

Introduction to Language

Derek Denis

University of Toronto
derek.denis@mail.utoronto.ca

Lecture 3: Sept. 24 2013

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Phonology Phonotactics Prosody Segmental Phonology

To speak a language, you need to know more than just the sounds in that language.

- ▶ Knowing the IPA ≠ polyglot
- ▶ We need to know how the sounds of a language are able to combine into meaningful sound patterns.

The **phonological** component of a language's grammar determines what combinations of sounds are possible and which are not.

1. How do we segment the speech stream?
2. How do sounds interact with each other?
3. How do syllables, stress, and intonation differ cross-linguistically?

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Phonology

Phonotactics (Greek: *phōnē* 'voice, sound'; *taktikós* 'of arranging/arrangement')

Phonotactics of a language are the set of constraints on how sound segments can be arranged.

Prosody (Greek: *prosōidía* 'sung to music')

Prosodic phonology deals with suprasegmental features such as stress and intonation.

Segmental phonology

Segmental phonology is concerned with how sounds interact when they are close to each other.

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Phonology Phonotactics Prosody Segmental Phonology

Phonotactics

Phonology Phonotactics Prosody Segmental Phonology

Phonotactics

'New Words'

- ▶ *prasp*
- ▶ *flib*
- ▶ *traf*
- ▶ **psapr*
- ▶ **bflf*
- ▶ **ftra*

Our competence of English **phonotactics** is what allowed us to come to a consensus about these words.

- ▶ Grammatically acceptable **syllables** vs. grammatically unacceptable **syllables**.
- ▶ Descriptively speaking.

Definition: A **syllable** is "a unit of phonological organization, typically larger than a segment and smaller than a word." (Rogers 2000:314)
"A syllable is the smallest unit of sound that can be pronounced all by itself." (L4D pg. 70)

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The Syllable

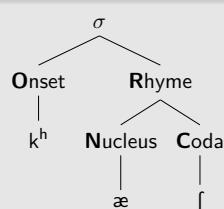
Fact: All words are made up of syllables.

- Some words have one syllable, others have many.

Syllables are made up of...

- A **nucleus** (e.g., a vowel).
- An **onset** before the nucleus.
- A **coda** after a nucleus.
- The nucleus and coda together form the **rhyme**

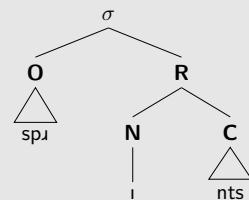
'cash' [k^hæʃ]



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The Syllable

'sprints' [sp्रnts]



English allows for complex onsets and codas. Different languages allow for different amounts of complexity in onsets and codas.

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The Syllable

σ
R
N
ʌ

σ
O
b
N
i

σ
R
N
ɛ
C
b

σ
O
b
N
ʌ
C
t

σ
O
sk
N
i
C
t

σ
O
d
N
ɛ
R
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σ
O
sk
N
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mp

σ
O
sk
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Restrictions on English Syllable Structure

Acceptable Nuclei in English

- All the vowels of English are acceptable nuclei.
- But [m], [n], [l], and [ɹ] can also be for some speakers.
- We use the IPA symbol [‿] to mark a syllabic consonant.
- We won't be using syllabic consonants in this course, only [ə] plus the consonant.**

'sudden'
[sʌ.dən]
'prism'
[pri.zm]
'ladle'
[le.dəl]
'reader'
[ri.dər]

[sʌ.dən]
[pri.zm]
[le.dəl]
[ri.dər]

Restrictions on English Syllable Structure

Acceptable Onsets in English

- Every English consonant except [ɹ] can be in an onset.
- English also allows for many possible complex onsets.

Labial+Approx. Alveolar+Approx. Velar+Approx.

[p̪]	please	[t̪j]	trade	[k̪l]	clean
[pɹ]	proud	[t̪w]	twin	[kɹ]	cream
[pɹ]	pure	[t̪j]	tune*	[kɹ]	cute
[bɹ]	bring	[d̪z]	dry	[kw]	queen
[bɹ]	bling	[d̪w]	dweeb	[gɹ]	grow
[bɹ]	beauty	[d̪j]	dew	[gɹ]	glow
[fɹ]	fly	[s̪l]	slim	[gw]	Gwen
[fɹ]	fry	[sw]	swim		
[fɹ]	future				

...

