Perception of voicing in English word-final obstruents by Malay speakers of English: Examining the Perceptual Assimilation Model

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Abstract

This paper presents the findings of a perception experiment that was conducted to examine the relative difficulty encountered by Malay speakers of English in contrasting voicing in word-final obstruents. The pairs of obstruents examined in the paper were /t/-/d/, /s/-/z/ and /f/-/v/. Results from the experiment are discussed in relation to the Perceptual Assimilation Model developed by Best (1994, 1995). The theory essentially claims that non-native listeners would classify foreign/ second language sounds into different categories. The relative difficulty faced by foreign or second language learners in discriminating a pair of sounds can then be predicted based on how the second language sounds are categorized. The pairs of sounds under study can be categorized as a Two Category contrast (/t/-/d/ and /f/-/v/) and a Category Goodness contrast (/s/-/z/). Because /t/-/d/ and /f/-/v/ are Two Category contrasts, it is predicted that /t/-/d/ and /f/-/v/ would be well discriminated for voicing. As a Category Goodness contrast, /s/-/z/ is predicted to be difficult to discriminate. In fact, it would be the most difficult pair to distinguish for voicing among the pairs of obstruents investigated. This paper examines whether or not the findings from the experiment fulfill the above predictions. The paper then discusses some of the implications of the findings on the model.

Introduction

Studies on second language (L2) acquisition have long established that certain L2 sounds are more difficult to acquire than others. The ease or difficulty of acquiring certain L2 sounds is often attributed to the influence of first language (L1) phonological knowledge. The assumption is that learning an L2 sound is easier when the L2 sound is similar to an L1 sound and is more difficult when the L2 sound is different from an L1 sound. However, research on L2 speech perception has informed us that perceiving L2 sounds is not as simple as deciding whether an L2 sound is similar to or different from an L1 sound. There are many psychological and linguistic factors that need to be taken into account. Thus, the question of how we actually perceive the similarities and differences between native and non-native sounds still intrigues researchers and has been the impetus for the formulation of theories on L2 phonological learning.

This paper examines the Perceptual Assimilation Model (PAM), a theory formulated by Best (for example, Best 1994, 1995). The model is interesting to examine because its hypotheses are not only testable but are quite reflective of the complexity of speech and speech perception. For example, among other factors, the model postulates that the difficulty associated with listening to L2 sounds lies in the phonetic-articulatory similarities, and at the same time the differences between two L2 sounds as well as between L1 and L2 sounds. This means that listening to L2 sounds is not a straight-forward process of deciding whether an L2 sound is similar to or different from an L1

sound. It involves discriminating between two L2 sounds from one another as well as distinguishing the L2 sounds from L1 sounds.

This paper discusses the above hypothesis made by the PAM by examining the perception of voicing contrasts in three pairs of word-final obstruents in English. Although there are quite a number of studies on the perception of voicing in word-final consonants by second language speakers (for example, Crowther and Mann, 1992, Flege, 1993, Nagao et al. 2003, Park and de Jong, 2005), these studies neither specifically compared the three pairs of consonants tested in the present study nor examined the perception of voicing contrasts to directly test the PAM. The studies mainly focused on the effect of acoustic or syllabic properties on the perception of voicing. This paper hopes to fill in the gap by investigating the relative difficulty encountered by Malay speakers of English in distinguishing voicing in three pairs of word-final obstruents, /t/-/d/, /s/-/z/ and /f/-/v/ and using the perception data to test the PAM. Firstly, the paper briefly describes the PAM and three of the L2 sound categories proposed by the model. Secondly, the paper presents findings from an experiment conducted on Malay speakers of English. The paper then discusses the implications of the findings and concludes with some notes on the limitations and contributions of the paper.

