Announcements

HW1 due at the end of class today

Review questions for phonological development available

HW2 available (not due till 2/23/12 – after midterm), but helpful for studying for the midterm

All kinds of useful sound charts available (including interactive ones, in case you forget what sound corresponds to what symbol).
Our Strange Lingo, by Lord Cromer (1902)

When the English tongue we speak,
Why is break not rhymed with freak?
Will you tell me why it's true
We say sew but likewise few?
And the maker of the verse,
Cannot rhyme his horse with worse?
Beard is not the same as heard.
Cord is different from word.
Cow is cow but low is low.
Shoe is never rhymed with foe.
Think of hose, dose, and lose.
And think of goose and yet with choose.

... Think of comb, tomb and bomb,
Doll and roll or home and some.
Since pay is rhymed with say
Why not paid with said I pray?
Think of blood, food and good.
Mould is not pronounced like could.
Wherefore done, but gone and lone -
Is there any reason known?
To sum up all, it seems to me
Sound and letters don't agree.

One Sound - Many Characters

International Phonetic Alphabet: [i]

ipa: [u]
### One Character - Many Sounds

<table>
<thead>
<tr>
<th>single character</th>
<th>sounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>dame</td>
<td>c</td>
</tr>
<tr>
<td>dad</td>
<td>æ</td>
</tr>
<tr>
<td>father</td>
<td>੒, a</td>
</tr>
<tr>
<td>call</td>
<td>ï, ë</td>
</tr>
<tr>
<td>village</td>
<td>ë</td>
</tr>
<tr>
<td>many</td>
<td>ë</td>
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</table>

### One Sound - Multiple Letters

<table>
<thead>
<tr>
<th>word</th>
<th>sound</th>
</tr>
</thead>
<tbody>
<tr>
<td>shoot</td>
<td>ʃ</td>
</tr>
<tr>
<td>either</td>
<td>ð</td>
</tr>
<tr>
<td>character</td>
<td>k</td>
</tr>
<tr>
<td>deal</td>
<td>i</td>
</tr>
<tr>
<td>Thomas</td>
<td>t</td>
</tr>
<tr>
<td>physics</td>
<td>f</td>
</tr>
<tr>
<td>rough</td>
<td>r</td>
</tr>
</tbody>
</table>

### One Letter - 0, 1, 2 Sounds

<table>
<thead>
<tr>
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<th>sounds</th>
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</thead>
<tbody>
<tr>
<td>mnemonic</td>
<td>4</td>
</tr>
<tr>
<td>psychology</td>
<td>4</td>
</tr>
<tr>
<td>resign</td>
<td>4</td>
</tr>
<tr>
<td>ghost</td>
<td>= no sound!</td>
</tr>
<tr>
<td>island</td>
<td></td>
</tr>
<tr>
<td>whole</td>
<td></td>
</tr>
<tr>
<td>debt</td>
<td></td>
</tr>
<tr>
<td>cute</td>
<td>[kju:ə]</td>
</tr>
<tr>
<td>= 2 sounds!</td>
<td></td>
</tr>
</tbody>
</table>

### Differences across Languages

<table>
<thead>
<tr>
<th>language</th>
<th>words</th>
<th>sounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>judge, juvenile, Jesus</td>
<td>[dʒ]</td>
</tr>
<tr>
<td>Spanish</td>
<td>jugar, Jesus</td>
<td>[b]</td>
</tr>
<tr>
<td>German</td>
<td>Jugend, jubeln, Jesus</td>
<td>[j]</td>
</tr>
<tr>
<td>French</td>
<td>Jean, j’accuse, jambon</td>
<td>[ʒ]</td>
</tr>
</tbody>
</table>
International Phonetic Alphabet

Sounds: Speech Production

How you look to a phonetician

How you look to a phonetician

- Palate
- Velum
- Tongue
- Glottis (vocal folds)
- Lips, teeth etc.

- Nasal Cavity
- Oral Cavity
Major division: consonants vs vowels

Consonantal sounds: narrow or complete closure somewhere in the vocal tract.

Vowels: very little obstruction in the vocal tract. Can form the basis of syllables (also possible for some consonants).

Describing Speech Sounds

Where/how is the air flowing? (manner of articulation) *nasal/oral, stop, fricative, liquid, tap/flap* etc.

Where is the air-flow blocked? (place of articulation) *labial, alveolar, palatal, velar* etc.

What are the vocal folds doing? (voicing) *voiced vs. voiceless*
Where is the air flow blocked?

labiodental
[v] [f]

Where is the air flow blocked?

interdental
[θ] [ð]

Where is the air flow blocked?

alveolar
[d] [t] [n] [s] [z] [l] [ɹ]

right

Where is the air flow blocked?

postalveolar and palatal
[s] [ʃ] [dʒ] [tʃ]

shut, judge, church
Manner - How the Air is Flowing

** Stops **
[p] [t] [k] [b] [d] [g] [m] [n] [ŋ]

** Fricatives **
[f] [v] [θ] [ð] [s] [ʃ] [ʒ]

** Approximants/Glides **
[w] [j] (Like in “water” and “you”)

** Liquids **
[ɹ] [l]

** Tap/Flap **
[r] (Like in “water” and “butter”)
Fricatives & Affricates

Palatal sounds [ʒ] [ʃ] [dʒ] [tʃ]

Palatal Fricatives – [ʒ] [ʃ]  
[note: according to IPA chart these are strictly ‘post-alveolar’]

Affricates - combination of stop + fricative - [dʒ] [tʃ] as in judge, church

(ex: affricate in fast speech: “What should…?”, “What did you do? = Whad ja do)  
[tʃ] [dʒ]

Said fast, this sounds like “Whachould…?” or “Whajado?”

