Morphology, and, if there turns out to be time, some Phonetics, too

Two imaginable kinds of lexicons:

teach
teacher
teachers
teaching
mine
miner
miners
mining
....

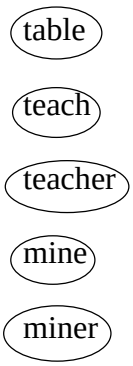
teach
mine
-er
-s
-ing

Two imaginable kinds of lexicons:

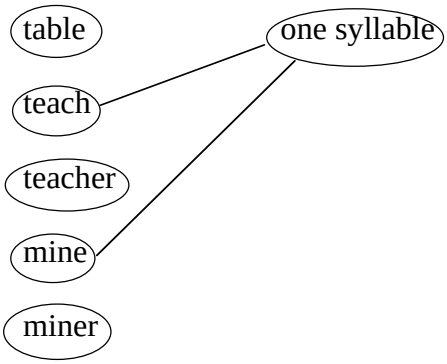
teach teacher teachers teaching mine miner miners mining	teach mine -er -s -ing

(the wrong theory) (the right theory)

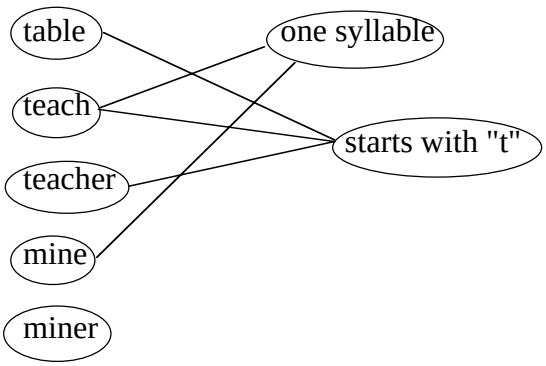
A toy connectionist model



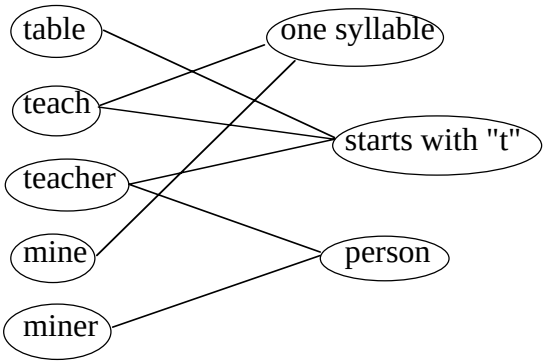
A toy connectionist model



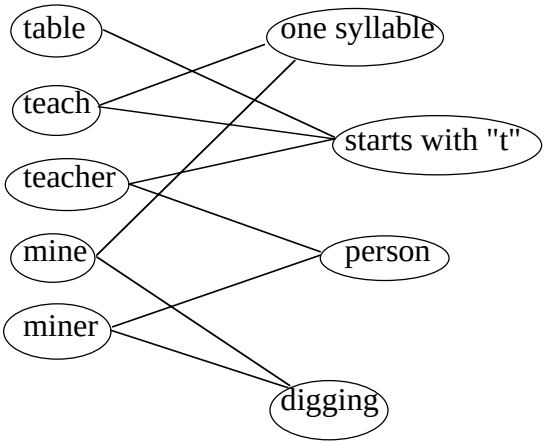
A toy connectionist model



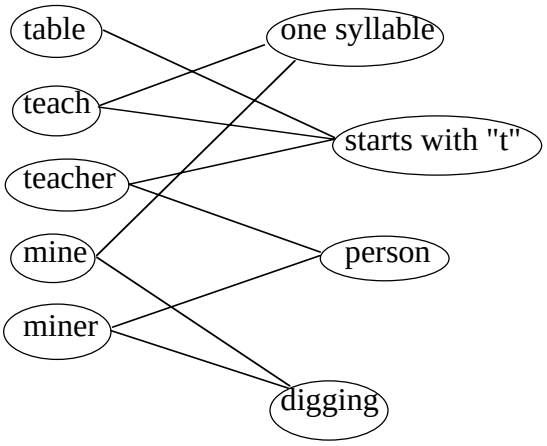
A toy connectionist model



A toy connectionist model



A toy connectionist model



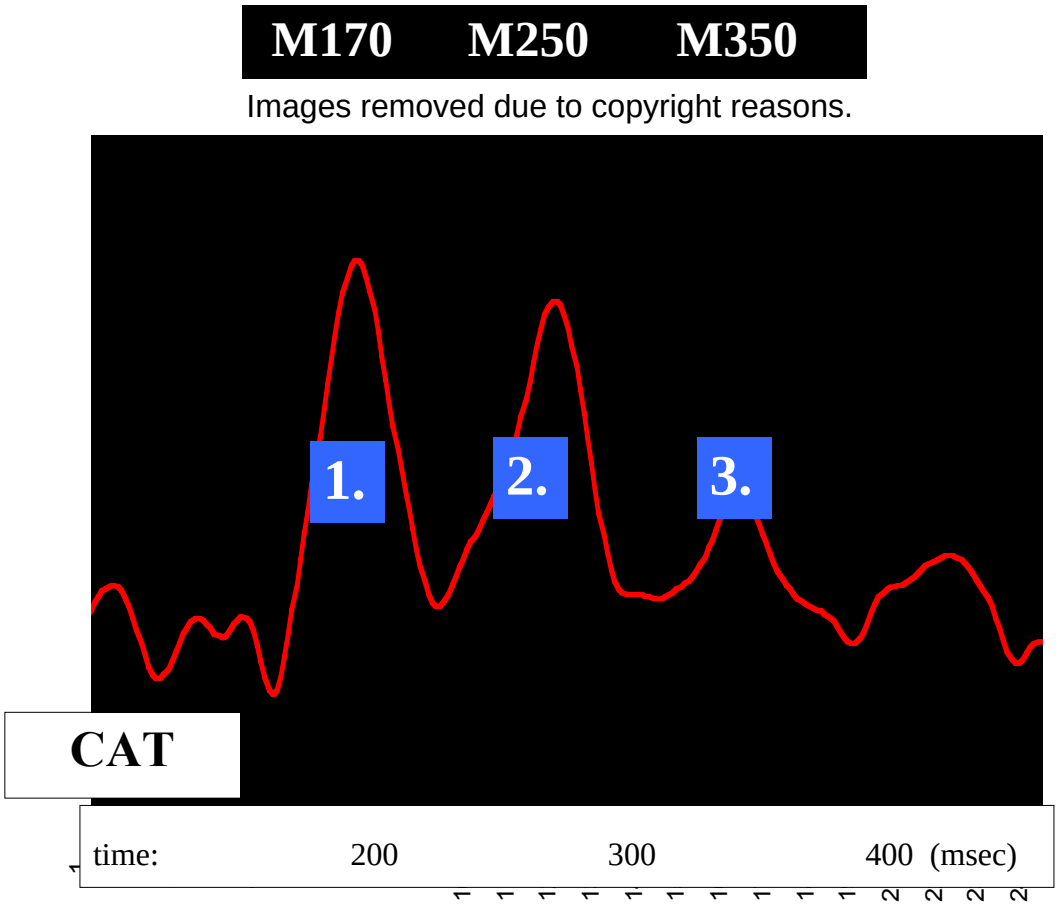
