



# Environment Input in Second Language Acquisition of Phonetic Details: The GOOSE Fronting Among Chinese English Learners

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**Abstract.** Pronunciation accuracy has always been an important goal in teaching English as a second language. However, the recent phonetic changes among English varieties often make it difficult for conventional methods of teaching English as a second language to achieve the goal. This paper focused on the phenomenon of GOOSE fronting as a typical example of vowel change in English. After reviewing previous studies on GOOSE fronting, this paper attempted to discuss the distribution of GOOSE fronting among Chinese students and the possible influencing factors, using a combination of quantitative and qualitative methods. The findings of this paper suggested that the classroom may have a minor impact on the acquisition of second language phonetic details, while the input of the language environment may be considered as a crucial contributing factor.

**Keywords:** GOOSE fronting · English vowel change · English second language acquisition · Second language phonetics

## 1 Introduction

Among issues currently being researched in English language teaching in China, the acquisition of English pronunciation by Chinese students is a frequently discussed topic. In the process of learning English, the pursuit of accurate pronunciation is a common goal in teaching and learning. However, the phonetic nature of English had undergone natural changes, including changes in the quality of vowels. Although many of these changes have been occurring for over three decades, they were not reflected in either dictionaries or textbooks. This made it very difficult for second language learners of English to catch up with these recent changes in their learning of pronunciation.

In this paper, the GOOSE fronting is used as an example of English vowel change, combining quantitative and qualitative analysis methods to examine the extent to which Chinese university students have acquired contemporary English phonetic changes. It also attempts to analyse and summarise the relevant factors affecting the acquisition of phonetic changes.

Before introducing the experimental methodology, the paper will first review relevant studies on GOOSE fronting, including the influence of phonological constraints and

sociolinguistic factors. Attention will also be paid to papers on topics related to vowel change in second language acquisition.

## 2 Literature Review of the GOOSE Fronting

The GOOSE vowel in English was conventionally described as a high-back rounded vowel and represented by the IPA symbol [u:] in textbooks and dictionaries. However, in the past couple of decades, the GOOSE vowel has been noticed to undergo a fronting process, changing the vowel quality back to mid or front [1]. Although this fronting process is especially dramatic in southern British English [2], it is not a regional change but widely existed in many English varieties across the world [1, 3, 4]. Wells had reported that a back rather than the central quality of GOOSE vowels was a feature of conservative varieties of English [4] showing that this process has become popular in the 1980s [5]. Since then, many studies focused on vowel quality fronting showing that the English variants with GOOSE fronting are existing in worldwide. There were studies on the Received Pronunciation and British English dialects [2, 6–13], in Irish English [14], in American English [15–22], in Australian [23] and New Zealand English [24, 25] and South African English [26].

### 2.1 Changes Over the Last Six Decades

The most basic way of quantifying GOOSE fronting in these studies is the measurement of F2 data. This is because the main phonetic change involved in this process is the frontness that is reflected on the F2 value. Among the many English variants studied, GOOSE fronting presents as a recent feature, and studies covering the historical span show that GOOSE vowel has made the transition from a typical back vowel to a mid-vowel or even a front vowel over more than 60 years.

In Southern British English, GOOSE fronting is rather a recent feature since there was a dramatic change of F2 of GOOSE vowels in the latest six decades. In 1962, the reported average F2 value of GOOSE vowel for male speakers was 939 Hz [27] but it increased to 1191 Hz in 1997 [28]. In the next decade, the F2 figure of the GOOSE vowel continually rose and eventually reached 1983 Hz in 2010 [2] which should be regarded as a central vowel rather than a back vowel. Similar findings were shown in Hawkins and Midgeley's [29] study. It recorded the F2 frequencies figures for /u:/, /ʊ/ and /i:/ across four different age groups in 2001. The averaged F2 frequencies of the GOOSE vowel for 20–25 males was 1626 Hz in comparison with 994 Hz for aged 65–73s. The figure indicated a fronting change, and it was a gradual process since the younger the speakers were, the higher F2 frequency data were collected. Besides, it was also found by Harrington et al. [30] that the F2 values for the GOOSE vowel among younger speakers (18–20) had partially overlapped with the F2 values for the /i:/ category while the two categories were distinct among older speakers (over 50s).

