A Study of Perceptual Errors of Liquids /r/ and /l/—Evidence from a Diction Task by Chinese Learners of English

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Abstract. The Chinese language consists of a variety of dialects, and they can be generally divided into northern dialects and southern dialects. A significant difference between these two kinds of dialects is that whether there are rhoticities. This study focuses on the second-language learners' perception of liquids. Based on the different state of similarity that the second language (L2) has to the first language (L1), there are two contrastive theories separated. This study utilizes a diction task on two groups who have different levels of familiarity towards /r/ sound to find out which model is more suitable to predict second-language learners' perception towards liquid sounds. The author also sets a pair of comparative factors in the diction material to verify, in terms of syllable structure, in which position a liquid is more likely to be misperceived. Results of the diction task shows that compared to the Featural Model (FM), Perceptual Assimilation Model (PAM) is the more reasonable one to explain the relationship between the perception of a sound exists in the second language (L2) and its similarity to the counterpart in one's first language (L1). Additionally, Coda liquid has a much lower level of overall accuracy than Onset liquid, which indicates that Coda liquid is more difficult for people to perceive.

Keywords: Liquid · Phonetics · Second-language acquisition · Onset · Coda

1 Introduction

Liquid, in phonetics, is a consonant sound in which the tongue produces a partial closure in the mouth, such as English /l/ and /r/ [1]. /r/ and /l/, as English liquids, have been considered consonants like vowel, which is reflected in that they are recognized as intermedium between vowels and stop consonants in perceptual, articulatory, acoustical, and phonological way [2]. Chinese learners of English, especially learners from the south of China, often have difficulty pronouncing /r/ sound. That is because many Northern Mandarin dialects have coda /r/ and are often spoken with rhoticity while some southern dialects have no r-like liquids. Therefore, when some southerners need to pronounce /r/, they pronounce /l/ instead.

This research attaches great importance to the results of the application of two contrastive theories, namely the Perceptual Assimilation Model (PAM) and the Featural

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Model (FM), to the second-language acquisition. The purpose of this paper is to study which theory is more accurate in predicting people's perception of liquids. The two contrastive theories will be introduced and further explained in the next part. In this study, the author also intends to verify, in terms of syllable structure, in which position a liquid is more likely to be misperceived. To achieve this goal, the author designed a diction task and made calculation and analysis of the false rate of the Coda liquid and Onset liquid of participants in each group respectively. Although southern dialects and northern dialects are technically the same language, they can be seen as in different language systems in certain aspects and dimensions. Hence the PAM theory and the FM theory are appropriate for this research.

2 Theoretical Background

Although that there are considerable researches about the sound perception in the second language (L2), they mainly focuses on the vowel perception rather than consonant. There is an explanation to this phenomenon. It is challenging to predict the degree of perceptual similarity at a very precise level among different L2 sounds, and one way that is widely adopted is to compare the acoustic characteristics of the given sounds. This way has been confirmed to be effective in assessing vowel similarities [3]. However, consonants are generally considered more difficult to analyse for having more complex acoustic cues [4]. There are even fewer studies about the perceptual differences and errors of liquids. Apart from this, in the field of L2 sound perception, there are conflicting theories existing as well. There are still spaces left to be further explored and there are also variable theories that need more confirmation to prove their practicality.

It is widely accepted that the acquisition of L2 phonetic categories perceptual similarity plays a really significant role, and the Perceptual Assimilation Model (PAM) [5] clearly supports this view. According to PAM, the perception of the L2 sounds is based on their similarities to or distances from the closest counterpart sounds in L1. It indicates that it will be easier to perceive a sound in L2 if there is a same or at least familiar sound in one's L1 so that one could fit them into the same category. Accordingly, PAM agree that the perceived phonetic distance between L1 and L2 plays a crucial role in L2 perception. However, there are contrastive theories about how the L1 influences the perception of L2. A method known as the Featural Model (FM) [6] suggests that if the required distinctive features are absent in the learners' L1 phonological system, L2 sounds could be perceived as similar. This theory stands on a totally different viewpoint with PAM and it suggests that it would be better to perceive a sound which is absent in one's L1 so that one will not mix up and be confused. Therefore, there is a need to investigate how is the perception of liquids being influenced.

3 Methods

3.1 Participants

There are 10 participants in total and all participants are Chinese university students. They are divided into 2 groups. One group is consisted of 5 people whose first dialect

(D1) is non-rhotic dialect (NRD). Participants in NRD group pronounce /r/ wrongly as /l/ in daily life. The second group contains 5 people as well whose D1 is rhotic dialect (RD), and all of them pronounce /r/ correctly. To ensure there will not be a proficiency problem which might affect the experiment results, all participants are juniors majoring in English and they all passed the Test for English Majors-Band 4 (TEM-4). All participants are confirmed as having no hearing or speaking disorders.

4 Material

The materials are composed of 10 sentences. Each sentence only contains one liquid sound and all sentences are grammatical and semantically acceptable, so that it is ensured that no matter the participants perceive the liquid sounds right or wrongly, all sentence still make sense. That is to assure the results written by participants are truly based on their perception instead of their understanding of the whole sentence and the credibility of this experiment is guaranteed through this way. Based on the syllable structure, the materials are divided into two parts focusing on Onset liquid and Coda liquid respectively. Here are 2 examples.

