Examples of languages with multiple voicing contrasts

Overview:

Examples are given for

- 1. 4-way contrasts (Nepali, Hindi)
- 2. 5-way contrasts (Sindhi)
- 3. 3-way contrasts (Thai, Korean)

1. 4-way contrasts. Many Indo-Aryan languages, e.g Nepali, Hindi

Nepali is currently only available as a tape demo (Ladefoged).

For Hindi separate sets of examples are given from Illustrations of the IPA and SoWL. Somewhat confusingly, the category referred to as "retroflex" in IPA is referred to as "postalveolar" in SoWL, while the category referred to in IPA as "postalveolar" (affricate) is referred to in SoWL as "palatoalveolar". Here we have followed the IPA designations for both sets of examples (even though the best designation for the sounds transcribed with the retroflex symbols would probably be apical postalveoalar). Also, where identical words occur in both sets (the vast majority) the IPA English gloss has been used.

Both IPA and SoWL use superscript **fi** (voiced glottal fricative) to indicate the voiced aspirated category. This helps to emphasize that the aspiration phase of these sounds is generally voiced (i.e consists of breathy voice phonation), though interruption of voicing may frequently occur (refer to the sonagrams, especially the IPA examples).

Another interesting feature of Hindi is aspiration in the affricates, since aspiration following a fricative segment otherwise occurs quite rarely.

1a. Nepali tape demo (6 speakers: 5 male, 1 female)

voiceless voiceless unaspirated aspirated		voiced	voiced aspirated ("murmured", "breathy")		
pal	p ^h al	bal	b ^h al		
"rear"	"throw away"	"burn"	"forehead"		

1b. Hindi (IPA)

	<u>Bilabial</u>	<u>Dental</u>	<u>Retroflex</u>	<u>Post-</u> <u>alveolar</u> (affricate)	<u>Velar</u>
<u>Voiced</u>	bal ▶ "hair"	dal ▶ "lentil"	dal ▶ "branch"	d3al ▶ "net"	gal ▶ "cheek"
<u>Voiceless</u> unaspirated	pal ▶ "nurture"	t al ▶ "beat"	tal ▶ "postpone"	t∫al ▶ "gait"	kal ▶ "span of time"
<u>Voiceless</u> aspirated	p^hal ▶ "knife blade"	t ^h αl ▶ "platter"	t ^h al ▶ "lumber shop"	t ∫^hal ▶ "tree bark"	k^hal ▶ "skin"
<u>Voiced</u> aspirated	b ^{fi} al ▶ "brow"	dٍ ^ĥ ar ▶ "knife edge"	d ^ĥ al ▶ "shield"	d3 ^ĥ əl ▶ "glimmer"	g ^ĥ an ▶ "bundle"

1c. Hindi (SoWL)

	<u>Bilabial</u>	<u>Dental</u>	<u>Retroflex</u>	<u>Post-</u> <u>alveolar</u> (affricate)	<u>Velar</u>
Voiced	bal ▶ "hair"	dal ▶ "lentil"	dal ▶ "branch"	d3al ▶ "net"	gal ▶ "cheek"
<u>Voiceless</u> <u>unaspirated</u>	pal ▶ "nurture"	t al ▶ "beat"	tal ► "postpone"	t∫al ▶ "gait"	kal ▶ "span of time"
<u>Voiceless</u> aspirated	p^hal ▶ "knife blade"	t ^h αl ▶ "platter"	t ^h al ▶ "lumber shop"	t∫ ^h al ▶ "tree bark"	k^hal ▶ "skin"
<u>Voiced</u> aspirated	b ^ĥ al ▶ "brow"	dٍ ^ĥ ar ▶ "knife edge"	d ^ĥ al ▶ "shield"	d3 ^ĥ al ▶ "cymbals"	g ^ĥ al ▶ "confusion"

2. 5-way contrast (Sindhi)

Sindi (Indo-Aryan) also has implosive in addition to the above 4 categories (see BPM, p. 202). As for Hindi, both IPA and SoWL provide examples (though with much less overlap than for Hindi).

Both sources use the designation "post-alveolar" for the sounds transcribed with the traditional retroflex symbols. On the other hand L&M use the term retroflex, but transcribe the sounds using normal alveolar symbols with subscript dot (p.83, see also p.25). In short, there seems to be agreement that the sounds are apical postalveolar, rather than fully retroflexed.

