A corpus-based analysis of transfer effects and connected speech processes in Vietnamese English

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Abstract

This paper presents a corpus-based descriptive analysis of the most prevalent transfer effects and connected speech processes observed in a comparison of 11 Vietnamese English speakers (6 females, 5 males) and 12 Australian English speakers (6 males, 6 females) over 24 grammatical paraphrase items. The phonetic processes are segmentally labelled in terms of IPA diacritic features using the EMU speech database system with the aim of labelling departures from native-speaker pronunciation. An analysis of prosodic features was made using ToBI framework. The results show many phonetic and prosodic processes which make non-native speakers' speech distinct from native ones. The corpus-based methodology of analysing foreign accent may have implications for the evaluation of non-native accent, accented speech recognition and computer assisted pronunciation- learning.

1. Introduction

As the rationale and methodology for the present study is reported in a companion paper (Ingram and Nguyen, in the same conference), the focus of this paper lies in the analysis of the most prevalent transfer effects and connected speech processes produced by Vietnamese speakers of English compared with native speakers. We report the incidence rate of non-native phonetic processes in the Vietnamese English speakers relative to a base rate in a control group of native English speakers. A discriminant analysis is also reported, using the most typical phonetic and prosodic processes, in order to examine how well the two speaker groups can be discriminated and whether an Australian Vietnamese female speaker who has a native-like accent is classified into the native or Vietnamese speaker group.

2. Method

2.1. Speech elicitation method

As previously discussed (Ingram & Nguyen, this volume), a *grammatical paraphrase task* was found to meet the requirements of an elicitation procedure that reflected as closely as possible the speaking conditions under which one would wish to assess an L2 speaker's pronunciation or intelligibility.

2.2. Subjects

There were two groups of subjects: a control group of 12 native Australian speakers of English (6 males and 6 females) and a non-native group of 11 Vietnamese speakers of English (5 males and 6 females).

The native English speakers whose age ranged from 17 to 48 (mean age: 23) were first year Linguistics students at University of Queensland. The Vietnamese subjects 'age ranged from 17 to 29 (mean age: 24). 10 of them were MA students in TESOL program at University of Queensland. They all had a BA. in English (EFL teaching) and had been EFL teachers for 2,3 years before doing MA studies. As MA students in TESOL, they all had overall IELTS scores of at least 6.5 and they had been in Australia from 4 months to 1,5 years at the time of participation in the experiment. In general, it can be said that they had an advanced level of proficiency in English. One Vietnamese female subject (age: 17), a first-year Linguistics student, was a Vietnamese Australian with a native-like accent, who had grown up in Australia.

2.3. Annotation

The phonetic processes are segmentally labeled in terms of IPA diacritic features using the EMU speech database system (Cassidy, 1999) with the aim of labeling departures from native-speaker pronunciation. Phonetic processes or features are annotated with reference to what the transcribers take to be normal or standard Aust. English pronunciation. That is, only phonetic features which represent *departures* from expected pronunciation and which will contribute to the perception of 'foreign accent' are annotated. A complete list of phonetic and prosodic processes which are analyzed in this paper is presented in Ingram &

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Nguyen, this volume. It is noted that there are other phonetic features which were annotated but had low incidence of occurrence and thus not reported in this paper.

3. Results

3.1. Connected speech and assimilation processes

The connected speech and assimilation processes discussed in this section include five phonetic processes: (1) coalescence, (2) liaison, (3) consonant elision, (4) vowel reduction, and (5) syllabic consonant. Sum and mean of incidences of connected speech and assimilation processes by speaker groups are presented in table 1.

