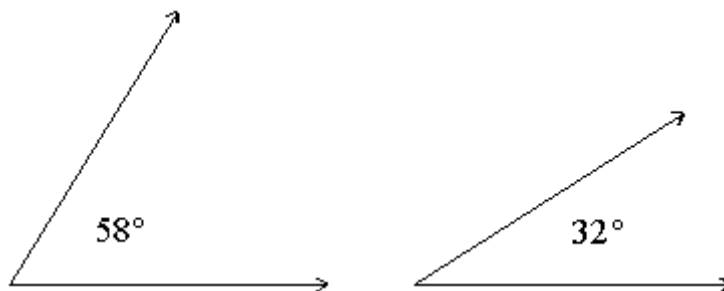


## On Sound Alternation

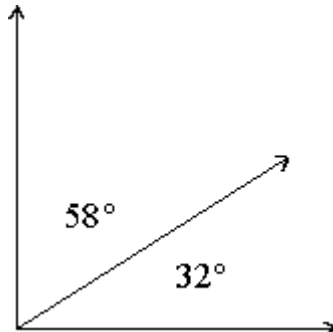
*Language occupies a completely isolated place in the realm of nature: it is a combination of physiological and acoustic phenomena governed by physical laws, and of unconscious and psychical phenomena governed by laws of an entirely different kind. This fact leads us to a most important question: what is the relation...between the physical principle and the unconscious and psychical principle?*

-Mikołaj Kruszewski, 1881

- Complementary angles in geometry: “Two angles are called complementary if the sum of their degree measurements equals 90 degrees. One of the complementary angles is said to be the complement of the other.



“These two angles are *complementary*.”



“These two angles can be “pasted” together to form a right angle.”

(from <http://www.mathleague.com/help/geometry/angles.htm#complementaryangles>)

- Complementary distribution in phonology: two (or more) sounds that never appear in the same context, but instead appear in complementary contexts, such that one sound is never found where the other is found, and vice versa. (The analogy: taken together, both (or all) sounds add up to one complete distribution (one right angle))
- By definition, allophones of a single phoneme are phonetically distinct, but functionally indistinct—despite their phonetic differences, the replacement of one by the other does not change the meaning of the morpheme. They are, in an abstract psychological sense, the same.
- Traditionally, sounds are considered allophones of the same phoneme provided
  - 1) They are in complementary distribution AND

- 2) They are phonetically similar (consider [ŋ] and [h] in English: in complementary distribution, but phonetically *dis*similar—they are not regarded as allophones)
- I argue today that (3) is the *only* thing that matters:
  - 3) The sounds *alternate* (they substitute for one another when morphemes attach, for example, ‘atom’ [ˈʔæɾəm] ‘atom+ic’ [ʔəˈtʰamɪk])
- NEITHER (1) nor (2) is a good test for the relatedness among sounds.
- We cannot conclude that sounds are phonologically related (allophones), even when in complementary distribution AND phonetically similar.
- The *only* way sounds can be allophones of the same phoneme (functionally equivalent) is if (3) they *alternate* with each other when morphemes are added or subtracted, whether they are phonetically similar or not.

### THREE CASES OF PHONOLOGICALLY RELATED SOUNDS

#### CASE 1: ENGLISH

(1)

<b>Clear “I”</b> (tongue body is forward) alternates with <b>Dark “I”</b> (tongue body is back)	
Before a vowel: <b>Clear “I”</b>	Elsewhere: <b>Dark “I”</b>
[fɪ̟+ɪŋ]      fill+ing	[fɪ̠]      fill
[fu̟+ɪʃ]      fool+ish	[fu̠]      fool

- In nature, things happen for a *reason*:

**Phonetic motivation:**

For **auditory** reasons, sonorant consonants tend to be influenced by a preceding vowel, when a vowel does not follow; they tend to become more vowel-like.

Detail: The inner ear is more adept at detecting *increases* (especially *sharp* increases) in acoustic energy, and less adept at detecting *decreases* (especially *minor* decreases) in acoustic energy.

