplitude was coded as a tap. The trill was identified when there were a series of closures and openings marked by dark vertical lines on the spectrograms. A fricative was identified when there was a lack of formant structure and clearly aperiodic noisy spectrum. The formant structure with F3 dipping sharply into and rising out of adjacent vowels was coded as approximants. They also marked diminution of energy in the spectrum above the F2/F3 prominence. In addition to the identification of rhotic types, their duration was also

measured. The next section presents the results of this study.

5. RESULTS

The manner of articulation and duration of the Persian rhotics produced by Mandarin speakers were found and compared to the existing results in the literature for the native speakers. Table 1 shows the range and average length for different variants of rhotics for the seven speakers.

Table 1: Rhotic length

Rhotic Type	Average Length	Range
Approximant	53^{ms}	13-161
Fricative	46^{ms}	14-168
Tap	43^{ms}	17-111
Trill	74^{ms}	32-179

Note: Length values are in milliseconds

According to this table, trills with the average of 74 ms are the longest and taps with the average of 43 ms are the shortest variants of rhotics. This shows difference from the results of native speakers reported by Rafat [9]. The average length of the trills produced by the native speakers (i.e., 167 ^{ms}) is much bigger than the Mandarin speakers in this study. Taps produced by the native speakers, in the contrary, are shorter than the ones produced the Mandarin speakers. This could be due to using different tasks in these two studies. Rafat has mainly used reading task resulting in more articulate speech in her study.

Figure 1 below shows the percentages of each variant production. The seven speakers of the study produced mainly three variants of the rhotics ranked as taps, approximants, and trills. This is different from the results reported for the native speakers which showed fricatives and taps as the most frequent variants.

Figure 1: Distribution of rhotic types across all subjects

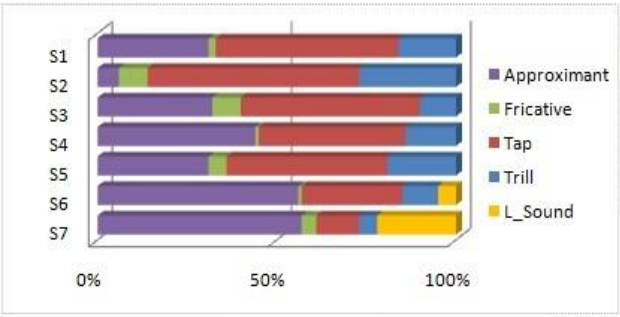
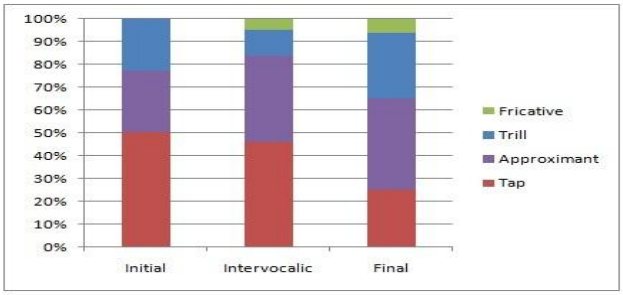


Figure 1 also shows that fricatives were the variant produced the least with the range of 1-8 percent. This shows a striking difference with the results of the native speakers. Moreover, this figure shows that subjects #6 and #7 replaced 5% and 22% of the rhotics with some L-sound, respectively. It is interesting to notice that these two subjects also produced the highest rate of approximants (i.e., 56% & 57%) among all subjects.

Figure 2 below shows the distribution of the four rhotic variants in word-initial, intervocalic, and word-final positions.

Figure 2: Distribution of the rhotic types in three environments for all subjects



According to this figure, subjects show the highest frequency in using trills in the final position (i.e., 29%), followed by initial (23%) and intervocalic (11%), respectively. Rafat [9] has reported that native speakers used the singleton trills only in the word-final position. It seems that the Mandarin speakers have extended the positional dominance for the native use of trills (i.e., word-final) to other environments. Similar to trills, the other rhotic variants are being used differently by native and non-native speakers across the three environments. Taps are used by the speakers in the initial, mid, and final positions 51%, 46%, and 25%, respectively. Rafat has reported 70% of taps in the mid and 9% in the word-final positions. Approximants have also been reported to be dominantly used (i.e., 24%) only in the word-initial position by the native speakers. Figure 2 shows that Mandarin speakers use approximants in all three environments (initial 27%, mid 38%, and final 40. Rafat [9] has also reported that fricatives constitute 85% and 76% of the rhotics in word-final and word-initial positions; whereas, fricatives are rarely produced by the subjects in this study.

All in all, the results of the subjects presented here show that the Mandarin native speakers use the trills as an allophonic variant of /r/ in their Persian production. However, they have extended its use to the environments where native Persian speakers rarely produce singleton trills.

6. DISCUSSION AND CONCLUSIONS

The main goal of this research was to investigate whether the non-native Persian learners acquire the allophonic variant of a phoneme which does not exist in their L1 and L2. This also created the context to test one of the predictions made by SLM regarding the acquisition of position-sensitive L2/L3 allophone. According to this, if the non-existent allophone in L1 provides salient acoustic/auditory cues to L2/L3 learners, then a position will be created for the new sound. The results of this study showed that all the subjects produced the trill as an allophonic rhotic variant. This partially supports the prediction made by SLM that mapping between L1 and L2/L3 sounds happen at allophonic rather than phonemic level. However, the subjects of this study, except subject #4, extended the environment of using this variant beyond the one mainly used by the native speakers (i.e., word-final position).

Despite of the fact that fricatives were shown to be the dominant variant in the native Persian production, the Mandarin subjects in this study produced them the least. This could be due to different reasons. The literature of the child phonology has shown that children at the developmental stages of their language acquisition usually replace fricatives with stops. The reason for this could be the articulatory mechanism and the precision needed to produce a fricative consonant versus a stop. Language learners could stick to the variant with the least articulatory effort if this does not put the communication at risk. The other reason for such a variation could be the nature of tasks used in this study and the one used for the native speakers. Research has shown that the production of a position-sensitive allophone could vary according to factors such as speaking rate and style. The study for the native speakers has used word list which illicit more deliberate speech (Rafat [9]).

The very high frequency for approximant production could show the influence of Mandarin where rhotics could appear as approximants. One could argue that the subjects of the study could be at different developmental stages in their Persian language acquisition. This idea gets support by looking at the results for subjects #6 & #7, the two subjects with L_sound production, who also showed the highest frequent of approximant production.

The result of this small-scale study could be used to assess the findings in the sociolinguistics field. Research in this area has shown that men favour more complex structures than women. If we consider trills as a more complex variant among rhotics, men are expected to show the higher frequency of trills compared to women. Adding some other non-linguistic factors such as the value or prestige associated with different variants of a phoneme could also shed more light on this issue.

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