**(in a real network, it's not "connected vs. unconnected"--
it's about "connection strength")**

We've seen evidence that words are broken up into **morphemes**
(evidence that the **right** theory is right)

- gives you a lexicon with fewer entries
  - the plight of the Nimborans (27,000 forms per verb)
- lots of evidence that we manipulate morphemes, including:
  - application of morphemes to new words (wug-**s**)
  - creation of new morphemes (Water**gate**, Monica**gate**...)
  - backformation (sculptor > sculpt, pease > pea)

Another argument for breaking words into morphemes: MEG (magnetoencephalography)

- involves measurement of electrical events in the brain
  (by measuring magnetic fields on the scalp)

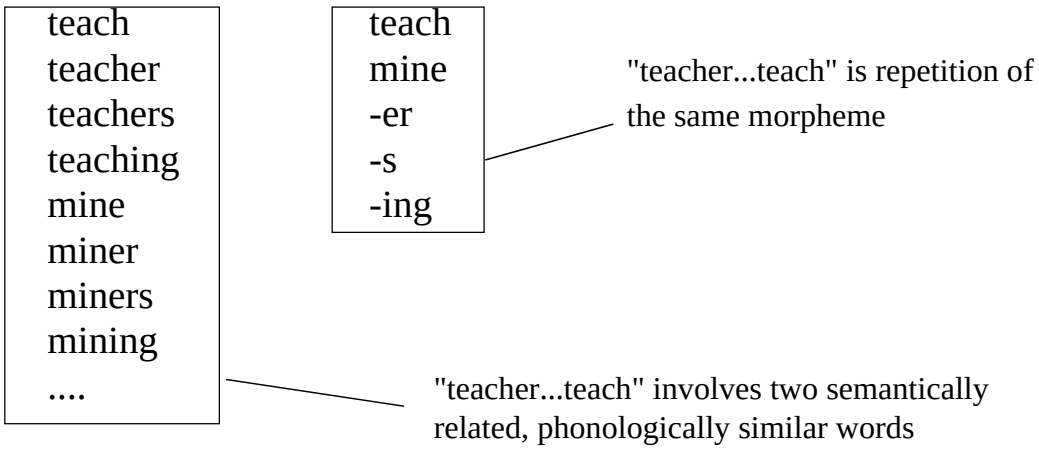


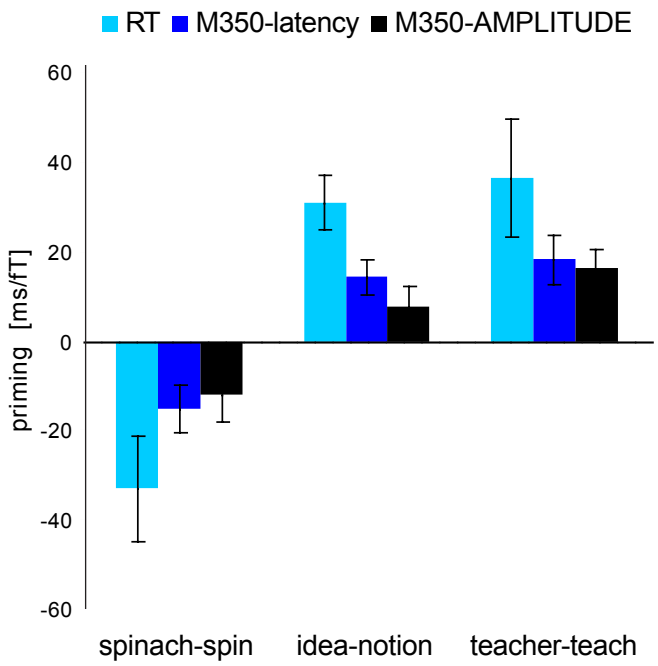
Images removed due to copyright reasons.

