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UNVOICED ASPIRATED VS. VOICED UNASPIRATED POLAR PLOSIVES: A CRITIQUE OF SOME THEORIES

INTRODUCTION

All vowels are voiced, is a universal statement (Bailey 1985: 225; Dalbor 1969: 104; Steinberger 1991: 73; Navarro-Tomás/Espinosa 1926: 2; Viberg/Ballardini/Stjärnöf 1991: 50). This is refuted by the observation that there are, for example, voiceless vowels in Spanish (Resnick 1975: 7), and Japanese (Vance 1987: 48). All-statements of this sort are a threat to scientific description and to narrow transcription. Similarly, it is a universal statement that p, t, k are unvoiced, and that b, d, g are voiced. They also are defined on the IPA (1989) chart in this way. For American English it is also asserted that the former are aspirated, the latter are unaspirated, and that both series are always plosive. It will be shown that each of these views is false. p vs b is paradigmatically chosen for analysis, but what is said will apply equally to the other plosive voiced-unvoiced pairs such as [t-d, k-g, q-ɢ, c-ɟ, ʔ-ʏ], etc.

A. VOICE–VOICELESS THEORY

To say that a consonant is either voiced or voiceless commits the either-or fallacy, and lacks descriptive precision. IPA (1989) gives the symbol [̥] for voiceless, and [̬] for voiced. Pei/Gaynor (1954: 229) define *voiceless* as: *a consonant pronounced without any vibration of the vocal cords.* Consonants are, however, often only partially voiced, or partially voiceless. Instead of the use of [̥] for *completely voiced,* it may be used for partially voiced (Shriberg/Kent 1982: 108). Nor should [̬] be regarded as necessarily completely unvoiced.

The voiced-unvoiced distinction and symbols are also equivocal in that they refer to: a) a fixed state, b) a change of state. The IPA chart indicates voiced consonants by placing them to the right of paired consonants, for example, p b. The voiced member is b. Thus, to write b̥ is correct, but redundant. [̬] may also mean that a symbol which is usually considered to be voiceless, is voiced, e.g., p̬. [̥] used to refer to the change of a feature, may mean increased voicing. Thus, s̥ may refer to an s which is not completely, but only partially voiced. The same considerations apply to unvoiced-devoiced [̥]. In terms of the quantity or quality of voicing, the symbolism remains silent. It is thus said that the degree of voicing is difficult to reliably transcribe (Duckworth et al. 1990: 27). In these senses, *voiced* is not *voiced*, and *voiceless* is not *voiceless*.

The pair p-b is generally described as being aspirated unvoiced, and unaspirated voiced plosive stops, respectively. This description will be placed in question in ways other than those already discussed. A *voiced stop* is an oxymoron, or contradiction. Voice requires an

open oral passage enabling air to move through to vibrate the vocal cords. A blocked passage prevents that. There can, however, be prevoicing due to the fact that a limited amount of air can be forced through the vocal cords before the stop is released. This sounds understandably muffled.

Voice onset time (VOT) in experimental phonetics is the time between the stop release and the beginning of vocal cord vibrations, measured from spectrograms, etc. Care must be taken not to identify the psychological perception of sound with the physical measurement of sound. Voiced, as a perception, is not the same as the vibration of the vocal cords, and the physiological duration of VOT is not the same as perceived length. In fact, VOT may not be perceived at all. Vocal fold vibrations and sound wave patterns are not the same as heard voice. Thus, the definitions of VOT in these terms equivocates between the physical and perceptual paradigm. *Voiced* applies to the latter in ordinary language; it is a category-mistake if applied to the former in ordinary language. It is a category-mistake if applied to vibrations. The cause or concomitant of an event taken for the event itself, is a false-cause fallacy, or genetic fallacy. Vibration onset time is not voice onset time. The voice may not be heard at all. What instruments measure may not be perceived.