Watt and Tillotson [9] from the University of York had run a spectrographic analysis of vowel fronting processes of Bradford English. According to the data they had collected, the frontness of GOOSE vowels, along with the previously mentioned findings, showed a big difference between different age groups. The speaker aged 75 has an F2

figure of GOOSE vowels around only 500 Hz, while the youngest speaker aged 17, has an F2 figure of GOOSE vowels above 1200 Hz.

In New York City English, the GOOSE fronting is also suggested to be a recent feature. Wong's study [3] mentioned that Labov's study [31] indicated that the GOOSE vowel was in a non-fronted position in 1960s New York City English, while the fronting development of GOOSE vowels happened afterwards among young middle-classed New Yorkers [18].

The impression following current research and Ferragne and Pellegrino's acoustic vowel survey [2] may be that GOOSE fronting was occurring in the same way under a similar timeline. However, Lawson, Stuart-Smith and Rodger [4] suggested that historical evidence shows that GOOSE fronting has had very distinct diachronic trajectories in different regions of the British Isles. The GOOSE fronting in Standard Southern British English has already been studied as a recent change, while in Scottish English, the frontness of GOOSE may be partially attributed to the fronting and unrounding of Middle English  $\bar{o}$  that occurred in the late 13th century, and this also results in a range of front monophthongal and diphthongal dialectal reflexes for the GOOSE lexical set [32]. This finding showed that the results of GOOSE fronting may have multiple origins and were triggered by different phonology.

## 2.2 Phonological Constraints

It is also vital to introduce the phonological condition of the fronting of the GOOSE vowel. Wong [3] carried out a study on the distribution of GOOSE fronting among Chinese Americans in New York City. In her study, GOOSE vowels were distinguished into three different types with the bearing of their phonological characteristics. The subset of preceding coronals as in *too* and *do* has a distributional favor to be fronted in a greater extent in comparison with the subset of non-coronals as in *food* and *who*. While the laterals (/l/ sound) tend to inhibit fronting in many classes (as in *tool* and *cool*). In later her lab study, preceding coronals were indeed tending to be more fronted than non-coronals on average. This finding was also reported in Strycharczuk and Scobbie's paper [33] and other related studies. In this paper, laterals will not be involved in the trial, but no distinguishment will be made between coronals and non-coronals.

## 2.3 Gender Differences and Sociolinguistic Factors

IT is widely noticed that the GOOSE fronting has a gender difference. Within the same age group, female speakers tend to have relatively higher F2 frequencies than male speakers [28, 34]. Young women, in particular, were found by research to be the leading groups of the fronting of GOOSE vowels [35–38]. It reflects Labov's overall principles of linguistics change [39] which is that young women are usually the main leaders of change below the level of consciousness [38]. Wong [3] also suggested that fronting is in part socially motivated [39]. She further pointed out that fronting is so common that instead of indicating any specific regional distinctions, fronted GOOSE vowels may only carry weak and general social meanings. In Hall-Lew's study [40] and Wagner's study [41], retreated variants of GOOSE vowels were found to index certain emotional stances.

## 2.4 GOOSE Fronting in Second Language Acquisition and Research Question

The primary aim of this paper is to discuss to what extent do Chinese L2 speakers have acquired detailed English phonetics using GOOSE vowels fronting as a typical example for discussion. This purpose is related to a specific question is what the contributive factors for English L2 learning are. The prediction made by this paper would be that the environment input outside the classroom is an important contributing factor.

Since there are not many studies that particularly link second language acquisition and the GOOSE fronting change, Šimáčková and Podlipský's study [42] provides a vital angle for looking at how L2 speakers deal with fine phonetic detail. The study of the paper was aiming to involve advanced Czech English learners and focused on whether they form new phonetic categories in L2 and realize them accurately. A little instructive information was provided in this paper. Firstly, it was stressed that the sensitivity to phonetic details of all speech sounds declines by the development of their native language [43]. Therefore the phonological system of the native language would have a huge impact on their acquisition of L2 and overcoming the constraints posed by native phonological systems are crucial in the learning process. In comparison with English fronted back vowels, Czech has typical back vowels that do not have fronted features. This difference is regarded to affect the L2 acquisition of Czech English speakers. Besides, environmental input plays an important role in L2 acquisition. As Bohn & Flege pointed out [44], learners who are not consistently exposed to L2 input environment may not show improvement over time in contrast to L2-immersed individuals.

