

INFLUENCE OF JAVANESE VOWEL PATTERNING ON INDONESIAN: AN ACOUSTIC INVESTIGATION

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ABSTRACT

The majority of Indonesians are bilingual, speaking a regional language and the national language, Indonesian. It is often assumed that in the use of either language, the influence of the other manifests itself; yet systematic documentation of such influence is lacking. In this study, the Indonesian of Javanese/Indonesian bilinguals is compared with that of monolingual Indonesian speakers, using vowel height as a case study to assess the phonetic effects of this influence. The results show that high vowels in CVCs are lower and more centralized than in CVs. For the bilinguals, /i/'s in CVCs overlap with /e/'s in the acoustic space, while /u/'s in CVCs are as low as but more centralized than /o/'s. I argue that this is the realization of Javanese vowel centralization on the Indonesian of the bilinguals. Vowel duration is shorter in CVCs than in CVs, which may enhance the perceived vowel centralization of the bilinguals.

1. INTRODUCTION

In the Indonesian archipelago, there are over 600 languages [2], most of which belong to the Western Austronesian language family. Javanese, spoken in the island of Java, and Indonesian, a dialect of Malay, are the focus of the present study. Indonesian, a lingua franca in the area for a long time, is the national language of the country. It is the language of instruction at school, it is used in most formal settings such as news media, official matters, etc. acquired by the majority of Indonesians at school. The regional languages, Javanese included, are spoken at home, and in most informal matters. Given such a setting, the majority of Indonesians are at least bilingual, speaking Indonesian and a regional language. Note, however, that across ethnic groups more and more children are raised with Indonesian as their first language. It is often assumed that in the use of either language, the influence of the other manifests itself. The influence of one language on another in such a bilingual setting may be realized at different levels, e.g. syntactic, morphological, etc. [6] This study focuses on the realization of such influence at the phonological and phonetic levels, by comparing the Indonesian of bilingual Javanese/Indonesian speakers with that of monolingual Indonesian speakers. Here, we take vowel height as a case study to assess the phonetic effects of the influence of the Javanese vowel patterning on Indonesian.

The structure of the paper is as follows: the phonological facts of Javanese and Indonesian are discussed in section 2; the methodology of the acoustic experiment and the analysis of the results are presented in sections 3 and 4 respectively; in section

5, the findings in this study are summarized.

2. PHONOLOGICAL FACTS

2.1. Vowel inventories

This study focuses on Indonesian as produced by bilingual Javanese/Indonesian and monolingual Indonesian speakers. In order to evaluate the manifestation of the influence of Javanese on Indonesian, we also need to know the nature of these phenomena in Javanese. Since vowel height is our point of comparison, let's consider the vowel inventories of the two languages.

Both Javanese and Indonesian are typically described as having six vowels, including a schwa, as shown in (1).

(1) *Vowel inventories of Javanese and Indonesian*

| | | | |
|------|---|---|---|
| high | i | | u |
| mid | e | ə | o |
| low | | a | |

These vowels, with the exception of the schwa, undergo vowel centralization depending on syllable structure (section 2.2) and in Javanese, vowel harmony (section 2.3) as well.

2.2. Vowel centralization and syllable structure

Impressionistically, high and mid vowels in Javanese are realized as tense in word-final CV syllables and lax in CVC ones, and the low vowel /a/ is realized as [ɔ] in CVs and [a] in CVCs. This alternation is exemplified in (2). For further discussion of vowel alternations in Central Javanese, see Yallop [7], among others.

(2) *Word-final vowel alternation in Javanese*

| | <u>CV#</u> | | <u>CVC#</u> | |
|------|------------|-------------|-------------|---------|
| high | baɿ̥ | ‘benefit’ | baɿ̥ʔ | ‘batik’ |
| | aɿ̥ | ‘fight’ | aɿ̥ʔ | ‘bathe’ |
| mid | suwɛ̆ | ‘long time’ | suwɛ̆ʔ | ‘torn’ |
| | ʃaɔ̆ | ‘rooster’ | ʃaɔ̆ŋ | ‘chat’ |
| low | timbɔ̆ | ‘pail’ | timbaŋ | ‘weigh’ |

Vowels in Indonesian have also been described as undergoing tense/lax alternations triggered by syllable structure [3]. However, impressionistically Indonesian high vowels in CVCs produced by monolingual Indonesian speakers (I-M) are different from those produced by bilingual Javanese/Indonesian speakers (I-J): high vowels in CVCs are impressionistically similar to [e, o] respectively, when produced by I-J speakers, but

not by I-M speakers. The data in (3) show some Indonesian words as produced by monolinguals and bilinguals.