If the vibration onset time is 25 msec. or more, we may find that it is perceptible as a voice onset time as well. Prevoicing (negative VOT) may be -30 msec. (Shriberg/Kent 1982: 108, 111). It is then incorrect to say that voicing begins at the stop release if the VOT = 0. That is only the physical dimension. Feeling the vibrations of the vocal cords by touching the Adam's Apple is also unacceptable because both p and b may produce vibrations. However voice-voiceless may be defined, it is also claimed that this is not what distinguishes p/t/k from b/d/g (Ball/Jones 1984: 41). p/t/k can be voiced, and b/d/g can be voiceless. The perceptual difference between them is not voice-voiceless (esp. intervocally) (Shriberg/Kent 1982: 111). Swiss and Bavarian stops are often voiceless (Baur 1969: 15; Waterman 1966: 169). Stops in the Regensberg dialect are voiceless (Keller 1976: 64). In English, final stop voicing is not a differentiating factor between b/p (Ball/Jones 1984: 42). English is said to have a voiced t (Heffner 1950: 129). The Farsi and Spanish final d may not only be voiceless, but omitted. In Chinese romanizations, p and b are exchanged: (Wade romanization) *pa* = (Pinyin and Yale romanizations) *ba*, which in IPA would be [ba}]. p and b are here voiceless, or slightly voiced. p alternates with b. Swiss orthography gives *puur* for Zürich, *buur* for Bern dialect. There are also other possibilities for the aspirate h, or [î] such as p^{H},$p^{©}$, $p^{?}$, etc. Hindi h may be voiced H. Irish *deach* "drink" = dZO©. Irish *bláthach* "buttermilk" blA.© is a strong © release, to English ears, like an interjection of disgust.

B. Aspiration Theory

Aspiration can refer to an h-like non-fricative sound, or a plosive sound produced by an occlusion such as lip or velar closure. Thus, IPA pî does not distinguish between these two.

Einarsson (1945) uses pî for an Icelandic sound which is more properly rendered as a syllabic h, p.h. Hindi and Japanese have a similar syllabic h. Chatterji (1921: 4) notes that in Bengali, there is no breath release at all for p/t/k. The aspiration of p is not the same as p plus an offglide pî or p, although these symbols may be used to represent progressive strength. IPA symbolism does not reveal the quantitative force of the plosive p. It could range from being highly stressed to being barely distinguishable from b. Aspiration can also refer to either a physical gesture or a perceived sound. This must also be distinguished from breathy voiced [ ], e.g., b. In Gujarati, two voiced vowels are distinguished in the basis of being breathy voiced or not. Irish contains consonantal breathiness. h is almost pure breath in Arabic "salt" mIl.©. In Arabic, "tomorrow morning" bukra./ssUbh, the last h is just a breath of air let out. In Japanese it is a less aspirated h.

In some sense of aspiration, it is held that the difference between p and b is mainly aspiration (Ladefoged 1975: 44, Ball/Jones 1984: 41). Traditionally, it is said that p is voiceless aspirated, b is voiced unaspirated. An either-or fallacy is created whereby if there is aspiration, voicing is absent, and if there is voicing, aspiration is absent, at least for English (Jones 1967: 39). Shriberg/Kent (1982: 111) say the difference for English is aspiration, not voicing.

The distinction is not neat. There is some aspiration for b, and p can lack aspiration and still be recognized as p. Aspiration is not built into p. If we consider only the two features, voiced and aspiration, there should be an equivalence between unaspirated voiceless p [p^{-h}] and unaspirated voiceless b [b]; p^{-h} • b, or p • bî. But, in fact, we find this is true in only the one case where we cannot tell the difference between them. For example, Zehetner (1977: 42) says that, in Bavarian there is *no difference between p and b* [before consonants]. In the *Südhessisches Wörterbuch* (1965 ff.) words beginning with the following letter pairs are alphabetized together: p/b, t/d, f/v. However, in most cases, the sound is closer to either p^{-h} or b. In Norwegian (*Bokmål*), *god* is gu:dî. Thai "chicken" is k^{-h}\gai. Bengali *Poob* "East" is b\p^{-h}u:.b\p^{-h}. Finnish *teetä* is t^{-h}e:.da. Tswana *kofi* is g\k^{-h}o:.fi, and "mail" is b\p^{-h}o:.so. In <Xu, "yonder" u:.t^{-h}0, the t^{-h} is closer to t than to d. In Zulu, Doke (1926: 62-63) observed aspirated bî\bh. There must, then, be additional distinguishing features. In an attempt to analyze the quantity of lenis/fortis, Bithell (1952: 109) presents the following to which has been added the IPA-S (Transcription by Shibles) equivalent, and modified.