The Perceptual Assimilation Model

The Perceptual Assimilation Model essentially claims that the difficulty encountered by second language (L2) learners in learning L2 speech is determined by perceptual limitations. The PAM proposes that L2 listeners classify L2 sound contrasts into different categories depending on the degree of similarity and at the same time discrepancy perceived between the native and non-native sounds. These classifications of L2 contrasts determine how the contrasts are assimilated to native categories. The classification of L2 contrasts is generally based on whether the L2 sounds are perceived as speech or non-speech sounds. L2 contrasts that are perceived as speech sounds are categorized differently from those that are perceived as non-speech sounds. L2 contrasts that are classified as speech sounds are further classified into native or new (non-native) categories depending on whether they can assimilate to native categories or not. If the L2 contrasts can assimilate to native phonemes they are classified as a *Two Category, Category Goodness* or *Single Category* contrast depending on the similarities and discrepancy between the L2 contrasts and between the L2 sounds and L1 sounds. This paper investigates only these contrasts, that is, those whose members can assimilate to native phonetic categories. The L2 contrasts postulated by the PAM are as follows:

Two-Category (TC): members of the L2 contrast assimilate to two different native categories, that is, one member assimilates to one native category and the other one to another native category.

Category goodness (CG): each member of the L2 contrast assimilates to the same one native category with one of the members being more deviant from the native sound than the other.

Single Category (SC): both L2 phones assimilate to one phoneme in the native category and both are equally deviant from the native sound.

The TC contrast should be well discriminated because they are phonemically distinct. Discrimination of the CG contrast can range from good to moderate depending on the perceived contrast between the two sounds and the goodness-of-fit between the L2 and the L1 sound. If the L2 sounds clearly differ from each other and from the native sound or sounds, discrimination of the two L2 sounds is expected to be good. If the sounds are similar to each other or to the native sound, discrimination is predicted to be moderate. The SC contrast is predicted to be difficult since the two sounds are either equally different from or similar to the native sound. The TC contrast is therefore easier to discriminate than the CG contrast which in turn is easier to discriminate than the SC contrast.

There have been some studies supporting the PAM. Best et al. (2001) examined twenty-two native speakers of American English on the discrimination and identification of a TC, CG and SC contrast in Zulu. The contrasts were voiceless and voiced lateral fricatives, voiceless and ejective velar stops and plosive and implosive bilabial stops respectively. The TC contrast was well discriminated, followed by the CG contrast and the SC contrast. The subjects' identification of the contrasts revealed the same assimilation pattern as the discrimination test, thus confirming the predictions made by the PAM. Harnsberger (2001) tested native speakers of Malayalam, Marathi, Punjabi, Tamil, Oriya, Bengali and American English on the identification and discrimination of nasal consonants varying in place of articulation in Malayam, Marathi and Oriya. Based on the identification results, each contrast was classified as a TC, UC (uncategorizable categorizable), UU (both uncategorizable), CG or SC contrast. The results showed that the mean percent correct discrimination scores corresponded to the predictions made by the PAM. Nagao et al. (2003) tested Japanese listeners from three different age groups and levels of experience with English on the identification of non-native syllable structures and voicing in non-native syllables presented at a slow and fast rate. The study found that the Japanese listeners could correctly identify non-native syllable structures, that language experience had positive effects on the identification of voicing and syllable structures and that
the performance of the Japanese listeners was accurately predicted by the PAM.

Sounds tested in this study

This study tested the perception of voicing in the consonant pairs /t/-/d/, /f/- /v/ and /s/- /z/ in word-final position. The first pair consists of stops, the last two pairs are fricatives. /f/-/v/ differs from /s/-/z/ in stridency, that is, the amount of noise produced in their production. An analysis of the native phonemes of Malay revealed that Malay does contrast /t/ from /d/ in word-initial and medial position although not in word- final position. The last two contrasts, /f/-/v/ and /s/-/z/ do not exist in Malay. Neither /f/ nor /v/ exists in Malay. There is /s/ in Malay but no /z/. However, these sounds do exist in loan words from Arabic and English. The question is whether or not these sounds are actually represented in the minds of the Malay speaker.