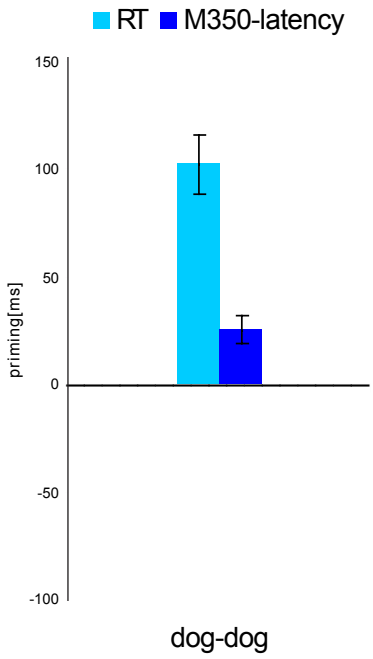
The speed of the M350 can be affected by a number of factors (**priming**):

- if you've recently seen a "semantically related" word, it speeds up ("idea.....notion")
- if you've recently seen exactly the same word, it speeds up even more ("dog....dog")
- if you've recently seen a phonologically similar word, it slows down ("spinach....spin")

So, how about "teacher....teach"?







Lardil

Nom.	Acc.	
mela	melan	'seawater, beer'
barnga	barngan	'stone'
katha	kathan	'nest'
thungal	thungalin	'tree'
ketharr	ketharrin	'river'
miyar	miyarin	'spear'

Lardil

Nom.	Acc.	
mela	melan	'seawater, beer'
barnga	barngan	'stone'
katha	kathan	'nest'
wunda	wundan	'stingray species'
thungal	thungalin	'tree'
ketharr	ketharrin	'river'
miyar	miyarin	'spear'
wunda	wunin	'rain'
belda	belin	'tip'
dalda	dalin	'curve'

Lardil

Nom.	Acc.	Underlying Form	
mela	melan	mela	'seawater, beer'
barnga	barngan	barnga	'stone'
katha	kathan	katha	'nest'
wunda	wundan	wunda	'stingray species'
thungal	thungalin	thungal	'tree'
ketharr	ketharrin	ketharr	'river'
miyar	miyarin	miyar	'spear'
wunda	wunin	wun	'rain'
belda	belin	bel	'tip'
dalda	dalin	dal	'curve'

Lardil

Nom.	Acc.	Underlying Form	
mela	melan	mela	'seawater, beer'
barnga	barngan	barnga	'stone'
katha	kathan	katha	'nest'
wunda	wundan	wunda	'stingray species'
wunda	wunin	wun	'rain'
belda	belin	bel	'tip'
dalda	dalin	dal	'curve'
yaka	yakin		'fish'
birrka	birrkin		'string'
lelka	lelkin		'head'

Lardil

Nom.	Acc.	Underlying Form	
mela	melan	mela	'seawater, beer'
barnga	barngan	barnga	'stone'
katha	kathan	katha	'nest'
wunda	wundan	wunda	'stingray species'
wunda	wunin	wun	'rain'
belda	belin	bel	'tip'
dalda	dalin	dal	'curve'
yaka	yakin	yak	'fish'
birrka	birrkin	birrk	'string'
lelka	lelkin	lelk	'head'

Lardil

Nom.	Acc.	Underlying Form	
mela	melan	mela	'seawater, beer'
barnga	barngan	barnga	'stone'
katha	kathan	katha	'nest'
wunda	wundan	wunda	'stingray species'
wunda	wunin	wun	'rain'
belda	belin	bel	'tip'
dalda	dalin	dal	'curve'
kanda	kandun		'blood'
nguka	ngukun		'water'
ngawa	ngawun		'dog'
karda	kardun		'woman's child, man's sister's child'

Lardil

Nom.	Acc.	Underlying Form	
mela	melan	mela	'seawater, beer'
barnga	barngan	barnga	'stone'
katha	kathan	katha	'nest'
wunda	wundan	wunda	'stingray species'
wunda	wunin	wun	'rain'
belda	belin	bel	'tip'
dalda	dalin	dal	'curve'
kanda	kandun	kandu	'blood'
nguka	ngukun	nguku	'water'
ngawa	ngawun	ngawu	'dog'
karda	kardun	kardu	'woman's child, man's sister's child'

Lardil

Nom.	Acc.	Underlying Form	
mela	melan	mela	'seawater, beer'
barnga	barngan	barnga	'stone'
katha	kathan	katha	'nest'
wunda	wundan	wunda	'stingray species'
wunda	wunin	wun	'rain'
belda	belin	bel	'tip'
dalda	dalin	dal	'curve'
ngalu	ngalukin		'story'
wangal	wangalkin		'boomerang'
thalkurr	thalkurrkin		'kookaburra'
kundul	kundulkin		'umbilical cord'

