Psych 3371 / Ling 3701: Language and the Mind – Lecture 05

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WEAVER++ (Levelt & al’99) model of language production errors:

1. **conceptual preparation** → **concept**
   given previous concept(s), prev. lemma(s), traversing event participants

2. **lexical selection** → **lemma** (Escort): a classification for concepts
   given concept, facil. by recent use of word (evid. from lexical priming)

3. (syn. prediction) → expected category, incl. diacritic feats (VP-prog)
   given previous expected category, previous lemma

4. **morphological encoding** → **morphemes** (escort -ing)
   given lemma (Escort), expected cat (VP-prog), prev. morpheme (escort)

5. **phonological encoding / syllabification** → **phon. word** (/ə 'skɔr tɪŋ/)  
   given morphemes (escort -ing), prev. words (/'bi/) – may be swapped
   ▶ phon. words made of **syllables**, indexed by position (may be swapped)
   ▶ syllables made of **phonemes**, indexed by position (may be swapped)

6. **phonetic encoding** → **phonetic gestural score** (voice/tongue/lips)
   given syllable (/ɪŋ/), previous voice/tongue/lip state, ...

7. **articulation** → **sound wave** (end of model)
Linguistic competence

Language production gives clues to linguistic categorizations / ‘competences’

1. referents / concepts:
   ▶ tip of tongue phenomena (have concept, lack word)

2. syntactic constituents:
   ▶ speech repairs (play harp by – uh play..., not play harp by – uh harp...)

3. lexemes:
   ▶ tip of tongue phenomena (distinct from referent)

4. morphemes:
   ▶ over-regularization in child language acquisition (eat + ed)

5. syllables:
   ▶ Spoonerisms (Cavalerie → Calaverie)

6. phonemes:
   ▶ Spoonerisms (distinct from syllable)
A **phonemic inventory** is a set of speech sounds distinguished in a language. These distinguished sounds are called the **phonemes** of that language.

People are efficient, distinguishing words by phoneme (\textit{cap/cat}) → large set. But people are sloppy, so phonemes can’t be too close together → small set. Balance (in English) is a phoneme set of about 40 or so.

We break down phonemes by...

- **prosodic classes**: classed by whether phones can receive stress
  - **vowel** – can receive syllable stress
  - **consonant** – cannot receive syllable stress

- **articulatory classes**: classed by how phones are produced
  - **obstruant** – characterized by ‘white noise’ from obstructed vocal tract
  - **sonorant** – unobstructed, just voicing sound

- **articulatory properties**: details of how phones are produced
Phonological competence: (1) phonemic inventory

articulatory properties: details of how phones are produced...

- **voicing**: laryngeal vocal folds ‘raspberry’ sound, resonates in throat
- **manner of articulation**: different sequences of actions in vocal tract

for obstruent consonants:

- **oral stop** – complete obstruction (+ optional plosive burst): p, b, t, d, k, g, ?
- **fricative** – sustained obstruent noise: f, v, θ(th), ð(dh), s, z, j(sh), ʒ(zh)
- **affricate** – stop followed by fricative: tʃ(ch), dʒ(jh)

for sonorant consonants:

- **nasal stop** – voicing, lips closed, velum open to nasal cavity: n, m, ŋ(ng)
- **approximant** – obstruction but no obstruent noise: w, r, l, j(y sound)
- **flap** – tap roof of mouth: r

for (sonorant) vowels:

- **monophthong** – single static vowel: i, i, e, æ, ə, ɔ, ɔ, u, ɔ, ɔ
  i(beat), i(bit), e(bet), æ(bat), ə, ɔ, (bert), ɔ(-er), u(boot), ɔ(book), ɔ(bot)
- **diphthong** – blend of two vowels from beginning to end: ei, ju, ai, au, ou, ɔi
Phonological competence: (1) phonemic inventory

articulatory properties: details of how phones are produced...

- place of articulation: continuous dimensions of location in vocal tract
  for consonants:
  - **bilabial** – obstruction betw. lips: p, b, m, w
  - **labiodental** – obstruction betw. lip and teeth: f, v
  - **dental** – obstruction betw. tongue and teeth: θ, ð
  - **alveolar** – obstruction betw. tongue and alveolar ridge: t, d, s, z, n, r, l, r
  - **postalveolar** – obstruction betw. tongue and ant. hard palate: ʃ, ʒ, ʒ, θ
  - **palatal** – obstruction betw. tongue and hard palate: j
  - **velar** – obstruction betw. tongue and velum: k, g, ɳ
  - **glottal** – obstruction betw. glottis and top of trachea: ?, h

for vowels: **front** – back

for vowels: **low** – **high**
### Phonological competence: (1) phonemic inventory