Plus, [sn] *snob*, [sm] *smoke*, [st] *stick*, [sp] *spin*, [sk] *skin*, [spl] *split*, [spr] *sprint*, [spɹ] *spew*, [stɹ] *street*, and [sku] *scream* etc.

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Restrictions on English Syllable Structure

Acceptable Codas in English

Even more possibilities!!

- Two segment coda: 'fox' [faks]
- Three segment coda: 'hands' [hændz]
- Four segment coda: 'sixths' [siksθs]
- ...

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How to Syllabify English Words

1. How many syllables are there?
 - How many parts of the word can be said in isolation?
2. Identify the nuclei
 - These are usually vowels, but not for all languages.
 - **Every syllable must minimally have a nucleus.**
3. Maximize the Onset
 - If a combination of sounds can start a word in English, it can be in the onset.
4. Create codas
 - The consonants that could not fit into the onset become codas.

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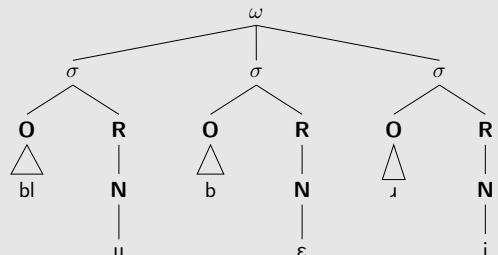
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Be aware!

- Sometimes certain segments might sound like they are part of the coda of one syllable and the onset of the next syllable.
 - *buzzer* [bʌ.zər]? [bʌz.ər]? [bʌz.rər]?
 - This is called ambisyllabicity.
- **We will follow the algorithm on the previous slide in this class.**

How to Syllabify English Words

'blueberry' [blubərɪ]

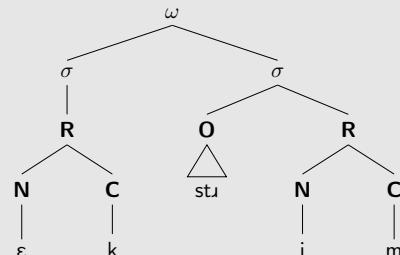


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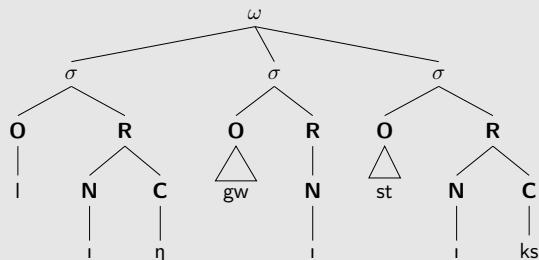
How to Syllabify English Words

'extreme' [ekstrem]



How to Syllabify English Words

'linguistics' [lɪŋgwɪstɪks]



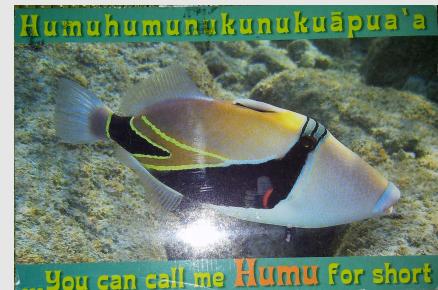
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Linguistic Diversity

Many languages have more strict phonotactic restrictions.

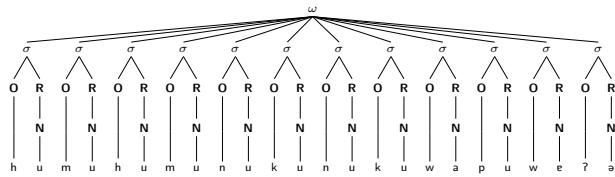
- Many only allow CV syllables.
- This can lead to very long words!

