Phonotactics: Putting Sounds Together to form Syllables and Words

Karen Dacy
Academic Skills
The University of Melbourne

Phonotactic Errors
Sequential or linear errors in words
- Sounds: are left out
- are substituted
- order is reversed (Consonant Clusters: CC)
- vowels are inserted between consonants (CC)

Phonotactic Errors in English from a Variety of L1 Speakers

<table>
<thead>
<tr>
<th>Word</th>
<th>Realisation</th>
<th>L1</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explain</td>
<td>/ɛks'plein/</td>
<td>Thai</td>
<td>/ɛks'plein/</td>
</tr>
<tr>
<td>Fleming</td>
<td>/fəmɪŋ/</td>
<td>Vietnamese</td>
<td>/fəmɪŋ/</td>
</tr>
<tr>
<td>technology</td>
<td>/tekˈnɒlədʒi/</td>
<td>Thai</td>
<td>/tekˈnɒlədʒi/</td>
</tr>
<tr>
<td>brokerage</td>
<td>/brəˈkeɪdʒ/</td>
<td>Cantonese</td>
<td>/brəˈkeɪdʒ/</td>
</tr>
<tr>
<td>spoons</td>
<td>/spɔnts/</td>
<td>Spanish</td>
<td>/spauz/</td>
</tr>
<tr>
<td>dream</td>
<td>/drɛm/</td>
<td>Vietnamese</td>
<td>/drɛm/</td>
</tr>
<tr>
<td>school</td>
<td>/skɔl/</td>
<td>Vietnamese</td>
<td>/skɔl/</td>
</tr>
</tbody>
</table>

What Makes Learner’s Speech Hard to Understand?
Intonation and Rhythm? (Brazil 1994) (Keys, 2000) (Fraser 2001)
Jenkins: “Lingua Franca Core” includes 'repertoire of consonants and consonant clusters.'
Huang and Radant (2009) majority of Mandarin learner errors in English are phonotactic.
Gasser (2006) Tonal languages have simpler segmental structure because distinctions are carried in tones.

What Pronunciation Skills do these Learners have?

- Intonation patterns? ✓
- Word stress? ✓
- Accurate vowel sounds? ✓
- Range of English consonants? ✓
- Ability to produce consonants in all positions and combinations in English words and syllables? ✗
Your Turn…

Vietnamese /ŋok/ Ngoc
Russian /kto/
Greek /kseo/
Italian /pane/ /pan:e/ (pane vs panne)

How do Phonotactic Rules Work?

Based on the syllable:

Syllable

Rhyme

Onset Peak Coda

(from Gussenhoven and Jacobs, 2005)

Syllable structures in Thai, Vietnamese and English

<table>
<thead>
<tr>
<th>Language</th>
<th>Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>(C)(C)(V) (V) (C)(C)</td>
</tr>
<tr>
<td>Thai</td>
<td>C(R)(V)(C2) 2+h dg</td>
</tr>
<tr>
<td>Mandarin</td>
<td>G(V)(C2)</td>
</tr>
<tr>
<td>Vietnamese</td>
<td>G(V)(C2)</td>
</tr>
</tbody>
</table>

Sonority Sequencing Principle

Hierarchy of sonority within the syllable

<table>
<thead>
<tr>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

Principle of syllable well formedness

No language has a complete repertoire of these ranked differently in different languages

2 kinds of constraints

• Markedness
• Faithfulness

Optimality Theory: a Quick Look

Universal principles of syllable well formedness

Minimum Sonority Distance Principle

Optimality Theory (faithfulness versus L1 and universal constraints)(Prince and Smolensky, 2004)

Perceptual Salience Model (Coté, 2000)
Perceptual Salience (Côté, 2000)

Sounds are deleted or epenthesised according to the acoustic energy

- in the sound itself (voice, length, loudness)
- position – either enhances or diminishes acoustic energy

  e.g. Onset versus coda

- Proximity to vowel CCCV
- Proximity to similar consonants

My Research

Experiment

13 speakers of Thai L1
Repeated 100 words containing consonant clusters
Words two syllables or less

  e.g. explain, transfer, software, abstract

Observations and Findings

Position Effect: Final clusters hardest
Medial Clusters: No clear pattern

Perceptual Salience: More sonorant clusters better preserved

Sonority Sequencing principle:
Evident in processes of students with high overall errors; not low overall errors

Faithfulness and Markedness Constraints: Some evidence of a role
Increased Cluster Length: Very long clusters much harder

Position Effect: Final clusters hardest

Expected. Fujimura et al (***) Consonants in onset are louder and clearer than consonants in the coda – supports perceptual salience.

Medial Clusters: No clear pattern

Maximum Onset Principle (Gussenhoven and Jacobs, 2005) Divide medial clusters into the shortest coda and the longest onset:

  excuse → /ek-skju:z/

Perceptual Salience or Reranking of Constraints?