Linguists dealing with Malay (Asmah Omar, 1991; Farid Onn, 1980; Teoh, 1994) generally agree that loan sounds are often nativized. Farid Onn (1980) in fact believes that only /z/ would occur as a subsystem in the Malay sound system. This is because /z/

contrasts with /s/. However, because /f/ exists in word-final position (Asmah Omar, 1988), it too may have a strong influence on the native system. This is important especially since this paper studies consonants in word-final position. Therefore, the influence of the loan sounds, /z/ or /f/ may be expected if these two sounds are well established in Malay. In terms of voicing contrasts, the existence of these sounds may have an effect on /s/-/z/ and /f/-/v/. If truly, /z/ were adopted in the language, then Malays would not face difficulty discriminating /s/ from /z/. In contrast, distinguishing /f/ from /v/ would be difficult because it is the only pair in this study in which one of the members, /v/, is not well established in the phonology.

Because the status of loan sounds cannot be determined, at this stage, the paper assumes that the effect of loan sounds is minimal especially since this paper examines voicing contrasts, not individual sounds for which the difference in phonemic status of the sounds may play a more prominent role. Such effects are considered only if the results show strong preference for the pairs involving /f/ or /z/ that cannot be accounted for by the PAM.

Based on the native phonemic inventory of Malay and the description of L2 categories in the PAM, the English consonant in this study can be categorized as follows:

a) /t/-/d/: This pair is a TC contrast. Both /t/ and /d/ exist in the Malay phonemic inventory. If the position of the sounds is not taken into account, /t/ and /d/ can each assimilate to the respective native category in Malay.
b) /s/-/z/: Most likely, this is a CG contrast. /s/ would assimilate to the Malay /s/. /z/ differs from /s/ in voicing and therefore, it is reasonable to assume that /z/ would also assimilate to /s/, not to any other Malay categories.
c) /f/-/v/: This is most probably a TC contrast. Both sounds do not exist in Malay. They have the same place and manner of articulation and differ only in voicing. It is reasonable to assume that they would assimilate to two sounds, which differ in voicing. Presumably, /f/ and /v/ would assimilate to /p/ and /b/ respectively because although Malay does not have labio-dentals, it does have bilabial sounds.

The above categorization of L2 sounds predicts that the /t/-/d/ and the /f/-/v/ pairs would be discriminated equally well and that the two pairs would be better discriminated than the /s/-/z/ pair.

The study

The subjects were 21 Malays speakers of English who at the time of the study were studying at the University of Wisconsin- Madison in various fields. Their age ranged from 18-22 years old. All of them are considered second language speakers of English because they first learned English when they were at least 7 years old. None of them first learned the language before 7 years old. Although the subjects were mostly bi-dialectal, all of them used the Standard Malay frequently and most of them claimed that it was the only dialect they used while in Madison. Thus, the subjects were quite homogenous as far as their age, exposure to English and use of standard Malay is concerned. Ten native speakers of American English were also tested as controls.

The subjects were tested using two tasks: an identification and a discrimination task using Psyscope (Cohen et al., 1993). In both tasks, the subjects were presented with real and made-up minimal pairs (please see appendix 1). The final consonant of each

word is one of the consonants tested or the nasal /m/ or /n/. The nasals acted as fillers. In the forced-choice identification task, the subjects were presented with one word at a time over headphones and were asked to identify the word from a minimal pair shown on a computer screen. Subjects recorded their responses by pressing a number on the computer keyboard that corresponded to the choices given on the computer screen. Each word was presented twice. In the discrimination task, the subjects were presented with the same tokens as in the identification task but for this task, the words occurred in pairs. Each pair consisted of either the same word or a minimal pair. The subjects were asked to indicate whether the two words were the same or different words. As in the identification task, subjects recorded their responses by pressing a number on the computer keyboard that corresponded to the choices given on the computer screen. Subjects were given some practice before attempting each task.

