Ling 403/603

Introduction to Phonology

DAY 2
CESAR KOIRALA
The science of phonetics provides descriptions and classifications of speech sounds. Phonology employs these descriptions and classifications to describe sound systems and explain sound processes.
The vocal tract

nasal cavity
oral cavity
larynx
pharynx
esophagus
trachea
lungs
bronchial tubes
The upper vocal tract

- nasal cavity
- alveolar ridge
- upper lip
- teeth
- lower lip
- tongue tip
- tongue blade
- jaw
- hard palate
- oral cavity
- velum (soft palate)
- velar port
- uvula
- tongue body (dorsum)
- tongue root
- epiglottis
- pharynx
- larynx
- trachea
The upper vocal tract
The upper vocal tract

- nasal cavity
- alveolar ridge
- upper lip
- teeth
- lower lip
- tongue tip
- tongue blade
- jaw
- hard palate
- oral cavity
- velum (soft palate)
- velar port
- uvula
- tongue body (dorsum)
- tongue root
- epiglottis
- pharynx
- larynx
- trachea
The upper vocal tract

- A bony ridge just behind the base of the upper incisors.
- The part of the roof of the mouth underlain by bone.
- A flap of soft tissue that separates the mouth from the nasal passage.
The upper vocal tract

http://www.uiowa.edu/~acadtech/phonetics/english/fram eset.html
The Larynx

(a) Larynx with vocal cords in position to vibrate
- arytenoid cartilages
- thyroid cartilage
- glottis (narrow slit suitable for vibration)
- vocal cords

(b) Open larynx (vocal cords spread)
- arytenoid cartilages
- thyroid cartilage
- glottis (wide open)
- vocal cords
Descriptions of speech sounds?
The IPA chart

- In the IPA, each sound is in a one-to-one relationship with a symbol.
- This allows us to describe the sound systems of languages without ambiguity.
- Let's look at how IPA is organized.
  - We will just look at English consonant sounds for now.
The IPA chart (Consonants)

<table>
<thead>
<tr>
<th></th>
<th>bilabial</th>
<th>labiodental</th>
<th>interdental</th>
<th>alveolar</th>
<th>palatal</th>
<th>velar</th>
<th>glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>stop</strong></td>
<td>voiceless</td>
<td>p</td>
<td></td>
<td>t</td>
<td></td>
<td>k</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td>voiced</td>
<td>b</td>
<td></td>
<td>d</td>
<td></td>
<td>g</td>
<td></td>
</tr>
<tr>
<td><strong>nasal</strong></td>
<td></td>
<td>m</td>
<td></td>
<td>n</td>
<td></td>
<td>η</td>
<td></td>
</tr>
<tr>
<td><strong>fricative</strong></td>
<td>voiceless</td>
<td>f</td>
<td>θ</td>
<td>s</td>
<td>š</td>
<td>h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>voiced</td>
<td>v</td>
<td>ō</td>
<td>z</td>
<td>ž</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>affricate</strong></td>
<td>voiceless</td>
<td></td>
<td></td>
<td></td>
<td>ĺ</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>voiced</td>
<td></td>
<td></td>
<td></td>
<td>Ľ</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>liquid</strong></td>
<td>lateral</td>
<td></td>
<td></td>
<td>l</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>retroflex</td>
<td></td>
<td></td>
<td>r</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>glide</strong></td>
<td>voiceless</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
<td>y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>voiced</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# The IPA chart (Consonants)