	Closure	Plosion	Voice	IPA-S
1. normal p	1/2	1/2	0 = 1	p or pî
2. normal b	1/3	1/3	1/3 = 1	b
3. b	1/3	1/3	0 = 2/3*	b
4. lenis p	1/3	1/3	0 2/3*	p^{-h}

Thus, b = lenis p = 2/3. Note that in some languages there is a strong, unaspirated p^{-h}.

A few examples of plosive representation in German dialects are the following. [Sources: Phonai (P), Lautbibliothek (Göttingen) (L), and Görlach tapes (1982) (G). M = Monograph, Bd= Band, H = Heft. IPA-S = transcription by Shibles. See References.]

High German or dialect.	IPA-S	Dialect Place	Tape Source
Abend	o˗.bEtî	Dudenrode	P, M 14, Bd 23
Leute	lit-h		
weg	vEkî\k-h		
hat	h0t}	Gimmeldingen	P, M 6, Bd 13
habe	h Ï p-h		
Gruppen	gåup-h\bm	Mannheim	P, M 8, Bd 16
Kriegs	k-hRig\k-hs		
Mondag	mi˗n.dax\k-h	Dahn	P, M 15, Bd 25
gut	xud*	Riesenbeck	P, M 1, Bd 6
gab	j0b\p-h	Gluel	P, M i, Bd 6
Äppel	Ep}.pl	Köln	G
drop	dR0p-h		
Pläät	p-hlEt-h		
Daig	daig	Steigerwald	G
kömmen	g\k-hEna	Hemsbach	L, H 15/16
tut	t-hit-h	Kassel	L, H 6/7
genug	gnUg}	Beuren	L, H 12/13
Brugg	båuk-h	Swabian	G
Dabagg	dAbAk-h		
warde	vaåt-h\d		
gehabt	k-hap-ht-h	Bavarian	G
net	ne˗t\d, nIt-h		
Tag	d0˗g	Freising	P, M 2, Bd 7
gekriegt	gIrIg}t	Graslitz	L, H 30
Schönbach	S Ï p-hIk-h	Schönbach	L, H 28
Auftrag	aufdr•g\k-h		
gekauft	k Ï } (stressed k)	Kirchwerder	L, H 33/34

* Analogous to the approximant F for b, we may expand the IPA chart by adding an approximant for d, here d.

C. THE PLOSIVE THEORY

It was mentioned that one meaning of aspiration is plosion, that it may vary from weak aspiration to a strong burst. It is assumed, especially for English, that p has a strong plosion and that b has little or none. But French initial p and Chinese initial b, can be bursts, though with little aspiration. The French initial p may be produced from air captured within the oral cavity which when released makes a different sound than English p which is released through the glottis. Using air trapped in the oral cavity only, we may find little difference between p^{-h} and b in *Paul* and *ball.*

The final p of English *cap, cab* are even *unreleased plosions* p^{-h}, p}, b. They are plosions without plosions. For Zehetner (1977: 42), the difference between p and b is only lip pressure. So the criterion becomes an articulatory one. The Japanese b is said to involve more lip pressure than is the case in English. The inner (endolabial) or outer (exolabial) lips may also be used to articulate b or p. In terms of articulation, a stop would sound different before a round vowel than before an unrounded one. The b in bP would sound different than in bi. And both would still sound different than the p in pP and pi. Here we discover the difference. The IPA chart shows an ejective p', but no ejective b'. This could be added to the IPA chart, for example, for the strong b in Chinese *bau.*

D. DURATION THEORY

On this theory, all qualitative distinctions are reduced to the quantitative parameter of duration. p is 1.6 times as long as b (.06 sec.) (Heffner 1950: 130). *Unaspirated* refers to the occurrence of voice at the same time as release (VOT = 0). *Aspiration* is when voice is released after occlusion. *Bit* and *pit* are distinguished by reducing aspiration, vowel quality, and the stops to duration. *Stop* refers here not to an articulatory quality, but a duration.

Ball/Jones state:

> "The contrast operates on the voice-onset axis, i.e., on the duration of the release stage of the plosives. The delay in the onset of voicing is consistently longer for /p, t, k/ than for /b, d, g/."
>
> Ball/Jones (1984: 41)

This need not be true if b is devoiced, and it is not true if the aspiration of p is voiced, which it is in some languages; and it is not true for rapid speech. Furthermore, we can tell the difference between p and b, regardless of duration. If it is assumed that voiceless p involves aspiration, and that voiced b has little aspiration, and that while there is aspiration, there is no voice, then p would require a longer time before a subsequent voiced sound begins.