(3) Indonesian vowels in CVs and CVCs

| | <u>I-M/I-J</u> | | <u>I-M</u> | <u>I-J</u> | |
|------|----------------|-----------|-------------------------|-------------------------|---------|
| | CV | | CVC | CVC | |
| high | baki | ‘tray’ | sak <u>ɪ</u> t | sak <u>ɪ</u> t | ‘sick’ |
| | paru | ‘lung’ | par <u>u</u> t | par <u>u</u> t | ‘grate’ |
| mid | lele | ‘catfish’ | ser <u>e</u> t | ser <u>e</u> t | ‘drag’ |
| | soto | ‘soup’ | k <u>o</u> t <u>o</u> r | k <u>o</u> t <u>o</u> r | ‘dirty’ |
| low | suka | ‘like’ | sik <u>a</u> t | sik <u>a</u> t | ‘brush’ |

Indonesian mid vowels in CVCs are realized as lax. When the penult and final vowels are identical, the penult vowels harmonize with the final ones which are realized as lax in CVCs. The present study focuses only on the high vowels.

2.3. Vowel harmony

Javanese exhibits vowel harmony whereby a vowel in penult syllable harmonizes with that in a final syllable. Impressionistically, this is also mirrored in Indonesian of the bilingual speakers. However, vowel harmony is realized differently by the Central Javanese/Indonesian speakers (I-CJ) and the Eastern Javanese/Indonesian speakers (I-EJ). For the I-CJ speakers, vowel harmony only affects mid and low vowels; for the I-EJ speakers, all vowels may participate in the harmony. Vowel harmony in Javanese of the Eastern and Central dialects is illustrated in (4) (harmonizing vowels are underlined and in bold).

(4) Vowel harmony in Eastern and Central Javanese

| | <u>EJ and CJ</u> | | <u>EJ</u> | <u>CJ</u> | |
|------|-----------------------|-------------|-------------------------|-------------------------|-----------|
| | CV | | CVC | CVC | |
| high | b <u>ɪ</u> b <u>ɪ</u> | ‘aunt’ | b <u>ɪ</u> b <u>ɪ</u> t | b <u>ɪ</u> b <u>ɪ</u> t | ‘seed’ |
| | k <u>u</u> k <u>u</u> | ‘nail’ | k <u>u</u> k <u>u</u> r | k <u>u</u> k <u>u</u> r | ‘scratch’ |
| mid | k <u>e</u> r <u>e</u> | ‘poor’ | k <u>e</u> r <u>e</u> ? | k <u>e</u> r <u>e</u> ? | ‘lift up’ |
| | č <u>o</u> r <u>o</u> | ‘cockroach’ | č <u>o</u> r <u>o</u> ŋ | č <u>o</u> r <u>o</u> ŋ | ‘funnel’ |
| low | b <u>a</u> l <u>a</u> | ‘follower’ | b <u>a</u> l <u>a</u> ŋ | b <u>a</u> l <u>a</u> ŋ | ‘throw’ |

Given the vowel patterning described here, if the influence of Javanese manifests itself in Indonesian, we would expect to see its effect in such cases. The data given in (5) summarize the impressionistically observed realization of Indonesian vowels in CVs and CVCs as produced by speakers of the language groups considered here. Acoustic realization of the high vowels is the focus of the present study.

(5) Indonesian vowels in CVs and CVCs

| | <u>I-EJ/I-CJ/I-M</u> | | <u>I-EJ</u> | <u>I-CJ</u> | <u>I-M</u> | |
|------|----------------------|-----------|-------------|-------------|------------|-------------|
| high | sisi | ‘side’ | sisip | sisip | sisip | ‘insert’ |
| | susu | ‘milk’ | susut | susut | susut | ‘decrease’ |
| mid | lele | ‘catfish’ | leleh | leleh | leleh | ‘melt’ |
| | toko | ‘shop’ | təkoh | təkoh | təkoh | ‘character’ |
| low | saja | ‘I’ | sajap | sajap | sajap | ‘wing’ |

3. EXPERIMENTAL METHOD

3.1. Subjects

Six speakers were recorded for this study: two bilingual speakers of each Eastern Javanese/Indonesian (both male, I-EJ1 and I-EJ2), and Central Javanese/Indonesian (1 male, I-CJ1 and 1 female, I-CJ2), and two monolingual Indonesian speakers (1 male, I-M1 and 1 female, I-M2). The criteria used to select the speakers are the following:

- the I-EJ speakers were born and have lived most of their life in the city of Malang in the Eastern Java province, and speak no regional language other than Eastern Javanese;
- the I-CJ speakers were born and have lived most of their life in the city of Solo in the Central Java province, and speak no regional language other than Central Javanese;
- the I-M speakers were born, grew up and have lived most of their life in the city of Jakarta, and speak no regional language at all.