<table>
<thead>
<tr>
<th>Manner of articulation</th>
<th>Place of articulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>stop</td>
<td>p</td>
</tr>
<tr>
<td></td>
<td>t</td>
</tr>
<tr>
<td></td>
<td>k</td>
</tr>
<tr>
<td></td>
<td>?</td>
</tr>
<tr>
<td>voiced</td>
<td>b</td>
</tr>
<tr>
<td></td>
<td>d</td>
</tr>
<tr>
<td></td>
<td>g</td>
</tr>
<tr>
<td>nasal</td>
<td>m</td>
</tr>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>η</td>
</tr>
<tr>
<td>fricative</td>
<td>f</td>
</tr>
<tr>
<td></td>
<td>θ</td>
</tr>
<tr>
<td></td>
<td>s</td>
</tr>
<tr>
<td></td>
<td>š</td>
</tr>
<tr>
<td></td>
<td>h</td>
</tr>
<tr>
<td>voiced</td>
<td>v</td>
</tr>
<tr>
<td></td>
<td>ō</td>
</tr>
<tr>
<td></td>
<td>z</td>
</tr>
<tr>
<td></td>
<td>ž</td>
</tr>
<tr>
<td>affricate</td>
<td>ŝ</td>
</tr>
<tr>
<td>voiced</td>
<td>ĉ</td>
</tr>
<tr>
<td>voiced</td>
<td>Ľ</td>
</tr>
<tr>
<td>liquid</td>
<td>l</td>
</tr>
<tr>
<td>lateral</td>
<td></td>
</tr>
<tr>
<td></td>
<td>r</td>
</tr>
<tr>
<td>glide</td>
<td>w</td>
</tr>
<tr>
<td>voiced</td>
<td>w</td>
</tr>
<tr>
<td></td>
<td>y</td>
</tr>
</tbody>
</table>
• Sounds are characterized by various types of properties.

• There are 3 basic types of properties that, when taken together, describe consonants.

  1. Place of articulation
  2. Manner of articulation
  3. Voicing
Place of articulation
(Where is the closure?)

- Bilabial
- Labiodental
- Dental
- Alveolar
- Palato-alveolar
- Retroflex
- Palatal
- Velar
- uvular
- Pharyngeal
- Glottal

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Place of articulation
(Where is the closure?)

- Bilabial
- Labiodental
- Dental
- Alveolar
- Palato-alveolar
- Retroflex
- Palatal
- Velar
- uvular
- Pharyngeal
- Glottal

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Place of articulation
(Where is the closure?)

- Bilabial ([p],[b],[m])
- Labiodental
- Dental
- Alveolar
- Palato-alveolar
- Retroflex
- Palatal
- Velar
- Uvular
- Pharyngeal
- Glottal

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Place of articulation
(Where is the closure?)

- Bilabial ([p],[b],[m])
- Labiodental ([f], [v])
- Dental
- Alveolar
- Palato-alveolar
- Retroflex
- Palatal
- Velar
- uvular
- Pharyngeal
- Glottal

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Place of articulation
(Where is the closure?)

- Bilabial ([p],[b],[m])
- Labiodental ([f], [v])
- Dental ([θ],[ð])
- Alveolar
- Palato-alveolar
- Retroflex
- Palatal
- Velar
- uvular
- Pharyngeal
- Glottal

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Place of articulation
(Where is the closure?)

- Bilabial ([p],[b],[m])
- Labiodental ([f], [v])
- Dental ([θ],[ð])
- Alveolar([t],[d],[n],[s],[z])
- Palato-alveolar
- Retroflex
- Palatal
- Velar
- uvular
- Pharyngeal
- Glottal

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Place of articulation
(Where is the closure?)

- Bilabial ([p],[b],[m])
- Labiodental ([f], [v])
- Dental ([θ],[ð])
- Alveolar([t],[d],[n],[s],[z])
- Palato-alveolar([ʃ],[ʒ],[tʃ],[dʒ])
- Retroflex
- Palatal
- Velar
- uvular
- Pharyngeal
- Glottal

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Place of articulation
(Where is the closure?)

- Bilabial ([p],[b],[m])
- Labiodental ([f], [v])
- Dental ([θ],[ð])
- Alveolar([t],[d],[n],[s],[z])
- Palato-alveolar([ʃ],[ʒ], [tʃ],[dʒ])
- Retroflex([t], [d])
- Palatal
- Velar
- uvular
- Pharyngeal
- Glottal

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Place of articulation
(Where is the closure?)

- Bilabial ([p],[b],[m])
- Labiodental ([f],[v])
- Dental ([θ],[ð])
- Alveolar([t],[d],[n],[s],[z])
- Palato-alveolar([ʃ],[ʒ],[ʒ],[ʒ])
- Retroflex([t],[d])
- Palatal ([j])
- Velar
- uvular
- Pharyngeal
- Glottal

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Place of articulation
(Where is the closure?)