Hawaiian (Polynesian language)



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Linguistic Diversity



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Linguistic Diversity

This restriction on syllable structure (combined with the fact that Hawai'iian does not have an [s], [r] or the same [t] sound) leads to what appear to English speakers to be very striking changes to English loan words!

- ▶ *Merry Christmas* → *Mele Kalikimaka*
- ▶ [ʃ] → [l]
- ▶ [s] → [k]
- ▶ CVC → CV.CV
- ▶ CCVC → CV.CV.CV
- ▶ A few vowel changes... voila!
- ▶ [mɛ.u.i.kʰris.məs] → [me.le.ke.li.ki.me.ka]

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Linguistic Diversity

Other languages have less restrictions than English and even allow a wide array of consonants to be syllabic.

Oowekyala (Wakashan)

- a. t.p.kʷ 'something squeezed'
- b. ḵ.x.xs 'canoe thwart'
- c. c'f.c'kʷ short (plural agreement)
- d. t.pxʷ.ps.Ṅ.k.c something invisible here with me that is nice or pleasant will undergo squeezing

Prosody

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Word Stress

English **stress** is extremely complex, but here's some generalizations

- ▶ All words have a syllable that has **main stress** [']
- ▶ Words with three or more syllables might have a syllable with **secondary stress** [,.].
 - 'phonology' [fə.'na.lə.dʒi]
 - 'phonological' [fə.nə.'la.dʒə.kəl]^a
- ▶ Two syllable **nouns** have main stress on the first syllable
 - 'subject' (noun) ['sʌb.dʒɛkt]
- ▶ Two syllable **verbs** have main stress on the second syllable
 - 'subject' (verb) [səb.'dʒɛkt]
- ▶ Compound nouns stress the first part, while compound verbs usually stress the second part.
 - 'blackbird' (noun) ['blæk.bərd]
 - 'outrun' (verb) [awt.'ʌn]

^aRemember, that [ə] often appears in unstressed syllables.

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Intonation

As we saw last week, English uses pitch to distinguish questions and statements.

Type	Intonation	Example
Question	rising	You're the boss? [↗]
Statement	falling	You're the boss. [↘]
List	rise, rise, fall	I'll have a coke [↗], fries [↗], and a burger [↘]

Uptalk which is a feature of younger (especially female) speakers of North American English is a rising intonation on statements.

This pattern is by no means universal!

- ▶ Chickasaw (Muskogean) fall on questions and rise on statements.

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Segmental Phonology

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All the sounds of the world's languages have unique acoustic properties

- Individual languages make use of a subset.

If we substitute one sound for another within a word, this can change the meaning of the word (see Lecture 1).

- [s] for [m]: 'seen' [sɪn] ~ 'mean' [mɪn]
- [i] for [æ]: 'tip' [tʰip] ~ [tʰæp]
- [t] for [f]: 'caught' [kʰat] ~ 'cough' [kʰaf]

If we can substitute one sound for another and change the meaning like above, we conclude that the two sounds are **phonologically distinct/contrastive**.

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Non-distinct/Non-contrastive Sounds

Every language has a set of contrastive sounds, but also a set of sounds that are not distinct from the contrastive sounds and show up in **predictable contexts**.

Nasalized vowels

- 'beet' [bit]
- 'beam' [bɪm]
- BUT [bɪt] ≈ 'beet'
- and [bɪm] ≈ 'beam'

Aspirated stops

- 'stop' [stap]
- 'top' [tʰap]
- BUT [stʰap] ≈ 'stop'
- and [tap] ≈ 'top'

In English...

Nasalized vowels and aspirated stops are **not contrastive**.

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Minimal Pairs/Sets

The best way to discover if a pair of sounds are contrastive in a language is to try to find **minimal pairs**.

Definition: A **minimal pair** is a set of two words in a language with the same structure, differing by only a single sound.

'two'	[tʰu]	vs.	'do'	[du]
'hat'	[hæt]	vs.	'hit'	[hit]
'run'	[rʌn]	vs.	'rung'	[rʌŋ]
'bead'	[bid]	vs.	'bees'	[biz]
'beet'	[bit]	vs.	'bit'	[bit]
'seat'	[sit]	vs.	'suit'	[sut]

Note that each of these minimal pairs differ in terms of a **single articulatory detail**: voicing, vowel height, place of articulation, manner of articulation, tongue rigidity, tongue backness. This is not a requirement of a minimal pair, so long as the words differ with respect to a single sound.