For English pronunciation learning among Chinese students, in particular, Shi involved a study to compare vowel distribution of Chinese and American English by drawing vowel triangles [45]. It was shown that the two triangles were very different in shape. The F2 of high back rounded vowel /u/ in Chinese is below 800 Hz while in American English it was above 800 Hz. Shi then recorded the English /u/ vowels that were produced by Chinese students and found that they had made some effort to mimic the vowel position in English. They had a fronted /u/ vowel compared with its native Chinese version, although it has not to overlap with the English version. This demonstrated the impact of native phonological systems in L2 speech along with Šimáčková and Podlipský's finding [42].

In the next section, this paper is going to introduce the methodology of the study for answering the research question.

## 3 Methodology

### 3.1 Participants

In this experiment, 11 Chinese students were involved. All of them are native in Mandarin Chinese. They are aged between 18–23 and are all university students. And they all had their secondary education in China. According to later English learning environment, this experiment divides them into two groups. Group 1 (Domestic Group) contains students who are doing their undergraduate course in China, and it consists of four female students and three male students. Group 2 contains students who are doing or have done their undergraduate course overseas (in London, UK), and it consists of two

female students and two male students. In terms of their English ability, all students have had English learning over 10 years. Group 1 students have passed General Senior Secondary Academic Level Examination and College Entrance Examination (known as ‘Gaokao’). Group 2 students have obtained IELTS 7 or equivalent for entering UK universities.

### 3.2 Experiment Design

In this experiment, both quantitative and qualitative methods will be used, and the experiment will be divided into two parts accordingly. There were 20 monosyllabic words containing the GOOSE vowel involved in the quantitative part of the study, they are **soup, goose, too, tooth, zoo, move, do, food, roof, mood, noodle, boot, who, noon, rude, loop, crew, true, stoop and juice**. Due to the phonological conditioning of GOOSE fronting that was discussed in the previous section, the words with GOOSE vowel followed by laterals will not be included, but no distinction between coronals or non-coronals were set. Candidates would be recorded on the production for these trails for collecting formants data for GOOSE vowel production.

The qualitative part of the study was in a form of a short interview. The survey consisted of four questions acquiring students’ English education background. The first question asked students to rank from 1–5 on to what extent do they reckon their high school teachers stressed pronunciation while teaching. Question 2 asked students to choose whether they prefer listening-imitation or IPA when they were studying English pronunciation. The third question asked students to rank from 1–5 on their frequency of accessing English outside the learning environment. The final question asked in what way they are commonly exposed to English environments, examples like English videos, songs or games were given as hints.

The survey was provided as a word document for students involved in the study. It is attached in Appendix.

### 3.3 Procedures

This is an online study; students will have a word document containing both the quantitative part and the qualitative part. They will have to record using a recording device on the production of the 20 trail words. They were told to speak loudly and clearly but not deliberately correct their pronunciation in general. After that, they would answer the questions in part 2.

The mean F1 and F2 figures would be extracted from the recording using Praat [46] and Formant Pro [47] for drawing vowel charts for each individual. Quantitative results and qualitative results will be discussed together in the next section.

## 4 Results

### 4.1 Results for Group 1 (Domestic Group)

Figure 1 shows the vowel chart of the 20 GOOSE vowels produced by the no.1 female student in the Domestic Group. As same as the standard vowel charts, the horizontal

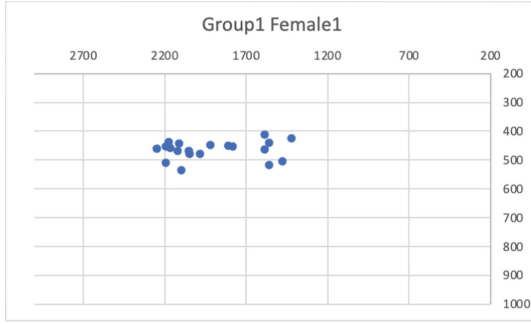


Fig. 1. Vowel chart for GOOSE vowel production of Group1 Female1.