Lardil

Nom.	Acc.	Underlying Form	
mela	melan	mela	'seawater, beer'
barnga	barngan	barnga	'stone'
katha	kathan	katha	'nest'
wunda	wundan	wunda	'stingray species'
wunda	wunin	wun	'rain'
belda	belin	bel	'tip'
dalda	dalin	dal	'curve'
ngalu	ngalukin	ngaluk	'story'
wangal	wangalkin	wangalk	'boomerang'
thalkurr	thalkurrkin	thalkurrk	'kookaburra'
kundul	kundulkin	kundulk	'umbilical cord'

Lardil

some rules:

1. one-syllable stems add -*da*: *bel* ->*belda* 'edge'
2. ..unless they end in -*k*, then just add -*a*: *lelk* -> *lelka* 'head'
3. final *u* ->*a*: *kandu* -> *kanda* 'blood'
4. final *k* drops: *wangalk* -> *wangal* 'boomerang'

Lardil

some rules:

1. one-syllable stems add -*da*: *bel* ->*belda* 'edge'
2. ..unless they end in -*k*, then just add -*a*: *lelk* -> *lelka* 'head'
3. final *u* ->*a*: *kandu* -> *kanda* 'blood'
4. final *k* drops: *wangalk* -> *wangal* 'boomerang'

lelk-->
rule 2: *lelka* 'head'

Lardil

some rules:

1. one-syllable stems add -*da*: *bel* ->*belda* 'edge'
2. ..unless they end in -*k*, then just add -*a*: *birrk* -> *birrka* 'string'
3. final *u* ->*a*: *kandu* -> *kanda* 'blood'
4. final *k* drops: *wangalk* -> *wangal* 'boomerang'

lelk-->
rule 2: *lelka* 'head'

why not rule 4? *lelk*--> *lel*
(then maybe rule 1: *lel*-->*lelda*)

Lardil

some rules:

1. one-syllable stems add -*da*: *bel* ->*belda* 'edge'
2. ..unless they end in -*k*, then just add -*a*: *birrk* -> *birrka* 'string'
3. final *u* ->*a*: *kandu* -> *kanda* 'blood'
4. final *k* drops: *wangalk* -> *wangal* 'boomerang'

ngaluk-->
rule 4: *ngalu* 'story'

Lardil

some rules:

1. one-syllable stems add -*da*: *bel* ->*belda* 'edge'
2. ..unless they end in -*k*, then just add -*a*: *birrk* -> *birrka* 'string'
3. final *u* ->*a*: *kandu* -> *kanda* 'blood'
4. final *k* drops: *wangalk* -> *wangal* 'boomerang'

ngaluk-->
rule 4: *ngalu* 'story'

why not then apply rule 3? *ngalu* --> *ngala*

Lardil

some rules:

1. one-syllable stems add -*da*: *bel* ->*belda* 'edge'
2. ..unless they end in -*k*, then just add -*a*: *birrk* -> *birrka* 'string'
3. final *u* ->*a*: *kandu* -> *kanda* 'blood'
4. final *k* drops: *wangalk* -> *wangal* 'boomerang'

standard response to this kind of problem:
rule ordering

Rules 2 and 3 apply before Rule 4.

Lardil

some **ordered** rules:

1. one-syllable stems add -*da*: *bel* ->*belda* 'edge'
2. ..unless they end in -*k*, then just add -*a*: *birrk* -> *birrka* 'string'
3. final *u* ->*a*: *kandu* -> *kanda* 'blood'
4. final *k* drops: *wangalk* -> *wangal* 'boomerang'

input	*lelk*
rule 2	*lelka*
rule 3	--
rule 4	--
output	*lelka*

Lardil

some **ordered** rules:

1. one-syllable stems add -*da*: *bel* ->*belda* 'edge'
2. ..unless they end in -*k*, then just add -*a*: *birrk* -> *birrka* 'string'
3. final *u* ->*a*: *kandu* -> *kanda* 'blood'
4. final *k* drops: *wangalk* -> *wangal* 'boomerang'

input	*lelk*	*ngaluk*
rule 2	*lelka*	--
rule 3	--	--
rule 4	--	*ngalu*
output	*lelka*	*ngalu*

Lardil

some **ordered** rules:

1. one-syllable stems add -*da*: *bel* ->*belda* 'edge'
2. ..unless they end in -*k*, then just add -*a*: *birrk* -> *birrka* 'string'
3. final *u* ->*a*: *kandu* -> *kanda* 'blood'
4. final *k* drops: *wangalk* -> *wangal* 'boomerang'

input	*lelk*	*ngaluk*
rule 2	*lelka*	--
rule 3	--	--
rule 4	--	*ngalu*
output	*lelka*	*ngalu*

(...these all happen to be cases in which only one rule applies...)