Table 1: Sum and mean of incidences of connected speech and assimilation processes (N: Native; V: Vietnamese)

Coales.		Liaison		C-elision		V-reduce		Syll-	
N	V	N	V	N	V	N	V	N	V
32	7	158	36	158	30	33	14	25	15
2.6	0.6	13	3.2	13	2.7	2.7	1.2	2	1.3

Coalescence, the process whereby two (consonant) segments mutually influence each other, occurred in only two words in the data: *students* and *tulips* where the /t +j/ is palatalized into /ʧ/. As shown in table 1, while coalescence was produced 89% (32/36 incidences) by native speakers, the number of occurrences for Vietnamese speakers is very low (less than 20% and by 5/11 speakers). A Wilcoxon signed rank test showed significant differences in incidences of coalescence between native speakers and Vietnamese speakers [Z = 2.8, p-value = 0.0039].

Liaison refers to the "smooth link between a final consonant in one word and an initial vowel in the next word"(Kenworthy, 1987, p. 136). In this corpus, liaison occurred not only between final consonant and initial vowel (e.g., *because of, box of, in a, ran away, was admired*) but also between final stop consonant and initial approximant or velar fricative /h/ (e.g., *Jack will, Jack who, plate who, kept his*). A lack of liaison in Vietnamese speech was easily recognised either from auditory perception or from spectrogram with a glotalised stop before the vowel or a short gap or a lack of linking between the final release of the preceding final stop and the following fricative /h/. A Wilcoxon signed rank test showed that incidences of liaison in native speakers' speech were significantly far greater (e.g., 4.5 times) than that of Vietnamese speakers [Z = 2.8, p-value = 0.0038].

Consonant elision in this assimilation category consists of two main types. The first is a kind of co-articulation where the final consonant of one word and the initial consonant of the following word are of the same place of articulation (e.g., *dark cloud* or *mask covered*). As a result, there is a holding phase of closure of the first and second stop with only one release burst into the vowel of the second word. In contrast to many incidences where native speakers produced the two stops separately (with either a release of the first one and then a closure for the second one or a prolonged stopping phase in case of no final release), this co-articulation with a fairly short closure phase is treated as a deletion of the final stop as a result of assimilation. The second kind of consonant elision is the deletion of the second consonant in a final consonant cluster as a result of assimilation with the initial consonant in the following words (e.g., /d/ is deleted in *and_ mouth*, *and_ hides*, *friendly*, *used_ to*, *tried_ to*), or /ð/ in *in_the*, *on_the*). The analysis showed that native speakers' speech had significantly far more incidences of consonant elision due to assimilation processes (e.g., 4.5 times) than that of Vietnamese speakers [Z = 2.8, p-value = 0.0038].

Vowel reduction in this analysis refers to either a reduction or a complete elision of a schwa vowel in an unstressed syllable or before a syllabic consonant due to word-internal assimilation; for example "*to"* is pronounced only with an aspirated [tʰ], or continent [kɒntʰ(ə)n̥(ə)(n)t]. The results showed that native speakers produced more vowel reduction than Vietnamese [Z = 2.0 p-value = 0.04].

Syllabic consonant is the phonetic process in which a nasal or lateral forms the nucleus of a syllable; for example, in the corpus, many final nasals and lateral become syllabic as a result of vowel reduction or deletion in words such as *student*, *stumbled*, *elephant, couldn't*, and *will*. Even though there were more occurrences of syllabic consonants in native speakers' speech than Vietnamese's, there was no statistical significance [Z = 0.6, p-value = 0.5]

In general, the results presented in this section show that in spite of an advanced level of English proficiency, many Vietnamese speakers of English failed to produce the connected speech and assimilation processes which characterize native speakers' spontaneous natural speech.

3.2. Syllable structure processes

Syllable structure processes examined in this section consist of phonetic processes occurring mainly in the non-native speech due to the constraints of the syllable structure of the first language including (1) consonant deletion, (2) vowel epenthesis, (3) vowel gliding, (4) l-vocalisation and (5) monothongisation. The results are in table 2.