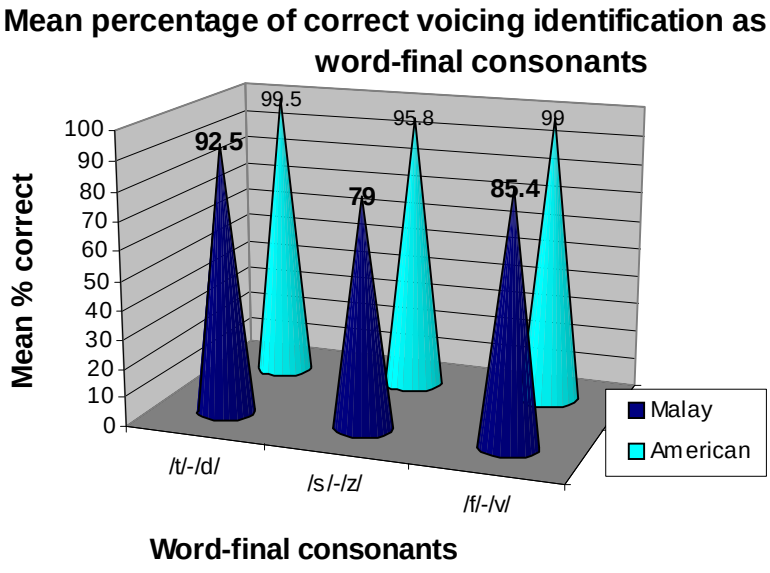
Tokens for the experiments were read by a female native speaker of American English who was a graduate student in Linguistics at UW-Madison. Each subject listened to a total of 160 words in the identification task and 160 pairs of words in the discrimination task. The order of the experiment was counter-balanced across subjects and the words or pairs of words were randomly presented within each task.

Findings

a) Identification task

Unlike the native speakers of American English, the Malays were found to face more problems distinguishing voicing in the pairs of sounds tested as shown in figure 1 below. Except for /s/ and /z/ for which the Americans scored relatively lower scores, the rest of the pairs of obstruents were well identified by the Americans. There was no effect of repetition found.

Figure 1:

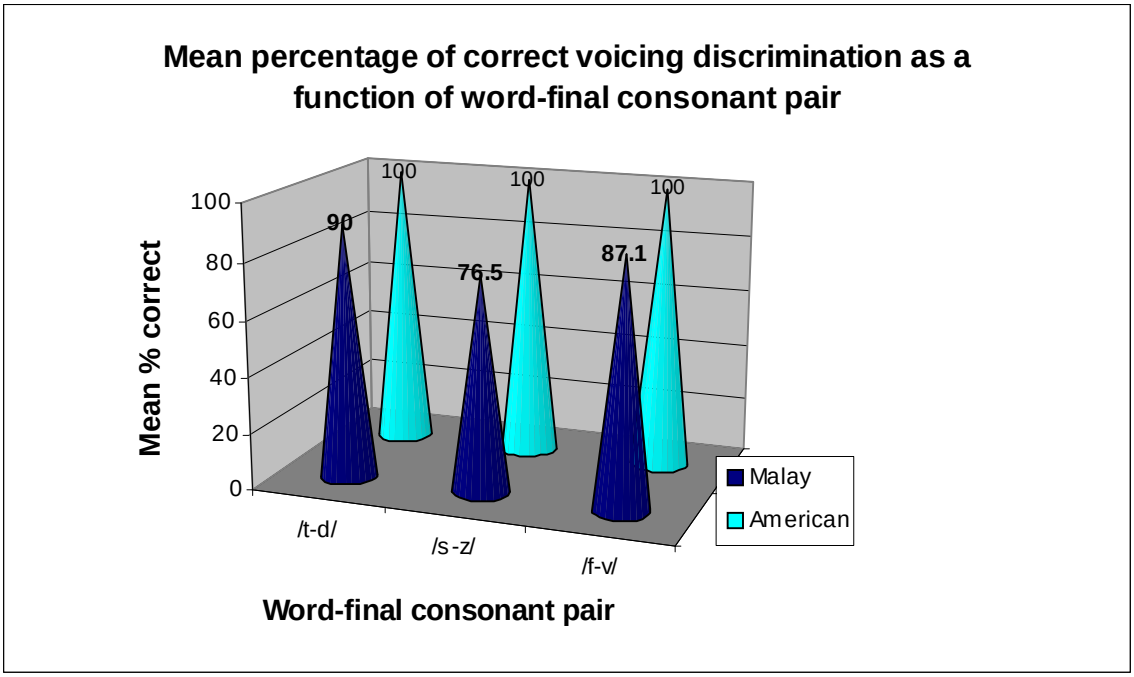


The table also shows that the difficulty encountered by the Malays in distinguishing voicing differs according to the pair of sounds. /t/-/d/ was well identified (92.5%), followed by /f/-/v/ (85.4%), and lastly /s/-/z/ (79%). The difference in these scores was found to be statistically significant ($F(2,2517) = 31.67$, $p = 0.000$). The scheffé post hoc test revealed that the scores for each pair were significantly different from one another. The prediction that the Malays would face an equal level of difficulty for /t/-/d/ and /f/-/v/ is not fulfilled although the prediction that /s/-/z/ is the most difficult pair for the Malays is upheld.

b) Discrimination task

Figure 2 below illustrates the discrimination performance of both groups.