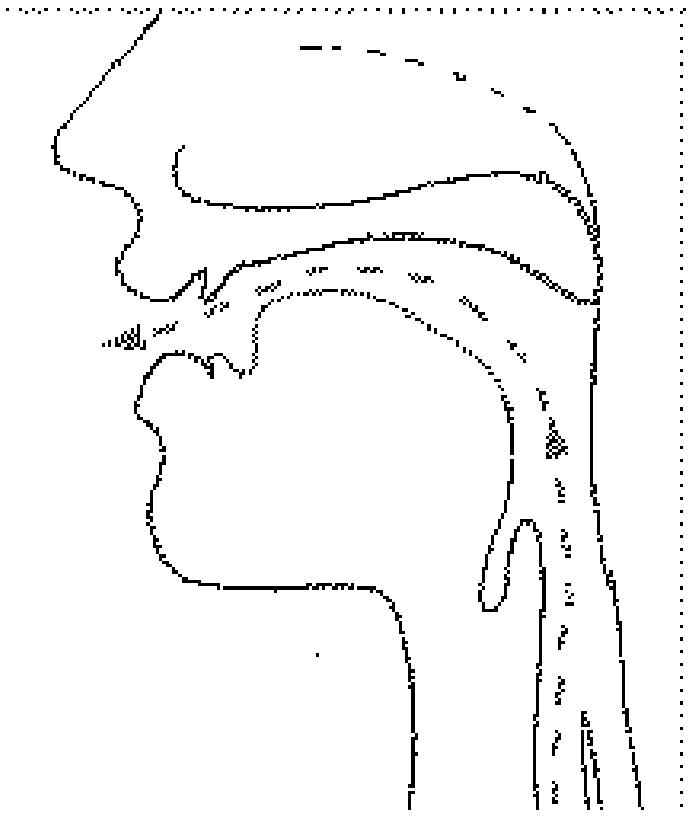
- abstract underlying forms (***yak*** 'fish', ***nguku*** 'water'; Polish ***brzeg*** 'bank of a river')

- rule ordering (***ngaluk*** 'story' becomes ***ngalu***, not ***ngala***)

And now for something somewhat different...**Phonetics**

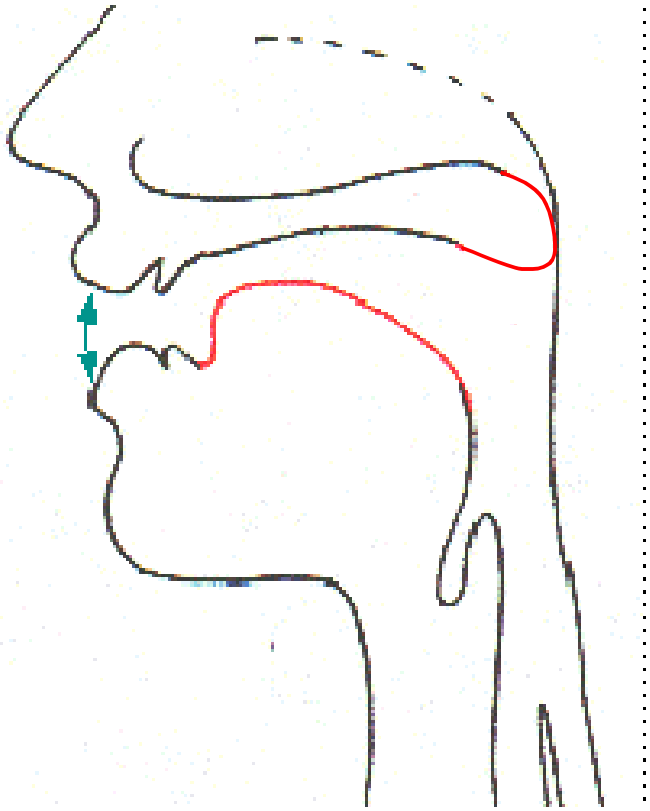
Speech involves the production of an airflow, typically from the lungs, which gets obstructed in various ways in the vocal tract.

One way of categorizing these obstructions is by **place of articulation**.



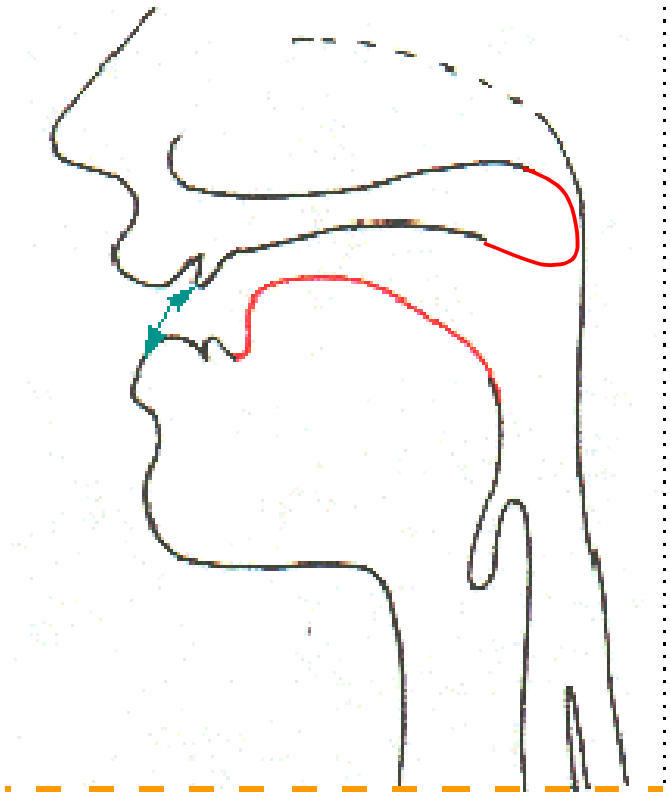
Bilabial: both lips.