Table 2: Sum and Mean of incidences of syllable structure processes

C- delete		V-epen		V- glide		l-vocal		mono	
N	V	N	V	N	V	N	V	N	V
76	224	0	53	0	14	2	77	0	15
6.3	20	0	4.8	0	1.2	0.1	7	0	1.3

Consonant deletion includes final consonant deletion (e.g., final plural form/s,z/ as in *students, soldiers, elephants, hides* or past form/t,d/ as in *used, stumbled, covered* and other final consonants: /s/ in *house*, /z/ in *was*) and consonant cluster simplification by a deletion of either the first consonant in the cluster (e.g.,/s/ in *driest*, /v/ in *eaves*, /s/ in *invest*) or the second consonant in the cluster (e.g., /t/ in *paint*, /k/ in *mask*). As shown in table 2, Vietnamese deleted segments particularly final consonants at a marked rate compared to native speakers [Z = -4.0176, p-value = 0.0001].

Vowel epenthesis is the process of resyllabification by insertion of a schwa vowel between consonants in a cluster or after a final consonant. This process occurred only in the Vietnamese speech data. An important feature to note is that Vietnamese speakers in this study produced vowel epenthesis only after final consonants and mostly after voiced consonants (e.g., *those [z], clouds [z], covered [d], bluebells [z]*). Therefore, it is argued that vowel epenthesis in advanced Vietnamese speakers of English in this study did not result from the underlying process of resyllabification due to syllable structure constraints but stemmed from the strengthening of the voicing of final voiced consonants which Vietnamese lacks (Vietnamese only has voiceless stops or nasals in coda position).

Vowel gliding, a transfer effect from Vietnamese syllable structure, is a process in which vowels (particularly diphthongs ending in /i/ as /ai, oi, ei/ in such words as *admired, hides, by*) became palatalized.

L-vocalization is the process of delateralization whereby the final dark /l/ becomes a central or back vowel (e.g., in *will, Bill, bell, stumbled, cold, all, fold, royal, soldier, jewel, steal*). Even though l-vocalization is a phonetic process in many dialects of English (Wells, 1982), only 2 incidences were produced by 1 male native speaker, while all Vietnamese speakers delateralised /l/ at a high rate (a mean incidences of 7 over 11 potential words).

Monothongisation was produced by Vietnamese speakers in words such as *paint* and *came* because in Vietnamese diphthongs only occur in open syllables but not in closed syllables. As a result, the diphthongs in these words were monothongised to conform to Vietnamese syllable structure.

3.3. Stop consonant processes

In this section, results on phonetic processes of stop consonants are presented, including (1) spirantization, (2) initial aspiration, (3) final release, (4) final checked stops, (5) lenis burst release in initial stops, and (6) initial implosive stops. A summary of incidences is in table 3.

Table 3: Incidences of phonetic processes of stop consonants

Spiran-tisation		Initial aspiration		Fnl. release		Fnl. checked		Lenis release		Initial. implosive	
N	V	N	V	N	V	N	V	N	V	N	V
21	18	410	394	77	123	0	112	24	88	0	95
1.7	1.6	34.1	35.8	6.4	11.1	0	10.1	2	8	0	8.6

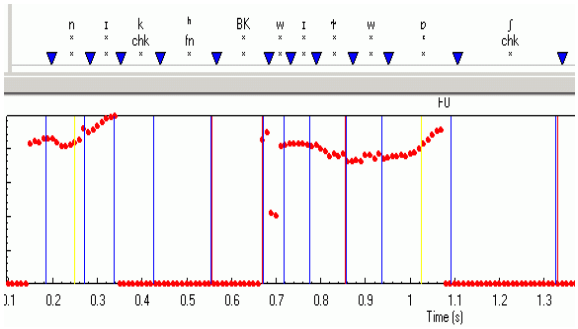
Spirantisation is a lenition process by which an oral stop is converted into some kind of continuant (spirantisation) that is typically voiced (sonorisation) and may have a relatively open articulation (vocalisation). Both native speakers and Vietnamese sometimes spirantised stops but at very minimal rate (1.7 vs. 1.6 incidence per speaker) which was not significantly different [Z = 0.09, p-value = 0.9]. Speakers of both groups strongly aspirated initial voiceless stops and Vietnamese produced aspiration at more or less the same rate as native speakers [mean: 35.8 vs. 34.1 respectively; Z = -0.8, p-value = 0.3].

