TIMING DIFFERENCES IN THE VC RHYME OF STANDARD AUSTRALIAN ENGLISH AND LEBANESE AUSTRALIAN ENGLISH

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ABSTRACT

This paper reports on an acoustic phonetic study of the VC rhyme in two Australian English dialects. The aim is to examine the timing features of the rhyme to determine the extent to which characteristics of Arabic predict differences between the two dialects. Eight speakers of Standard Australian English and seven of Lebanese Australian English were recorded using a standard word list task. Results show significant dialect specific timing differences which are dependent on vowel quantity and coda voicing. The results suggest that Lebanese Arabic prosodic constraints may have become ethnolinguistically functionalised in this new AusE dialect.

Keywords: Australian English, coda consonants, duration, VC rhyme, vowel duration, voicing

1. INTRODUCTION

In Australia, the dominant dialect of English is Standard Australian English (SAusE) [5] but the community is also home to various ethnocultural AusE varieties which have arisen quite recently as a result of increased migration from non-English speaking countries. This extensive immigration has contributed to a vast increase in cultural diversity and the desire for Australian-born individuals to freely express their cultural heritage through new varieties of AusE. Clyne, *et al* [3] consider "stabilised transference" to be the process by which a new local dialect is created through L1 to L2 phonetic feature transfer from the substratum language that occurred in the parents' or grandparents' generation. These second and third generation AusE ethnolects are not considered the product of second language learning as many speakers of Lebanese Australian English (LAusE) ethnolect have English as their first language [3]. If feature transfer from Arabic has occurred in previous generations to create the LAusE dialect we would expect to see similarities between Arabic accented English and LAusE.

Several studies report the characteristics of Arabic accented English (e.g. [6, 7, 11, 12]). Such studies show that the major temporal characteristics for the VC rhyme are reductions in vowel duration, short/long vowel contrast and cues to final stop voicing including a reduction in preceding vowel length and closure duration effects. It is suggested that these voicing related patterns occur because vowel duration differences play only a minor role in distinguishing coda voicing in Arabic, e.g. [12]. Vowel length has a dual role in English as it is exploited in vowel identity but also as a cue to final consonant voicing. Relatively long vowels with short codas cue voicing and relatively short vowels with long codas cue voicelessness. Furthermore, voiceless stop codas have longer more intense bursts than voiced codas (e.g. [13, 14, 15]). Arabic and English also differ in their phonotactic and therefore prosodic characteristics. Monosyllabic content words in Lebanese Arabic are minimally bimoraic such as CV:C, CVCC and CVC: [8, 10]. That is, short vowels only precede geminates and clusters in such words.

The present study aims to examine whether LAusE reflects phonetic feature transfer from Arabic as suggested by Clyne, et al [3] and whether this can be explained as higher order phonological processes manifesting as phonetic implementation [4]. Feature transfer would predict:

1. reduced vowel length
2. reduced vowel length contrast
3. reduced consonant voicing effect on preceding vowel duration and consonant features: closure and burst durations

2. METHOD

2.1. Speakers

Fifteen male university students in their early twenties who were born in Sydney took part in the study. Seven males identified by the researchers as speakers of LAusE and whose parents were born in

Lebanon made up the LAusE group. All were bilingual in English and Vernacular Arabic. The remaining eight participants, identified by the researchers as speakers of SAusE, made up the SAusE group.

2.2. Data

Data was collected in the Centre for Language Sciences recording studio in the Department of Linguistics at Macquarie University using an AKG C535 EB microphone, Cooledit audio capture software via M-Audio delta66 soundcard, onto a Pentium 4 PC at 44.1kHz sampling rate. Each speaker read a standard elicitation list of words containing the 18 stressed vowels of AusE in the following environments: /hVd/, /hVl/, hVn/, /hV/, /hVt/ three times in random order upon individual orthographic presentation on a computer screen. Only data for monophthongs from /hVd/ and /hVt/ will be reported here.

2.3. Analysis

Speech data was sampled at 20 kHz with 16 bit resolution. F1 and F2 were automatically tracked using ESPS/Waves (12th order LPC analysis with a 49 ms raised cosine window and a frame shift of 5 ms). Labelling was carried out in Emu [2] using high resolution grey scale wideband spectrograms, LPC spectra and aligned waveforms. Vowels were hand labelled according to criteria described in Harrington, et al [9]. Vowel onset was marked at the first full glottal pulse. Vowel offset was determined by the sudden reduction of energy in the higher harmonics at the point of stop closure. Stop release was determined from a spike/transient in the acoustic spectrum. The end of the burst was assigned to the cessation of high intensity aperiodic energy. Durations were calculated for vowel, stop closure, stop burst. There were some productions of /t/ (36 tokens) where the stop was either unreleased or replaced by a glottal stop and these were excluded from the analysis.