<table>
<thead>
<tr>
<th>Word</th>
<th>Target</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>exciting</td>
<td>/ekasitin/</td>
<td>/eit/</td>
</tr>
<tr>
<td>example</td>
<td>/eg-lempil/</td>
<td>/ek-sæmpl/</td>
</tr>
<tr>
<td>break</td>
<td>/bre ɪ/</td>
<td>/bre r/</td>
</tr>
<tr>
<td>expect</td>
<td>/ek-spekt/</td>
<td>/e-spek/</td>
</tr>
<tr>
<td>went</td>
<td>/went/</td>
<td>/wents/</td>
</tr>
<tr>
<td>hand</td>
<td>/hænd/</td>
<td>/hænd/</td>
</tr>
<tr>
<td>once</td>
<td>/w/ins/</td>
<td>/w/ns/</td>
</tr>
</tbody>
</table>

What do these examples indicate?

The louder or longer a sound is, the more likely it is to be preserved.
Salient sounds more successfully preserve syllable and cluster form.
Cluster reductions may be driven by universal principles or L1 constraints
There is a strong drive for faithfulness
Students with difficulties tend to simplify according to the SSP
Increased Cluster Length and Difficulty

Cluster Length | 10 | 20 | 30 | 40 | 50 | 60
---|---|---|---|---|---|---
Mean % error | CC | CCC | C | CCC | C | CCC

What can teachers do about it?

What do we teach first?

How do we teach it?

What do we teach first?

Clusters of higher perceptual salience
Voiced clusters, longer, more sonorant features
Well formed syllables
Aim for and reward, even if voicing or other features are lost.
Variety of sounds in all syllable positions especially final position
Maximum onset principle
To aid medial clusters, once they can produce clusters of two or more elements in any position

Implications for Teaching

Many students will progress over time with sufficient quality and quantity of input. Identify those who do not.

Teach highly sonorant sounds first, especially in medial and final position.

Keep clusters short: build length later.

Aim for syllable well-formedness.

Use contrastive, problem solving activities to improve perception and production.
Teaching Learners to Perceive New Categories

Goals: Students will
- Examine new sound combinations
- Hold sounds in short term memory
- Rehearse sound patterns (mentally or physically)
- Increase amount of 'cognitive background' in discrimination

1. Simple contrast: Minimal Meaningful pairs

<table>
<thead>
<tr>
<th>Waits</th>
<th>Wait</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raised</td>
<td>Raids</td>
</tr>
</tbody>
</table>

2. Increase confusion factor: bingo, phonetic 'find my partner'

<table>
<thead>
<tr>
<th>Rocks</th>
<th>Licks</th>
<th>Tip</th>
<th>Toast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arcs</td>
<td>Fogs</td>
<td>Whips</td>
<td>Lots</td>
</tr>
<tr>
<td>Tips</td>
<td>Boats</td>
<td>Lost</td>
<td>Ask</td>
</tr>
<tr>
<td>Coal</td>
<td>Taps</td>
<td>Toast</td>
<td>Whips</td>
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</tbody>
</table>

Incidental Work: It is Worth the Time!
For new vocabulary, 'lift out' clusters and write them on the board phonetically
'excuse'
ksk
Count them on your fingers
mps → stamps
123

To Aid Motor Planning / Motor Melody Development
Have student repeat long strings of the cluster
sksksksksksksksksksksksksksk
esk sk use me?

Nsnsnsnsnsnsnsnsnsnsnsnsnsnsns
ns → once

Perception aids production, production aids perception

Draw Attention to Manner of Production
Length:
______ *o* ______
s → top s

Or use gestures (swipe, finger click)

Clusters with /l/ and /r/
Have them say a long /l/ or /r/, then say the other consonant 'over' it:
rrrrrrrrppprpprrpprprICE
llllllblblblUE
NB: order of difficulty = p, b > k, g > t, d

Reward students for creating a cluster, even if they confuse /l/ and /r/
**Exaggerate the Part of the Cluster Most Likely to be Deleted**
This works well with /l/ and /r/.

pRICE
bREAD
Write omitted sounds larger:
leFt

**Shift Sounds from the Front to the Back of a Word:**
This is fun!

reep>reepreeepree pre-intermediate.

It also helps to 'loosen' the connection between consonant and syllable position.

**Blend Two Words**
I need a pencil.
I nee da pencil.
I need a pencil.

whisper this part.

**Between Two Words, Treat Final Consonants Like a Cluster**
dgdgdgdgdgdg

I would go...
In clusters containing two stops (p,t,k,b,d,g),
teach students NOT to release the first consonant.
NB: ability to produce English stops without audible release is essential.

**In summary**
Where L1 has a simple, or unmarked syllable structure, learners’ greatest pronunciation problems are likely to be phonotactic, or linear/sequential.
English has a very complex syllable structure relative to many world languages.
High quality interaction with English over time will resolve many problems, as the perception of these features is quickly learned.
Learners who remain of low intelligibility are likely to benefit from perception training, combined with problem solving activities that help them to form new categories.

*Thank you*
References