- The sounds are in complementary distribution?      YES
- The sounds are phonetically similar?                      YES
- The sounds *alternate* with one another?                      YES
- The sounds are allophonically related?                      YES: meaning does not change

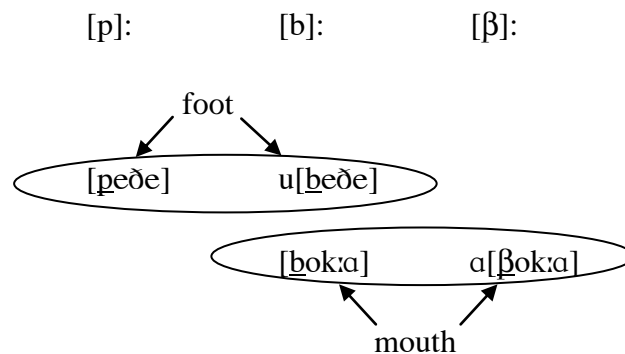
## CASE 2: CORSICAN

(2)

Voiceless stops alternate with Voiced stops	
Word-initially: Voiceless stops	Between vowels: Voiced stops
[p̥eðe]      foot	[u+b̥eðe]      the foot
[t̥eŋgu]      I have	[u+d̥eŋgu]      I have it
[k̥aza]      house	[a+g̥aza]      the house

Voiced stops alternate with Voiced fricatives	
Word-initially: Voiced stops	Between vowels: Voiced fricatives
[b̥ok̥:a]      mouth	[a+b̥ok̥:a]      the mouth
[d̥ente]      tooth	[u+d̥ente]      the tooth
[g̥ola]      throat	[di+y̥ola]      of throat

(3)

**Phonetic motivation:**

For **aerodynamic** reasons, voiceless stops tend to become voiced between vowels, and this may trigger a further change from voiced stops to voiced fricatives.  $VpV \rightarrow VbV$ ;  $VbV \rightarrow V\beta V$  (though this second change might not be phonetically motivated).

Detail: A stop that is flanked by vowels is very short in duration, and the vocal folds, vibrating for the vowels, are quite likely to continue vibrating during the brief stop.

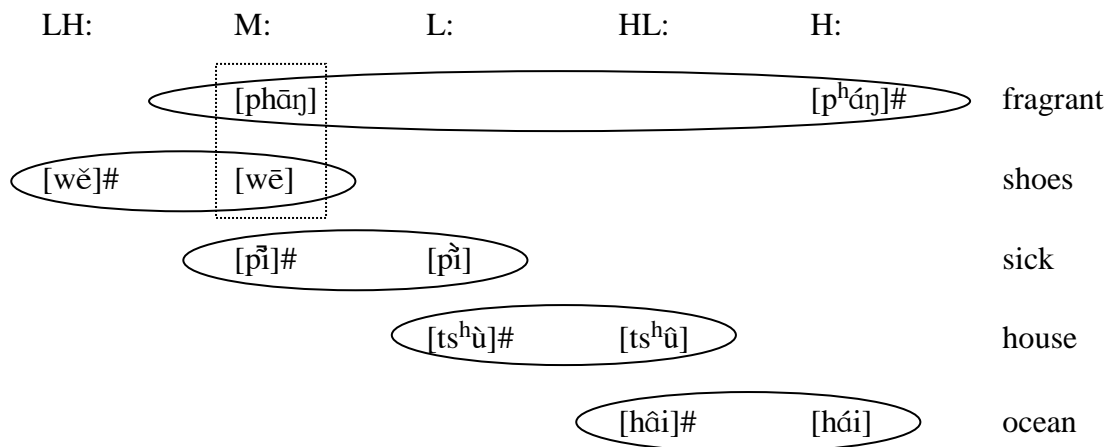
- The sounds are in complementary distribution?    YES
- The sounds are phonetically similar?                **NO**: they are more similar to *other* sounds
- The sounds *alternate* with one another?            YES
- The sounds are allophonically related?             YES: meaning does not change
  
- Similarity is clearly not playing a role in the Corsican pattern, as learners do not mistakenly group the two voiced stops into the same category.
- So phonetic similarity is not a good test for allophonic relatedness.

