

Day 3: Phonetics

Ling L303/L503: Introduction to Linguistic Analysis

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What is phonetics?

Phonetics

What is phonetics?

Phonetics

Definition

The scientific study of human speech sounds

- Articulatory phonetics:

What is phonetics?

Phonetics

Definition

The scientific study of human speech sounds

- Articulatory phonetics: how sounds are produced

What is phonetics?

Phonetics

Definition

The scientific study of human speech sounds

- Articulatory phonetics: how sounds are produced
- Auditory phonetics:

What is phonetics?

Phonetics

Definition

The scientific study of human speech sounds

- Articulatory phonetics: how sounds are produced
- Auditory phonetics: how sounds are perceived

What is phonetics?

Phonetics

Definition

The scientific study of human speech sounds

- Articulatory phonetics: how sounds are produced
- Auditory phonetics: how sounds are perceived
- Acoustic phonetics:

What is phonetics?

Phonetics

Definition

The scientific study of human speech sounds

- Articulatory phonetics: how sounds are produced
- Auditory phonetics: how sounds are perceived
- Acoustic phonetics: the physical properties of sounds

What is phonetics?

Phonetics

Definition

The scientific study of human speech sounds

- Articulatory phonetics: how sounds are produced
- Auditory phonetics: how sounds are perceived
- Acoustic phonetics: the physical properties of sounds
- ...but also for signed languages

Videos

Some videos to watch

- 'Phonetics', from Human Language series
- "Why did Ken set the soggy net on top of his deck?"

Goals

Goals for Phonetics section:

- Be able to *identify* human speech sounds
- Learn symbols used for *transcribing* speech sounds
- *Describe* and classify sounds according to articulatory properties
- Understand basic *analytical* methods used by phoneticians

Decoding the speech stream

- How many words in this sentence?

Decoding the speech stream



Decoding the speech stream

- How many sounds in these words?

Example

'leaf' 'feel'

Decoding the speech stream

- How many sounds in these words?

Example

'leaf' 'feel'

- 'leaf' [lif] vs. 'feel' [fi]
- 'feel' [fi] vs. 'fael' [fi] ('leaf' backwards)
- 'lull' vs. 'llul' ('lull' backwards)

Decoding the speech stream

- How many sounds in these words?

Example

'leaf' 'feel'

- 'leaf' [lif] vs. 'feel' [fi]
- 'feel' [fi] vs. 'fael' [fi] ('leaf' backwards)
- 'lull' vs. 'llul' ('lull' backwards)

- Sounds in a string are continuous
- ...but we hear them as discrete, separate sounds

Anatomy of the vocal tract

What basic organs go into producing speech?

Anatomy of the vocal tract

What basic organs go into producing speech?

- Lungs
- Larynx
- Tongue
- Oral cavity
- Nasal cavity

Anatomy of the vocal tract

Structures used for articulation

What are the major articulators used to produce speech sounds?

Anatomy of the vocal tract

Structures used for articulation

What are the major articulators used to produce speech sounds?

Structure (noun)	Descriptor (adjective)
lips	
teeth	
alveolar ridge	
hard palate	
velum (soft palate)	
nasal cavity (nose)	
glottis	

Anatomy of the vocal tract

Structures used for articulation

What are the major articulators used to produce speech sounds?

Structure (noun)	Descriptor (adjective)
lips	labial
teeth	
alveolar ridge	
hard palate	
velum (soft palate)	
nasal cavity (nose)	
glottis	

Anatomy of the vocal tract

Structures used for articulation

What are the major articulators used to produce speech sounds?

Structure (noun)	Descriptor (adjective)
lips	labial
teeth	dental
alveolar ridge	
hard palate	
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Anatomy of the vocal tract

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Anatomy of the vocal tract

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Anatomy of the vocal tract

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Anatomy of the vocal tract

Structures used for articulation

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nasal cavity (nose)	nasal
glottis	

Anatomy of the vocal tract

Structures used for articulation

What are the major articulators used to produce speech sounds?