The monophthongs /ɪ, e, æ, ɐ, ɔ, ʊ/ as in *hid, head, had, hud, hod, hood* were classified as short vowels. /iː, ɐː, oː, ʉː, ɜː/ *heed, hard, horde, who'd, herd* were classified as long vowels [5].

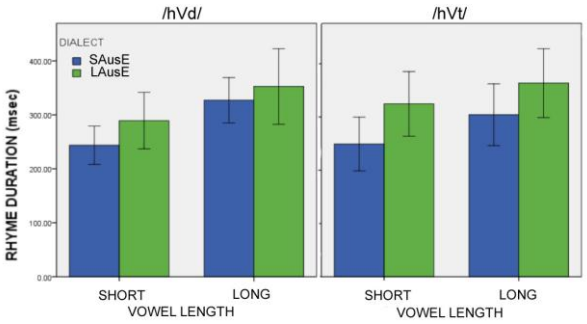
Data were subjected to mixed model ANOVA with DIALECT (SAusE/LAusE) and vowel LENGTH (long/short) as fixed effects and speaker (SPK) as a random effect (with post-hoc Bonferroni correction of $p<0.025$). /hVt/ and /hVd/ data were analysed separately.

3. RESULTS

3.1. CV Rhyme Duration

The rhyme duration is a measure combining the lengths of the vowel, the closure and burst. Figure 1 illustrates the results and shows that rhymes in the short vowel context were significantly shorter than long vowel rhymes for both the /hVd/ [$F(1,478) = 737.75$, $p=0.000$] and /hVt/ [$F(1,438) = 247.98$, $p=0.000$]. The DIALECT analysis found that LAusE speakers had longer rhymes than SAusE speakers but this difference was only significant in the /hVt/ context [$F(1,12.99)=7.17$, $p<0.019$]. There was however an interaction in both /hVd/ [$F(1,478)=13.87$, $p=0.000$] and /hVt/ [$F(1,438.01)=6.39$, $p<0.012$] with a greater difference between the accent groups for the short vowel rhymes ($p<0.011$).

Figure 1: Mean duration of the VC rhyme (vowel, closure, burst) in milliseconds for /hVd/ and /hVt/. Error bars represent +/- 1 sd.



3.2. Vowel Duration - /hVd/

We calculated the ratios of long/short vowels for both dialect groups for /hVd/ and /hVt/ and found larger ratios for the LAusE speakers indicating a reduced length contrast between long and short vowels.

- /hVd/ short/long vowel ratios LAusE= 0 .623
  SAusE = 0.598
- /hVt/ short/long vowel ratios LAusE = 0.698
  SAusE = 0.623

The results also show a smaller ratio for both dialect groups in /hVd/ compared with /hVt/ indicating greater difference between the short and long vowels in the voiced compared with the voiceless context. It is interesting that the LAusE /hVd/ ratio is the same as the SAusE /hVt/ ratio.

Figure 2: Mean vowel duration in milliseconds for the /hVd/ and /hVt/. Error bars represent +/- 1 sd.

