Phonetics 2.1:  
The vowels of American English  

April 15, 2020
Recap

Characterize consonants by three main features:

(i) Voicing

(ii) Place of articulation

(iii) Manner of articulation
Extra extra sauce...

We also have centrality and nasality to describe the nature of airflow.

Last, we have terms to describe airstream generation

~⇒ What generates the airstream? (Pulmonic, Ejective, Implosive, Click)
~⇒ Does air flow out (egressive) or in (ingressive)?

Need to know: All English sounds are pulmonic, meaning they involve air flowing outward (egressive) from the lungs through the vocal tract.
Non-English sounds (do not need to know)

Non-pulmonic manners:

**Ejectives (egressive):** A stop closure is formed in the vocal tract. The glottis (gap between vocal folds) is closed and the glottis raised, building up positive pressure behind the stop closure. The closure is then released.

**Implosives (ingressive):** Stop closure formed and closed glottis moves down, creating negative pressure in the vocal tract before the closure is released.

**Clicks (ingressive):** A stop closure is formed in the vocal tract and then the back of the tongue is moved to create negative pressure in the vocal tract. Then, stop closure is released.
What is a **vowel**?

A sound produced with minimal constriction in the vocal tract and no audible friction.
Articulatory phonetics point of view for vowels

**Question**: How do we describe vowels in terms of how they’re articulated?

**Answer (for this class)**: Position of the peak of the tongue in the mouth
Main features for vowels (need to know)

**Height:** high, mid, low, near-high, low-mid...

**Backness:** front, back, central, near-back...

**Lip rounding:** rounded, unrounded
Note the position of the tongue for front [i] v. back [u]
Secondary feature for vowels (do not need to know)

Also relevant, but we’ll focus less on them in this course:

**Tenseness / “advanced tongue root” (ATR):** tense, lax
Full IPA for vowels

VOWELS

Front  Central  Back

Close  i • y  i • u  u • u

Close-mid  e • ø  θ  θ • θ  ø • ø

Open-mid  e • œ  θ  θ • θ  œ • œ

Open  a • œ  œ • œ  œ • œ

Where symbols appear in pairs, the one to the right represents a rounded vowel.
Characterizing vowels

Read the table for monophthongs as follows:

(i) Rows
   What height is the vowel

(ii) Columns
    How far front/back is the vowel

(iii) Within cell position
    Rounded (right) or unrounded (left)
Two main flavors of vowel

Two types of vowels:

(i) Monophthongs — single vowels

(ii) Diphthongs — typically a sequence two different vowels that behaves as a single vowel (not necessary for vowels to be different)

That is why there will be two tables on the next slide showing vowels for American English.
Vowels of American English

Monophthongs:
- Front high: i
- Front mid-high: i
- Front mid: æ
- Front mid-low: æ
- Back high: u
- Back mid-high: u
- Back mid: ʌ
- Back mid-low: ʌ
- Back low: a

Diphthongs:
- Front high: eɪ
- Front mid-high: ai
- Front mid: aɪ
- Front mid-low: aʊ
- Back high: ɔʊ
- Back mid-high: ɔɪ
- Back mid: aɪ
- Back mid-low: aʊ
- Back low: a
Characterizing vowels

Read the table for monophthongs as follows:

(i) Rows What height is the vowel
(ii) Columns How far front/back is the vowel
(iii) Within cell position Rounded (right) or unrounded (left)

Same principles hold for diphthong table, but note movement to show first and second part of vowel (green = start; red = end).
Don’t hate the lecturer, hate the game

The name of the game with IPA is

(i) Understand the tables
(ii) Memorize

What does each dimension mean?
Just gotta do it; makes life easier.
Typing IPA

A note on typing IPA:

Word, other conventional word processors:

http://ipa.typeit.org/

Generally best to copy from browser - careful with [g], [a], [a], [u]
\textipa{[t2N]} \rightarrow [t\eta]
Typing IPA

tipa symbol correspondence (\LaTeX):

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End of video lecture material. Use the rest of the slides to practice and eventually memorize English vowels in IPA.
Summary — Vowels

. We characterize vowels by **height**, **front/backness** and **roundedness**.