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Phones, Phonemes, and Allophones

All sounds used in a language (regardless of whether they are contrastive or not) are called **phones**. We indicate a phone with square brackets (e.g., [tʰ]).

If a sound is contrastive in a language, it is a **phoneme** of that language. Phonemes are an **abstract** concept and are part of a speaker's mental grammar. We indicate phonemes with slash brackets (e.g., /t/).

The set of predictable realizations of a phoneme are called **allophones**. Allophones are overtly realized variants of a single abstract phoneme.

- The allophones of /t/ in English include [tʰ] and [t].
- Allophones are said to be in **complementary distribution**. Never get one in the context where the other occurs.

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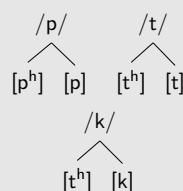
Phones, Phonemes, and Allophones

Different languages have different **phonemic inventories**.

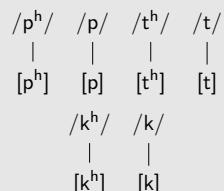
While [pʰ] and [p] are allophones of a single phoneme (/p/) in English, in Thai, the sounds are contrastive.

- /pʰ/ and /p/ are phonemes in Thai (and other languages)
- 'to spit' [pʰaa] vs. 'forest' [paa]

English



Thai



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Phones, Phonemes, and Allophones

Different languages have different **phonemic inventories**.

Likewise, while /ɹ/ and /l/ are individual phonemes in English, in Korean, the 'r' and 'l' sounds are allophones of a single phoneme.

- 'Seoul' [səʊl] but *[səʊr]
- 'wind' [param] but *[palam]

Korean



English



More evidence from morphological alternations...

- 'know' root /al/
- 'to know' [al-da]
- 'I know (polite)' [ar-ajo]

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Phonetic vs. Phonemic Transcription

Some linguists are interested in the fine details of how a word is articulated.

- When transcribing, we often use **phonetic** (or narrow) transcription to include all the allophonic details of a language, as well as stress and other details.
- For example, [ə.'tʰén̩]

Other times, we are just interested in representing the phonemes in transcription.

- This is **phonemic** (or broad) transcription and we omit details that are **predictable**.
- For example,
 - 'top' /tɒp/ (rather than [tʰɒp])
 - 'beam' /bɪm/ (rather than [bɪm̩])

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Phonetic vs. Phonemic Transcription

From now on, when we do phonetic transcription we will include the following information:

- Aspiration
- Nasalization of vowels
- Flapping
- Canadian Raising

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Aspiration

As we've already seen, voiceless stops in English (/p/, /t/, and /k/) have aspirated allophones [p^h], [t^h], and [k^h] when they are the only segment in the onset of a stressed syllable.

Word	Phonemic	Phonetic
taking	/tekiŋ/	[tʰe.kiŋ]
tally	/tæli/	[tʰæ.li]
caller	/kələr/	[kʰə.lər]
penny	/pəni/	[pʰə.ni]
attain	/əten/	[ə.'tʰen]
recant	/rəkænt/	[rə.'kʰænt]
appease	/əpiz/	[ə.'pʰiz]

▸ Compare: 'cover' [kʰə.və.ɹ] and 'discover' [dɪ.'skvə.ɹə]

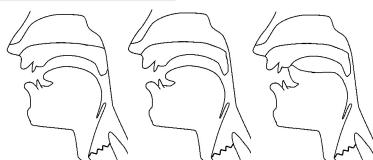
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Nasalization

Vowels that are the nucleus of syllables with a nasal consonant in the coda are nasalized.

Word	Phonemic	Phonetic
tonne	/tʌn/	[tʰʌ̃n]
country	/kʌntɪ/	[kʰʌ̃n.tɪ]
cone	/kon/	[kʰõn]
attain	/əten/	[ə.'tʰēn]
room	/uːm/	[uːm̩]
sing	/sɪŋ/	[sɪŋ̩]

Why does this happen? The velum lowers a bit early in anticipation of the following nasal consonant, allowing air to pass through the nasal cavity for part of the vowel.