What are the vocal folds doing?

Voiced & Voiceless Consonants

Consonants either voiced or voiceless.

English pairs:

\[
\begin{array}{llllll}
  b & p & v & f & d & t \\
  z & s & ð & θ & f & tʃ dʒ \\
\end{array}
\]

Describing Sounds
Features

Ways of describing sounds

e.g., [t] = voiceless, alveolar, stop

Stronger claim: features are the smallest building blocks of language, used to store sounds in the mind

Atoms of Speech

Roman Jakobson, 1896-1982

Features

Prediction: by combining a small number of atomic features, it should be possible to create a larger number of speech sounds

Goal: a set of universal features should make it possible to describe the speech sounds of all of the languages of the world

Different languages choose different feature combinations
<table>
<thead>
<tr>
<th></th>
<th>bi-labial</th>
<th>labio-</th>
<th>lateral</th>
<th>alveolar</th>
<th>palatal</th>
<th>velar</th>
<th>glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>oral</td>
<td>p</td>
<td>t</td>
<td>k</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nasal</td>
<td>m</td>
<td>n</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fricative</td>
<td>φ</td>
<td>f</td>
<td>s</td>
<td>j</td>
<td>χ</td>
<td>h</td>
<td></td>
</tr>
<tr>
<td>affricate</td>
<td>β</td>
<td>v</td>
<td>z</td>
<td>j</td>
<td>χ</td>
<td>h</td>
<td></td>
</tr>
<tr>
<td>liquid</td>
<td>l</td>
<td>d</td>
<td>m</td>
<td>j</td>
<td>χ</td>
<td>h</td>
<td></td>
</tr>
<tr>
<td>glide</td>
<td>j</td>
<td>m</td>
<td>w</td>
<td>j</td>
<td>χ</td>
<td>h</td>
<td></td>
</tr>
</tbody>
</table>

- "Fuji" "Cuba"
- "año"
- "Bach" "agua"
- "caballo"
The parts we care about for this class

The International Phonetic Alphabet (revised to 1993)

<table>
<thead>
<tr>
<th>Consonants (IPUMO)</th>
<th>Bilabial</th>
<th>Labio-dental</th>
<th>Inter-dental</th>
<th>Alveolar</th>
<th>Palatal</th>
<th>Velar</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front</td>
<td>b</td>
<td>d</td>
<td>k</td>
<td>g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nasal</td>
<td>m</td>
<td>n</td>
<td>ŋ</td>
<td>ñ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fricative</td>
<td>β̂</td>
<td>θ̂</td>
<td>ŝ</td>
<td>χ̂</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>affricate</td>
<td>β̂</td>
<td>θ̂</td>
<td>ẑ</td>
<td>χ̂</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>glide</td>
<td>j̃</td>
<td>m̃</td>
<td>w̃</td>
<td></td>
<td></td>
<td></td>
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IPA (full) chart

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<tbody>
<tr>
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<td>k̂</td>
<td>ĝ</td>
<td>m̂</td>
<td>n̂</td>
<td>ŋ̂</td>
</tr>
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<td>χ̂</td>
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<td>affricate</td>
<td>β̂</td>
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<td>ẑ</td>
<td>χ̂</td>
<td>β̂</td>
<td>θ̂</td>
<td>ẑ</td>
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<tr>
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<td>m̃</td>
<td>w̃</td>
<td></td>
<td></td>
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VOWELS
What can you do to alter the shape of your vocal tract?
You can:

(1) Raise or lower your tongue
(2) Advance or retract your tongue
(3) Round or spread your lips
(4) Tense or not tense your mouth

So what vowels do you have?

[i] “sheep, sleep”
[u] “ship, slip”
So what vowels do you have?

i ɪ “laid, spade, trade”
e ɛ “led, sped, tread”
æ “bat, lad”

u “Luke, who’d, suit”
“look, hood, soot”

o “coat, wrote, hoed”
“caught, wrought, hawed”
So what vowels do you have?

“bah, father, cot, Don”

“but, putt, rut”

So here they are!
The full(er) vowel chart

Cross-language Differences

Feature Combinations
- English: back vowels are rounded, others are not
- German/French has high, front, rounded vowel [y]
- Russian has high back unrounded vowel [ɯ]

- Many languages don’t make the tense/lax distinction found in English (ex: Spanish [i], rather than [i] and [ɪ])
- Many languages distinguish short and long vowels (unlike English), ex: Japanese [i] vs. [iː]

Cross-language Differences

Languages carve up the acoustic space in different ways. Children find these categories (called phonemes), based on the distributions of sounds they hear in their linguistic environment (using statistical learning).
Diphthongs: Two vowel-ish sounds together

- "side, my, kind"
- "loud, brow, hour"

- a
- aj or aɪ
- aɪ
- aw or aʊ
Diphthongs: Two vowel-ish sounds together

More details of American English pronunciation
http://en.wikipedia.org/wiki/General_American

Speech Production - Summary
Airflow set in vibration by vocal folds
Airflow modified by vocal tract
Consonants: narrowing or blocking of oral/nasal cavity
Vowels: shaping of oral cavity
Different languages choose different selections of these
Speech Perception

Speech production processes must be undone by the ear.

Motions of articulators must be reconstructed from patterns of air vibration.

Requires extremely precise hearing, possibly a system specialized for hearing speech.

Substantially developed at birth.

Questions?

You should be able to do question 1 on HW2, and up through question 2 on the phonological review questions.