Structure (noun)	Descriptor (adjective)
lips	labial
teeth	dental
alveolar ridge	alveolar
hard palate	palatal
velum (soft palate)	velar
nasal cavity (nose)	nasal
glottis	glottal

Anatomy of the vocal tract

Active and passive articulators

Definition (Active articulator)

Active articulator —

Anatomy of the vocal tract

Active and passive articulators

Definition (Active articulator)

Active articulator — Moves during articulation

Anatomy of the vocal tract

Active and passive articulators

Definition (Active articulator)

Active articulator — Moves during articulation

Definition (Passive articulator)

Passive articulator —

Anatomy of the vocal tract

Active and passive articulators

Definition (Active articulator)

Active articulator — Moves during articulation

Definition (Passive articulator)

Passive articulator — Remains stationary during articulation

Anatomy of the vocal tract

Active and passive articulators

Definition (Active articulator)

Active articulator — Moves during articulation

Definition (Passive articulator)

Passive articulator — Remains stationary during articulation

Examples

[v] — active: , passive:

[s] — active: , passive:

[k] — active: , passive:

Anatomy of the vocal tract

Active and passive articulators

Definition (Active articulator)

Active articulator — Moves during articulation

Definition (Passive articulator)

Passive articulator — Remains stationary during articulation

Examples

[v] — active: lower lip, passive:

[s] — active: , passive:

[k] — active: , passive:

Anatomy of the vocal tract

Active and passive articulators

Definition (Active articulator)

Active articulator — Moves during articulation

Definition (Passive articulator)

Passive articulator — Remains stationary during articulation

Examples

[v] — active: lower lip, passive: upper teeth

[s] — active: , passive:

[k] — active: , passive:

Anatomy of the vocal tract

Active and passive articulators

Definition (Active articulator)

Active articulator — Moves during articulation

Definition (Passive articulator)

Passive articulator — Remains stationary during articulation

Examples

[v] — active: lower lip, passive: upper teeth

[s] — active: tongue tip, passive:

[k] — active: , passive:

Anatomy of the vocal tract

Active and passive articulators

Definition (Active articulator)

Active articulator — Moves during articulation

Definition (Passive articulator)

Passive articulator — Remains stationary during articulation

Examples

[v] — active: lower lip, passive: upper teeth

[s] — active: tongue tip, passive: alveolar ridge

[k] — active: , passive:

Anatomy of the vocal tract

Active and passive articulators

Definition (Active articulator)

Active articulator — Moves during articulation

Definition (Passive articulator)

Passive articulator — Remains stationary during articulation

Examples

[v] — active: lower lip, passive: upper teeth

[s] — active: tongue tip, passive: alveolar ridge

[k] — active: back of tongue, passive:

Anatomy of the vocal tract

Active and passive articulators

Definition (Active articulator)

Active articulator — Moves during articulation

Definition (Passive articulator)

Passive articulator — Remains stationary during articulation

Examples

[v] — active: lower lip, passive: upper teeth

[s] — active: tongue tip, passive: alveolar ridge

[k] — active: back of tongue, passive: velum

Articulatory Description

Consonants

For consonants, three-part classification system:

Articulatory Description

Consonants

For consonants, three-part classification system:

- voicing
- place (of articulation)
- manner (of articulation)

Articulatory Description

Consonants

For consonants, three-part classification system:

- voicing
- place (of articulation)
- manner (of articulation)

Example

voiced labiodental fricative =

Articulatory Description

Consonants

For consonants, three-part classification system:

- voicing
- place (of articulation)
- manner (of articulation)

Example

voiced labiodental fricative = [v]

Articulatory Description

Voicing

Definition (Voicing)

Articulatory Description

Voicing

Definition (Voicing)

What's going on at the larynx—vocal folds vibrating or not

Articulatory Description

Voicing

Definition (Voicing)

What's going on at the larynx—vocal folds vibrating or not

- Vocal folds spread

Articulatory Description

Voicing

Definition (Voicing)

What's going on at the larynx—vocal folds vibrating or not

- Vocal folds spread = not vibrating

Articulatory Description

Voicing

Definition (Voicing)

What's going on at the larynx—vocal folds vibrating or not

- Vocal folds spread = not vibrating = voiceless

Articulatory Description

Voicing

Definition (Voicing)

What's going on at the larynx—vocal folds vibrating or not

- Vocal folds spread = not vibrating = voiceless
- Vocal folds together

Articulatory Description

Voicing

Definition (Voicing)