Although we cannot always make all these assumptions, they still would not give us the required distinguishing characteristics. The vowel oɛ́ may always be longer than b in a certain language, but length is not the significant difference between them. In the case where we cannot clearly hear whether p or b is being uttered, the duration may sometimes serve as a clue. Shriberg/Kent (1982: 111) say that for all languages, vowels before voiced conso-

nants have longer duration than if before voiceless consonants. All-statements of this sort are easily refuted. It is not even true of the more well-known languages, and the claim of application to all languages goes beyond empirical support. Also, mechanical duration must not be identified with psychological or perceived duration. To use physical duration as a method of description is useful, but is not a substitute for qualitative descriptions of the sounds themselves.

If duration is to be a factor in the pronunciation of p and b, there should be some way to symbolize it. The symbols used for vowel length may be used as well for consonants. This is a relative, not an absolute scale:

> "There is no absolute division of a duration scale for vowels (or consonants) into values of 'short,' 'half-long,' 'long,' and 'overlong,' as the IPA and other similar systems may seem to suggest."
>
> (Rischel 1990: 399)

Norwegian, for example, has both long and short consonants (Haugen/Chapman 1964: 34). Arabic has lt̋ in *Allah*, French *baisse* is bEst̡. For h used to show length following vowels and consonants, it equivocates with the sound h. Ladefoged/Roach (1986: 26) recommend the development of ways of symbolizing the time course of phonetic events, though without offering specific proposals. It may be suggested that the duration of aspiration be represented as t^{-h}, t, tî, tîî, tîîî. We could have t̡îî. The pattern of double consonants for English, Finnish, Italian, Swedish and other languages can often be described as follows: *The first consonant becomes an 'incomplete plosive'…while the second is pronounced as a normal plosive.* (McClean 1969: 13) This may be represented as -p}.p or t}.t as in Italian *petto* pE..t}.to. Here a pause is added both before and after the first t. In Danish, *suppe* is sup}.pa.

E. Nonsegmental Vowel Theory

Daniel Jones (1967: xxviii ff.) held that it may be an error to separate consonants from vowels as we do. For Ladefoged (1975: 44), the major difference between final b an p in English *cap* and *cab*, is vowel length. Shriberg/Kent (1982: 108) suggest that the voicing may be due to preceding vowels. This is a nonsegmental position according to which the consonant is not treated atomistically. It is rather part of accompanying vowels.

It is difficult or impossible to pronounce p or b alone without a vowel or vowel offglide. p > p¿, p^a, etc. Vowels are usually voiced and when we are said to hear a voiced stop we may be largely hearing the subsequent voiced vowel.

> "Words such as 'rap, rat, rock,' are all distinguishable, even consonants are unexploded. The difference in the sounds must therefore be in the way vowels end - after all, the rest is silence."(Ladefoged 1975: 45)

Strictly speaking, the stop is not voiced. Voice precedes and follows the stop. In this sense, b/d/g are not genuinely voiced. They may be represented as offglides, e.g., a^p, or a^b. If there is prevoicing, p and b may be regarded as prevoiced aspects of vowels, consonantal

onglides as represented by ᵖa, or ᵇa. The nonsegmental approach is in this way needed to show the dynamic relationships between sounds.

F. LENIS-FORTIS THEORY: FORCE

The distinction between p and b is said to rest not on the previously mentioned features, but on the feature, *tense-lax* or *fortis- lenis*. In Swiss and some German dialects, both p and b are relatively unaspirated and voiceless, such that other criteria are needed to distinguish them. The voiceless-voiced distinction is replaced by fortis-lenis (Alexander 1983; Baur 1969: 14). Lenis (or *tenuis*) is a devoiced plosive, or unaspirated voiceless stop.

> "The consonantal system of *Züritüütsch*, and in fact of Southern Germanic as a whole, rests on an opposition between lenis and fortis. Intensity and duration in S. Gm. play the part of voice in NHG (New High German)." (Keller 1961: 54, cf., Russ 1990: 460-461)

The feature is here used for a number of other languages as well as illustrated by the following descriptions:

Anglo-Irish stops involve fortis-lenis opposition (Henry 1957: 17; Ó Siadhail 1989: 113).

