Production and Perception of English /l/ and /r/ by Native-speaking Children

Kaori Idemaru, Dept of East Asian Languages and Literatures, University of Oregon
Lori L. Holt, Dept of Psychology and the Center for the Neural Basis of Cognition, Carnegie Mellon University

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Introduction

The /l/ vs /r/ distinction: Acoustically, /l/ and /r/ are distinguished, primarily, by the onset frequency of the third formant (F3)

However, acoustic cues of speech are multidimensional.

Method (production)

Stimuli

Synthesized based on specifications reported in Yamaha & Tohkura (1993) and also used in Ingvall et al (in prep)

Task

16 sounds x 5 reps = 80 trials
Children heard the stimuli through headphones, and pointed to either picture to indicate which word they heard
Location of the pictures were randomized 80 identifications / child

Table: Stimuli

<table>
<thead>
<tr>
<th>Stages</th>
<th>/l/</th>
<th>/r/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young</td>
<td>25</td>
<td>28</td>
</tr>
<tr>
<td>Mid</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td>Adult</td>
<td>28</td>
<td>32</td>
</tr>
</tbody>
</table>

Analysis

F1, F2 and F3 were measured at visible peaks examining the spectrogram and LPC-smoothed spectrum.

Mean onset F3

Younger: 13 3.95-4.37 4.16
Mid: 13 4.42-5.04 4.71
Older: 13 5.05-6.13 5.46

*8 Yr Old: 11 7.31-9.54 8.45
Adult: 18 undergraduate

Method (perception)

Stimuli

158

F3*F2

p<.001 F2

* in the /l/ and /r/ categorization

Result (perception)

Results

Children use /r/, but not /l/ in the /l/ and /r/ categorization
Response patterns become more consistent in the Older group

From Older (age 5) to Age 8, the response shape become more steep in the boundary area (F3 = 2000-2400)
Age 8 still does not show the use of F2 in the way adults do.
Adults used F2 when F3 was ambiguous.
Still not clear whether:
Greater F2 = more /l/ percept, or Smaller F3-F2 distance = more /r/ percept

Results (production)

F3 distinguished L and R productions in all groups.
F3 increased from Younger to Older children for both L and R.
F2 decreased from Younger to Older children for both L and R.
F2 increased for R from Younger to Older

Findings

Although both F3 and F2 effectively differentiated /l/ and /r/ productions in children, these categories were still being refined and tuned at age 5 in terms of F2 and F3 values.
Perhaps these refining and tuning are related to changes in category goodness of the child productions.
F3-F3 distance seems to have a potentially important role (i.e., acoustic cue?) differentiating /l/ and /r/ categories.
Although the perceptual pattern does become adult-like around age 8, the integration of the secondary cue (F2) was not observed in our oldest group.

These findings are consistent with developmental work on the perception of other sounds (e.g., fricatives). Fine-tuning of speech categories continue through the childhood, sometimes till 10-12 yrs of age.

Method

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Production tasks

Repetitions: /l/, /u/, /r/, /u/, /l/ in the frame “This is ___”.
Naming: /write/ and /light/ in isolation

Perception task

Categorization of “tight” and “wetta”

Method (perception)

Stimuli

F3 only

% R responses

Younger

Mid

Older

Analysis

F3*F2

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