<table>
<thead>
<tr>
<th>manner of articulation (+ vowel height place)</th>
<th>place of articulation (front – back long vocal tract)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>of lip:</td>
</tr>
<tr>
<td></td>
<td>lip teeth</td>
</tr>
<tr>
<td></td>
<td>of tongue:</td>
</tr>
<tr>
<td></td>
<td>teeth a.r. palate velum glottis</td>
</tr>
<tr>
<td>unvoiced (slow) oral stop:</td>
<td>p t k</td>
</tr>
<tr>
<td>unvoiced fricative:</td>
<td>f θ s ʃ</td>
</tr>
<tr>
<td>unvoiced affricate:</td>
<td></td>
</tr>
<tr>
<td>voiced (fast) oral stop:</td>
<td>b d g ?</td>
</tr>
<tr>
<td>voiced fricative:</td>
<td>v ɹ z ö</td>
</tr>
<tr>
<td>voiced affricate:</td>
<td></td>
</tr>
<tr>
<td>nasal stop:</td>
<td>m n ŋ</td>
</tr>
<tr>
<td>approximant:</td>
<td>w r,l j</td>
</tr>
<tr>
<td>flap:</td>
<td>r</td>
</tr>
<tr>
<td>vowel, high:</td>
<td>i u i ɹ ʊ</td>
</tr>
<tr>
<td>vowel, middle:</td>
<td>e ə o</td>
</tr>
<tr>
<td>vowel, low:</td>
<td>æ a</td>
</tr>
</tbody>
</table>

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Language and the Mind, Lecture 05
Phonological competence: (1) phonemic inventory

Languages carve phonological/articulatory space into phonemes.

Different languages divide this space differently:

English: /r/ → [ɾ], /l/ → [ɭ]
Korean: /L/ → [ɾ] or [ɭ]

English: /p/ → [p] or [pʰ]
Korean: /p/ → [p], /pʰ/ → [pʰ]

Questions about phonemes?
Continuing with other areas of phonological competence...

**Phonological rules** are rules for pronouncing phonemes in different contexts. They exploit redundant information in **allophones**: alternate pronunciations. When allophones are context-specific, this redundancy can help disambiguate.

Some examples:

- `/p/ → [pʰ]` only in stressed syllable.
- `/t/ or /d/ → [ɾ]` only between vowels in onset of unstressed syllable.
- lengthen vowels before voiced consonant: `/æd/ → [æːd]`
- vowel preceding nasal must be nasalized: `/æn/ → [ãːn]`
- `/l/ → [l]` ‘light’ at beginning of word (*leap*), `/l/ → [ɬ]` ‘dark’ at end (*peal).*

Allophones differ from phonemes because they do not distinguish words. Violations of these rules just sound wrong (‘ungrammatical’).
Phonological competence: (3) phonotactic constraints

**Phonotactic constraints** are rules for placing phonemes in syllables.

**Syllables** are metric units made of vowels (stressable), consonants (no stress):

```
<table>
<thead>
<tr>
<th></th>
<th>Syllable</th>
<th>Rhyme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Onset</td>
<td>Nucleus</td>
</tr>
<tr>
<td></td>
<td>C (consonant)</td>
<td>V (vowel)</td>
</tr>
<tr>
<td>/l/</td>
<td>/ɛ/</td>
<td></td>
</tr>
<tr>
<td>/str/</td>
<td>/s/ or /θ/</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C (consonant)</td>
<td>Coda</td>
</tr>
<tr>
<td></td>
<td>/ŋ/ or /ŋ/</td>
<td></td>
</tr>
</tbody>
</table>
```

Example constraint:
All of /bl/, /pl/, /gl/, and /kl/ can occur in onset: *blaze, place, glass, class.*
But /dl/ and /tl/ can only occur between syllables: *bedlam, butler.*

This may help identify syllables and segment words during comprehension.
Prosody defines allowable pitch patterns and metric rhythms.

**Syllabic stress**: higher pitch, louder, longer vowel for some syllables. It helps distinguish words: *PERmit* (document) / *perMIT* (to allow)

Some languages (Chinese) have more than one. These are called **tones**.

**Rhythm**: patterns of syllabic stress.
In **stress-timed** languages (English), time between stresses is regular. May help gauge speed, calibrate distinction between voiced/unvoiced stops.

**Intonation**: pitch pattern (end is low for statement, high for question)

*My computer has wireless.* / *My computer has wireless?*

**Pitch accent** (default end prominence): *Tony disconnected the MODEM.*

**Focus accent** (give prominence to answer of question):

*Who disconnected the modem? TONY disconnected the modem.*
*What did Tony do to the modem? Tony DISCONNECTED the modem.*