Figure 2:



The Americans successfully discriminated between the pairs of sounds in all instances. Unlike the Americans, the Malays scored between 76-90%. The highest score was for /t-d/ (90%), followed by /f-v/ (87.1%) and lastly /s-z/ (76.4%). The score for /s-z/ was significantly different from the scores for the other two pairs ($F(2,1257) = 16.84, p = 0.000$). This means that as predicted by the PAM, /t-d/ and /f-v/ were equally well discriminated and the two pairs of sounds were discriminated better than the /s-z/ pair.

Discussion

The results of the two perception tasks show that the /s-z/ pair was the most difficult among the final consonant pairs. The Malays found it difficult to distinguish /s/ from /z/ in the identification task as well as in the discrimination task. The PAM predicted that this would be so as the two L2 sounds /s/ and /z/ would be assimilated to one native category, /s/. The pair /t/-/d/, in contrast, was relatively easier to distinguish. In both tasks, the Malays scored the highest for /t/-/d/. This is probably because /t/-/d/ assimilated to two separate native categories, /t/ and /d/ respectively. The pair /f/-/v/ fell in between the two. However, the score for /f/-/v/ was significantly different from that for /t/-/d/ in the identification task although it was not so in the discrimination task. It can then be concluded that the pair /f/-/v/ was as difficult as the /t/-/d/ pair in the discrimination task, but was more difficult than the /t/-/d/ pair in the identification task. The finding that /f/-/v/ was as difficult as /t/-/d/ in the discrimination task is explained by the PAM. Like /t/-/d/, /f/-/v/ is a TC contrast, that is, each sound would assimilate to its own category. The finding that /f/-/v/ was more difficult than /t/-/d/ in the identification task however, contradicts the prediction made by the PAM.

The above findings show that the predictions made by the PAM are fulfilled except in one instance where /f/-/v/ was found to be more difficult than /t/-/d/. This one

instance of a mismatch between the prediction made by the PAM and the finding warrants further discussion. Does the finding that /f/ and /v/ were more difficult than /t/ and /d/ in the identification task mean that the /f/-/v/ pair is not a TC category? Is the pair a CG or an SC category instead? First of all, /f/ and /v/ are non-existent in the Malay phonemic inventory. However, Malay does have /p/ and /b/. Since /p/ and /b/, like /f/ and /v/, are labials, /p/ and /b/ are the two most suitable candidates for /f/ and /v/ to assimilate to respectively. Theoretically, /f/-/v/ cannot be a CG nor an SC contrast because both contrasts require the two members of the contrast to assimilate to one native category whereas in this case, they can assimilate to two different categories. The fact that the scores for /f/-/v/ in both tasks were statistically higher than the scores for /s/-/z/, a CG contrast, further indicates that /f/-/v/ cannot be a CG or an SC contrast. For /f/-/v/ to be a CG contrast, the difference in scores between /f/-/v/ and /s/-/z/ should not be significant while to be an SC contrast, /f/-/v/ should consistently obtain lower scores than /s/-/z/.

If /f/-/v/ were indeed a TC contrast, the variation in the scores could then be attributed to the tasks attempted by the subjects. Ingram and Park (1998), based on the findings of their study, assert that identification and discrimination of sounds involve two different processing strategies. The same may apply in this study. For the identification task, the subjects listened to one final consonant sound at a time while for the discrimination task, the subjects listened to two final consonants and had to make a decision of whether the two sounds are the same sound or not. Identifying a sound with no reference to another sound is a different process from discriminating between two sounds. However, the difference in the strategies employed for the tasks can only partly account for the difference in scores for /f/-/v/. It still does not explain why this occurs to /f/ and /v/, not to /t/ and /d/.

