Differences in Non-native Vowel Perception by Native English Speakers

Rekha Crawford
Briarcliff High School
1.0 Review of Literature

The discrimination of different sounds is an essential skill in any language. From a very young age people develop and hone the ability to perceive different cues in their native language. This makes it harder for people to understand and learn to differentiate between cues that are not native to their language (Monod, 1971). These cues range from timing to differences in stress, but the feature under consideration is the ability to perceive non-native phonemes. When learning a language, the development of one’s ability to perceive these non-native cues is paramount to successfully gaining fluency or a greater understanding of the language. For example, in languages such as Japanese and Spanish there are a total of five vowel sounds a, e, i, o, and u. English has many more vowel sounds including a variety of diphthongs that are not found in either of the aforementioned languages. This makes perception and production of non-native English vowels more difficult on second language (L2) learners learning English native to either of those languages.

There is much precedent for a study on the discrimination of nonnative phonemes. An et al. 2013 studied the ability of native Japanese and Korean speakers to perceive the difference between the /l/ and /r/ phonemes as compared to native English speakers. Tamminen has done multiple studies on the effects of training on the discrimination of different English phonemes by Finnish speakers. What this study proposes to do is: to access the degree to which French students are able to recognize the /ø/ and /y/ vowel sounds which is nonnative to
English, to compare the ability of students not taking French to recognize the same vowel their as French- taking counterparts

Models of perception of non-native sounds

The Perceptual Assimilation Model (PAM) (Best, 1995) is a commonly used model of understanding non-native sound perception. PAM-L2 is an addition of PAM that branches from the perception of non-native sounds by listeners with no experience with the language to second-language (L2) learners (Best and Tyler, 2007). According to PAM and PAM-L2 the ability of non-native listeners to perceive and accurately differentiate between non-native phonemes is based on the similarity between native and other non-native phonemes to the one phoneme in question (Best and Tyler, 2007).

According to PAM (Best, 1995) non-native sounds are categorized by non-native speakers in one of a few ways. The phoneme is generally assimilated into a native-category with a degree of “goodness” or similarity to the original native phoneme. Single-category assimilation occurs when non-native phonemes are rated with the same “good” or “poor” rating relative to the native category, making it difficult for L2 learners to recognize and learn the difference between the non-native categories. Category-goodness assimilation occurs when phonemes are assimilated within a native category with varying degrees of goodness relative to the native phoneme. Best and Tyler speculate in PAM-L2 (2007) that in the case of category-goodness assimilation the phoneme most similar to the native one will not be replaced with an entirely new category for the L2 sound, but instead will continue to be perceived as the native phoneme. Best and Tyler believe on the other hand that the more deviant phoneme of the non-native phonemes will be categorized into another group by the L2 learner with continued exposure to the sound and frequent contrast between it and other similar non-native sounds because of the need for a new category for communication. Lastly, according to the PAM model two-category assimilation may occur. This entails non-native phonemes being grouped into separate native categories.

Flege’s Speech Language Model (SLM) approaches language acquisition in a similar way to PAM. It too references non-native sounds being assimilated into similar native categories, however SLM more specifically tackles the difficulties faced by L2 learners than PAM, stressing problems from inaccurate production of non-native phonemes and how perception of non-native sounds changes over time in L2 learners. According to SLM the creation of a new category for a non-native phoneme depends on how different the phoneme is from the original L1 sound. A “phonetic category” according to SLM refers to: being able to put sounds into the same category despite irrelevant auditory differences and being able to distinguish that sound from other categories despite commonalities.

2.0 Research questions and Hypotheses

This study tested students taking French (French takers) against students not taking French (non-French takers) in distinguishing the front-rounded French vowels /ø/ and /y/ against the native vowel /u/ as well as /o/ in a minimal pairs experiment.

- How do French takers and non-French takers vary in their ability to discriminate between non-native front rounded vowels?
- Do French takers and non-French takers struggle in differentiating between the same contrasts or different ones?

H₀: There will be no difference between French takers and non-French takers in their perception of French front rounded vowels and both groups will have troubles with the same contrasts.
H₁: French takers are more adept at perceiving the non-native vowels than non-French takers.
H2: French takers and non-French takers will have troubles with different contrasts

- Methods
  - Participants

There were 45 participants total. Participants were high schoolers and middle schoolers taking either French or Spanish between the ages of 12-17. The mean age of the French takers was 14.3 years whereas the mean age of the non-French takers was 15.4 years. The mean age of all participants was 15.0 years. There was a higher frequency of younger age students in the French takers. There were 18 French takers and 28 non-French takers. 25 of the participants were female and 21 of the participants were male. Thirty-four participants were right handed and 12 participants were left handed. None of the participants that completed the task reported trouble hearing. Participants were gathered from mainly from two suburban High School and Middle school via an email blast sent to every student in the school, through posters, and through actively gathering participants.

3.2 Procedure

This study was completed in two different ways. 18 of the participants were tested in a very controlled fashion. Participants took the test in a room completing worksheets while listening to the same stimuli at the same time. In an effort to gather more participants this study was expanded by creating a completely online version. The actual task was the same in both methods, however students did the task independently on the online version losing some control of the study.

Participants were asked to complete a short minimal pairs task in which they were given a stimulus to listen for and were asked to circle or click on whether the stimuli they were listening for was the first or second sound they heard. To eliminate any possible advantages French-takers could gain by seeing the stimuli written out how it would be in French participants were questioned using the international phonetic alphabet (IPA). Figure 2 is an example of how the questions were posed during the task.