Vietnamese produced final stop release at a significantly higher rate than native speakers [Z = 2.8, p-value = 0.0038]. It is observed that there are three main conditions in which native speakers released final stops. First, stops were released particularly in phrase-final or utterance-final content words which received special emphasis or nuclear tone (e.g., *the soup is **cold**, John stumbled on the blackboard because it was **dark**, the queen was sleeping in the royal **tent***). Second, when the final aspirated release was linked to the following word (i.e., *sou**p** is, Nic**k** will, Jac**k** who, hun**t** elephant*). Third, final release was more common in voiceless stops than in voiced stops. By contrast, there was no consistent motivation for Vietnamese's final stop release which occurred both in voiceless and voiced stops. It is argued that most of Vietnamese speakers of English (10/11) were teachers of English with some formal phonetic and pronunciation training in their BA course, this strong tendency of final stop release can either stem from an overgeneralization of initial stop release or due to their "strong and conscious effort" in realizing final consonants which beginning learners of English tend to drop.

The final checked stop is a phonetic process transferred from Vietnamese syllable structure. Vietnamese syllables are closed by only two kinds of consonants: unreleased voiceless stops (/p/, /t/, and /k/) and nasals. A syllable closed by a voiceless stop tends to be checked, i.e., the vowel is shortened or stopped abruptly by the stop, the final consonant is glotalised and unreleased, the tone contour is also "checked" with a sharp rise and abrupt stop (see an illustration in figure 1 below). There is also a constraint on tone distribution in checked syllables in Vietnamese such that only two tones (the high rising Sac and the creaky low falling Nang) can occur in checked syllables. In Vietnamese English speech, the "checked" quality is triggered by

not only by final stops but also other final obstruents. It is found that "checked" syllables in the target language tend to invoke Vietnamese learners' production of the Sac tone in the interlanguage (Riney, 1988) and they have a segmental constraint on Vietnamese perception of English stressed and unstressed syllables (Nguyen, 2003). The results on table 3 showed that while native speakers had no checked syllables, Vietnamese showed a strong preference in production of checked sounds (a mean of 10 incidences per speaker). These checked syllables were accompanied by a checked tone quality which is discussed later in the section on tones.

Figure 1: checked syllables and checked tones on *Nick* and *wash* by a Vietnamese speaker.



A lenis release or absence of a burst in initial release of stops refers to a phonetic process in which there is no aspiration of voiceless stops or no prevoiced burst of voiced stops in syllable initial position. In the corpus, it is observed that a few native speakers occasionally failed to produce a strong release burst of stops particularly in clusters (e.g., /bl/ in *black*, *blue*) and in some other voiced stops in unstressed syllables (e.g., no prevoice burst of /d/ in *students* or /b/ in *stumbled*). Vietnamese had a significantly higher rate of no burst in initial release of stops than native speakers [Z = -2.6, p-value = 0.0073].

Implosive stops are glottalic ingressive consonants, meaning that air is sucked in by the larynx due to the downward movement of the vibrating glottis while pronouncing them rather than strongly expelled out of the mouth as in pulmonic consonants, majority of implosive consonants are voiced. Vietnamese voiced stops are implosive, as a result, the implosive feature is transferred into Vietnamese English speech. Unlike initial stops without a release burst discussed above, there is a prevoiced release but ingressive which is quite perceptually salient in implosive stops produced by many Vietnamese speakers. The results in table 3 showed that implosive release of initial consonants were produced at a high rate by many Vietnamese speakers (a mean of 8.6 incidences per speaker). Nevertheless, this feature seems to characterize some speakers over others (a female and a male speaker produced fewer than 1 implosive stop)

3.4. Other segment processes

The results on phonetic processes of some other segments such as stopping of fricatives, devoicing, palatalisation of /s,z/, voicing and nasalisation of /l / are presented in table 4.

