ILLUSTRATION OF THE IPA

Vietnamese (Hanoi Vietnamese)

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Vietnamese, the official language of Vietnam, is spoken natively by over seventy-five million people in Vietnam and greater Southeast Asia as well as by some two million overseas, predominantly in France, Australia, and the United States. The genetic affiliation of Vietnamese has been at times the subject of considerable debate (Diffloth 1992). Scholars such as Tabard (1838) maintained a relation to Chinese, while Maspero (1912), despite noting similarities to Mon-Khmer, argued for an affiliation with Tai. However, at least since the work of Haudricourt (1953), most scholars now agree that Vietnamese and related Vietic languages belong to the Mon-Khmer branch of the Austroasiatic family.

It is important to make a distinction between 'literary Vietnamese', a prescriptive construct in which several orthographic distinctions are maintained in production, and the colloquial or standard speech of a given dialect region. This illustration describes the modern Hanoi dialect of Northern Vietnamese; segmental and tonal inventories, as well as lexicon, vary considerably between Vietnamese dialects, including those spoken in areas adjacent to Hanoi.

The earliest systematic account of Vietnamese phonology was given by de Rhodes (1651), whose analysis is reflected in the modern orthography. Other important descriptions include those of Maspero (1912), Lê Văn Lý (1948), Emeneau (1951), and Thompson (1965). Vietnamese historical phonology has played an important role in the broader study of Southeast Asian diachrony (Barker 1966; Barker & Barker 1970; Ferlus 1975, 1982, 1992, 1996, 1997; Gregerson & Thomas 1976; Thompson 1976; Diffloth 1992), and has proven central to our understanding of the process of tonogenesis (Haudricourt 1954; Matisoff 1973; Gage 1985; Diffloth 1989; Alves 1995; Ferlus 1998, 2004; Thurgood 2002, 2007; Stebbins 2010). Indeed, much of the synchronic phonetic and phonological research on Northern Vietnamese has similarly focused on its tonal system. The work of Vũ Thanh Phương (1981, 1982) provides a comprehensive overview, but experimental studies have also been undertaken by Andreev & Gordina (1957), Earle (1975), Han & Kim (1974), Hoàng Cao Cương (1986), Seitz (1986), Nguyễn Văn Lơi & Edmondson (1998), Brunelle (2003, 2009ab), Pham (2001, 2003), Michaud (2004), Michaud, Vũ Ngọc Tuấn, Amelot & Roubeau (2006), Brunelle & Jannedy (2007), Brunelle, Nguyễn Duy Dương & Nguyễn Khắc Hùng (2010), and Kirby (2010). Other aspects of Vietnamese phonetics and phonology have been addressed by Nguyễn Bat Tuy (1949, 1959), Gordina (1960a, b, 1961, 1964), Han (1966), Đoàn Thiên Thuật (1977), Gordina & Bystrov (1984), Ngô Thanh Nhàn (1984), and Nguyễn

¹ The Vietic branch is sometimes referred to as Việt-Mường, although this latter term is also used to refer exclusively to a sub-branch of Vietic containing Vietnamese and Mường. See Diffloth (1992) and Hayes (1992) for further discussion.

Đình Hoà (1997). Studies of Vietnamese dialectology include Cadière (1902), Thompson (1959, 1965), Gordina (1963), Cao Xuân Hao (1978, 1986, 1988), Hoàng Thị Châu (1989), Ferlus (1991, 1995, 1997), Alves & Nguyễn Duy Hương (1998 [2007]), Alves (2002 [2007]), Pham (2005), and Honda (2006).