The bilingual speakers use their respective Javanese dialect in most informal occasions and use Indonesian for formal communications, while the monolingual speakers use Indonesian exclusively.

3.2. Materials

Words selected for the materials have the following shapes: CICI, CICIC, CECE, where C = any consonant, I = high vowel, E = mid vowel. A wordlist including the sorts of sets in (6) was read by the speakers at a comfortable reading speed. Each word was read four times embedded in a carrier phrase. The recordings were done in Indonesia, in a quiet room. The recorded material was then digitized into a SUN SPARC station at 11,025 Hz.

| | | | | |
|-----|------|-----------------|-------|------------|
| (6) | sisi | ‘side’ | sisip | ‘insert’ |
| | susu | ‘milk’ | susut | ‘decrease’ |
| | sese | ‘nonsense word’ | soto | ‘soup’ |

Acoustic measurements using WAVES+/ESPS include F1/F2 frequencies at the vowel steady state, duration, F0 at mid point of the vowel and overall amplitude of the vowel. The onset of the vowel is taken to be the beginning of F2, and the offset the end of F2. This study reports only the F1/F2 frequencies and duration of the target vowels, since there is no systematic pattern found for F0 and amplitude.

4. RESULTS AND ANALYSIS

4.1. F1/F2 frequencies

4.1.1. The role of syllable structure. If the vowel alternations sketched out in (5) are acoustically realized, we would expect to see the manifestation of the tense/lax difference in the F1/F2 frequencies of the high vowels. The F1 values, corresponding inversely to vowel height, would be lower for high vowels in CVs; their F2 values would be higher for /i/ and lower for /u/ in CVs, indicating that they are more peripheral. The results for each pair of speakers are roughly the same, even though there are minor individual variation. Since male and female speakers have different fundamental frequency (thus different range of

formant values) and due to space limit, the formant plots for one speaker, representing each of the speaker groups, are shown in Figures 1-3.

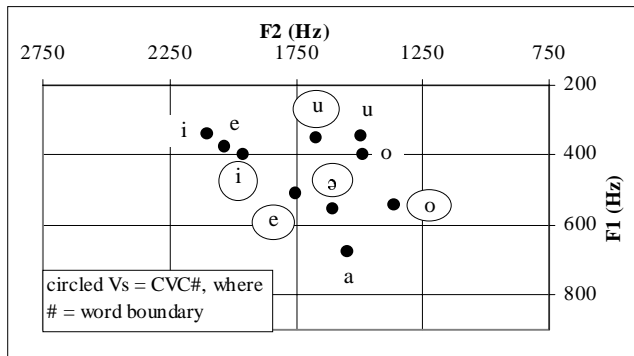


Figure 1. Formant plot of vowels in CVs vs. CVCs for I-EJ2.

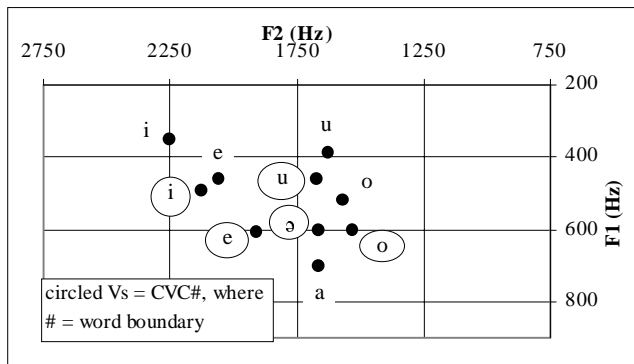


Figure 2. Formant plot of vowels in CVs vs. CVCs for I-CJ2.

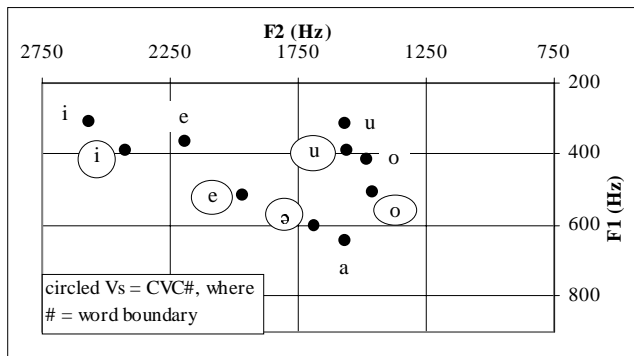


Figure 3. Formant plot of vowels in CVs vs. CVCs for I-M2.