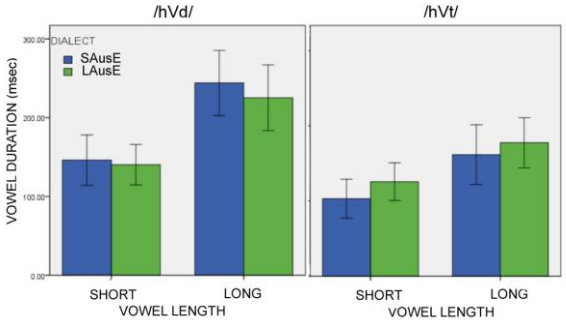


Figure 2 shows the mean durations for vowels across vowel length and dialect groups. Both dialects differentiate between the long and short vowels as indicated by a main effect for LENGTH for /hVd/ [F(1,478)=1518.26, p=0.000] and /hVt/ [F(1,438.01)=571.19, p=0.000]. LAusE speakers appear to have shorter vowels than SAusE speakers for /hVd/ but this effect is not significant. In /hVt/ the LAusE speakers have significantly longer vowels [F(1,13.04)=4.77, p<0.048]. There is also an interaction between DIALECT and LENGTH for /hVd/ [F(1,478)=7.74, p<0.006] because LAusE speakers have shorter long vowels than SAusE speakers. However, this difference is not strong enough to yield any significant post hoc results. There was a trend towards an interaction for /hVt/ [F(1,438.14)=3.19, p<0.075] with LAusE speakers displaying longer vowels than SAusE speakers in the short vowel context compared with the long vowel context (p<0.021).

In summary, a voiced final stop increases the difference in vowel duration between the dialect groups for long vowels. A voiceless final stop increases the difference between the dialect groups for short vowels.

3.3. Closure duration

Figure 3 shows the closure duration for /d/ and /t/. For /hVd/, there are main effects for both DIALECT [F(1,13.00)=12.60, p<0.004], with LAusE speakers producing longer closures than SAusE speakers, and for LENGTH [F(1,478)=225.2, p=0.000] with all speakers producing shorter closures in the long vowel category. A significant interaction (F[1,478) =6.61, p<0.010) is also present as there is a greater difference between the two dialect groups in the short vowel context (p<0.002) compared to the long vowel context (p<0.007). LAusE speakers lengthen short vowel closures more than long vowel closures.

For /hVt/, short vowels contribute to longer closures than long vowels and this is consistent across dialect categories [F(1,438.005)=55.05, p=0.000]. There are no dialect effects or interactions for /hVt/ closure duration.

Figure 3: Mean closure duration in milliseconds for /d/ and /t/. Error bars represent +/- 1 sd.

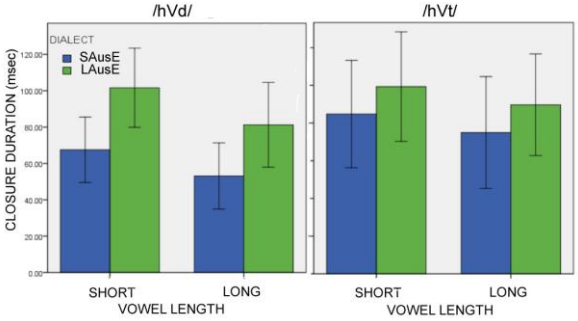
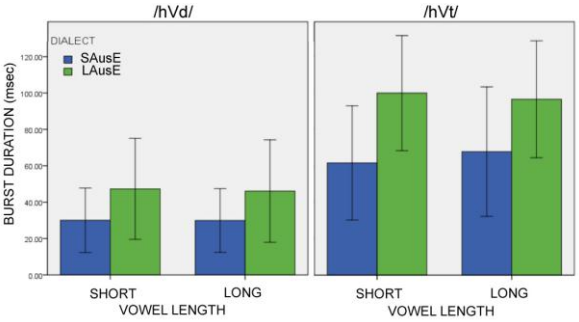


Figure 4: Mean burst duration in milliseconds for /d/ and /t/ (Panel B). Error bars represent +/- 1 sd.



3.4. Burst duration

Figure 4 shows that the LAusE speakers use longer bursts. However, there is considerable variability and no significant effects can be found for /hVd/ although a trend can be seen (F(1,13.01)=3.47, p<0.085) for DIALECT. For /hVt/ there is again no LENGTH effect but a DIALECT effect is present with LAusE speakers producing a significantly longer burst [F(1,12.995)=6.471, p<0.024]. There is also a trend towards an interaction F(1,438.021=3.116,p<0.075) with these speakers producing comparatively longer bursts in the short vowel context than the long vowel context.

3.5. Results Summary

These results show that differences in the durational features of the VC rhyme between and within dialect groups are related to the duration of the syllable nucleus and the voicing of the coda.

Rhymes are shorter in short vowel contexts compared to long vowel contexts despite the increase in stop closure durations after short vowels. Burst durations do not appear to be related to preceding vowel length. The differences in the VC rhyme for LAusE speakers compared with SAusE speakers relate to the nucleus length and to coda voicing. Rhymes for LAusE are longer than those for SAusE and this is particularly the case for the short vowels in /hVt/. When the syllable contains a short vowel nucleus LAusE have longer vowels for /hVt/ and longer closures for /hVd/. They also have longer bursts for /t/ with a trend for this being more extreme in the short vowel context.