The recordings accompanying this illustration are of a 32-year-old male native of

Consonants

Initials

	Labial	Labio- dental	Dental	Alveolar	Palatal	Velar	Glottal
Plosive	6		t t ^h	ď	tç	k	?
Nasal	m		n		ŋ	ŋ	
Fricative		f v		S Z		х у	h
Approximant	W						
Lateral approximant			1				

6a∃	ba	'three'	da∃	đа	'banyan tree'	ka∃	ca	'mug'
ma⁻	ma	'ghost'	na∃	na	'custard apple'	ŋa∃	Nga	'Russia'
ta∃	ta	'we, our'	t ^h a⁻	tha	'to forgive'	la√	là	(existential copula)
fa∃	pha	'to brew'	va√	và	'and'	wan∃	oan	'unjustly'
sa⁻	xa	'far'	za∃	da	'skin'	ha√	hà	'river'
tça∃	cha	'father'	na√	nhà	'house'	h ^w a⁻	hoa	'flower'
xa∕	khá	'rather'	ya√	gà	'chicken'	?a√	à	(question particle)

The voiced plosives are canonically, but not consistently, realized as implosives. Initial /t t^h / are apico-dental [t t^h], lamino-alveolar [t t^h], or contiguous apico-dental lamino-alveolar ('denti-alveolar', Harris 2006), while /d n l/ are apico-alveolar.

Some previous treatments such as that of Thompson (1965) recognize an unaspirated, unaffricated palatal stop /c/. However, in the speech of many younger Vietnamese native speakers from Hanoi, such as that of the present consultant, this segment is consistently realized as an affricate [t_G], a well-attested areal feature (Harris 2006). The tongue body contacts the alveolar or post-alveolar region during the production of both the palatal nasal [n] and the palatal affricate [tc] in initial position (Henderson 1965).

While some varieties of Vietnamese maintain a distinction in the phonetic realizations of orthographic (tr-) and (ch-), these onsets are completely merged in modern Hanoi Vietnamese. The highly salient (and socially stigmatized) merger of /l/ and /n/ > /l/, characteristic of the speech of many lower- and working-class Vietnamese in the Red River Delta, is sometimes consciously manipulated to humorous and/or pejorative effect in colloquial Hanoi speech, as in e.g. /nšw⁻/ nâu 'brown' + /nonm⁻/ nóng 'hot' = 'hot coffee with milk' > $\lceil |\tilde{y}w^{\dagger}| \log m/ \rceil$.

In syllable-initial position /p j r/ occur in a small number of foreign (mainly French) loans, e.g. $[pan^{\dagger}] < panne$ 'breakdown', $[ya^{\dagger} ra^{\dagger}] < garage$, $[bi^{\dagger} ja^{\dagger}] < billiard$. For many speakers, however, /p/ is realized as [b/6] and /r/ as [z].

Finals

Hanoi Vietnamese licenses eight segments in coda position: three unreleased voiceless obstruents /p t k/ ([p² t² k²]), three nasals /m n ŋ/, and two approximants /j w/.² In final position /t n/ are canonically alveolar, though it is not clear if they are chiefly laminal or apical. While the EGG study of Michaud (2004) found no evidence of glottalization accompanying unreleased final stops /p t k/, the laryngoscopic study of Edmondson et al. (2010) suggests that glottal reinforcement (in the sense of Esling, Fraser & Harris 2005) may not always be absent in this context.

Velar fronting

Although the phonetic realization of the stops /ŋ k/ following /i e ϵ / have sometimes been described as palatal [η c], they are actually pre-velar [η] and [ξ], with no point of alveolar contact (Henderson 1965). The conditioning vowels tend to be shortened and centralized, and may be produced with a noticeable palatal offglide.

```
Kinh
               'Vietnamese'
kiη∃
keη∃
       kênh
               'channel'
               'broth'
kεŋ∃
       canh
sik1
       xích
               'chain'
       xếch
sek1
               'slanting'
               'book'
sek1
       sách
```

There do exist a few instances of true velars following /ɛ/, e.g. [sɛːŋl] xêng 'shovel'.