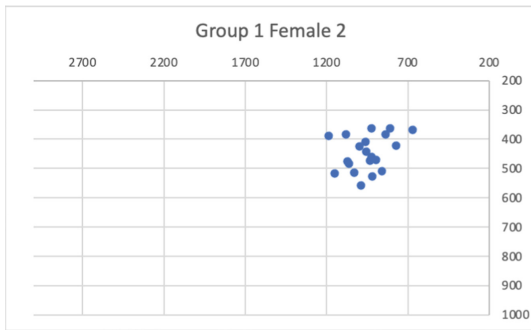
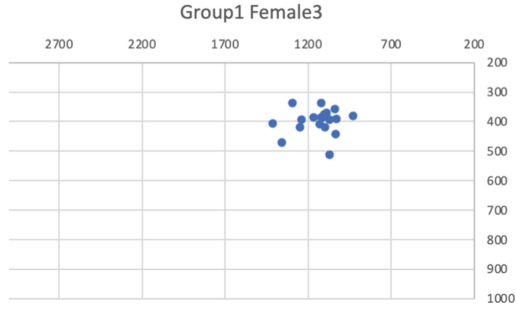


Fig. 2. Vowel chart for GOOSE vowel production of Group1 Female 2.

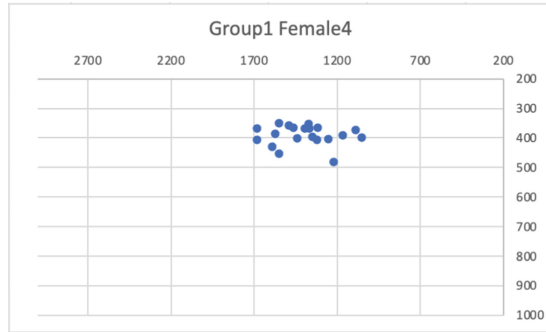
axis represents the mean F2 (Hz) that is related to the frontness of vowels while the vertical axis represents the mean F1(Hz) which is related to the highness of vowels. It was shown clearly that this student has F2 values above 1400 Hz for all the produced GOOSE vowels. In some words, the F2 values are concentrated around 2000 Hz. Wong [3] had given a reference that the suggested F2 value for a fronted GOOSE vowel is above 1550 Hz in American English, according to the Atlas of North American English. And a vowel that has an F2 value below 1200 Hz would be considered as a back vowel. According to the results shown in “Fig. 1”, it was confident to say that the no. 1 female student has to front in her GOOSE vowel production.

In the survey questions, she ranked 2 for question one, which means she was less likely to think her secondary school teacher stressed English pronunciation during teaching. For the second question, she reflected that she has very little knowledge about IPA and mainly learned pronunciation by listen-imitating. She ranked 4 for the third question means having relatively more time with the English environment outside her classroom and listening to English songs or American TV series for at least an hour is a part of her daily life.

“Figure 2” shows the results for the no. 2 female students in Group 1. The F2 value of GOOSE vowels she produced concentrated in the interval from 700 Hz to 1200 Hz may indicate that no GOOSE fronting had happened in her speech.



**Fig. 3.** Vowel chart for GOOSE vowel production of Group1 Female3.



**Fig. 4.** Vowel chart for GOOSE vowel production of Group1 Female4.

For the survey questions, she ranked 3 for teaching attention on English pronunciation and reflected that English IPA was her main guide for pronunciation learning. For questions 3 and 4, she reported that seldom actively engaged with English outside the classroom.

“Figure 3” shows the vowel chart for the no. 3 female students in Group 1. As demonstrated in the chart, the F2 figures of GOOSE vowels that she produced focused around 1200 Hz which means GOOSE vowels, although some attempts may be made for fronting, were still considered to be back vowels.

For the survey questions, she ranked 3 for teaching attention and answered to be preferring listen-imitating rather than using IPA. For questions 3 and 4, she ranked 3 for the frequency of being in an English environment and reported sometimes listening to the English songs.