- Bilabial ([p],[b],[m])
- Labiodental ([f], [v])
- Dental ([θ],[ð])
- Alveolar ([t],[d],[n],[s],[z])
- Palato-alveolar ([ʃ],[ʒ], [tʃ],[dʒ])
- Retroflex ([ʈ],[ɖ])
- Palatal ([j])
- Velar ([k],[g], [ŋ])
- uvular
- Pharyngeal
- Glottal

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Place of articulation
(Where is the closure?)

- Bilabial ([p],[b],[m])
- Labiodental ([f], [v])
- Dental ([ð],[θ])
- Alveolar([t],[d],[n],[s],[z])
- Palato-alveolar([ʃ],[ʒ], [tʃ],[dʒ])
- Retroflex([t], [d])
- Palatal ([j])
- Velar ([k],[g], [ŋ])
- uvular [N]
- Pharyngeal
- Glottal

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Place of articulation
(Where is the closure?)

- Bilabial ([p],[b],[m])
- Labiodental ([f], [v])
- Dental ([θ],[ð])
- Alveolar([t],[d],[n],[s],[z])
- Palato-alveolar([ʃ],[ʒ], [tʃ],[dʒ])
- Retroflex([t], [d])
- Palatal ([j])
- Velar ([k],[g], [ŋ])
- uvular [N]
- Pharyngeal
- Glottal ([h],[?])

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Place of articulation
(Where is the closure?)

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Manner of Articulation
(What kind of constriction is there?)

- Ranges from completely closed to completely open:
  - Stops
    - Air flow is COMPLETELY CLOSED
  - Fricatives
  - Affricates
  - Taps/flaps
  - Trills
  - Approximants
  - (Vowels) COMPLETELY OPEN

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Manner of Articulation
(What kind of constriction is there?)

- Ranges from completely closed to completely open:
  - Stops  
    Air flow is COMPLETELY CLOSED ([p],[t],[k]...)
  - Fricatives
  - Affricates
  - Taps/flaps
  - Trills
  - Approximants
  - (Vowels)  COMPLETELY OPEN ([a],[i]..)

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Manner of Articulation
(What kind of constriction is there?)

- Ranges from completely closed to completely open:
  - Stops  Air flow is COMPLETELY CLOSED ([p],[t],[k]...)
  - Fricatives  very small amount of air passes through ---turbulent sound ([f],[s]...)
  - Affricates
  - Taps/flaps
  - Trills
  - Approximants
  - (Vowels)  COMPLETELY OPEN ([a],[i]..)

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Manner of Articulation
(What kind of constriction is there?)

Ranges from completely closed to completely open:

- **Stops**  Air flow is COMPLETELY CLOSED ([p],[t],[k]...)
- **Fricatives**  very small amount of air passes through ---turbulent sound ([f],[s]...)
- **Affricates**  stop followed by a fricative ([tʃ],[dʒ])
- **Taps/flaps**
- **Trills**
- **Approximants**
- **(Vowels)**  COMPLETELY OPEN ([a],[i]..)

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Manner of Articulation
(What kind of constriction is there?)

- Ranges from completely closed to completely open:
  - **Stops** Air flow is COMPLETELY CLOSED ([p],[t],[k]...)
  - **Fricatives** very small amount of air passes through ---turbulent sound ([f],[s]...)
  - **Affricates** stop followed by a fricative ([tʃ],[dʒ])
  - **Taps/flaps** Articulator brushes off rapidly against articulatory surface [ɾ] – e.grider
  - **Trills**
  - **Approximants**
  - **(Vowels)** COMPLETELY OPEN ([a],[i]..)

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Manner of Articulation
(What kind of constriction is there?)

- Ranges from completely closed to completely open:
  - **Stops**  
    Air flow is COMPLETELY CLOSED ([p],[t],[k]...)
  - **Fricatives**  
    very small amount of air passes through ---turbulent sound ([f],[s]...)
  - **Affricates**  
    stop followed by a fricative ([tʃ],[dʒ])
  - **Taps/flaps**  
    Articulator brushes off rapidly against articulatory surface [ɾ] –e.grider
  - **Trills**  
    Articulator vibrates near the articulatory surface [ɾ]. e.g Spanish [ɾ]
  - **Approximants**
  - **(Vowels)**  
    COMPLETELY OPEN ([a],[i]..)

[http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html](http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html)
Manner of Articulation
(What kind of constriction is there?)