Table 4: Other segment processes

Stopping		Devoicing		/s,z/- Palatalisation		Voicing		L-nasalisation	
N	V	N	V	N	V	N	V	N	V
21	264	36	36	0	79	0	9	0	10
1.7	24	3	3.2	0	7.1	0	0.8	0	0.9

Stopping of fricatives, particularly interdental fricatives, is a prominent feature produced by Vietnamese speakers. While some native speakers occasionally produced stopping of fricatives (e.g., /v/ in *of*, /ð/ in *the* and *with*), Vietnamese produced almost 100% of interdental fricatives as stops (*the, their, they, that, other, with, without, gather, and mouth*) and many final fricatives as stops (e.g., *of, life*). The difference in stopping incidences between two speaker groups was highly significant [Z = -2.8968, p-value = 0.0038].

Native speakers and Vietnamese devoiced segments in different ways. While native speakers tended to devoice sonorants after stops (e.g., /l/ in *cloud*, /r/ in *tried, driest*), Vietnamese devoiced final voiced obstruents, particularly voiced fricatives (e.g., *bridge, bluebells, does, hides*) due to the transfer of syllable structure constraint of no voiced obstruents in coda in Vietnamese.

As shown in table 4, Vietnamese speakers had a strong preference for palatalisation of alveolar fricatives /s,z / because they substituted these two sounds with the Vietnamese counterparts which are in fact retroflex fricatives, as a result these consonants have a strong turbulence of a palatal fricatives. Some Vietnamese speakers occasionally produced voiceless sounds as voiced (/z/ in house, /f/ in life) and substitute a nasal /n/ for the final /l/ (e.g., *all, cold, fold*).

3.5. Vowel processes and voice quality

Most of vowel processes are a result of Vietnamese vowel substitution. A sum of incidences is in table 5.

Table 5: Incidences of vowel processes and creaky voice

lengthening								Creaky voice	
N	V	unreduced	deletion	fron	back	raise	round	N	V
10	59	58	22	28	44	5	16	76	3
0.8	5.3	5.2	2	2.5	4	0.4	1.4	6.3	0.2

One of the prominent features which contributed to a "syncopated" rhythm of Vietnamese English speech is their lengthening of vowel in unstressed syllables and function words (e.g., *co**vered**, sol**dier**, newspa**pers**,*

*friend**ly**, blue**bells** and his, was, is, all*). Another contributing factor is that they failed to reduce vowel quality of unstressed syllables and non-lexical words (e.g., *tu**lip**s, choco**late**, con**tinent**, **be**cause, to from, of*). Most Vietnamese speakers (10/11) tended to delete the schwa in some English tripthongs (e.g., *admired, driest*), probably as a result of vowel gliding as discussed in section 3.1. Fronting is the process in which Vietnamese substituted the Vietnamese /e/ for the central schwa (e.g., in *and, **ad**mired*). Backing is the process in which central vowels were replaced by a Vietnamese back vowels (e.g., Australian English /ʉ/ and /ɐ/ were replaced by Vietnamese /u/ and /o/ in words like *spoon, blue, co**v**ered, **o**ther*). Raising occurred when English a low vowel /æ/ is substituted by a Vietnamese mid vowel /e/ as in the words *Anne, Allen, carry*. Rounding quality accompanied a central vowel /ɐ/ when pronounced with a rounded Vietnamese vowel/o/ in words like *co**v**ered, **o**ther, so**c**iety, roy**a**l*, which may stem from a grapheme interference.

By contrast, creaky voice is a feature popular in young Australian speakers of English's speech but not frequent in Vietnamese English. Australian speakers tended to have creaky voice at the end of phrases or utterances.