“Figure 4” shows the situation for no. 4 female students in the domestic group that is in between fronted GOOSE vowel and back GOOSE vowel where the F2 values were evenly distributed in the interval between 1200 Hz and 1700 Hz. There are fronting attempts to a certain extent yet no clear evidence for indicating whether fronted GOOSE vowels are preferred in her speech.

In survey questions, she ranked 2 for teaching attention on pronunciation and thought IPA was the main tool guiding her English pronunciation learning. For question 3, a

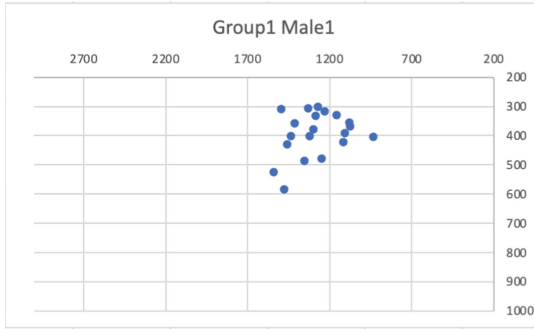


Fig. 5. Vowel chart for GOOSE vowel production of Group1 Male1.

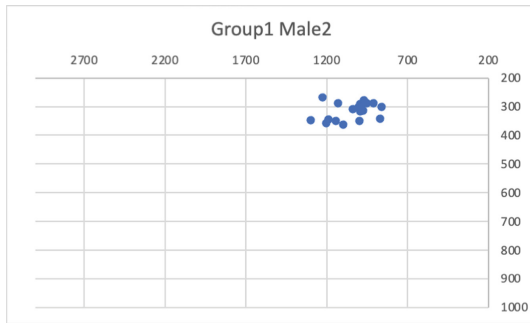


Fig. 6. Vowel chart for GOOSE vowel production of Group1 Male2.

4-point answer indicated that she was often exposed to English in her free time and American TV series and English in Games was her main environments.

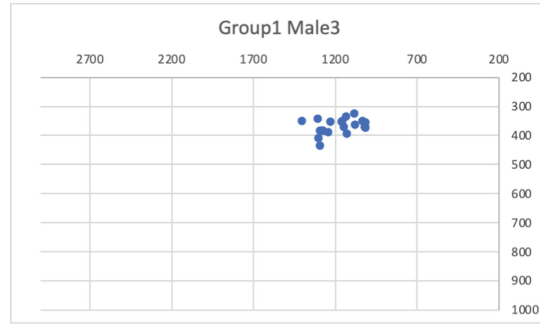
“Figure 5” reflected the performance of GOOSE vowel production of the no.1 male student in Group 1. Like no. 4 female student, according to his vowel chart, the F2 value was generally above 1200 Hz but never got beyond 1600 Hz. There is a fronting process happening to some extent in his speech.

In the survey questions, he reported an experience of great teaching attention paid by his secondary school teacher on the English phonetics information and the main way he studied the pronunciation was listen-imitating. He reflected to be engaged with English outside the classroom quite often (with a rank of 4) and mainly had the environment from English websites.

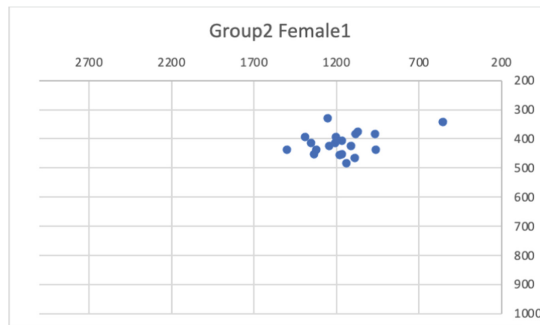
The information showed by “Fig. 6” was clear that the F2 values of GOOSE vowels produced by no. 2 male students relatively concentrated at 1000 Hz with only a few exceptions This indicated that no GOOSE fronting was presented in his speech.

For the survey questions, he had a strong memory of his teacher paying enough attention to pronunciation teaching and gave a rank 5 for question 1. Listen-imitating was his main way of pronunciation learning. For being engaged in an English environment, he ranked 3 for question 3 and reported watching British TV series as his main source of outside classroom input.