[p] **p**aint
[b] **b**ath
[m] **m**ath
[w] **w**ipe



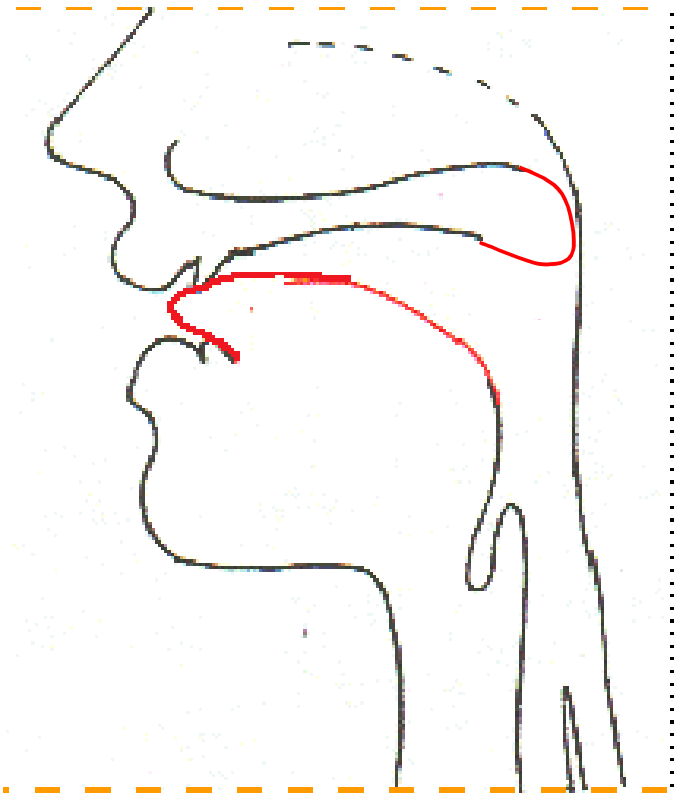
Labiodental: top teeth and lower lip.

[f] **f**ace
[v] **v**ase



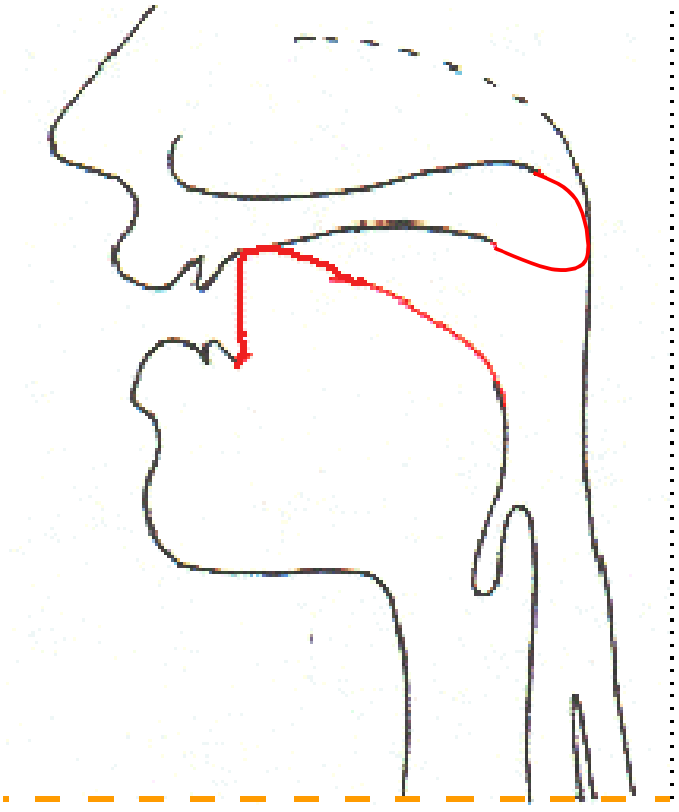
<u>Interdental:</u> tongue between the teeth.

[θ] **<u>th</u>**istle
[ð] **<u>th</u>**is



<u>Alveolar</u>: tongue tip against the alveolar ridge, just behind the top teeth.