3.6. Tonal processes

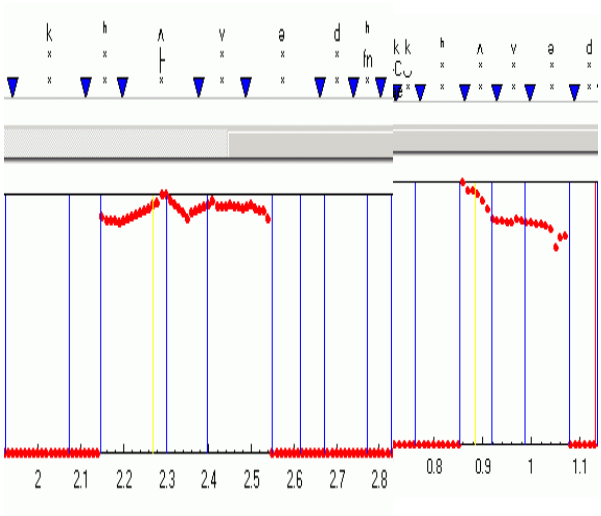
As shown in table 6, Vietnamese produced the same incidences of H* tones as native speakers [Z = 0.48 p-value = 0.6]. A few native speakers and an Australian Vietnamese speakers (f1) produced H+!H* tones. A few native speakers used more incidences of the L* and L*+H tones than Vietnamese. By contrast, Vietnamese had higher incidences of a steep rising L+H* tone than native speakers (mean of 7.4 vs. 5.1 respectively).

Table 6: Incidences of Tones

H*		H+!H		L*		L*+H		L+H*		Sustain		Check	
N	V	N	V	N	V	N	V	N	V	N	V	N	V
810	706	6	1	43	6	9	6	62	82	7	138	0	77
67	64	0.5	.09	3.5	0.5	.75	0.5	5.1	7.4	0.5	12	0	7

There are two distinctive tonal features which characterize the prosody of Vietnamese English. The first one is checked tones (a steep rising contour with an abrupt stop) which usually accompanied checked syllables as illustrated in figure 1. The second feature is a sustained high tone contour trailing over the unstressed syllables in many disyllabic words or compounds (e.g., *covered, soldiers, students, window, blackboard, bluebells, greenhouse, strong box*) while the pitch contours of native speakers tended to fall in the following unstressed syllables of these words (see figure 2 below).

Figure 2: An example of a sustained high tone in the unstressed syllable of the word *covered* (left: Vietnamese, right: native speaker's falling tone)



3.7. Boundary tones

As shown in table 7, the majority of utterance boundary tones by both groups of speakers were falling (L-L%) because all elicited speech were statements. There was no significant difference in incidences of L-L% between two speaker groups [Z = -0.13, p-value = 0.8]. A few speakers of each group occasionally ended an utterance in high tone (H-H%, L-H%). Speakers of both groups produced boundary tones (medial L-, and H-) between intermediate phrases, usually between clauses. There was no significant difference in incidences of intermediate low boundary tones (medial L-) [Z = -1.4, p-value = 0.13], but a difference in incidences of intermediate high boundary tones (medial H-) was significant [Z = -2.6294, p-value = 0.0086], favored by Vietnamese. A statistical comparison of the total incidences of intermediate boundary tones between two groups was highly significant [Z= -2.7, p-value = 0.006], indicating that Vietnamese made more pauses than native speakers.