The sounds labelled as palatal actually have similarities with the Hindi postalveolar affricate examples. In the IPA handbook these sounds are referred to as being laminal postalveolar, and having some frication (p. 133). L&M also refer to affrication, suggesting the use of the little-used alveolo-palatal fricative symbols.

The implosive in the alveolar region is placed in the postalveolar retroflex column in SoWL, while IPA uses a separate alveolar column. As there is no standard IPA symbol for retroflex implosive, we have put it in the dental column, but without the dental diacritic.

Note that Sindhi also has several contrasting breathy-voiced (voiced aspirated) nasals and liquids. A separate short demo contrasting pulmonic voiced plosives with voiced implosives is also available.

2a. Sindhi (Illustrations of the IPA)

	<u>Bilabial</u>	<u>Dental</u>	<u>Retroflex</u>	<u>Palatal</u>	Velar
Voiced	but ʊ ▶ "shoes"	dunu ▶ "navel"	dəpυ ▶ "fear"	Juto ▶ "shoes"	gano ▶ "song"
<u>Voiceless</u> unaspirated	pənʊ ▶ "leaf"	təro ▶ "bottom"	topi ▶ "cap"	calu ▶ "cunning"	kano ▶ "straw"
<u>Voiceless</u> aspirated	p ^h utə ▶ "rift"	t ^h αli ▶ "plate"	t ^h ərʊ ▶ "be cool"	c ^h ati ▶ "breast"	k ^h ano ▶ "drawer"
<u>Voiced</u> aspirated	b ^ĥ ʊlə ▶ "mistake"	d ^{fi} arə ▶ "separate"	d ^ĥ əkυ ▶ "cover"	J^ĥəţı ▶ "immedi- ately"	g ^{fi} oro ▶ "horse"
Voiced	6arv	ɗaru		faro	gəro
<u>implosive</u>	▶ "child"	"crevice"		▶ "cobweb"	▶ "heavy"

2b. Sindhi (SoWL)

	<u>Bilabial</u>	<u>Dental</u>	<u>Retroflex</u>	Palatal	<u>Velar</u>
Voiced	bənʊ ▶ "forest"	dərʊ ▶ "door"	dorʊ ▶ "you run"	Jəțʊ ▶ "illiterate"	gυηυ • "quality"
<u>Voiceless</u> unaspirated	pənʊ ▶ "leaf"	ṯərʊ ▶ "bottom"	tənʊ ▶ "ton"	cətʊ ▶ "destroy"	kənʊ ▶ "ear"
<u>Voiceless</u> aspirated	p^həηυ ► "snake hood"	ţ ^h ərʊ ▶ "(district)"	t^hə₫ʊ ▶ "thug"	c ^h əţʊ ▶ "crown"	k^həηʊ ▶ "you lift"
<u>Voiced</u> aspirated	b ^ĥ aηυ ▶ "manure"	dٍ^ĥəṟʊ ▶ "trunk of body"	d ^ĥ əgu ▶ ''bull''	J ^ĥ ətʊ ▶ "grab"	g ^{fi} əηι ▶ "excess"
<u>Voiced</u> implosive	bəni ▶ "field"	d 1nυ ► "festival"		fəţʊ ▶ "illiterate" (variant)	∮∍ŋʊ ▶ "handle"

3. 3-way contrasts, e.g Thai, Korean

Thai has voiced, voiceless unaspirated and voiceless aspirated categories.

L&M (p.56) comment that the voiced category tends to show stiff voice (their term for slightly creaky phonation) during at least part of the closure phase. IPA makes no reference to this.

Thai also contrasts voiceless unaspirated and aspirated sounds at the velar and postalveolar (affricate) places of articulation. It is thus a good example of the phenomenon that if a voiced stop is missing from the system, then it is usually the velar one (Ohala). Thai is also included in the separate demo on tone languages.

Korean is particularly interesting because here it is even clearer that the differences cannot be explained just by differences in laryngeal-oral timing.

The three categories can be described as follows:

- 1. Voiceless aspirated
- 2. Voiceless unaspirated, or weakly aspirated, in initial position; often voiced intervocalically. Frequently referred to as 'lenis'
- 3. Voiceless unaspirated, fortis (also referred to as 'forced'). Particularly characteristic of these stops is the abrupt onset of phonation after closure release, with what L&M (p.56) refer to as a stiff voice quality; i.e there can be assumed to be much higher tension in the vocal folds at voice onset in this category, compared to the lenis category.