Labial-velar finals

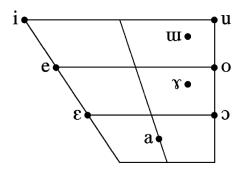
Following back rounded vowels /u o o/, the velar stops /k ŋ/ are produced as doubly articulated labial-velars $[\widehat{kp} \widehat{\eta m}]$. This articulation is sometimes accompanied by a visible puffing of the cheeks as air becomes trapped in the oral cavity.

```
uηm⊤
               'tumor'
        ung
        ông
onm⊤
               'grandfather'
               'bee'
oη̂m⊤
        ong
ukp1
        Úc
               'Australia'
okp1
        ôс
               'snail'
okp1
        óс
               'mind, brain'
```

Note the differences between the doubly articulated labial-velars and plain final bilabials:

```
sukp1
                 'to scoop'
         хúс
sup1
         súp
                 'soup'
honm⊤
         hông
                 'hip'
hom∃
         hôm
                 'day'
hokp√
         hoc
                 'to study'
                 'to meet'
ldcd
         hop
                 'wave'
sonm∕
         sóng
                 'hamlet'
√mcs
         xóm
```

² Whether these segments are transcribed as final approximants /j w/ or as semivowels /i ω / is largely a matter of analytic perspective. From a phonological standpoint, these segments may be regarded as approximants (consonants) on the grounds that they may not be followed by another consonant. However, these segments are articulated somewhat differently from the initial approximants, with a lesser degree of closure.



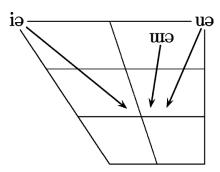


Figure 1 Location of monophthong and diphthong centroids in a schematic F1-F2 space, based on acoustic analysis of the accompanying sound files.

As with velar fronting, there are rare exceptions to the realization of final velars as labial-velar after back rounded vowels: compare e.g. [bɔŋm+] bong 'to come loose' with [bɔŋ+] bong 'deck (of ship)' (< French pont; Nguyễn Bạt Tụy 1949; Haudricourt 1952; Sampson 1969).

Vowels

Hanoi Vietnamese distinguishes nine vowel qualities /i e ɛ a uɪ y u o ɔ/ and three falling diphthongs /iə uɪə uə/. Length is normally distinctive only in closed syllables and then only for the vowels /a/ and /y/, although there do exist a small number of lexical pairs which provide evidence for a length distinction between the vowels /ɛ ɔ/ such as [sɛɪŋ\] xeng 'shovel' and [sɛɪŋ\] xanh 'green' or [sɔɪŋ\] xoong 'saucepan' and [sɔɪʃm\] xong 'to finish'. Although these differences are phonetically robust, the fact that such pairs are also distinguished by differences in the articulation of the coda segment has led to some debate on the proper phonological treatment of the vowel system (Nguyễn Bạt Tụy 1949, 1959; Haudricourt 1952; Đoàn Thiên Thuât 1977).

While acoustic analysis of the accompanying audio files reveals small but consistent spectral differences between long and short /v/, it has not been established that these differences are perceptually or psychoacoustically salient; therefore, they are transcribed here as instances of the same vowel quality, i.e. [γ $\tilde{\gamma}$]. /tm/ is frequently realized as midcentralized [\tilde{u} i], leading some authors to transcribe it as [i] (Han 1966; Brunelle 2003). /tmw unaw/ neutralize to [iw] in colloquial Hanoi speech, although speakers who control a formal register may still be able to produce a difference based on the spelling, as can be heard by comparing the accompanying recordings of [ziw \downarrow] diu 'to soften' and [zuizvuz) zvuz0 'liquor'.

Monophthongs	M	on	op	ht	ho	nas
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t ^h i [†]	thi	'test'	tuı√	từ	'word'	tu√	tù	'prison'
tim∃	tim	'heart'				tum∃	tum	(placename)
$\mathrm{zip} \!\! \downarrow$	dip	'occasion'				zup1	giúp	'to help'
tin∃	tin	'news'				lun√	lùn	'short'
mit1	mít	'jackfruit'	muit1	mứt	ʻjam'	6ut1	bút	'pen'
siŋ∃	xinh	'pretty'	swŋ∃	sưng	'to swell'	suŋ͡m∕	súng	ʻgun'
t ^h ik∕1	thích	'to like'	suik1	sức	'energy'	sukp1	xúc	'to scoop'
*			ŋɯj√	ngửi	'to smell'	muj√	mùi	'smell, taste'
ziw-	dịu	'to soften'	kww∕	си́и	'to rescue'			