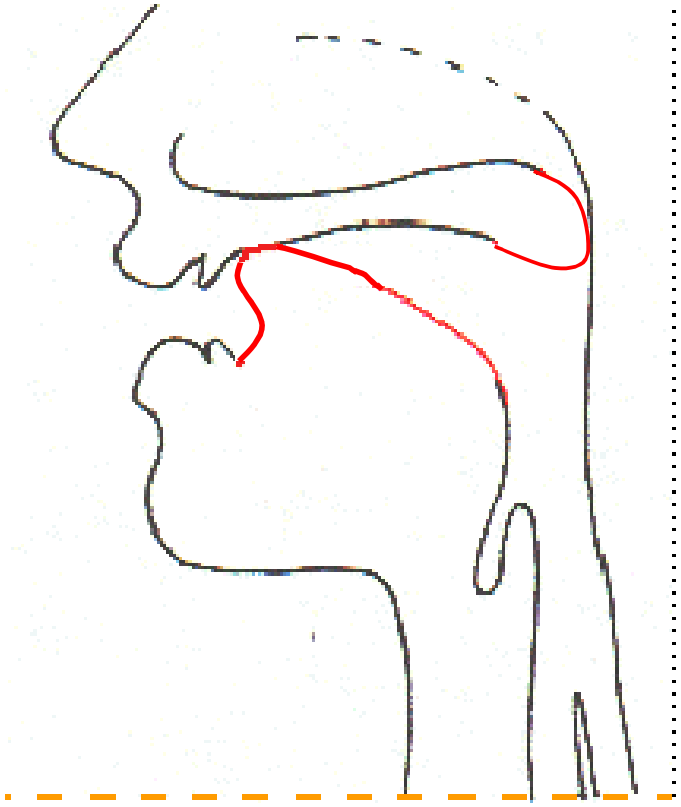
[t] **<u>t</u>**eeth
[d] **<u>d</u>**uck
[s] **<u>s</u>**ail
[z] **<u>z</u>**oom
[n] **<u>n</u>**ail



Alveopalatal: tongue blade slightly behind the alveolar ridge (also called "postalveolar").

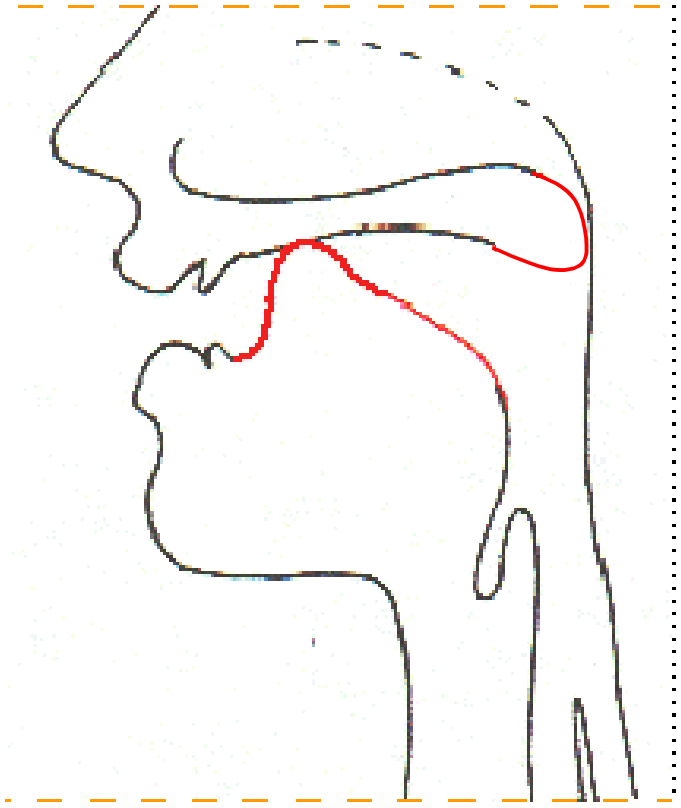
[ʃ] **sh**ip

[ʒ] a**z**ure



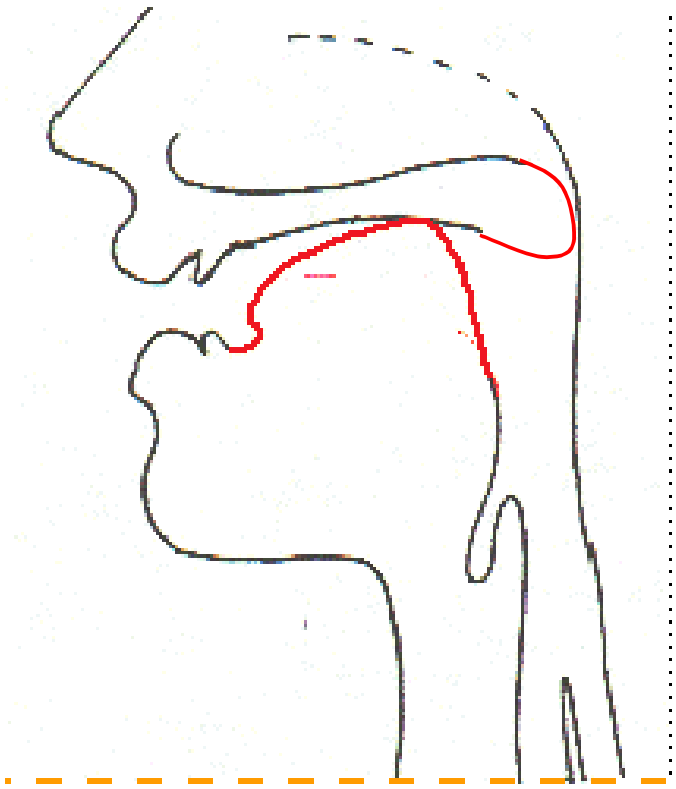
Palatal: even further behind the alveolar ridge, back where the roof of the mouth reaches its height.