What's going on at the larynx—vocal folds vibrating or not

- Vocal folds spread = not vibrating = voiceless
- Vocal folds together = vibrating

Articulatory Description

Voicing

Definition (Voicing)

What's going on at the larynx—vocal folds vibrating or not

- Vocal folds spread = not vibrating = voiceless
- Vocal folds together = vibrating = voiced

Articulatory Description

Voicing

Voicing pairs

Voiceless	Voiced
[p]	<u>pat</u>
[t]	<u>tie</u>
[k]	<u>kill</u>
[f]	<u>fat</u>
[s]	<u>sip</u>
[θ]	<u>thigh</u>
[ʃ]	<u>dilution</u>
[tʃ]	<u>etch</u>

Articulatory Description

Voicing

Voicing pairs

Voiceless	Voiced
[p] <u>pat</u>	[b] <u>bat</u>
[t] <u>tie</u>	
[k] <u>kill</u>	
[f] <u>fat</u>	
[s] <u>sip</u>	
[θ] <u>thigh</u>	
[ʃ] <u>dilution</u>	
[tʃ] <u>etch</u>	

Articulatory Description

Voicing

Voicing pairs

Voiceless	Voiced
[p] <u>pat</u>	[b] <u>bat</u>
[t] <u>tie</u>	[d] <u>die</u>
[k] <u>kill</u>	
[f] <u>fat</u>	
[s] <u>sip</u>	
[θ] <u>thigh</u>	
[ʃ] <u>dilution</u>	
[tʃ] <u>etch</u>	

Articulatory Description

Voicing

Voicing pairs

Voiceless	Voiced
[p] <u>pat</u>	[b] <u>bat</u>
[t] <u>tie</u>	[d] <u>die</u>
[k] <u>kill</u>	[g] <u>gill</u>
[f] <u>fat</u>	
[s] <u>sip</u>	
[θ] <u>thigh</u>	
[ʃ] <u>dilution</u>	
[tʃ] <u>etch</u>	

Articulatory Description

Voicing

Voicing pairs

Voiceless	Voiced
[p] <u>pat</u>	[b] <u>bat</u>
[t] <u>tie</u>	[d] <u>die</u>
[k] <u>kill</u>	[g] <u>gill</u>
[f] <u>fat</u>	[v] <u>vat</u>
[s] <u>sip</u>	
[θ] <u>thigh</u>	
[ʃ] <u>dilution</u>	
[tʃ] <u>etch</u>	

Articulatory Description

Voicing

Voicing pairs

Voiceless	Voiced
[p] <u>pat</u>	[b] <u>bat</u>
[t] <u>tie</u>	[d] <u>die</u>
[k] <u>kill</u>	[g] <u>gill</u>
[f] <u>fat</u>	[v] <u>vat</u>
[s] <u>sip</u>	[z] <u>zip</u>
[θ] <u>thigh</u>	
[ʃ] <u>dilution</u>	
[tʃ] <u>etch</u>	

Articulatory Description

Voicing

Voicing pairs

Voiceless	Voiced
[p] <u>pat</u>	[b] <u>bat</u>
[t] <u>tie</u>	[d] <u>die</u>
[k] <u>kill</u>	[g] <u>gill</u>
[f] <u>fat</u>	[v] <u>vat</u>
[s] <u>sip</u>	[z] <u>zip</u>
[θ] <u>thigh</u>	[ð] <u>thy</u>
[ʃ] <u>dilution</u>	
[tʃ] <u>etch</u>	

Articulatory Description

Voicing

Voicing pairs

Voiceless	Voiced
[p] <u>p</u> at	[b] <u>b</u> at
[t] <u>t</u> ie	[d] <u>d</u> ie
[k] <u>k</u> ill	[g] <u>g</u> ill
[f] <u>f</u> at	[v] <u>v</u> at
[s] <u>s</u> ip	[z] <u>z</u> ip
[θ] <u>th</u> igh	[ð] <u>th</u> y
[ʃ] dil <u>u</u> sion	[ʒ] del <u>u</u> sion
[tʃ] <u>et</u> ch	