- Ranges from completely closed to completely open:
  - **Stops**  
    Air flow is COMPLETELY CLOSED ([p],[t],[k]...)
  - **Fricatives**  
    very small amount of air passes through ---turbulent sound ([f],[s]...)
  - **Affricates**  
    stop followed by a fricative ([tʃ],[dʒ])
  - **Taps/flaps**  
    Articulator brushes off rapidly against articulatory surface [ɾ] –e.g. grider
  - **Trills**  
    Articulator vibrates near the articulatory surface [r]. e.g Spanish [ɾ]
  - **Approximants**  
    constriction is FAIRLY OPEN e.g [l], [j], [w]
  - **(Vowels)**  
    COMPLETELY OPEN ([a],[i]..)

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Manner of Articulation
(What kind of constriction is there?)

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Voicing

- State of glottis: Are the vocal folds vibrating or not?

http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html
Oral/Nasal

- How does air move through the vocal tract above the glottis:
  - Through the mouth only: “Oral” sounds
  - Through the nose only or through the mouth and nose: “Nasal” sounds

- [http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html](http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html)
### The Consonant Chart (Pulmonic)

#### The International Phonetic Alphabet (revised to 2005)

**Consonants** (Pulmonic)

<table>
<thead>
<tr>
<th></th>
<th>Bilabial</th>
<th>Labiodental</th>
<th>Dental</th>
<th>Alveolar</th>
<th>Post Alveolar</th>
<th>Retroflex</th>
<th>Palatal</th>
<th>Velar</th>
<th>Uvular</th>
<th>Pharyngeal</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plosive</td>
<td>p b</td>
<td></td>
<td>t d</td>
<td>t d</td>
<td>c j</td>
<td>k g</td>
<td>q g</td>
<td></td>
<td></td>
<td></td>
<td>?</td>
</tr>
<tr>
<td>Nasal</td>
<td>m nj</td>
<td></td>
<td>n</td>
<td>ē n</td>
<td>ñ ñ</td>
<td>ñ ñ</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trill</td>
<td>B</td>
<td></td>
<td>r</td>
<td>ι ι</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tap or Flap</td>
<td>ñ</td>
<td></td>
<td>r</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fricative</td>
<td>φ β</td>
<td>f v</td>
<td>θ ð</td>
<td>s z</td>
<td>ž ž</td>
<td>c j</td>
<td>x y</td>
<td>χ ψ</td>
<td>h Ɪ</td>
<td>h Ɬ</td>
<td>h Ɪ</td>
</tr>
<tr>
<td>Lateral Fricative</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>l Ʝ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approximant</td>
<td>u</td>
<td>j</td>
<td>l Ʝ</td>
<td>j Ʝ</td>
<td>m Ʝ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral Approximant</td>
<td></td>
<td></td>
<td>l</td>
<td>Ʝ Ʝ</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

[http://www.phonetics.ucla.edu/course/chapter1/chapter1.html](http://www.phonetics.ucla.edu/course/chapter1/chapter1.html)
The consonant chart (non_pulmonic)

Airflow comes from the tongue body

Airflow comes from the motion of the larynx with inward airflow

Airflow comes from the motion of the larynx with outward airflow

**CONSONANTS (NON-PULMONIC)**

<table>
<thead>
<tr>
<th></th>
<th>Voiced implosives</th>
<th>Ejectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clicks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bilabial</td>
<td>ɓ</td>
<td>’</td>
</tr>
<tr>
<td>Dental</td>
<td>ɗ</td>
<td>p’</td>
</tr>
<tr>
<td>(Post)alveolar</td>
<td>ʱ</td>
<td>t’</td>
</tr>
<tr>
<td>Palatoalveolar</td>
<td>ɠ</td>
<td>k’</td>
</tr>
<tr>
<td>Alveolar lateral</td>
<td>ʢ</td>
<td>s’</td>
</tr>
</tbody>
</table>

Examples: Bilabial, Dental/Alveolar, Palatal, Velar, Alveolar fricative

http://www.phonetics.ucla.edu/course/chapter1/chapter1.html
Vowels can also be characterized using 3 basic properties:

- Height
- Backness
- Rounding
Vowels can also be characterized using 3 basic properties:

- **Height**: How high is the tongue body?
- **Backness**: How front, in the mouth, is the body of the tongue?
- **Rounding**: Are the lips rounded?