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Flapping

In many North American English dialects, when the phonemes /t/ and /d/ are preceded by a stressed syllable and followed by an unstressed vowel, they are realized as [ɾ], or what we call a **flap**.

- The tongue has a more "ballistic" trajectory toward the alveolar ridge.

Word	Phonemic	Phonetic
latter	/lætər/	[l̩æ.tər]
ladder	/lædər/	[l̩æ.dər]
betting	/bɛtɪŋ/	[b̩ɛ.tɪŋ]
bedding	/bɛdɪŋ/	[b̩ɛ.dɪŋ]

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Flapping

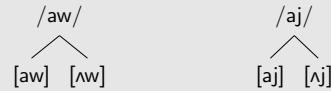
Because this process changes two phonemes into phonetically identical allophones, we get pairs of words that are pronounced the same on the surface, but **underlyingly** they are composed of different phonemes.

Root	Phonemic	Phonetic	Root+ing	Phonemic	Phonetic
'seat'	/sit/ →	[sit]	'seating'	/sitiŋ/ →	[si.ɾɪŋ]
'seed'	/sid/ →	[sid]	'seeding'	/sidɪŋ/ →	[si.ɾɪŋ]

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Canadian Raising

Most speakers of Canadian English have two separate allophones each for the phonemes /aw/ and /aj/.



- These [əw] and [ɛj] allophones occur when /aw/ and /aj/ come before voiceless consonants.

Word	Phonemic	Phonetic
right	/aɪt/	[aɪt̪]
ride	/aɪd/	[aɪd̪]
ice	/aɪs/	[aɪs̪]
eyes	/aɪz/	[aɪz̪]
house (n.)	/haws/	[haws̪]
house (v.)	/hawz/	[hawz̪]
now	/naw/	[naw̪]
pie	/paɪ/	[p̪aɪ̪]

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Canadian Raising

Canadian Raising is the reason that many Americans think Canadians say "oot and aboot"!

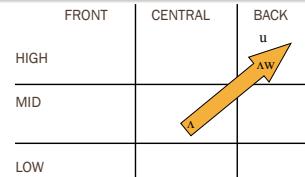


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Canadian Raising

Of course, Canadians don't say 'oot' [ut̪] or 'aboot' [əbut̪] but we also don't say [awt̪] or [ə.'bawt̪]!

When someone who doesn't speak Canadian English hears a Canadian say [awt̪] and [ə.'bawt̪], they hear a vowel different from [aw] but because they don't have [aw] in their vowel space, they perceive it as closer to [u]!



For some reason Americans don't pick up on the /aj/ → [ɛj] alternation.

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The nuts and bolts of phonology

These phonological processes/alternations are organized in speakers' mental grammars by means of **distinctive features**.

- These features are what contrast different sounds in speakers' grammars.
- These features make reference to **natural classes** of sounds (e.g., all the voiced sounds, all the labial consonants, all the high vowels)
- All the phones of language can be described in terms of distinctive features.

On page 63, in the textbook, you can find a **partial** list of the distinctive features of English sounds with their articulatory correlates.

Distinctive features of /p/, /b/, and /m/

	/p/	/b/	/m/
BILABIAL	+	+	+
CONTINUANT	-	-	-
VOICE	-	+	+
NASAL	-	-	+

Phonology	Phonotactics	Prosody	Segmental Phonology	Phonology	Phonotactics	Prosody	Segmental Phonology
Distinctive features of /p/, /b/, and /m/						Distinctive features of /p/, /b/, and /m/	

	/p/	/b/	/m/
BILABIAL	+	+	+
CONTINUANT	-	-	-
VOICE	-	+	+
NASAL	-	-	+

	/p/	/b/	/m/
BILABIAL	+	+	+
CONTINUANT	-	-	-
VOICE	-	+	+
NASAL	-	-	+

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Phonology	Phonotactics	Prosody	Segmental Phonology		
Distinctive features of /p/, /b/, and /m/					