## CASE 3: TAIWANESE

(4)

Tone alternations	
At the end of phrase	Not at the end of phrase
H# [tsĩn p <sup>h</sup> áŋ]    very fragrant	M [p <sup>h</sup> āŋ tsũi]    fragrant water
LH# [p <sup>h</sup> ē wě]    leather shoes	M [wē tuà]    shoe laces
M# [wì pī]    stomach ailment	L [pǐ lǎŋ]    sick person
L [k <sup>h</sup> í ts <sup>h</sup> ũ]    build a house	HL [ts <sup>h</sup> ũ tĩŋ]    roof top
HL# [tuà hâi]    big ocean	H [háí kǐ]    ocean front

(5)

**Phonetic motivation:**

We have no good **phonetic** motivation for the present-day patterns in Taiwanese—these factors surely existed once, but they are now lost to history

- There is really no simple generalization we can make about the relationships between final versus non-final tones.
- The phonetic difference within one set is completely dissimilar to the phonetic difference within the other sets; they are all changing in their own independent ways.
- But Taiwanese children master their tonal alternations just as readily as Corsican children master their consonant alternations
- The sounds are in complementary distribution?    **YES**
- The sounds are phonetically similar?                    **NO**
- The sounds *alternate* with one another?                **YES**
- The sounds are allophonically related?                 **YES: meaning does not change**

## (6) Interim summary (disparities are highlighted)

	English laterals	Corsican obstruents	Taiwanese tones
Sounds are in complementary distribution	YES	YES	YES
Sounds are phonetically similar?	YES	NO	NO
Sounds <i>alternate</i> with one another?	YES	YES	YES
Sounds are allophonically related?	YES	YES	YES

- So phonological relatedness does not require phonetic similarity. Does it require complementary distribution?

## TWO CASES OF MISTAKEN IDENTITY

## CASE 1: AKAN

## (7)

Before <b>front vowels</b> ([i, i, e, ε]), we can find [tɕ]		preceding the <b>other vowels</b> ([u, u, o, ɔ, a]), we can find [k]	
[tɕim]	umbrella	[kun]	kill
[tɕitɕε]	divide	[akoma]	the heart
[ɔtɕe]	river	[kɔʔ]	go
[tɕε]	divide	[ka]	to bite

**Phonetic motivation:**

**Articulatorily**, in the context of front vowels, there may have been a very gradual shift from [k] to [k̟] to [k̟ç] to [tɕ]. This is an assimilation process.

Detail: over time, [ki] may *palatalize*: [k] may *coarticulate* with a following [i]. The [k] may be made with a slightly fronted tongue position. This makes the release of the [k] sound like more like a [t], but with added fricative-like noise.

- In Akan, there are no cases of one morpheme ending with a consonant, followed immediately by another morpheme beginning with a vowel.
- Never found: ...k+u → ku / ...k+i → tɕi (where [k] belongs to a single morpheme)
- [k] and [tɕ] *never* alternate with each other in Akan. The only circumstances in which we encounter [k] or [tɕ] in Akan is when a vowel immediately follows *within the same morpheme*.

- Sounds are in complementary distribution? YES (but...)
  - Sounds are phonetically similar? YES
  - Sounds *alternate* with one another? NO
  - Sounds are allophonically related? *LET'S FIND OUT...*
- Akan has a process of partial reduplication in which a root-initial syllable is copied with a high vowel. This morphological process creates verbs.

## (8) Akan reduplication

[s <sub>i</sub> -siʔ]	stand	[b <sub>u</sub> -bu(ʔ)]	bend
[f <sub>i</sub> -fiʔ]	vomit	[s <sub>u</sub> -su(ʔ)]	carry on the head
[s <sub>i</sub> -seʔ]	say	[s <sub>u</sub> -soʔ]	seize
[s <sub>i</sub> -seʔ]	resemble	[s <sub>u</sub> -soʔ]	light

[k <sub>i</sub> -kaʔ]	bite	(not [tɕ <sub>i</sub> -kaʔ])
-----------------------	------	------------------------------

- In the one circumstance when [k] and [tɕ] finally have the opportunity to alternate with each other, still, they remain oblivious to each other's existence.

## (9) A proposed history of the pattern:

early form:	palatalization:	reduplication:	present-day form:
kaʔ (bite)	---	ki- kaʔ	ki- kaʔ
kɛr (bind)	tɕɛr	tɕi-tɕɛr	tɕi-tɕɛr
time →			

- Sounds are in complementary distribution? YES (but...)
- Sounds are phonetically similar? YES
- Sounds *alternate* with one another? NO
- Sounds are allophonically related? **NO**: if they were, we would expect them to alternate when they have the opportunity to do so

## CASE 2: NEW YORK ENGLISH

## (10)

The low front lax vowel and the low front tense vowel in New York			
[ˈmænəɹdʒ]	manage	[ˈmæɹn]	man
[ˈdʒæniɹs]	Janice	[ˈplæɹn]	plan
[k <sup>h</sup> æfəˈtɪriə]	cafeteria	[ˈlæɹf]	laugh
[k <sup>h</sup> ænəbəl]	cannibal	[ˈmæɹndəbəl]	mandible
[ˈplæniʔ]	planet	[ˈplæɹniʔ]	plan it

**Phonetic motivation:**

The diphthong ([æ̟̞]) used to be a long monophthong ([æ:] ) in these closed syllables. For **auditory** reasons, Long vowels have a tendency to become diphthongs.