[http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html](http://www.uiowa.edu/~acadtech/phonetics/english/frameset.html)
3 dimensional classification of English Vowels
# Examples

## Vowels and Diphthongs

<table>
<thead>
<tr>
<th></th>
<th>Front Unrounded</th>
<th>Central Unrounded</th>
<th>Back Unrounded</th>
<th>Back Rounded</th>
<th>Diphthongs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upper high</strong></td>
<td>/i/ beat</td>
<td></td>
<td>/u/ boot</td>
<td>/ɔ/</td>
<td>/ai/, /au/, /ɔi/</td>
</tr>
<tr>
<td><strong>Lower high</strong></td>
<td>/i/ bit</td>
<td></td>
<td>/u/ foot</td>
<td>/ə/</td>
<td>bite, bout, Coit</td>
</tr>
<tr>
<td><strong>Upper mid</strong></td>
<td>/ɛi/ bait</td>
<td>/ɔ/ abbot</td>
<td>/ɔu/ boat</td>
<td>/ɔ/ bought</td>
<td>Rhotacized upper mid central unrounded</td>
</tr>
<tr>
<td><strong>Lower mid</strong></td>
<td>/ɛ/ bet</td>
<td></td>
<td>/ʌ/ but</td>
<td>/ɔ/</td>
<td></td>
</tr>
<tr>
<td><strong>Low</strong></td>
<td>/æ/ bat</td>
<td></td>
<td>/ɑ/ father</td>
<td>/ɔ/</td>
<td>Bert</td>
</tr>
</tbody>
</table>
IPA chart for vowels

http://www.phonetics.ucla.edu/course/chapter1/chapter1.html
Practice

Refer to the IPA chart and give the description for the group of sounds below.

(1) [Ө, ð]
Dental Fricatives

(2) [m, n, ɳ]

(3) [k, g, ɳ]

(4) [i, u]
Practice

Refer to the IPA chart and give the description for the group of sounds below.

(1) [ϴ, ð]
Dental Fricatives

(1) [m, n, η]
Nasals

(3) [k, g, η]
Velar Consonants

(4) [i, u]
High Tense Vowels
Diphthongs

- Two part vowel
- Combination of vowel and glide
- Single syllable

e.g.  [aI] as in ride
      [eI] as in bay
Phonetic Transcriptions

Representing pronunciation of a word using phonetic symbols.
Testing your knowledge of IPA symbols

- Give the conventional spelling for the following phonetically transcribed words. The first one (a) is given as an example.

a. [kaɪt] ‘kite’
b. [baks]
c. [ʃak]
d. [ritʃ]
e. [rIðm]
Testing your knowledge of IPA symbols

- Give the conventional spelling for the following phonetically transcribed words. The first one (a) is given as an example.

a. [kaIt] ‘kite’
b. [baks] ‘box’
c. [ʃak] ‘shock’
d. [ritʃ] ‘rich’
e. [rIðm] ‘rhythm’
Phonetic Transcription

- Transcribe the following words. The first one (a) is given as an example.

  a. Batch [bætʃ]
  b. Move
  c. Breathe
  d. Easy
  e. Women
Phonetic Transcription

- Transcribe the following words. The first one (a) is given as an example.

  a. Batch [bætʃ]
  b. Move [muv]
  c. Breathe [brið]
  d. Easy [izi]
  e. Women [wImn]
Phonetic Transcription

- Transcribe the following words. The first one (a) is given as an example.

a. Batch [bætʃ]
b. Move [muv]
c. Breathe [brið]
d. Easy [izi]
e. Women [wImn]
Stress is the degree of loudness or effort with which a syllable is pronounced. Languages, like English, make distinctions of stress. Hence, it is necessary to represent stressed syllable in transcriptions.

- Syllable break  \( \text{ri.ækt} \)

- Primary stress
- Secondary stress  \( \text{'founə'tʃen} \)
Representing syllables and stress

Transcribe the following words. Please indicate primary stress. The first one (a) is given as an example.

(a) Ahead -> [ə'hɛd]
(b) Sing
(c) Behold
(d) Onion
Representing syllables and stress

Transcribe the following words. Please indicate primary stress. The first one (a) is given as an example.

(a) Ahead -> [ə'hɛd]
(b) Sing -> ['siŋ]
(c) Behold -> [bi'hold]
(d) Onion -> ['ʌnjən]