Articulatory Description

Voicing

Voicing pairs

Voiceless	Voiced
[p] <u>pat</u>	[b] <u>bat</u>
[t] <u>tie</u>	[d] <u>die</u>
[k] <u>kill</u>	[g] <u>gill</u>
[f] <u>fat</u>	[v] <u>vat</u>
[s] <u>sip</u>	[z] <u>zip</u>
[θ] <u>thigh</u>	[ð] <u>thy</u>
[ʃ] <u>dilution</u>	[ʒ] <u>delusion</u>
[tʃ] <u>etch</u>	[dʒ] <u>edge</u>

Articulatory Description

Place

Definition (Place of articulation)

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial — both lips

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]

Articulatory Description

Place

Definition (*Place of articulation*)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental

Articulatory Description

Place

Definition (*Place of articulation*)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth

Articulatory Description

Place

Definition (*Place of articulation*)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]

Articulatory Description

Place

Definition (*Place of articulation*)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental

Articulatory Description

Place

Definition (*Place of articulation*)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental — tip of tongue between the teeth

Articulatory Description

Place

Definition (*Place of articulation*)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental — tip of tongue between the teeth [θ], [ð]

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental — tip of tongue between the teeth [θ], [ð]
- Alveolar

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental — tip of tongue between the teeth [θ], [ð]
- Alveolar — tip or blade of tongue on near alveolar ridge

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental — tip of tongue between the teeth [θ], [ð]
- Alveolar — tip or blade of tongue on near alveolar ridge
 - [t], [d], [n], [l], [ɹ], [s], [z]

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental — tip of tongue between the teeth [θ], [ð]
- Alveolar — tip or blade of tongue on near alveolar ridge
 - [t], [d], [n], [l], [ɹ], [s], [z]
- (Alveo-)Palatal

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental — tip of tongue between the teeth [θ], [ð]
- Alveolar — tip or blade of tongue on near alveolar ridge
 - [t], [d], [n], [l], [ɹ], [s], [z]
- (Alveo-)Palatal — blade of tongue at or near hard palate

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental — tip of tongue between the teeth [θ], [ð]
- Alveolar — tip or blade of tongue on near alveolar ridge
 - [t], [d], [n], [l], [ɹ], [s], [z]
- (Alveo-)Palatal — blade of tongue at or near hard palate
 - [ʃ], [ʒ], [tʃ], [dʒ], [j]

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental — tip of tongue between the teeth [θ], [ð]
- Alveolar — tip or blade of tongue on near alveolar ridge
 - [t], [d], [n], [l], [ɹ], [s], [z]
- (Alveo-)Palatal — blade of tongue at or near hard palate
 - [ʃ], [ʒ], [tʃ], [dʒ], [j]
- Velar

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental — tip of tongue between the teeth [θ], [ð]
- Alveolar — tip or blade of tongue on near alveolar ridge
 - [t], [d], [n], [l], [ɹ], [s], [z]
- (Alveo-)Palatal — blade of tongue at or near hard palate
 - [ʃ], [ʒ], [tʃ], [dʒ], [j]
- Velar — back of tongue at or near soft palate

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental — tip of tongue between the teeth [θ], [ð]
- Alveolar — tip or blade of tongue on near alveolar ridge
 - [t], [d], [n], [l], [ɹ], [s], [z]
- (Alveo-)Palatal — blade of tongue at or near hard palate
 - [ʃ], [ʒ], [tʃ], [dʒ], [j]
- Velar — back of tongue at or near soft palate
 - [k], [g], [ŋ]

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental — tip of tongue between the teeth [θ], [ð]
- Alveolar — tip or blade of tongue on near alveolar ridge
 - [t], [d], [n], [l], [ɹ], [s], [z]
- (Alveo-)Palatal — blade of tongue at or near hard palate
 - [ʃ], [ʒ], [tʃ], [dʒ], [j]
- Velar — back of tongue at or near soft palate
 - [k], [g], [ŋ]
- Glottal

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental — tip of tongue between the teeth [θ], [ð]
- Alveolar — tip or blade of tongue on near alveolar ridge
 - [t], [d], [n], [l], [ɹ], [s], [z]
- (Alveo-)Palatal — blade of tongue at or near hard palate
 - [ʃ], [ʒ], [tʃ], [dʒ], [j]
- Velar — back of tongue at or near soft palate
 - [k], [g], [ŋ]
- Glottal — vocal fold approximation