While these plots show the relative position in the acoustic space of all vowels in the inventory in word-final CVs vs. CVCs, we focus only on the high and mid vowels.

For these speakers, high vowels in CVCs, tend to be lower and centralized (except /u/ in CVCs for I-M2, shown in Figure 3). These results are similar to, though less extreme than those found by van Zanten [8]. For the bilingual speakers (in Figures 1-2), the positions of the front vowels /i/ in CVCs and /e/ in CVs are very close, while the back vowels /u/ in CVCs and /o/ in CVs are relatively farther apart. For the monolingual speaker, the reverse is the case. Note also that the space between the

front vowels is quite small for the bilingual speakers, and relatively larger for the monolingual speaker. This may suggest that for the bilingual speakers, the acoustic region for these vowels is relatively narrow.

There are several observations that can be made based on these results. (1) While high vowels in word-final CVCs for I-M speakers may be described as tense, they are lower in the acoustic vowel space relative to their counterparts in CVs; this may be due to both syllable structure and the effect of the final consonant. If tense vowels in CVCs are lower than those in CVs in the acoustic space, distinguishing acoustic vs. phonological lowering is not straightforward. (2) As mentioned earlier, high vowels in closed syllables are impressionistically similar to mid vowels in open syllables as produced by the bilingual speakers, but this is not the case with the monolingual speakers. This may suggest that for the bilingual speakers the tense/lax alternation of high vowels is phonologized, as a manifestation of the Javanese influence on the Indonesian of these speakers, while for the monolingual speakers the high vowel lowering is at the phonetic level. Why these patterns, acoustically so similar, result in a different impression to Javanese hearers is an area for further investigation.

4.1.2. The role of vowel harmony. For the I-EJ speakers, high vowels in penult syllables harmonize with the final ones. When the final syllable is a CVC, the high vowel is realized as lax, and so is the penult vowel. The formant plot of the harmonizing vowels is shown in Figure 4.

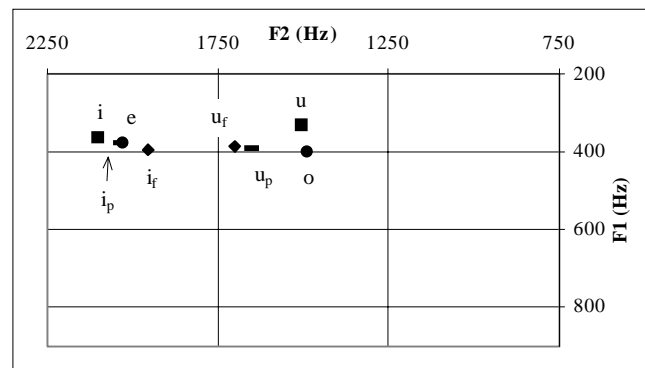


Figure 4. Formant plot of high vowel harmony and mid vowels for I-EJ.

The marker shapes indicated on the plot are (-) for $\underline{\text{C}}\underline{\text{I}}\underline{\text{C}}\underline{\text{I}}\underline{\text{C}}$ (i_p and u_p), *diamond* for $\text{C}\underline{\text{I}}\underline{\text{C}}\underline{\text{I}}\underline{\text{C}}$ (i_r and u_r), *square* for $\underline{\text{C}}\underline{\text{I}}\underline{\text{C}}\underline{\text{I}}$ (i and u), and *circle* for $\underline{\text{C}}\underline{\text{E}}\underline{\text{C}}\underline{\text{E}}$ (e and o).

Let's consider the penult (i_p , u_p) and final (i_r , u_r) vowels of the $\text{C}\underline{\text{I}}\underline{\text{C}}\underline{\text{I}}\underline{\text{C}}$ word shape in the figure above. The high vowels in word-final CVCs (i_r , u_r) are relatively more centralized compared to those in penult CVs (i_p , u_p), suggesting that the vowel which triggers vowel harmony is more centralized than that which undergo the harmony.

Other observations based on this figure are as follows. (1) For the front vowel, /e/ in penult CV overlaps with /i/ in final CVC (i_p); for the back vowel, penult /u/ (u_p) almost overlap with final /u/ (u_r). (2) High penult vowels in CVCV words are more

in the periphery relative to those penult vowels in CVCVC words, as expected: the high penult vowels in CVCV words are tense and high penult and final vowels in CVCVC words lax for the I-EJ speakers, due to syllable structure for the final vowels and to vowel harmony for the penult ones.

4.2. Vowel duration

Cross-linguistically, vowel duration in CVs is greater than in CVCs [4]. The duration comparisons of high vowels in word-final syllables are presented in Figure 5. The duration of high vowels in CVs is greater than in CVCs. This is true for all six speakers across the three groups, and therefore I pool the results across the speakers. Overall, the duration of high vowels in CVs is greater by almost twice than in CVCs.