Onset liquid: I'm going to correct/collect the homework.

Coda liquid: Did you find the tower/towel?

Each part is made up with 5 simple sentences within 10 words to empty disturbing factors as possible. The materials used in this diction are all recorded from native speakers to avoid inaccuracies caused by accents.

4.1 Procedure

All participants will be asked to finish a diction task using the material mentioned above independently in a quiet environment. All sentences will be played for only once and participants will be given a 30-s interval to write down each sentence integrally. Ten sentences will be played on a loop without pause or intermission. This task lasts for about 7 min per person. After the diction task is finished, the written results from all participants will be collected and then analyzed.

5 Results

The results of the number of mistakes that each group made in each part is shown in Table 1. There are three statistical elements that each group needs to be recorded concurrently: (1) the overall accuracy, (2) the false rate of Onset liquid, and (3) the false rate of Coda liquid. The accuracy statistic here refers to the sensitivity of liquid sounds, and the false rate is examined by the incorrect judgement of words. Therefore, the false rate represents bias. According to Casillas and Simonet [7], a low bias with a high sensitivity could, at some level, show a rather significant perceptual discriminability.

As shown in Fig. 1, it is obviously manifested that RD has a higher level of overall accuracy than NRD, and both of the Onset liquid and the Coda liquid false rates of RD are lower than those of NRD. Hence it can be proved that RD does have a higher sensitivity

Table 1. The number of mistakes each group made in each part.

Group	Part	
	NRD	RD
Onset	4	2
Coda	8	3

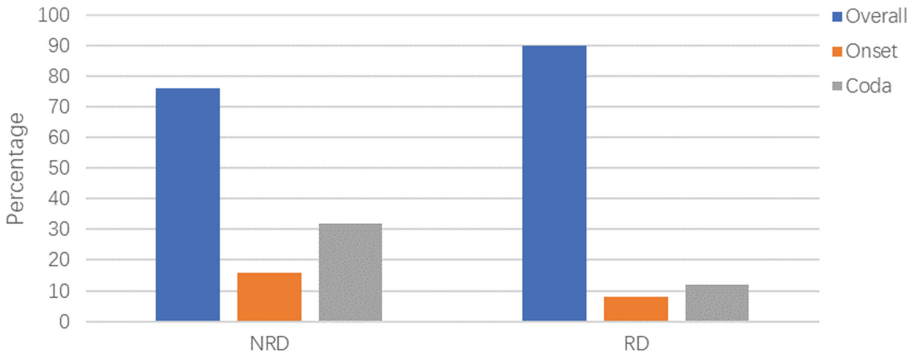

Fig. 1. The percentage of the overall accuracy, the Onset liquid accuracy, and the Coda liquid accuracy of each group.

and low bias towards the liquid sounds than NRD. Moreover, it can be observed obviously that there is a visible difference of the false rate of Coda liquid between NRD and RD.

Through specific and concrete analysis of these statistics it can be seen that RD (90%) has a 14% higher level of overall accuracy than NRD (76%), but there is not significant difference noticed between NRD's false rate of Onset liquid and RD's. The main difference exists in the Coda liquid part in which NRD's false rate amazingly reaches 32% while RD's is only 12%. This indicates that RD are more sensitive than NRD mainly in Coda liquid. Information in Fig. 2 also confirms this point of view. Figure 2 generally focuses on the contrast of the overall accuracy between Onset liquids and Coda liquids. By calculating the hit rate of all participants, it is evident to see in Fig. 2 that Onset liquid (76%) has a much higher level of accuracy than Coda liquid (56%). Hence Coda liquids are more difficult and harder for people to perceive than Onset liquids.

6 Discussion

The definition and specific characteristics of liquids will be focused on in this part again. A lot of academics have already put considerable efforts to investigate the unique qualities liquids have, and just as any other unsettled theories that still need to be developed further, there are different opinions existing concurrently. Larson-Hall [8] and Clements and Hume [9] proposed that [±lateral] should be the distinctive feature between /r/ and /l/, whereas Hall [10] noted that [±rhotic] can be utilized to specify all the r-sounds. There

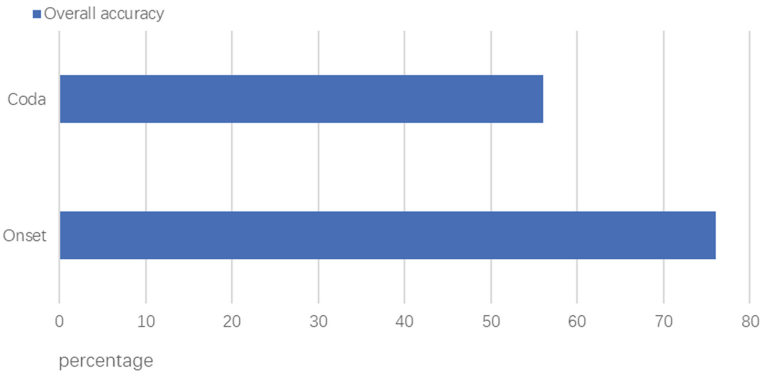

Fig. 2. The overall accuracy of Onset liquid and Coda liquid respectively

is a third view introduced by Rolsten [11] who suggested that /r/ should be described by the feature [±trill].