the/dem dem len met keŋ keŋ dem len	thể đêm xếp lên mệt kênh	'so' 'night' 'to sort' 'go up' 'tired' 'channel'	tr\ thrm lrp1 lrn4 6rt1	tờ thơm lớp lớn bớt	'sheet' 'fragrant' 'class' 'big' 'to reduce'	tod tom hop non bot son	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	tô tôm hộp nôn bột sông	'to fill' 'shrimp' 'box' 'to vomit' 'powder' 'river'
sek1 new4	xếch nếu	'slanting' 'if'	mvj∕	mới	'new'	sok mo	L	sốc môi	'shock' 'lip'
then tem	thể tem dép khen mét xanh	'card' 'stamp' 'sandals' 'to praise' 'meter' 'green'	třm† lřp† lřn↓ 6řt† třŋ↓	tâm lấp lần bất tầng	'center' 'to fill in' 'time, turn' 'no, none' 'floor, storey	"		to tom họp lon bọt xong	'large' (onmptc.) 'to meet' 'can' 'foam' 'to finish'
seķ1	sách	'book'	ŋێk¹ mێj₄	nhấc mấy	'take up, lift' 'how many'	sək məj		sóc mọi	'squirrel' 'every'
zεw∃	gieo	'to plant'	zĭw⁻	râu	'beard'				
thad tam/ sap1 land 6at1 sand sak1 majd zawd	tha tám sáp lan bát sang xác mai dao	'to forgive' 'eight' 'wax' 'orchid' 'bowl' 'to cross' 'corpse' 'tomorrow' 'knife'	tăm/ săp1 lăn† 6ăt1 săŋ† săk1 măj† zăw†	tắm sắp lăn bắt xăng sắc may rau	'to bathe' 'soon' 'to roll' 'to catch' 'petrol' 'sharp' 'lucky' 'vegetable'				
t ^h iə√	thìa	'spoon'	t ^h uə∃	thua	'to lose'	thuna⊤	thưa		polite part.)
tiəm∃ tiən⊴	tiêm tiếp	'to inject' 'continue'	6uəm√	buồm	'sail'	tmemt	tươn		torn'
tiəp1 liən∃	nep liên	'to link'	luən∃	luôn	'often'	twəp1 lwən1	tướp lươn		rent, torn' eel'
6iət1	biết	'to know'	6uət1	buốt	'sharp pain'	mət1	ướt	•	wet'
tiəŋ/	tiếng	'sound'	suəŋ/	xuống	'go down'	swəŋ†	XUOI	0	bone'
t ^h iək↑	thiếc	'tin'	t ^h uək1 6uəj√	thuốc buổi	'medicine' 'time period'	thwək1 6wəjJ	thướ bưởi		ruler' pomelo'
√wein	nhiều	'many'	Баоји	Suoi	inic period	zmən-	rượi		liquor'

Tones

Hanoi Vietnamese distinguishes eight tones: a six-tone paradigm in open or sonorant-final syllables and a two-tone paradigm in syllables ending in an unreleased oral stop. For convenience, the traditional Vietnamese names of the tones are provided here along with an alphanumeric code indicative of the tones' historical origins (Michaud 2004).

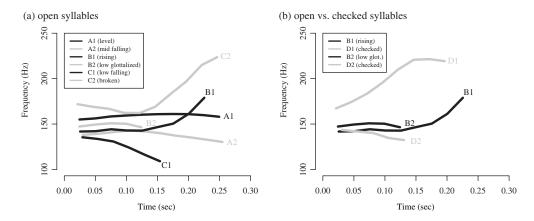


Figure 2 FO tracks of tones for a male speaker of Hanoi Vietnamese. Panel (a) shows the six tones found in open sonorant-final syllables; panel (b) compares the pitch of rising and low glottalized tones in open or sonorant-final syllables (black lines) with their checked counterparts (gray lines).

ngang	A1	∃ (level)	ma⁻	ma	'ghost'
huyền	A2	√ (mid falling)	ma√	mà	'but, yet'
sắc	B 1	√ (rising)	ma∕	má	'cheek'
	D1	1 (rising checked)	mat1	mát	'cool'
nặng	B2	→ (low glottalized)	ma⊣	ma	'rice seedling'
	D2	√ (low checked)	mat√	mat	'louse, bug'
hỏi	C 1	√ (low falling)	$ma \lor$	må	'tomb'
$ng ilde{a}$	C2	√ (broken)	ma√	тã	'code'