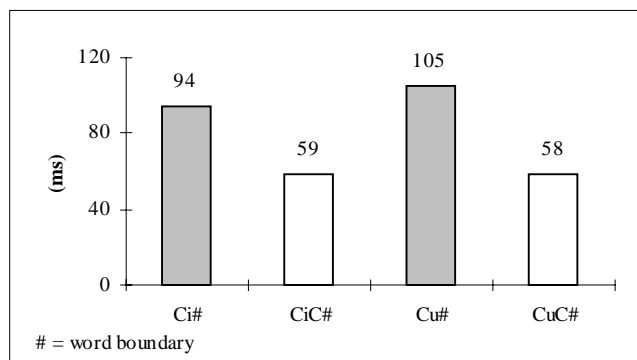


Figure 5. Vowel duration across all speakers.

We have seen earlier that even though high vowels in CVCs for the bilingual speakers tend to be lower than in CVs, the difference is not dramatic. Since their duration in CVCs is much shorter than in CVs, this may help enhancing the perceived difference in high vowel tenseness in word-final position. In languages like English, lax vowels are shorter than their tense counterparts [5]. However, in Madurese, a language closely related to both Indonesian and Javanese, what has impressionistically been described as a tense/lax alternation was found to be a difference solely in duration [1].

Note that this potential durational cue would not apply to the cases of lax high vowels in the penult syllable. These vowels harmonize with the word-final high vowels in CVCs, in the Indonesian of the I-EJ speakers. Their being in a CV syllable would mean that their duration is greater than the final vowels that they harmonize with. The similarities in F1/F2 frequencies may be a sufficient cue.

5. SUMMARY

Taking vowel height as a case study, this acoustic study examines the influence of Javanese on Indonesian. The results provide us with the following insights about Indonesian high vowels:

- a. As produced by the bilingual Javanese/Indonesian speakers, the Indonesian high vowels are acoustically realized as lower and more centralized in word-final CVC syllables than in CV syllables, following the vowel pattern in Javanese.
- b. Vowel duration, being almost half as short in CVCs

compared to in CVs, may help intensifying the perceived difference of high vowels in these two different syllable types, in cases with the bilingual speakers.

c. For the monolingual Indonesian speakers, determining whether high vowels in CVC syllables undergo tense/lax alternation is not straightforward. Their actual acoustic realization does not agree with their auditory impression. On the one hand, for bilingual Javanese/Indonesian speakers high vowels in CVCs as produced by monolingual Indonesian speakers sound like those in CVs; on the other hand, for monolingual Indonesian speakers high vowels in CVCs as produced by bilingual Javanese/Indonesian speakers do not sound like those in CVs. Perceptual studies to test this observation may provide the answer.

ACKNOWLEDGMENTS

I would like to thank Abby Cohn, and members of the Cornell Phonetics Laboratory for their valuable comments and suggestions. I would also like to thank Eric Evans for technical support, and all participating language consultants for their time and patience. This study was made possible with support from the NSF grant # SBR-9511185 to Abigail Cohn.

REFERENCES

- [1] Cohn, A. and Lockwood, K. 1994. *Working Paper of the Cornell Phonetics Laboratory*, 9, 67-92.
- [2] Grimes, B. (ed.) 1996. *Ethnologue*. Dallas, TX: Summer Institute of Linguistics.
- [3] Lapoliwa, H. 1982. *A generative approach to the phonology of Bahasa Indonesia*. Canberra: ANU. (Pacific Linguistics, Series D, No. 34)
- [4] Maddieson, I. 1985. Phonetic cues to syllabification. In Fromkin, V. A. (ed.) *Phonetic Linguistics*. Orlando: Academic Press, 203-221.
- [5] Peterson, G. and Lehiste, I. 1960. Duration of syllabic nuclei in English. *Journal of the Acoustical Society of America*, 32, 693-703.
- [6] Poedjosoedarmo, S. 1982. *Javanese influence on Indonesian*. Canberra: ANU. (Pacific Linguistics, Series D, No. 38)
- [7] Yallop, C. 1982. The phonology of Javanese vowels. In Halim, A., L. Carrington and S. A. Wurm (eds.) *Papers from the Third International Conference on Austronesian Linguistics, vol. 1: Tracking the travelers*. Canberra: ANU, 299-319. (Pacific Linguistics, Series C, No. 75)
- [8] Van Zanten, E. 1989. *The Indonesian vowels; Acoustic and perceptual explorations*.