Phonology	Phonotactics	Prosody	Segmental Phonology		
Distinctive features of /p/, /b/, and /m/					

	/p/	/b/	/m/
BILABIAL	+	+	+
CONTINUANT	-	-	-
VOICE	-	+	+
NASAL	-	-	+

	/p/	/b/	/m/
BILABIAL	+	+	+
CONTINUANT	-	-	-
VOICE	-	+	+
NASAL	-	-	+

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Phonology	Phonotactics	Prosody	Segmental Phonology		
Distinctive features of /p/, /b/, and /m/					

Phonology	Phonotactics	Prosody	Segmental Phonology		
Features and Rules: Types of Rules/Processes					

These four **distinctive features** distinguish /p/, /b/ and /m/ from each other and from all other sounds.

- Phonological processes operate over these kinds of features, changing their values from + to - or from - to +.



One common type of phonological process in languages is **assimilation**.

- Adjacent sounds can become more alike:
 - Voicing
 - Place of Articulation
 - Manner of Articulation
 - Nasalization
 - Vowel height/backness/rounding etc.

E.g., the English prefix in- /ɪn/.

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Features and Rules: An example

► inexplicable	[i.nɛk.'splɪ.kə.bəl]	ALVEOLAR
► intolerable	[ɪn.'t̪ə.lə.rə.bəl]	ALVEOLAR
► improbable	[ɪm.'p̪rə.bə.bəl]	BILABIAL
► incongruent	[ɪŋ.kən̪gr̪.ənt]	VELAR
► inflate	[ɪnf̪l̪.et]	LABIODENTAL

The *in-* prefix **assimilates** to the place of articulation of the following consonant.

- Next to a /p/, /n/ becomes [m].
- Next to a /k/, /n/ becomes [ŋ].
- Next to a /f/, /n/ becomes [ɱ].
- Next to a /t/ or a vowel, /n/ remains an [n].

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Writing Rules

We use a particular notation for writing phonological rules.

Let's use Canadian Raising as an example. We know that [aw] (and [aj]) change to [ʌw] (and [ʌj]) in a certain context or phonological environment (before a voiceless consonant).

The basics of any phonological rule.

1. State the phoneme/type of sound that's affected.
2. State what it changes to.
3. State the environment.

1 → 2 / 3

Canadian Raising: /aw/ → [ʌw] / ___ C_[-VOICE]
 /aj/ → [ʌj] / ___ C_[-VOICE]

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Features and Rules: Types of Rules/Processes

In addition to assimilation rules, languages also make use of other kinds of rules:

- **Dissimilation:** two adjacent sounds become less similar to each other.
- **Feature change:** Neither assimilation or dissimilation, just a change (e.g., aspirating /p/, /t/, and /k/).
- **Insertion** (or epenthesis): Insertion of a sound in a specific context.
 - Spanish disallows clusters like /sk/, /st/, and /sp/ in onsets, so an /e/ is inserted before the cluster, to break it up.
 - escuela 'school', estado, 'state', especial 'special',
- **Deletion:** e.g., schwa is often deleted in certain environments in English
 - 'memory': /mɛmɔ̄ji/ → [mɛm.ji]
- **Metathesis:** When two sounds switch positions (e.g., *ask*).

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Writing Rules

Another example: Flapping

/t/ and /d/ become [ɾ] when between a stressed vowel and unstressed vowel.

- /t/ → [ɾ] / 'V...V
- /d/ → [ɾ] / 'V...V

Another example: Nasalization

Vowels become nasalized when followed by a nasal consonant in the coda.

- V → [+nasal] / [__N]_σ

Discovering Phonological Processes

Phonological Processes In Other Languages

Consider this data set from Hungarian. ([a:] is a long version of an [a] and [c] is a voiceless palatal stop.)