Articulatory Description

Place

Definition (Place of articulation)

Where in the vocal tract constriction is made

- Bilabial — both lips [b], [p], [m], [w], [w̥]
- Labiodental — lower lip and upper teeth [f], [v]
- Interdental — tip of tongue between the teeth [θ], [ð]
- Alveolar — tip or blade of tongue on near alveolar ridge
 - [t], [d], [n], [l], [ɹ], [s], [z]
- (Alveo-)Palatal — blade of tongue at or near hard palate
 - [ʃ], [ʒ], [tʃ], [dʒ], [j]
- Velar — back of tongue at or near soft palate
 - [k], [g], [ŋ]
- Glottal — vocal fold approximation
 - [h], [ʔ]

Articulatory Description

Manner

Definition (Manner of articulation)

Articulatory Description

Manner

Definition (Manner of articulation)

How the air is being modified as it moves through the vocal tract

Articulatory Description

Manner

Definition (Manner of articulation)

How the air is being modified as it moves through the vocal tract

- Stops

Articulatory Description

Manner

Definition (Manner of articulation)

How the air is being modified as it moves through the vocal tract

- Stops — full obstruction in the oral cavity

Articulatory Description

Manner

Definition (Manner of articulation)

How the air is being modified as it moves through the vocal tract

- Stops — full obstruction in the oral cavity
 - [p], [b], [t], [d], [k], [g], [ʔ]

Articulatory Description

Manner

Definition (Manner of articulation)

How the air is being modified as it moves through the vocal tract

- Stops — full obstruction in the oral cavity
 - [p], [b], [t], [d], [k], [g], [ʔ]
- Fricatives

Articulatory Description

Manner

Definition (Manner of articulation)

How the air is being modified as it moves through the vocal tract

- Stops — full obstruction in the oral cavity
 - [p], [b], [t], [d], [k], [g], [ʔ]
- Fricatives — partial obstruction, with turbulence

Articulatory Description

Manner

Definition (Manner of articulation)

How the air is being modified as it moves through the vocal tract

- Stops — full obstruction in the oral cavity
 - [p], [b], [t], [d], [k], [g], [ʔ]
- Fricatives — partial obstruction, with turbulence
 - [f], [v], [θ], [ð], [s], [z], [ʃ], [ʒ]

Articulatory Description

Manner

Definition (Manner of articulation)

How the air is being modified as it moves through the vocal tract

- Stops — full obstruction in the oral cavity
 - [p], [b], [t], [d], [k], [g], [ʔ]
- Fricatives — partial obstruction, with turbulence
 - [f], [v], [θ], [ð], [s], [z], [ʃ], [ʒ]
- Affricates

Articulatory Description

Manner

Definition (Manner of articulation)

How the air is being modified as it moves through the vocal tract

- Stops — full obstruction in the oral cavity
 - [p], [b], [t], [d], [k], [g], [ʔ]
- Fricatives — partial obstruction, with turbulence
 - [f], [v], [θ], [ð], [s], [z], [ʃ], [ʒ]
- Affricates — stop followed by fricative

Articulatory Description

Manner

Definition (Manner of articulation)

How the air is being modified as it moves through the vocal tract

- Stops — full obstruction in the oral cavity
 - [p], [b], [t], [d], [k], [g], [ʔ]
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Articulatory Description

Manner

Definition (Manner of articulation)

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- Nasal — full obstruction in the oral cavity, velum lowered
 - [m], [n], [ŋ]
- Liquid

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- Nasal — full obstruction in the oral cavity, velum lowered
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- Glide — some constriction

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 - [w], [j]

Phonetic Alphabets

Why use a phonetic alphabet

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dad, father, about, many
 - Same sound, different letters:
believe, people, amoeba, tree

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shoot, nation, chord, chip
 - Multiple sounds, single letter:
box, use
 - Letters without sound:
gnaw, sword, debt, damn, bomb

Phonetic Alphabets

IPA

The IPA

Phonetic Alphabets

IPA

The IPA

Definition (IPA)

The International Phonetic Alphabet