Like many languages of mainland Southeast Asia, pitch is not the only or even primary cue to tone in Hanoi Vietnamese. Instead, tones are realized by a complex of pitch and voice quality features (Nguyễn Văn Lợi & Edmondson 1998; Phạm 2001, 2003), which serve as crucial perceptual cues for native speakers (Brunelle 2009b). In particular, glottalization plays an important role in the production and perception of the broken (C2) and glottalized (B2) tones. The falling tones (A2, C1) have been described by some researchers as accompanied by a breathy voice quality (Thompson 1965; Phạm 2001, 2003); the low falling tone (C1) has also been described as accompanied by light final laryngealization (Nguyễn Văn Lợi & Edmondson 1998; Michaud 2004; Kirby 2010). However, in a laryngoscopic and laryngographic study of Northern Vietnamese tones, Brunelle et al. (2010) found that tone production did not systematically involve visually detectable constrictions other than glottal constriction.

Although duration has not been shown to be a salient perceptual cue to Vietnamese tone, syllables bearing tones B2 [\dashv] and C1[\dashv] are often shorter than syllables bearing other tones due to the effects of final glottalization. Tone C1 [\dashv], sometimes pronounced with a falling–rising contour in conservative or careful speech, is colloquially realized as a low fall.

Coda-tone restriction

Syllables with obstruent codas are subject to a tonal co-occurence restriction. Citation tones D1 and D2 [$1 \ J$] occur only on syllables ending in a voiceless oral stop ('checked syllables'), and these are the only tones which occur on these syllables. While the D tones may be

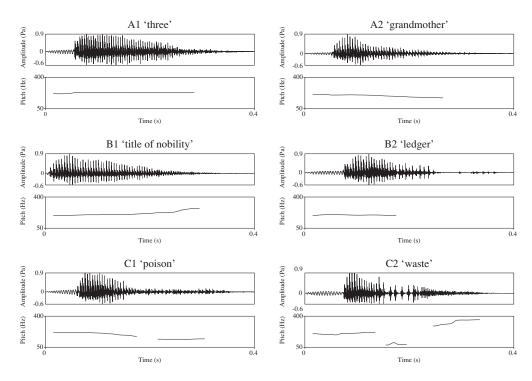


Figure 3 Waveforms and FO tracks for the production of six Hanoi Vietnamese tones on the carrier syllable /6a/ uttered by a female speaker.

analyzed as allophones of the B tones, they are phonetically quite distinct. Tone B1 [\dashv] differs from D1 [\dashv] both in pitch onset as well as trajectory (see Figure 2b), and while tone B2 [\dashv] is characterized by strong final glottalization, tone D2 [\dashv] is produced with modal voice quality (Michaud 2004).

Voice quality

Differences in the realization of voice quality in Hanoi Vietnamese tones can be seen in Figure 3, which shows waveforms and pitch tracks for the production of six tones on the carrier syllable /6a/ uttered by a female native speaker. Irregular glottal pulses are clearly visible in the waveforms of the B2 and C2 tokens, although in different locations: tone B2 [\downarrow] is characterized by initial periodicity followed by strong glottalization, whereas tone C2 [\downarrow] is interrupted by a strong medial glottal constriction. Some aperiodicity is also visible in the second half of the low falling token C1 [\downarrow].

Despite its central role in the production and perception of Vietnamese tone, voice quality is not transcribed in the present illustration for three reasons. First, as emphasized by Phạm (2001, 2003), voice quality is an intrinsic property of the TONE, not of the vocalic nucleus, and at present the IPA transcription provides no way to reflect this important difference. Second, the existing system of IPA diacritics cannot impart the relevant details of the temporal alignment between voice quality and pitch. As illustrated in Figure 3, glottal constriction can literally interrupt the realization of the vocalic nucleus during production of the broken tone (C2), while nonmodal voicing is restricted to the final portion of the glottalized tone (B2); conversely, syllabic rimes bearing a low falling tone (C1) may be laryngealized or breathy throughout. This is consistent with the findings of Nguyễn Văn

Loi & Edmondson (1998), who used airflow data to show changes of different degrees in the glottal stricture settings over the course of production of these three tones. Finally, as has been noted in all previous phonetic accounts, there exists considerable variation in the realization and magnitude of voice quality features between speakers and even within the speech of a single speaker, further complicating the issue of how such phonetically complex tones are best represented.