**Fig. 7.** Vowel chart for GOOSE vowel production of Group1 Male3.



**Fig. 8.** Vowel chart for GOOSE vowel production of Group1 Female1

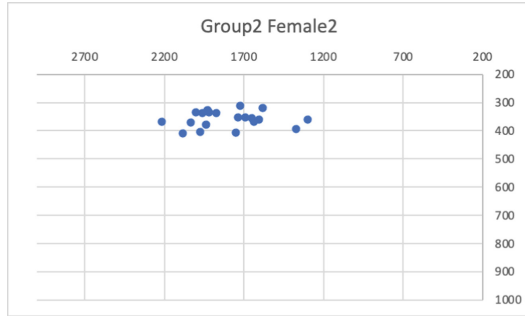
“Figure 7” shows the performance of GOOSE vowels by the no. 3 male student in Group 1. From the chart, although half of the trails were having F2 values above 1200 Hz, no words were produced with an F2 value above 1500 Hz, and the average was still around 1200 Hz. It should be suggested that GOOSE fronting is not presented in his speech or only a little attempt was made.

For the survey questions, he ranked 3 for the first question. For the second question, he reported that he was used to relying upon IPA in his English pronunciation learning but now tends to use listen-imitating as the main guide. For English environment engagement, he reflected to have little chance to be in an English environment outside the classroom.

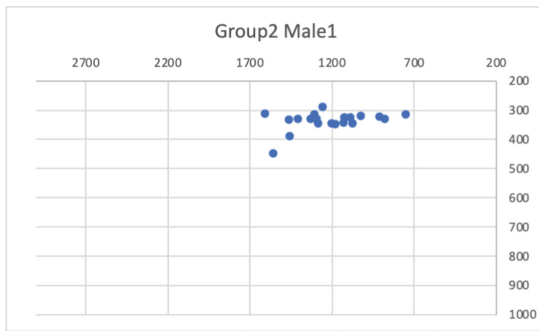
## 4.2 Results for Group 2 (Overseas Group)

The vowel chart in “Fig. 8” shows the results of GOOSE vowel production by the no. 1 female students in the Overseas group. With only one outlier, the F2 values for all other trails were concentrated around 1200 Hz. Some fronting attempts were made yet an evident GOOSE fronting was not presented in her speech.

For the survey questions, she ranked 2 for question 1 meaningless attention from her teacher in pronunciation teaching were experienced by her. Listen-imitating was the



**Fig. 9.** Vowel chart for GOOSE vowel production of Group1 Female2.



**Fig. 10.** Vowel chart for GOOSE vowel production of Group1 Male1

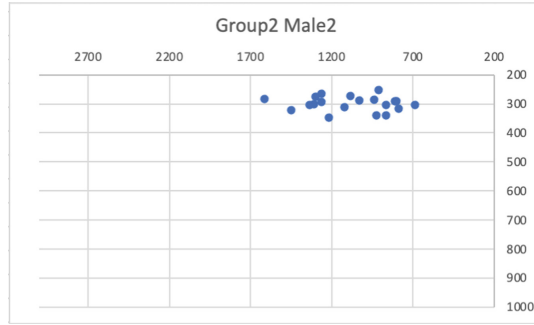
main way for her pronunciation learning. She reflected to be often exposed to English environments (ranked 4) and pop English songs, movies would be sources for her input.

“Figure 9” shows the performance of the no. 2 female speaker in Group 2 of her production on GOOSE vowels. It is very clear that the average F2 value for her is above 1700 Hz. With two exceptions, the trails were distributed around 1900 Hz and one of the GOOSE vowels produced by her were even having an F2 value higher than 2200 Hz. It is very clear that she has GOOSE fronting in her speech.

For the survey questions, she ranked only 2 for question 1 and listen-imitating was her main way of learning English pronunciations. She found herself often being exposed to English environments (ranked 4) and she was used to speaking in English with her friends when she was in an international school in China.