Table 7: Incidences of boundary tones

L-L%		H-H%		L-H%		H-L%		Medial L-		Medial H-	
N	V	N	V	N	V	N	V	N	V	N	V
229	214	11	12	14	8	0	3	67	82	2	54
19	19.4	0.9	1	1.1	0.7	0	0.2	5.5	7.4	0.1	4.9

3.8. Discriminant analysis

In order to examine whether the two speaker groups can be discriminated on the basis of the incidences of phonetic and prosodic processes they made and whether the Australian Vietnamese female speaker who has a native-like accent is classified into the native or Vietnamese speaker group, discriminant analyses were performed on the three most typical types of phonetic

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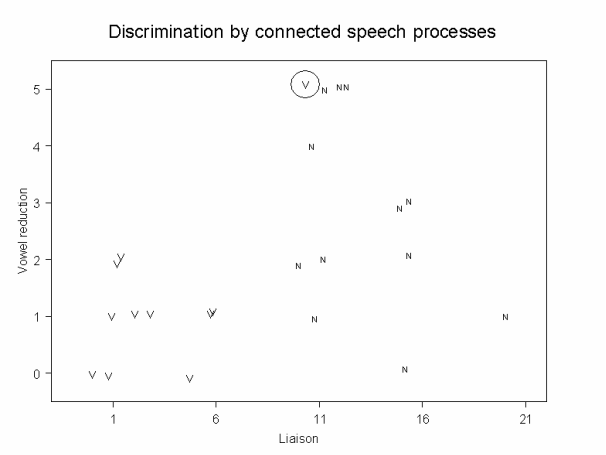
and prosodic processes (two processes in each type) made by speakers of both groups including: (1) connected speech processes (liaison and vowel reduction), (2) segment transfer (final release and consonant deletion), and (3) prosodic processes (intermediate phrase break and sustained high tones on unstressed syllables). The results of discriminant analysis is reported in table 8 and only one of the scatter plots (due to lack of space) is in figure 3.

Table 8: Results of discriminant analysis

	Liaison & V.reduction		Final release & C-deletion		Phrase break & Sustained tone	
	N	V	N	V	N	V
N	12	0	12	0	12	0
V	1	10	1	10	3	8

As shown in table 8 and figure 3, the native speaker and Vietnamese speaker groups are well classified into two distinct groups on the basis of the phonetic and prosodic features of their speech. The Australian Vietnamese female speaker is classified by the discriminant function into the native speaker group on all features: She produced connected speech and assimilation processes at the native speaker's level and her speech was not constrained by phonetic and prosodic transfer effects that other Vietnamese speakers made.

Figure 3: Scatter plot of discriminant analysis; N: native speaker, V: Vietnamese, circled V: the Austrralian Vietnamese female speaker



4. Conclusion

The results of the corpus-based analysis show that Vietnamese speakers' English is distinct from native speakers' in many phonetic and prosodic processes. First, in spite of an advanced level of English proficiency, many Vietnamese speakers of English failed to produce the connected speech and assimilation processes which characterize native speakers' spontaneous natural speech. Second, Vietnamese English is constrained by the transfer of many segmental, prosodic, timing and syllable structure from Vietnamese phonological system such as checked stop, implosive stop, vowel quality, suppression of vowel reduction and checked tones, to name a few prominent ones. Third, it can be seen from the analysis that there is an interrelation between many of Vietnamese phonetic processes and prosodic processes or constraints. For example, the checked tone quality, checked vowel and final checked stops were triggered in syllables with final voiceless stops. The suppression of vowel reduction in unstressed syllable and the lengthening of many unstressed vowels/ function words were projected under sustained high tones in unstressed syllables. Vowel epenthesis tended to accompany final obstruent devoicing. Finally, the evidence that the Australian Vietnamese female speaker who had grown up in Australia is classified into native speaker group by the discrininant function and her speech was free of many phonetic and prosodic transfer effects and the fact that the other Vietnamese speakers of English, in spite of an advanced level of English proficiency with a high proficient global accent and with phonetic and articulatory knowledge of English sounds were still constrained by many transfer effect from their first language suggests the importance of the exposure to the second language environment to the improvement of foreign accent.

In brief, the corpus-based analysis of Vietnamese accented speech has provided the researchers with an insight into phonetic and prosodic processes in learners' interlanguage and foreign accent. It is hoped that it may have implications for the evaluation of non-native accent, accented speech recognition and computer – assisted- pronunciation- learning.

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