How labeling objects influences speech and language learning

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des journées GDR - July 3rd, 2012
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Language-specific phonetic perception
Overview of Talk

1. Associated Input

- "Word form" cues to phonetic learning
  (Swingley, 2009; Thiessen, 2007; Feldman et al., 2012)

- "Amodal visual" cues to phonetic learning
  (Teinonen et al., 2008)

- "Associated visual" cues to phonetic learning
  (Yeung & Werker, 2009)

2. Lexical Factors

- "Referential" cues to phonetic learning
  (Yeung, Chen, & Werker, submitted)

- "Referential" cues to phonological learning
  (Yeung & Nazi, in prep.)
Auditory Word Forms:

Circles + Triangles = /i/ in “see” + “we”

Squares + Diamonds = /I/ in “this” + “Dillon”
Amodal Visual Cues:

Circles + Triangles = made by mom + dad

Squares + Diamonds = made by mom + dad

Teinonen, Aslin, Alku, Csibra (2008)
Associated Visual Cues:
Circles + Triangles = [keys]
Squares + Diamonds = [kiss]
Correlated

[da₁]  [da₂]  
[da₃]  [da₄]

[Da₁]  [Da₂]  
[Da₃]  [Da₄]

[Da₁]  [Da₂]  
[Da₃]  [Da₄]

[da₁]  [da₂]  
[da₃]  [da₄]

Uncorrelated

[da₁]  [da₂]  
[da₃]  [da₄]

[Da₁]  [Da₂]  
[Da₃]  [Da₄]

[da₁]  [da₂]  
[da₃]  [da₄]

Yeung & Werker (2009)
Yeung & Werker (2009)
Interim Summary

- Labeling objects may provide a (n) (associative) cue to learn phonetic information.

![Graph showing looking time in seconds for Baseline, Correlated, and Uncorrelated conditions. The graph compares Non-alternating and Alternating conditions. There is a significant difference (*).]
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Words as invitations to form (object) categories

“a toma”

[BEEP]
<table>
<thead>
<tr>
<th>Chinese Character</th>
<th>Tone symbol</th>
<th>Tone description</th>
<th>English gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>詩</td>
<td>1 55</td>
<td>high level</td>
<td>‘poem’</td>
</tr>
<tr>
<td>試</td>
<td>1 33</td>
<td>mid level</td>
<td>‘to try’</td>
</tr>
<tr>
<td>事</td>
<td>1 22</td>
<td>low level</td>
<td>‘matter’</td>
</tr>
<tr>
<td>時</td>
<td>1 21</td>
<td>low falling</td>
<td>‘time’</td>
</tr>
<tr>
<td>使</td>
<td>1 25</td>
<td>low high</td>
<td>‘to cause’</td>
</tr>
<tr>
<td>市</td>
<td>1 23</td>
<td>low mid</td>
<td>‘city’</td>
</tr>
</tbody>
</table>
Baseline (Exp. 1)

Cantonese Tone Contrast

- Tone 25 (rising)
- Tone 33 (level)

Fundamental Frequency (Hz)

Normalized Time

25_A  33_A

25_B  33_B

Yeung, K. H. Chen, & Werker (under revision)

Tuesday, July 10, 2012
Baseline (Exp. 1)

Looking Time (sec)

4m English
9m English

non-alternating
alternating

see also Mattock et al., 2008
Associating (Exp. 2a)

Training Phase (5-6 minutes)

[25₁] [25₂] [25₃] [25₄]

[33₁] [33₂] [33₃] [33₄]

Test Phase (2 minutes)

Yeung, L. Chen & Werker (submitted)

Tuesday, July 10, 2012
Labeling (Exp. 2b)

Labeling Phase (1 minute)

Training Phase (5-6 minutes)

Test Phase (2 minutes)

see also Fennell & Waxman, 2010
• X-axis: log-transform of vocab.
• Y-axis: Discrimination score

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• Correlation only in “labeling” condition (black line + dots)

• HIGH-VOCAB infants: distinct “labels” must be phonetically contrastive

• LOW-VOCAB infants: distinct “pairings” may not be phonetically contrastive
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(Yeung & Nazzi, in prep.) |
Introduction: Why generalization is useful

Generalization in statistical learning:  
(Maye, Weiss, & Aslin, 2008)

VOT categories clear at velar place of articulation  
[Korean] .....  

....not so clear at coronal place of articulation.

Maye, Weiss, Aslin, 2008
Introduction: Stress and generalization

<table>
<thead>
<tr>
<th>Study</th>
<th>Single words (Pl.ma vs. pi.MA)</th>
<th>Multiple words (trochaic vs. iambic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dupoux, et al., 1997; Friederici et al., 2007; Höhle, et al., 2009; Jusczyk et al., 1993; Skoruppa et al., 2009</td>
<td></td>
<td></td>
</tr>
<tr>
<td>English-learning infants</td>
<td>4 - 6 months</td>
<td>9 months</td>
</tr>
<tr>
<td>French-learning infants</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>French adults (easy vs. hard tasks)</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

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French-learners at 10 months

Familiarization

Test Phase - 4 pairs (2 minutes)

Novel
li.FO

Same
LI.fo

Bijeljac-Babic, Serres, Höhle, & Nazzi, 2012
Consistent Training

Labeling Phase (3 minutes)

Fam. Phase (1 minute)

Test Phase - 4 pairs (2 minutes)

Novel
li.FO

Same
li.FO

Regarde! MA.bu

Li.fo

Regarde! ma.BU

Li.fo
<table>
<thead>
<tr>
<th>Training Word</th>
<th>Test Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>/mabu/</td>
<td>/lifo/</td>
</tr>
<tr>
<td>/gimu/</td>
<td>/fabo/</td>
</tr>
<tr>
<td>/moga/</td>
<td>/bilu/</td>
</tr>
<tr>
<td>/lifa/</td>
<td>/mogu/</td>
</tr>
<tr>
<td>/fulo/</td>
<td>/gami/</td>
</tr>
<tr>
<td>/bago/</td>
<td>/mufi/</td>
</tr>
<tr>
<td>/fobi/</td>
<td>/buma/</td>
</tr>
<tr>
<td>/lumi/</td>
<td>/goba/</td>
</tr>
</tbody>
</table>
Fam. Phase (1 minute)

Test Phase (8 pairs of novel vs. same)

Same

Novel
Inconsistent Training

Labeling Phase (3 minute)

Fam. Phase (1 minute)

Test Phase - 4 pairs (2 minutes)

Regarde!
Ll.fo / li.FO

MA.bu

Regarde!
li.FO / Ll.fo

Novel
ma.BU

Same
MA.bu

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Exp 2: Non-referential/social Consistent (9-10m)

Labeling Phase (3 minute)

Regarde!
LI.fo

Regarde!
LI.FO

Labeling Phase (3 minute)

Regarde!
MA.bu

Regarde!
ma.BU
Generalizable stress patterns learned from labeling objects....
First steps towards phonological learning?

Results from 1st Pair of Test Trials

Looking Time (s)

<table>
<thead>
<tr>
<th></th>
<th>Exp. 1 - Consistent</th>
<th>Exp. 1 - Inconsistent</th>
<th>Exp. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same Stress</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Novel Stress</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Indicates a significant difference.
The functional **use** of words (by adults) shapes infant phonetic perception.
Acknowledgements

Josette Serres

Vivane Huet

Arielle Veenemans

Laurianne Cabrera

Fondation Fyssen