As for the latter two suggestions, the Johnson [12] and Ladefoged and Maddieson [13] analyzed these two suggestions from the perspective of liquids, and found that laterals are usually characterized by zero or anti-formants between F2 and F3, while the acoustic characteristic of trills is the existence of acoustic transients due to tongue trilling. This could, however, partly explained why FM successfully predicts the vowel similarity but fails to be suitable enough in this investigation. This is because vowels are generally characterized by F1 and F2, which are the common acoustic parameters, and different features chosen from above can also lead to different predictions of FM. Therefore, as multiple dimensions are entailed, it could be rather complicated to compare the acoustic features between trills and laterals. Now it is reasonable to conclude that in terms of predicting the perceptual similarity in L2 liquid contrasts, PAM is superior to other approaches or theories like FM because it is based on Articulatory Phonology.

7 Conclusion

This study generally focuses on the perceptual errors of liquids made by Chinese English learners and testify the exactitude of 2 contrastive theories, PAM and FM, in the field of their application in the second language acquisition. In the designed diction task conducted in this paper, participants were divided into two groups, RD and NRD, based on the classification of their D1. To check whether there is an influence made by the rhoticity existing in the first dialect to the perception of liquids in L2. Additionally, in order to identify in which position of a syllable is a liquid sound more likely to be misperceived, the author set a pair of control variables of the Coda liquid and the Onset liquid in the diction task. All participants were asked to finish this diction task in a quiet environment independently and the whole process lasted about seven minutes per person. Through the calculation and analysis of collected data, it turns that participants in RD has higher sensitivity towards liquids and they got better diction results than participants in their counter-group NRD. Thus it can be seen directly that people whose D1 is rhotic have better acquaintance of liquids than those whose D1 does not contain rhoticity.

This report supports the PAM theory which insists that it would be easier for people to perceive second-language sounds already existing in their first language, because this can help people to categorize and imitate L2 sounds to some extent. Moreover, through the comparison of the hit rate between the Coda liquids and the Onset liquids of all participants, the conclusion can be drawn that, compared to Onset liquids, Coda liquids are more difficult to be perceived correctly, and this conclusion is the same as what the author predicted to be.

To sum up, the current findings indicate that PAM is more appropriate in terms of predicting the competence of second-language learners to perceive and acquire the liquid sounds in L2. However, this assumption still needs to be tested in the future to ensure a better application of PAM in the acquisition and perception of L2.

References

1. T. Britannica, Editors of Encyclopedia, liquid. Encyclopedia Britannica, July 20, 1998, from https://www.britannica.com/topic/liquid-phonetics.
2. M. Katharine, The perception of /r/ and /l/ in syllable-initial and syllable-final position, University of Minnesota, 21(2), 1977, 162-170.
3. P. Escudero, P. Vasiliev, Cross-language acoustic similarity predicts perceptual assimilation of Canadian English and Canadian French vowels [J], Acoust. Soc. Am., 130(5), 2011, EL277–EL283.
4. Y.X. Yang, X.X. Chen, Within-organ contrast in second language perception: The perception of Russianninitial /r-l/ contrast by Chinese learners, The Journal of the Acoustical Society of America 146, EL117, 2019. doi: https://doi.org/10.1121/1.5120549.
5. C. Best, A Direct Realist View of Cross-Language Speech Perception. In: W, Strange. (ed.), Speech Perception and Linguistic Experience: Issues in Cross Language Research, York, Timonium, MD, 1995, 171–204.
6. C.A. Brown, The role of the L1 grammar in the L2 acquisition of segmental structure, Second Lang. Res 14(2), 1998, 136–193.
7. J.V. Casillas, M. Simonet, Production and perception of the English /æ/-/A/ contrast in switched-dominance speakers, Second Lang. Res., 32(2), 2016, 171–195.
8. J. Larson-Hall, Predicting perceptual success with segments: A test of Japanese speakers of Russian, Second Lang. Res., 20(1), 2004, 33–76.
9. G.N. Clements, E. Hume, The internal organization of speech sounds, in The Handbook of Phonological Theory, edited by J. Goldsmith (Blackwell, Oxford, UK), 1995, pp. 245–307.
10. T.A. Hall, The Phonology of Coronals (John Benjamins, Amsterdam), 1997.
11. L. Rolston, An independent assessment of phonetic distinctive feature sets used to model pronunciation variation, MA dissertation, Department of Linguistics, University of Washington, 2014.
12. K. Johnson, Acoustic and Auditory Phonetics, 3rd ed. (Wiley-Blackwell, Chichester), 2012.
13. P. Ladefoged, I. Maddieson, The Sounds of the World's Languages (Blackwell, New York), 1996.