One other possibility is the discrepancy between L2 and L1 sounds. Unlike /t/ and /d/, /f/ and /v/ are not native phonemes. Although /f/ and /v/ can assimilate to /p/ and /b/ respectively, Malay /p/ and /b/ are deviant exemplars of English /f/ and /v/. There are many phonetic-articulatory differences between /f/-/v/ and /p/-/b/. In contrast, Malay /t/ and /d/ are good exemplars of English /t/ and /d/. Presumably, there is no or possibly minimal differences in terms of articulation between the English and Malay /t/ and /d/. Thus, Malay /t/ and /d/ provide a good fit for the English sounds. The scores for the two pairs of sounds give support to this possibility. Regardless of whether or not the scores for /f/-/v/ were significantly different from the scores for /t/-/d/, they were consistently lower than the scores for /t/-/d/. The scores for /f/-/v/ were within the range of 85%-87% whereas the scores for /t/-/d/ were around 90%-93%. If the hypothesis that the perceived contrast between the members of a TC contrast can vary were correct, then what this study suggests is that like the CG contrast, there would also be sub-categories within a TC contrast.

Theoretical implications and conclusion

One of the findings in this study is that a TC contrast may not, in certain circumstances, be well discriminated. This leads to the proposal that there are sub-categories within the TC contrast. The existence of sub-categories is not new since the same has been said about the CG contrast. However, the problem is how to identify a TC contrast which is not so well discriminated from the one that is well discriminated. The

same question applies to the CG contrast. Unfortunately, the PAM has not been clear on this issue. In the PAM, the differences between sounds are judged based on the phonological relationship between the sounds and on the phonetic-articulatory characteristics of the sounds. However, the actual mechanism to validate the distance between sounds has not been well-defined. As s result, it is still unclear how we can determine the distance between sounds within as well as between categories. Thus, the PAM needs to refine the description of the categories and to be more specific on ways to classify L2 sounds.

The study has at least three limitations. Firstly, the findings were based on accuracy scores for a group of Malay speakers. It will be interesting to investigate the performance of each subject within the group to see if all subjects indeed conform to the same perceptual system. It is also necessary to use other methods of assessing perception such as testing perception boundaries. If this alternative analysis produced results that were similar to this study, then this would further confirm the hypotheses made by the PAM with regard to the classification of L2 sounds by L2 listeners. Secondly, the analysis was limited to three pairs of sounds. An analysis of more pairs of sounds is needed to prove or disprove the hypotheses. Thirdly, the study cannot answer the question on whether or not the non-native phonemes /f/, /v/ and /z/ are mentally represented. Although the finding that the Malays faced more difficulty in identifying /f/ -/v/ than /t/-/d/ (despite both being TC contrasts) may suggest the lack of mental representations for /f/ and /v/, the study has no strong motivation to postulate the lack or presence of mental representations for these sounds. Nevertheless, the study has some interesting findings in that there is a hierarchy of difficulty among the three pairs of sounds investigated and that the relative difficulty of the pairs of sounds can be mostly explained by the PAM.

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Appendix 1

Word List:

Real words

Seat, Seed, Leaf, Leave, Cease, Seize, Beam, Bean, Boot, Booed, Proof, Prove, Bruce, Bruise, Loom, Loon, Fate, Fade, Safe, Save, Grace, Graze, Came, Cane, Coat, Code, Loaf, *Loave, Dose, Doze, Foam, Phone, Right, Ride, Life, Live, Price, Prize, Dime, Dine.

*an ungrammatical form of 'loaves'.

Made-up words

Zeet, Zeed, Zeef, Zeev, Zeace, Zeeze, Zeem, Zeen, Zoot, Zood, Zoof, Zoov, Zoose, Zooze, Zoom, Zoon, Zate, Zade, Zafe, Zave, Zace, Zaze, Zame, Zane, Zote, Zode, Zofe, Zove, Zose/zoce, Zoze, Zoam, Zoan, Zight, Zide, Zife, Zive, Zice, Zize, Zime, Zine.