. Diphthongs function as one vowel: they begin at vowel with first symbol and finish with vowel of second symbol

(in the diagrams below, **green** = start / first vowel and **red** = end / second vowel)

. Front vowels are unrounded; back vowels are rounded, except for [ɑ]; rounding is basically irrelevant for central vowels in English, but you can consider them unrounded.
Upshot of next couple of slides: there are a lot of details in transcription; we will not grade for the details.
To help brace yourselves for the next slide

What you should know and what you shouldn’t worry about:

. Articulatory characterization (height, front/backness, roundedness) and sound for all vowels

For central vowels

. Schwa refers to [ʌ], [ə] ... (stressed, unstressed)
  .. if only one vowel in word and sounds like schwa, then it is [ʌ].
  .. in words > 1 syllables when to put [ʌ] v. [ə] 

. Rhotacized schwa [ɚ] v. consonant [ɨ]
  .. [ɨ] occurs before or after a vowel, otherwise [ɚ]
  .. potential exceptions

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Notes for the following slides and for the homework

(i) Schwa has a stressed [ɻ] and unstressed [ə] variant. These are the first vowels in butter and about respectively. If a word has only one vowel and it sounds like the first vowel in the words above, use [ɻ] (because only vowel is stressed by default). For words with more than one vowel, it can get tricky, so no need to worry about that and just use [ə] if you want. Optional: look at next slide if you want to think about stress.

(ii) Try to distinguish between [ʊ] and [ɔ]. If the sound is before or after a vowel, it is [ʊ]; otherwise, it is [ɔ]

First case = bird $\sim$ [bʊrd]
Second case = rope $\sim$ [ɹʊp]  bright $\sim$ [bɹæt]
Stress (optional)

For most purposes in English, you can think of stress being the most salient/prominent syllable in a word. If there is only one syllable, it is considered stressed by default.

We indicate stress with the mark ['] before the first sound of the syllable, so the words on the previous slide could be transcribed as:

*butter* ⇋ ['bʌrʌ]  and  *about* ⇋ [əˈbaʊt]

Salience/prominence is a tricky thing to work with, and to me it is not obvious in a lot of cases, so I think using a contrastive context is more reliable. With only very few exceptions, the stressed syllable in the first word is the only syllable of that word which can be lengthened (focused/emphasized) in that context.

**Contrastive context:** I said _____, not ______.

I said go *aroooound* the pool, not into it.  
I said get *butterrrrr*, not honey.  

[əˈraʊnd] GOOD  
[bəˈrʌ] BAD
Here is a step-by-step walkthrough of the vowels of English.
beet
beat

**Height:** high

**Backness:** front
Vowels of American English

[i]
high front vowel
Vowels of American English

Diagram of vowel positions:

- Front:
  - High: i
  - Mid-high
  - Mid
  - Mid-low
  - Low

- Central

- Back
Vowels of American English

bit

**Height:** near-high

**Backness:** near-front
Vowels of American English

[ɪ]
near-high near-front vowel
Vowels of American English

- front
- central
- back

- high
- mid-high
- mid
- mid-low
- low

Chart showing the positions of vowels in American English, with vertical axes for height (high, mid, mid-low, low) and horizontal axes for backness (back, central, front). The vowel /i/ is marked at the front, high position.
Vowels of American English

bet

**Height:** mid-low

**Backness:** front
Vowels of American English

[ε]  
mid-low front vowel
Vowels of American English

front

high

mid-high

mid

mid-low

low

central

back

The diagram illustrates the vowel space of American English, with axes for front/back and high/low, and central vowels marked with i and ε.
Vowels of American English

bat

**Height:** near-low

**Backness:** front
Vowels of American English

[æ]
near-low front vowel
Vowels of American English

boot

**Height:** high

**Backness:** back

**(Rounding:** rounded)
Vowels of American English

[u]
high back (rounded) vowel
book

**Height:** near-high

**Backness:** near-back

(Rounding: rounded)
Vowels of American English

[u]
near-high near-back (rounded) vowel
Vowels of American English

- Front vowels:
  - High: i, i
  - Mid-high: æ
  - Mid: ε
  - Mid-low: 
  - Low: 

- Central vowels:
  - High: u
  - Mid-high: 
  - Mid: 
  - Mid-low: 
  - Low: 

- Back vowels:
  - High: u
  - Mid-high: 
  - Mid: 
  - Mid-low: 
  - Low: 
bought

**Height:** mid-low

**Backness:** back

(Rounding: rounded)
Vowels of American English

[ɔ]
mid-low back (rounded) vowel
Vowels of American English

front  central  back

high  

mid-high  

mid  

mid-low  

low  

\(i\)  \(\text{ɪ}\)  \(u\)