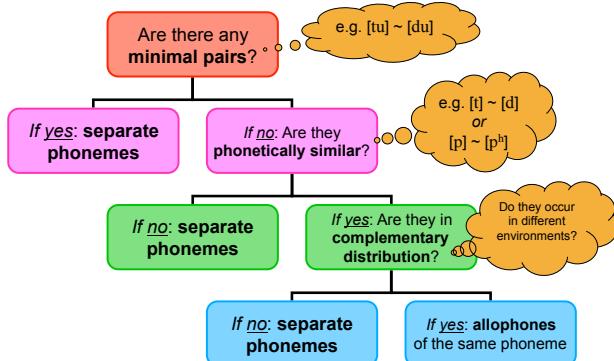
1. [bamba:n] 'foolishly'
2. [aga:r] 'greyhound'
3. [holta] 'posthumously'
4. [rak] 'to put'
5. [a:g] 'branch'
6. [ba:mul] 'wonder'
7. [ra:k] 'crayfish'

- Are [a] and [a:] separate phonemes or allophones of the same phoneme?
- If they are separate phonemes, write a rule that derives their distribution.

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How to Solve a Phonology Problem: Discovering phonological processes



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How to Solve a Phonology Problem: Discovering phonological processes

Consider this data set from Hungarian. ([a:] is a long version of an [a] and [c] is a voiceless palatal stop.)

1. [bamba:n] 'foolishly'
2. [aga:r] 'greyhound'
3. [holta] 'posthumously'
4. [rak] 'to put'
5. [a:g] 'branch'
6. [ba:mul] 'wonder'
7. [ra:k] 'crayfish'

- ▶ Are [a] and [a:] separate phonemes or allophones of the same phoneme?
- ▶ If they are separate phonemes, write a rule that derives their distribution.

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How to Solve a Phonology Problem: Discovering phonological processes

We have a minimal pair!:

- ▶ [rak] 'to put'
- ▶ [ra:k] 'crayfish'

Thus, [a] and [a:] are separate phonemes in Hungarian.

/a/	/a:/
[a]	[a:]

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How to Solve a Phonology Problem: Discovering phonological processes

Consider this data set from Greek. ([c] is a voiceless palatal stop)

1. [kano] 'do'
2. [cino] 'move'
3. [kali] 'charms'
4. [ceri] 'candle'
5. [kori] 'daughter'
6. [krima] 'shame'
7. [kufeta] 'candy'

- ▶ Are [k] and [c] separate phonemes or allophones of the same phoneme?
- ▶ If they are separate phonemes, write a rule that derives their distribution.

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How to Solve a Phonology Problem: Discovering phonological processes

Thus, [k] and [c] are allophones of a single phoneme, probably /k/.

/k/
 / \\\
 [k] [c]

/k/ → [c] / ... Front Vowels
→ [k] / ... elsewhere

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Mondegreens

Speakers of a language are generally good at segmenting the speech signal, but sometimes we get it wrong, and perceive something that wasn't said! When this happens in music, we call it a **mondegreen**.

There are a lot of examples of mondegreens out there, but here's three:

- ▶ Jimi Hendrix, *Purple Haze*
 - Lyric: 'Scuse me while I kiss the sky.'
 - Hard: 'Scuse me while I kiss this guy.'
- ▶ Shocking Blue, *Venus*
 - Lyric: I'm your venus, I'm your fire.
 - Heard: I'm your penis, I'm your fire.
- ▶ The theme song to the Fresh Prince of Bel-Air
 - Lyric: Shooting some B-Ball outside of the school.
 - Heard: Shooting some people outside of the school.

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Mondegreens

Why do mondegreens happen?

We often confuse featurally similar sounds!

- *kiss the sky*
 - [kʰɪsðəskaj] → [kʰɪsðɪsgaj]
- *your venus*
 - [jɔvɪnəs] → [jɔrpʰɪnvs]
- *some b-ball*
 - [sʌmbibal] → [sʌmpʰipəl]

Sometimes musicians take advantage of this phenomenon such as the 80s British punk band Blitz, with their song “4Q”... remember, most British dialects drop their *rs* in coda position.

Check out more: <http://www.kissthisguy.com/>

For Next Week...

1. Complete homework 3.
 - I'll post it tomorrow.
2. Read chapter 4 if you haven't yet and chapter 5.