French vowels are more tense than English vowels (Valdman 1976: 50).

The articulation of [i] in Louisiana French is less tense than in Standard French (Conwell/Juilland 1963: 33-34).

RP English is generally regarded as being more tense than American English.

In American English, [i, e, «, u, o] and unvoiced stops are said to be tense, [ɪ, ʊ, ɔ] and voiced stops are said to be lax. Opinions differ as to whether or not [ï] is tense (Ladefoged 1975: 298, Ohde/Sharf 1992: 43-45). Columbian [j] is so tense that it is heard as an affricate [ï] (Canfield (1981: 36). Which vowels in German are tense and which lax, is also controversial. Delattre (1981) found no evidence that ɛ is more tense than e. Not only is the characterization of individual sounds in question, the criterion tense-lax (fortis-lenis) is in question. What is it that is lax or tense?

Catford (1977: 199-208) suggested that because *tense* has ambiguous meanings, it should not be used. The tense-lax distinction appears to be unscientific. To say, *x is less tense than y* is both vague and equivocal. For example, Icelandic *verk*, and *mann* are less tense than German *Werk* and *Mann*, Japanese [m, w] are less tense than in American English. But unless the specific sense of *tense* is given, these statements are unacceptable. Benware (1986: 17) states that stops consist of air volume, air speed, muscular control (relaxation, speed, release), place of articulation, beginning and extent of voicing. Tense/lax may apply to any one or more of these elements.

Thus, tense-lax may mean a number of different things:

1. Degree of Muscle Activity (Shriberg/Kent 1982: 40). If it is muscular, it is important to specify which muscles are involved and how much: tongue, lip pressure, pharynx, etc.? We may use tense muscles to make a lax sound. The Southern American English is said

to involve soft, low-pitched languid speech with lips, tongue and all the vocal muscles relaxed and lacking in tonus. (Wise 1933: 42) *'Tense/lax' refers to the tension of the tongue muscles.* (Nash 1977: 23) He states that all Spanish vowels are tense. Front high rounded vowels [y, Y, P] etc. may be thought to be more tense because more muscle tension may be required than for a or o. It is conceivable that these may be pronounced, especially in fast speech, with no more stress than the latter, or that the latter may be pronounced with more muscle tension as is the case with emotional emphasis. German *für* [fyːå] may be uttered without tension. To say a sound is tense because of the muscular tension involved, is a genetic fallacy.

2. Degree of Energy. *Energy* is a pseudo-scientific term. It is used as if it refers to an entity, but there is no entity to which to refer. It may only be operationally defined as whatever activity happens. For example, by more muscular *energy* can be meant that the muscles contract more than usual. Energy, therefore, does not have degrees, because it does not exist as such at all. It has no scientific formula. An *energetic sound* would, for example, refer to the quality of a sound. As applied to the psychological field, *psychic energy* (Freudianism) commits the fallacy of mentalism - assuming entities for which we have no evidence, as recent work in philosophical psychology clearly shows.
3. Degree of Subglottal Pressure (Ohde/Sharf 1992: 43).
4. Duration (Borden/Harris 1984: 110; Shriberg/Kent 1982: 40; Delattre 1981).
5. Force as Intensity
6. Acoustic Space (Disner 1983: 120). In this sense, *tension* refers not to muscular quality, but to the quality of sound which is heard, and which Delattre (1981) calls *vowel color*. A tense sound is not the same as tense muscles. As with *energy*, there is no *force* as such. To be intelligible, it also must be reduced to an operational definition. What is the difference between force, energy and power? There is none. The tense-lax distinction can no longer be based on these concepts. One meaning of force is *intensity*. It is an attribute, the quantity of anything. We may pronounce a vowel with intensity (stress), or have an intense conversation. In this respect, *force* can refer to some gradation between strong or weak.