\(\varepsilon\)  \(\text{ɛ}\)  \(\text{ɔ}\)

\(\text{æ}\)
Vowels of American English

(ro)bot

**Height:** low

**Backness:** back
Vowels of American English

[a]

low back vowel
Vowels of American English

front  central  back

high  i  I  u

mid-high

mid  ε

mid-low  æ

low  a

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Vowels of American English

Note 1: For many American English speakers, [ɔ] and [a] do not contrast with one another. You won’t lose points for mixing them up in transcription exercises. Usually, these vowels collapse to [a] and not [ɔ].

Note 2: For some speakers, the pronunciation of [a] is more central (as opposed to back). We’ll treat it as a back vowel for this class.
Vowels of American English

butt
but

**Height:** mid-low

**Backness:** central
Vowels of American English

[^]

mid-low central vowel
Vowels of American English

<table>
<thead>
<tr>
<th>front</th>
<th>central</th>
<th>back</th>
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<tr>
<td>high</td>
<td>i</td>
<td>u</td>
</tr>
<tr>
<td>mid-high</td>
<td>i</td>
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<td>mid</td>
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<tr>
<td>mid-low</td>
<td>æ</td>
<td>ə</td>
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</table>

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Vowels of American English

**Note 3:** The actual pronunciation of [ʌ] in American English is somewhere like near-back. We’ll treat it as central for this class because it has an affinity with the next (central) vowel and to simplify the distinction between [ʌ] and [ɔ].
Vowels of American English

about
halibut

**Height:** mid

**Backness:** central
[ə]
mid central vowel
“schwa”
Note 4: [ə] and [ʌ] sound very similar.

Vowels of American English

Bert
bird

**Height:** mid

**Backness:** central

**Rhotic:** the vowel is accompanied by an [ᵻ]-like sound
Vowels of American English

[ə]

mid central rhotic vowel
Vowels of American English

front     | central     | back
---       |-------------|---
high      |             | u
mid-high  |             |   
mid       |               |   
mid-low   |               |   
low       |               | a
There are different schools of thought about what to do with *bird*.

Intuition: [bud]

When we look carefully at the signal, it’s not clear that there’s any separation of the vowel and the [\textmu\textmu].
So, we’ll transcribe them as happening simultaneously with [ə].

We’ll save [ɪ] for when it’s more clearly a separate segment, like the beginning of a syllable.

*bird* [bərd]  
*rot* [ɹat]
Vowels of American English

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<th>front</th>
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<td>æ</td>
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Vowels of American English

Are we done?

Nope!

*bait, bite, bout, boy, boat*
The vowels we’ve looked at so far are simplex

→ they involve the tongue at one position.

= monophthong

The remaining vowels are complex

→ they involve the tongue moving from one position to another.

= diphthong
Vowels of American English

bait

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<td>Start</td>
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<td>front</td>
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<td>Finish</td>
<td>near-high</td>
<td>near-front</td>
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\[\text{[eI]}\]
Vowels of American English

monophthongs

front  central  back
high  i  i  u
mid-high  I  e  u
mid  e  θ  ο
mid-low  η  η  s
low  α  α  a

diphthongs

front  central  back
high  eI  eI  eI
mid-high  eI  eI  eI
mid  eI  eI  eI
mid-low  eI  eI  eI
low  eI  eI  eI
## Vowels of American English

- **bite**

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\[ [\text{aɪ}] \]
Vowels of American English

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<td>Finish</td>
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bout

\[\text{[au]}\]
Vowels of American English

- Monophthongs:
  - high front: i
  - high central: ɪ
  - high back: u
  - mid-high front: ɛ
  - mid-high central: ə
  - mid-high back: a
  - mid low front: æ
  - mid low central: ʌ
  - mid low back: a

- Diphthongs:
  - high front: ɛɪ
  - high central: ɛə
  - high back: ɑʊ
  - mid-high front: ɛə
  - mid-high central: ɛɪ
  - mid-high back: ɑʊ

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Vowels of American English

boy

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[ɪ]
# Vowels of American English

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\[\text{oʊ}\]
Vowels of American English

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Vowels of American English

Now we’re done!
Authoritative chart of vowels for our course:

![Graph showing vowel positions and examples]