Detail: The inner ear responds more robustly to *changes* in the acoustic signal. A diphthong constitutes a better contrast with a short vowel than does a long monophthong.

- Do [æ] and [æ̟̞] alternate?

## (11) New York English Truncation

Full form	Truncated form	Another word
[k <sup>h</sup> æbərneɪ] Cabernet	[k <sup>h</sup> æb̥] cab-	[k <sup>h</sup> æ̟̞b̥] cab (taxi)
[k <sup>h</sup> æfət <sup>h</sup> ɪɪə] cafeteria	[k <sup>h</sup> æf] caf-	[k <sup>h</sup> æ̟̞f] calf
[mæsətʃ <sup>h</sup> usɪts] Massachusetts	[mæ̟̞s] Mass- (Ave.)	[mæs] mass

## (12) Some strange New York word pairs (not exactly minimal pairs though... Why not?):

	contrasts with
banner [ˈbænɹ̩] (pennant)	banner (ban+er) [ˈbæ̟̞nɹ̩] (one who bans)
adder [ˈædɹ̩] (species of snake)	adder (add+er) [ˈæ̟̞dɹ̩] (one who adds)
have [ˈhæv̩]	halve [ˈhæ̟̞v̩] (denominal of ‘half’)
Harry [ˈhæɹ̩] truncates to Har- [ˈhæɹ̩]	hairy [ˈhæ̟̞ɹ̩]  hair [ˈhæ̟̞ɹ̩]
camera [k <sup>h</sup> æmɹ̩ə] truncates to (web-) cam [k <sup>h</sup> æm]	Camden [k <sup>h</sup> æ̟̞mdn̩]  cam (-engine) [k <sup>h</sup> æ̟̞m]
Larry [ˈlæɹ̩] truncates to Lar- [ˈlæɹ̩]	lair-y [ˈlæ̟̞ɹ̩] (lair-like (??))  lair [ˈlæ̟̞ɹ̩]
Janice [ˈdʒænis] truncates to Jan- [ˈdʒæɹ̩]	Janny [ˈdʒæ̟̞ni] (from “Jan”)  Jan (full name) [ˈdʒæ̟̞n]
Cabernet [k <sup>h</sup> æbərneɪ] truncates to cab- [k <sup>h</sup> æb̥]	cabbie [k <sup>h</sup> æ̟̞bi]  cab [k <sup>h</sup> æ̟̞b̥]

- So, the sounds don’t alternate, even when given a unique opportunity to do so!

- Sounds are in complementary distribution? YES (within morphemes)
- Sounds are phonetically similar? YES
- Sounds *alternate* with one another? NO
- Sounds are allophonically related? **NO**: if they were, we would expect them to alternate when they have the opportunity to do so

(13)

Exceptions:		
l[æ]boratory	l[æ̥]b	“lab” is <i>lexicalized</i>
bl[æ̥]ster	m[æ]ster bl[æ]ster	Stevie Wonder intended these to rhyme

(14) Summary (disparities are highlighted)

	English laterals	Corsican obstruents	Taiwanese tone	Akan reduplication	NY English truncation
Sounds are in complementary distribution	YES	YES	YES	YES	YES
Sounds are phonetically similar?	YES	NO	NO	YES	YES
Sounds <i>alternate</i> with one another?	YES	YES	YES	NO	NO
Sounds are allophonically related?	YES	YES	YES	NO	NO

## CONCLUSIONS

- The traditional tests for allophonic relatedness—**phonetic similarity** and **complementary distribution**—fail to make the right predictions.
- The only reliable test for whether sounds are allophonically related is: “*Do they alternate?*”
- Ultimately, all this depends on our definition of **complementary distribution**.
- But if the term is to have any theoretical relevance, it should be based on the *linguistic behavior* of language users, not on the phonotactics regularities that phonologists might take note of.
- When alternation is present, it is often a consequence of **phonetic** pressures that play themselves out over time, due to the four “A”s:

- **A**erodynamics
- **A**rticulation
- **A**coustics
- **A**udition