This may be symbolized by: (weak to strong) o, o, o, o, o which coheres with but extends the traditional meaning of these symbols. It may be distinguished from intonation or relative pitch. The latter may be represented by superscript as follows: intonation = [^{1}] to [^{5}] = low to high. [ ] $^{=232}$, [ ] $^{=323}$. The latter symbols are useful especially for Swedish. In Swedish we can have strong, low pitch, or lax, high pitch. (If [^{3}] shown, other intonations are usually [^{2}], e.g., Ger. *Abend* [Aːˈ^{3}.bnd]). (German transcription for dialects gives [ ] for half-fortis, or middle strong intensity.) Bold superscripts can be used for tone languages: **Bold $^{1\text{-}12}$** = low to high tones. Duckworth, et al. (1990: 276) give [ ] for *unusually tense,* and [ ] for *extra lax.* Swiss p/t/k (fortis) and b/d/g (lenis) are distinguished by intensity (Baur 1969: 14). Resnick (1975) uses [$_{E}$] for *lax* , e.g., [r$_{E}$].

The difference between p and b can then be that one is strong and the other is weak. However, as each one may be strong or weak, it is not a distinguishing characteristic in general. For a specific language, it may be that in a particular environment, p is fortis and b is lenis. Russ states:

> "Lenition is the chief characteristic of Central Bavarian, all initial fortis consonants being subject to it."
> Russ (1990: 460)

Supposedly, all initial fortis consonants in German become lenis consonants in Central Bavarian. Only articulation, not voice and aspiration distinguishes p/b for German dialect (ibid. 162). Keller (1961) says that for Southern Germanic dialects, intensity (and duration) take the place of voice in New High German (cf., Waterman 1966: 169).

G EQUIVALENTS

It has been shown that the difference between p and b depends upon the feature and description in question. p may be equivalent to b in numerous ways. The presentation of the equivalencies of each of these symbols gives insight into their analysis and range of meanings. The equivalencies here are not identities. Specific qualities said to be similar, should be specifiable, e.g., acoustic, articulatory, definitional, intensity, etc. The following equivalencies may then be used as tools for securing narrow transcription.

EQUIVALENTS AND SIMILARITIES FOR ALTERNATE TRANSCRIPTIONS:

b • p-h, b} ≈ p}, b ≈ p-h, b p-h (Swiss), b ≈ b, bp • b (Gaelic, Holmer 1962: 16), (fast speech) b ≈ p, b • b«, b • b}, b • p, bî • b, b • (whispered b) b, bî (Welsh, Zulu).

d d ≠ t-h, dh ≈ t (Swiss), d • |, d¿ • d, d ≈ t-h, d ≈ t ≈ d, d ≈ t (Arabic), d ≈ t , d (Köln, Swiss), d • d, d > d (AP *width*), d (Chinese), d (Farsi). On an analogy b Ė õ ËË d Ė d, we can create an approximant d (Ger. dial. Riesenbeck).

g g≈ k-h (Swiss), ≈ k-h, Ng • Ngh (Chinese), g} • g • x • ï , g (Swedish), g} (in double consonants g}.g), g (Russian).

h ph ≈ pî, hî (strong asp.), h • î, (aspiration, and consonant lengthener), d.h ≈ dh (Hindi), h • H (If unvoiced, as in Japanese, vowels become h, creating a different h for each vowel.), h (Japan.), h (Turkish), h (Burmese).

© • ?, e© ≈ ejE (Farsi), © • (more fricative) h (Arabic), ≈ X (non-gutteral).

H h, (AP *ahead*), H ≠ ê

k k-h ≈ g, k ≈ q, k-h ≈ g, k-h • k k ≈ kî, k-h • k}, • c, • q (+ front vowel), k (Japan.), k-h (Hausa), kx (Cockney), kX (Dutch, Swiss).

p ≈ b}, p ≈ pî (Ladefoged 1975: 44), • b, • bî, p-h • p (whispered), p-h • p}, p} • b}

q q} • k}, q ≈ k (+back vowel), q ≈ k, • G, q (phg., Arabic), q-h (Portuguese).

t t • t-h (Swiss), t} • d}, t • d, tî ≈ d, t-h • |, t • t (Payne 1990),t-h • t}, tî ≈ dt, approximant t • t , t≈ d (Chinese), t (Arabic), t (Irish, Liverpool), ts (Cockney), t (Irish)

Standard French p becomes Alsace b, ò̀p > bô, which is called *douces sourdes* ("muffled sounds") (Léon 1983: 15). If one has a cold, the resonance and sound of p approaches that of b, for example, *prince* b¨Inds. This suggests also that the feature, *nasal*, can play a part in distinguishing p from b.

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