Participants were familiarized with the IPA symbols being used in the experiment. This was done by first writing the symbols for the vowels where the participants could see them and then playing back the vowels, in the same order that they were listed, three times. The participants then proceeded to fill out the worksheet or online survey form, making judgements on which of the two consonant-vowel (CV) sounds they heard was the vowel they were directed to look for after being played the CV pair twice.

The sounds themselves were recorded by a native Parisian French (PF) speaker and played in CV pairs, starting
with the same consonant but with different vowels. For example, subjects would have to choose between /fø-fy/.
There were 7 consonants used in this study: v, f, b, m, t, k, and g. These consonants were chosen because they were native to both English and French and because it is not uncommon to hear those consonants with any of the chosen vowels. Any CV combinations that formed French words were excluded.
The original test was administered to participants in a quiet room with headphones on. The online study was done independently so conditions could not be monitored, however the results from the online test were not significantly different than those of the in person test.

- **Analysis**

All participants’ answers were collected and their worksheets graded. Figure 2 is a chart detailing the questions, the percent of participants that got the question correct, the vowel pair being discriminated between in order of how it was played, the vowel they were supposed to pick, and the consonant used. The Percentages are highlighted based on the percent they got correct, green indicates a high percentage amongst both groups whereas red is poor performance. The lines highlighted in blue indicate a large difference between the French takers and non-French takers on a specific question. There was no significant difference between the average score from the online task and the task given in person. The results of both methods analyzed together.
The average score for non-French takers was 20.8 whereas the average score for French takers was 20.4. This does not support the hypothesis that French takers would be better than non-French takers in the completion of the task (p>.10). Although the French takers did not score better than their non-French counterparts a T-test for independence showed that the mean of the entire group is not 15 (p<.01). This suggests that participants were not randomly guessing while taking the test as the expected mean if subjects had been randomly guessing would be 15.

Although the average score for French takers was slightly lower the maximum score achieved was higher. One French taker received a 30 out of 30 on the task, and two others received 29. This is higher than the non-French taker maximum of 28. The frequency of higher scores could point to a slight right skew in the distribution of French takers scores. It also points to a possible difference between the distributions of French takers and non-French takers.

Though there is no significant difference between the mean scores of both groups, there does seem to be some difference between the groups in their answers to some of the questions. French takers did significantly better on questions 2, 4, and 6 (p<.05). They also showed some advantage on questions 3 and 18 (p< 0.1). Non-French takers did significantly better on questions 7, 25, 26, and 30 (p<.05). They also showed some advantage on question 17 (p< 0.1).
Figure 2. This chart shows: the number of the question, the number of participants that got a question correct in each group, the percent of participants who got each question correct for each group, and what the question asked (order of vowel contrast, vowel that was correct, and consonant used). O_ refers to the vowel ø. Red boxes show an advantage for French takers; blue boxes show an advantage for non-French takers.

Results

The study did not show a significant difference between the French and Non-French takers on their ability to complete the task. However, it did not show that the groups were entirely similar either. While for many questions the two groups had around the same percentage correct, there were also many that showed significantly different answers between the groups. The majority of questions French takers tended to get right a higher percentage of the time involved the vowel ø. Whereas, most of the questions non-French takers got right involved the vowel y. When the contrast was /ø-y/ the group that was better at perceiving it switched on and off. For example, in question 6, French takers were significantly better at perceiving this contrast. However, in question 26, Non-French takers showed a significant advantage.

French takers may have shown a lower average test result because of the difference in average age between French and non-French takers in this study. The average age of French takers was 14.3 years, whereas the average age of non-French takers was 15.4 years. As participants generally had more exposure and practice with the language at higher ages it is possible that this impacted the results somewhat.

Discussion

5.1 Conclusion
The data does not support my first or second hypothesis that French takers will … This study points to a need for more phonemic awareness in schools, at least in Briarcliff High School. The fact that there was no significant difference between the French taking and non-French taking group points to a few possibilities. The test is not designed in such a way that differences in phonemic awareness become apparent. Possible but made less likely by the fact that participants were not randomly guessing, meaning that they had to be gathering cues from somewhere to know what the correct choice was. It’s also relatively unlikely they were gathering those cues from vowel duration or other extraneous factor as the sounds and timings were varied consonant to consonant pair.

As it stands now it would not have any negative effects to introduce a short unit on the phonetics of a language before introducing the actual language. This would give students context for and greater understanding of the non-native sounds they will hear in their language of study beforehand, prepping them to be able to hear and produce these sounds.

5.2 Further Research
From this study it can be gathered that further research is necessary to truly see if high school students need more phonemic training in perceiving this contrast. New methods of measurement would be best. Another study mirroring this one but using the French spellings of these sounds instead of IPA may find different results. Measuring production of the French sounds by recording participants attempting to produce the sound
and comparing it to native French speaker’s production of the sound would also be helpful. An element of PAM L2 could be added by having participants report what category they believe each sound fits into would also produce interesting results. Finally, it would be best to do an event related potential (ERP) study on these contrasts. A mismatched negativity (MMN) study would most likely be best. MMN is a method where a variant stimulus is played intermittently between a common stimulus. The recognition of a difference between these stimuli is measured in the form of an N400 ERP, or a negative spike at 400 milliseconds. French-takers brain responses would be measured against non-French takers allowing for the difference between the groups to be measured.

Additional studies using a variety methods will allow for a more concrete understanding on how these two groups varied in their perception of stimuli and whether or not high school students need more phonetic training in languages such as French with many non-native sounds.

Bibliography