[j] **y**ear



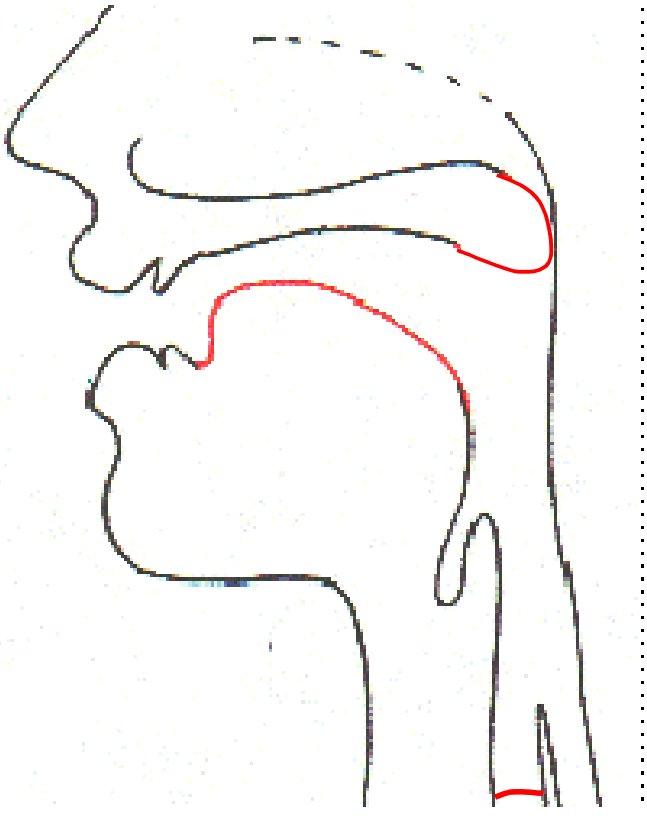
<u>Velar</u>: tongue body against the velum, the soft tissue at the back of the mouth.

[k] **<u>k</u>**ernel, **<u>c</u>**aught
[g] **g**one
[ŋ] si**<u>ng</u>**



<u>Glottal</u>: the glottis (vocal cords).

[ʔ] _uh-_uh ("no")
[h] **<u>h</u>**elp



But place of articulation isn't the whole story. What distinguishes [s] from [z], or [θ] from [ð], or [t] from [d]?

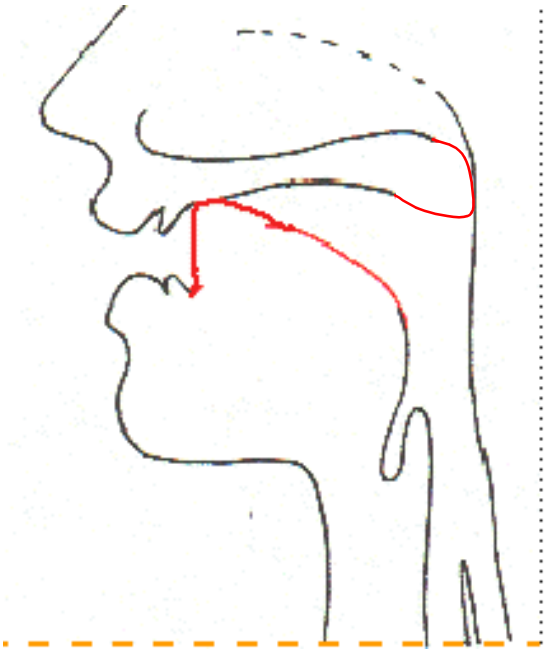
...**Voicing**: vocal cords can either vibrate or not.

[s], [z], [t], and [d] are all **alveolar**,
but [s] and [t] are **voiceless** and [z] and [d] are **voiced**.

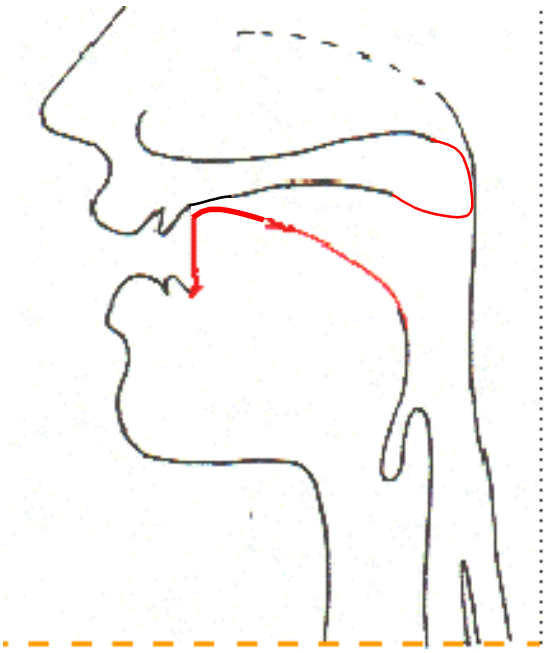
So if [s] and [t] are both voiceless alveolars, what distinguishes [s] from [t]? or [d] from [z]?

...**Manner of Articulation**: [t] is a **stop** (or a **plosive**),
and [s] is a **fricative**.

[t], [d]: airflow stopped



[s], [z]: airflow restricted, but not stopped



- **<u>place</u>**, **<u>manner</u>**, **<u>voicing</u>**:

	stop	fricative
bilabial	[b], [p]	
labiodental		[v], [f]
interdental		[ð], [θ]
alveolar	[d], [t]	[z], [s]
alveopalatal		[ʒ], [ʃ]
palatal		
velar	[g], [k]	
glottal	[ʔ]	[h]