4. DISCUSSION AND CONCLUSION

The results suggest that VC rhyme characteristics of LAusE cannot be explained as simple phonetic transfer from Arabic. If such transfer had occurred we might expect to see consistently shorter vowels and longer closures as has been suggested in the literature for Arabic accented English and reduction in the temporal voicing cues [6, 7, 11, 12]. Instead, an interesting set of effects that are related to both the length of the syllable nucleus and also coda voicing have been found. These effects can be explained with reference to Lebanese Arabic phonotactic constraints and therefore higher order prosodic features [1]. In Lebanese Arabic, monosyllabic content words are minimally bimoraic such as CVːC, CVCC or CVCː. In order to produce English short vowel CVC syllables certain adjustments may be made to accommodate the Arabic prosody. There are several possible strategies to increase syllable weight. One is to lengthen a short vowel thereby potentially increasing the number of mora in the nucleus. Another strategy is to increase the consonant duration (suggestive of a geminate) by either increasing the closure or the burst. We have seen evidence for each of these strategies and their use is predictable from context. In /hVt/ short vowel contexts, the main strategy involves vowel lengthening but an increase in the burst duration for /t/ also occurs. In /hVd/ contexts, which already have relatively long vowels as a result of the voicing effect, the strategy is to increase closure duration. These adjustments have the effect of potentially modifying the weight of the syllable in compliance with Arabic prosodic constraints. In accordance with these findings, we argue that Lebanese Arabic prosody has become ethnolinguistically functionalised in Australia. Further research on larger populations and from other Lebanese diaspora communities which include analysis of connected speech will help to determine the salience of prosody in the creation of new Englishes.

5. REFERENCES

[1] Broselow, E. 1988. Prosodic phonology and the acquisition of a second language. In Flynn, S., O'Neill, W. (eds.), *Linguistic Theory in Second Language Acquisition.* Dordrecth: Kluwer, 295-308.

[2] Cassidy, S., Harrington, J. 2001. Multi-level annotation in the Emu speech database management system. *Speech Communication* 33, 61-77.

[3] Clyne, M., Eisikovits, E., Tollfree, L. 2001. Ethnic varieties of Australian English. In Blair, D., Collins, P. (eds.), *Varieties of English Around the World: English in Australia*. Amsterdam: Benjamins, 223-238.

[4] Cohn, A. 2003. Phonological structure and phonetic duration: The role of the mora. *Working Papers of the Cornell Phonetics Laboratory* 15, 69-100.

[5] Cox, F., Palethorpe, S. 2007. Illustrations of the IPA: Australian English. *JIPA* 37, 341-350.

[6] Crowther, C., Mann, V. 1994. Use of vocalic cues to consonant voicing and native language background: The influence of experimental design. *Perception and Psychophysics* 55, 513-525.

[7] Flege, J., Port, R. 1981. Cross-language phonetic interference: Arabic to English. *Language and Speech* 24, 125-146.

[8] Ham, W. 2001. *Phonetic and Phonological Aspects of Geminate Timing*. New York: Routledge.

[9] Harrington, J., Cox, F., Evans, Z. 1997. An acoustic phonetic study of broad, general and cultivated Australian English vowels. *Australian Journal of Linguistics* 17, 155-184.

[10] McCarthy, J., Prince, A. 1990. Prosodic morphology and templatic morphology. In Eid, E.M., McCarthy, J. (eds.), *Perspectives on Arabic Linguistics II*. Amsterdam: Benjamins, 1-54.

[11] Mitleb, F. 1984. Vowel length contrast in Arabic and English: A spectrographic test. *J. Phon.* 12, 229-235.

[12] Munro, M. 1993. Productions of English vowels by native speakers of Arabic: Acoustic measurements and accentedness ratings. *Language and Speech* 36, 39-66.

[13] Raphael, L. 1972. Preceding vowel duration as a cue to the perception of the voicing characteristic of word-final consonants in American English. *JASA* 51, 1296-1303.

[14] Summers, W. 1987. Effects of stress and final-consonant voicing on vowel production: Articulatory and acoustic analyses. *JASA* 82, 847-863.

[15] Walsh, T., Parker, F. 1983. Vowel length and vowel transition: cues to [+/- voice] in post-vocalic stops. *J. Phon.* 11, 407-412.