The vowel chart in “Fig. 10” was the result for the no. 1 male students in Group 2. The special situation here for him is that the F2 value of his GOOSE vowels has a very scattered distribution with a range from just above 700 Hz to near 1700 Hz. Some of his GOOSE vowels were typical back vowels while some were entirely fronted. It can be concluded for this speaker that some fronting processes have happened, yet it was not a dominant feature in his speech.

For the survey questions, he reported his teacher was giving enough attention to English pronunciation teaching and he prefers listen-imitating in his learning. He



**Fig. 11.** Vowel chart for GOOSE vowel production of Group1 Male2

reported often (rank 4) engaging with English environments in his daily life including watching short videos and English TV programs.

Like the no.1 male student in Group2 (“Fig. 11”), the F2 value of GOOSE vowel produced by no. 2 male students also showed to be dispersed in the vowel chart. It has a range from below 700 Hz to nearly 1700 Hz. It should also be concluded that GOOSE fronting had taken place in his speech to some extent, yet it was not a dominant feature in any way.

For the survey question, he reported less attention from his teacher on the pronunciation teaching (with a rank of 2) and listen-imitating was his main way of studying. For questions 3 and 4, he reflected to have less chance of being exposed to English environments outside the classroom, yet he likes watching American TV series.

### 4.3 Overall Results

In general, among all eleven students, there were only two students who definitely have GOOSE fronting in their speech. They are all female students and were from two different groups. Four students are very unlikely to have GOOSE fronting in their speech. Two of them are male and two are female. They all came from Group 1. For the rest of the five students, there was some evidence showing that they have made some attempt for fronting their GOOSE vowels since they typically have many F2 values above 1200 Hz. However, the distribution is not clear enough to indicate that GOOSE has become a dominant feature in their speech. Some students of these five may even have a very flexible way of GOOSE vowel production, reflected on vowel charts as scattered distribution of F2 figures.

The grouping difference is not apparent or vital. It mainly reflects that all the non-fronted students are in group 1. The gender difference was not clear either. The only difference to notice was two fully-fronted students were all female.

## 5 Discussions

The prediction made by this paper is that a proactive exposure to the L2 environment especially outside the classroom will contribute the most to the learning of phonetic details for the target L2. Combining the quantitative results with qualitative results, we can conclude to a certain extent that this prediction has some succession. The two students with fully fronted GOOSE vowels in their English speech had all reported having intensive engagement with English outside the classroom. They either have the experience of using English in communication frequently or are greatly influenced by English pop music and TVs in her life. While for the students who have no or little fronted GOOSE vowels in their speech, no rank higher than 3 was given for the frequency of being exposed to English environment and some of them reported to have a very limited chance with English environments.

However, the impact from the environment was not so clear since the students with some fronted GOOSE vowels had also ranked 2 or ranked 4 for English engagement outside the classroom. The relationship between exposure frequency and mastery of phonetic details remained unclear in this study. Besides, it is noticeable that being study abroad did not have a determining effect on the realization of GOOSE fronting.

There are some other things shown by this study that need attention. Firstly, there were only two students reported using IPA for guiding their pronunciation study and there are no correlations between the knowledge of IPA with the acquisition of phonetic details such as GOOSE fronting. Besides, according to their answers to the first question about teaching attention on pronunciation and their performance in speech, there is some evidence to say that teaching activity has very limited influence on the mastery of detailed recent pronunciation like fronted GOOSE vowel. A few students ranked only 2 for their teachers' attention but still have some kind of fronting of GOOSE vowel in their speech.

The last thing that this paper found interesting is the scattered distribution of the frontness of GOOSE vowels for two male students in Group 2. These results might indicate that they have a different source of pronunciation learning and ended up forming a flexible pronunciation system. But this prediction needs further study particular on the source of input environments.

## 6 Conclusion

In short evaluation, this paper focused only on a very narrow scope of acquisition of English phonology of second-language speakers. Besides, the questions set in the survey were very simple and there is only limited information that can be collected for analysis.

Despite the shortcomings, to conclude, this paper has used the GOOSE vowel to show to a certain extent that the acquirement of detailed L2 phonetics has mainly happened in the engagement with environment input but not classrooms. The results and predictions in this paper can hopefully give help for more mature studies in the future.

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