3a. Thai examples from IPA and SoWL

	<u>IPA</u>						SoWL	
	E	<u>Bilabial</u>	<u>[</u>	<u>Dental</u>	Ē	<u>Bilabial</u>	Γ	Dental
Voiced	b	bāːn	d	dâːn	b	bâr	d	dà
	►	"to bloom"	▶	"calloused"	►	"crazy"	▶	"to curse"
<u>Voiceless</u>	р	pāːn	t	tām	р	pâ	t	tax
<u>unaspirated</u>	►	"birthmark"	►	"sugar palm"	▶	"aunt"	Þ	"eye"
<u>Voiceless</u>	թհ	p ^h āːn	t ^h	t ^h āːn	$\mathbf{p}^{\mathbf{h}}$	p ^h âx	t ^h	t ^h âx
aspirated	►	"belligerent"	Þ	"alms"		"cloth"	Þ	"landing place"

Tone marks: / $^{-}$ $^{-}$ / = (respectively) mid, falling, low

3b. Korean examples from IPA

	Ē	<u>Bilabial</u>	A	Alveolar	<u>P</u> A	ostalveolar Affricate	V	<u>elar</u>
<u>Aspirated</u>	p ^h	p^hal	t ^h	t^hal	t∫ ^h	t∫^hal	k ^h	k^hal
	▶	"arm"	►	"riding"	►	"kicking"	►	"knife"
<u>Unaspirated</u>	p	pal	t	tal	t∫	t∫al	k	kal
<u>lenis</u>	►	"foot"	►	"moon"	►	"well"	▶	"going"
<u>Unaspirated</u>	p*	p*al	t*	t*al	t∫*	t∫*al	k*	k*al
fortis ('stiff')	▶	"sucking"	▶	"daughter"	►	"squeezing"	▶	"spreading"

IPA uses $\mathbf{p}^{\mathbf{h}}$, \mathbf{b} and \mathbf{p} to designate categories 1, 2 and 3 respectively. However, we have preferred to follow the transcription used in L&M (p.56), namely $\mathbf{p}^{\mathbf{h}}$, \mathbf{p} and \mathbf{p}^{*} , as this helps to underline the special nature of the fortis consonants (even though '*' is not a standard IPA symbol).

(Further note: IPA uses palatal plosive symbols for the postalveolar series, but clearly states that they are in fact articulated as postalveolar affricates)

3c. Korean examples; own data

	<u>Bilabial</u>		
<u>Aspirated</u>	p ^h ▶	p^hal "arm"	
<u>Unaspirated</u>	p	pal	
<u>lenis</u>	►	"foot"	
<u>Unaspirated</u>	p*	p*al	
fortis ('stiff')	▶	"sucking"	

For this speaker there is actually a fairly consistent difference in VOT between the lenis and the fortis stops (longer VOT for the lenis stops). However, the more abrupt onset of the higher harmonics in the fortis category illustrates well the difference in voice quality at vowel onset following these two sounds. In addition a consistent difference in fundamental frequency at voicing onset is also found: higher for the fortis category. Findings of this kind have also been reported by Dart.

Additional Analyses of Korean (speaker from example 3c)

(1)

Measurements of VOT for a large number of tokens show that the lenis stop indeed lies on average between the fortis and aspirated stops, but that individual tokens can be very close to both these categories. Click here to see a plot of the VOT values.

VOT is on the y axis; the x axis simply arranges the tokens in the order they occurred in the experiment. PF = Fortis, PL = Lenis, PA = Aspirated.

(2)

For this speaker we also measured intra-oral air-pressure.

Despite its name, there were no clear differences between the fortis stop and the other two categories in terms of peak air-pressure during consonantal closure.

(It can be seen in the sonagrams, however, that the duration of closure is clearly longer for the fortis stop than for the lenis stop.)

(3)

A combination of voice quality and fundamental frequency (measured at the onset of phonation) also distinguishes the three categories well.

Thus even when VOT is ambiguous adequate differentiation is possible.

Click here to see a plot of fundamental frequency (on the y axis) vs. closed quotient (on the x axis). (Same colour coding as the VOT plot)

The closed quotient expresses the duration of glottal closure as a proportion (in percent) of the duration complete vibratory cycle during phonation.

Lower values indicate more breathy phonation

Higher values indicate more forceful glottal closure and should be accompanied by stronger upper harmonics in the spectrum (refer back to the sonagrams).

Findings:

- The lenis stop has lower fundamental frequency than the other two categories.
- The fortis stop has higher closed quotient values than the other two categories.

(The closed quotient was measured from the electroglottographic waveform.)