Tonal coarticulation

Although Vietnamese tones are not subject to phonological tone sandhi (i.e. the realization of a tone is not affected by the surrounding tonal environment), tonal realization in connected speech is subject to phonetic coarticulation effects. Although tonal height coarticulation is bidirectional, progressive tonal coarticulation is much stronger than anticipatory coarticulation in Hanoi Vietnamese; dissimilatory coarticulation is completely absent (Han & Kim 1974; Brunelle 2003, 2009a).

Conventions

Syllable structure

A Vietnamese syllable consists of three obligatory elements: an onset, a tone and a vowel. The syllable may optionally contain an obstruent, nasal, or approximant coda. The initial consonant may be accompanied by a secondary labial articulation, as in $[h^w a \neg] hoa$ 'flower'. This articulation never follows labial onsets except in loanwords, e.g. $[ti\ni n \neg] hoa$ 'flower'. (< French *pourboire*). The approximant /j/ never follows the front vowels /i iə e ɛ/, while /w/ never follows rounded vowels /u uə o ɔ/.

Transcription of recorded passage

zɔ/ 6ỹk¹ va/ mặt」 tựyj/ kaj/ naw¹ sɛm¹ aj¹ mɛŋฝ hyn¹ || tựɔŋ͡m¹ lukp¹ dɔ/ | mot」 zu¹ xɛk¹ mặk」 mot」 aw/ xwak¹ ym/ di¹ kwa¹ || hɔฝ zaw¹ kɛw/ vyj/ naw¹ zặŋฝ | ʔaj¹ la/ nuuj/ dỹw/ tiən¹ ma/ kɔ/ tʰeḍ 6ặt¹ nuuj/ zu¹ xɛk¹ kiə¹ | kyj/ ʔaw/ | tʰiḍ sɛḍ | duukl kɔj¹ la/ mɛŋฝ hyn¹ || săw¹ dɔ/ zɔ/ 6ỹk¹ 6ặt¹ dỹw/ tʰojḍ mɛŋฝ het¹ suk¹ kɔ/ tʰeḍ | nuuŋ¹ kaŋ/ tʰojḍ | tʰiḍ nuuj/ zu¹ xɛk¹ kaŋ/ zuu/ tṛatḍ ʔaw/ xwak¹ | va/ kuj/ kuŋ͡m/ | zɔ/ 6ỹk¹ da/ faj/ tuu/ bɔḍ || săw¹ dɔ/ | mặtḍ tṛyj/ ʔaw/ xwak¹ | va/ nuuj/ zu¹ xɛk¹ liən/ kyj/ ʔaw/ xwak¹ | ket¹ kukpḍ lad | zɔ/ 6ỹk¹ faj/ tʰuəḍ nੁˇnḍ zặŋḍ | mặtḍ tṛyj/ lad nuuj/ mɛṇḍ hyn¹ tṛơŋ͡m¹ haj¹ nuuj/

Orthographic version

Gió bấc và mặt trời cãi nhau xem ai mạnh hơn, trong lúc đó một du khách mặc một áo khoác ấm đi qua. Họ giao kèo với nhau rằng ai là người đầu tiên mà có thể bắt người du khách kia cởi áo thì sẽ được coi là manh hơn. Sau đó gió bấc

bắt đầu thổi mạnh hết sức có thể, nhưng càng thổi thì người du khách càng giữ chặt áo khoác và cuối cùng gió bắc đã phải từ bỏ. Sau đó mặt trời sưởi ấm và người du khách liền cởi áo khoác. Kết cục là gió bắc phải thừa nhận rằng mặt trời là người manh hơn trong hai người.

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