Lexical encoding of new phonological categories

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Phonetic decoding

Underlying phonological form

Phonological Decoding

Phonetic form

Japanese: [ra]
Spanish: [ε]
Catalan: [e, ɛ]

Consonants & vowels

Phonetic Decoding

Assimilate to the phonetically closest segment
- acquired early & bottom up
- non plastic in L2

Acoustic/Phonetic code

| [a, əa] | [e, ɛ] | ² [e, ɛ] |
Lexical encoding for L2 words

Underlying phonological form

Phonological Decoding

Phonetic form

Japanese

[ra]

Assimilate to the phonetically closest segment
- acquired early & bottom up
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Spanish

[ε]

Catalan

[e, ε]

Phonetic Decoding

Acoustic/Phonetic code

phonotactics

stress

Consonants & vowels

[la, ρa] [e, ε]

[3] [e, ε]

Consonants & vowels
In another case, however

Underlying phonological form

Phonological Decoding

Phonetic form

Phonetic Decoding

phonotactics
stress
Consonants & vowels

Acoustic/Phonetic code

Dutch
[ε]

Spanish
[ε]

Catalan
[e, ε]

- same architecture in L2?
## Four combinations

<table>
<thead>
<tr>
<th>+ targetlike Category</th>
<th>– targetlike Category</th>
</tr>
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<tr>
<td>+ Lexical Contrast</td>
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- **Native speakers**
  - Weber & Cutler 2004
  - Hayes-Harb & Masuda 2008

- **L1 acquisition**
  - Pallier et al. 2001
  - Ota et al. 2009

**Perceptual learning**
Is there a dissociation between both levels in L2?

• Closer look at the link between category learning and lexical encoding in a second language
• 2 groups of learners of French
• 2 experiments:
  – Examine categorization performance
  – Look at the form of lexical representations
THE EXPERIMENTS
Methods and participants

**ABX**
- 19 advanced
- 19 intermediate
- 8 French natives
- 13 'monolinguals'

**Lexical Decision**
- 19 advanced
- 19 intermediate
- 8 French natives

**late learners of French**

**Advanced learners**
Residence in France (6 mo. ~ 3+ years)
min. 8 semesters of French

**Intermediate learners**
no long exposure in France/French speaking country;
max. 4 semesters of French

**native speakers (control)**

**French** (knowledge of English)
**American English** (no French)
Stimuli:

FRONT ROUNDED VOWELS

[i] [ɛ] [y] [oe] [u] [o]
Our Stimuli in ABX and Lexical Decision

\[ 9 = \text{[œ]} \]

\[ o = \text{[ɔ]} \]
Category acquisition

• High phonetic variability for [u] in English (across contexts), which overlaps the [y]-[u] distribution in French, makes acquisition of the contrast difficult
  – generally less confusion of [i] with [y]

• Similar pattern is predicted for [ɔ]-[œ]
  – Mid-vowels could be harder to discriminate due to the narrower vowel space
  – However, categorization might be easy if [œ] is associated with a rhotic sound [Ъ] in English (Kingston 2003), while [ɔ] is mapped onto AE [ɔ]
Exp 1: ABX on [u]-[y] and [ɔ]-[œ]

Conditions:

**control**: sun vub, tid ted

**high**: mub myb, tud tyd

**mid**: mɔb mœb, tɔd tœd

192 randomized trials:

16 control  8 i/e  + 8 cons.

16 high  u/y

16 mid  ɔ/œ
All groups have higher errors on the mid vowel contrast.

But note the scale: below 50%.

- Both learner groups differ from the native speakers on all experimental vowel pairs, but not on the control.
- Intermediate and advanced groups are not significantly different on any vowel pair ($p > .1$ in all cases).
Summary: Phonological ABX

• Learners: small error rate for \[u-y\] (12%)

• Performance overall worse for \[ɔ-œ\]
  – Establishing this category seems most difficult for both learner groups

• Seemingly persistent errors:
  – Intermediate and advanced learners are not different from each other, and both differ from the natives
Experiment 2: Lexical Decision

• Method (see Pallier et al. 2001)
  – Speeded auditory Lexical decision („real word?“)
  – Word pairs separated by 8 – 20 items in between
  – Facilitation (RT) on conditions „same“ vs. „minimal pair“

  - Stimuli (words + nonwords)
    – 40 test words: 5 pairs for 4 different contrasts:
      • i-y, u-y, o-oe, E oe
    – 40 nonwords (similar to the test words)
    – 180 fillers
    – Counterbalanced in 4 lists (aa – bb – ab – ba)
Exp 2: Repetition priming on minimal pairs

Mean reaction times for catalan-specific contrasts [e-ε] and [o-ɔ]
by early bilinguals:
**Catalan-dominant (a)** vs.
**Spanish-dominant (b)**
(Pallier, Colomé, and Sebastián-Gallés 2001)
Results for [i-y] (control)

![Bar chart showing reaction times for Intermediate, Advanced, and Native Speakers for [i-y].](chart.png)
Results for [u-y]

- **Priming!!**
- **ns**
- ** ns**

(u-y)

<table>
<thead>
<tr>
<th>Reaction Time (ms)</th>
<th>Intermediate</th>
<th>Advanced</th>
<th>Native Speakers</th>
</tr>
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<tbody>
<tr>
<td>Same 1</td>
<td><strong>ns</strong></td>
<td><strong>ns</strong></td>
<td><strong>ns</strong></td>
</tr>
<tr>
<td>Same 2</td>
<td><strong>ns</strong></td>
<td><strong>ns</strong></td>
<td><strong>ns</strong></td>
</tr>
<tr>
<td>Min Pair 1</td>
<td><strong>ns</strong></td>
<td><strong>ns</strong></td>
<td><strong>ns</strong></td>
</tr>
<tr>
<td>Min Pair 2</td>
<td><strong>ns</strong></td>
<td><strong>ns</strong></td>
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Results for [ɔ-œ]

Reaction Time (ms)

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<tr>
<th>Level</th>
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<th>Same 2</th>
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<tr>
<td>Intermediate</td>
<td></td>
<td>** ns</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Advanced</td>
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<td>ns</td>
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** ns indicates a significant difference.
Summary

- Condition **same** elicits priming in all contrasts for all groups.
- For the control contrast **[i-y]**
  - All three groups behave alike: no priming on minimal pair condition
    - => no sign of spurious homophony for this contrast
- For the test contrast **[u-y]**
  - Advanced = Native speakers: no priming
  - Intermediate: significant priming on minimal pair condition
- For the test contrast **[ɔ-œ]**
  - All three groups behave alike, and do not show priming on the minimal pair condition
General summary

• However, both learner groups are not different on the ABX task
  – Error rate is small, but significantly higher than the natives

• Advanced learners are like the native speakers in the lexical decision, even though they are like the intermediates on ABX
  – They establish lexical contrasts « regardless » of their performance in ABX – without experiencing any benefit at the level of categories

• Intermediate learners, despite rather good categorization of [u-y], experience lexical homophony
  – Conversely, they have lexical contrast for the categories which are most difficult to discriminate…… (o-oe)
Dissociated mechanisms

• For both learner groups, it seems that establishing a lexical contrast is possible
  – for both [u-y] and [o-oe] in case of the advanced
  – only for [o-oe] in case of the intermediate
• ...even if category „robustness“ remains limited.... Indeed, both groups are not target like at the categorization level
### Our results

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<tr>
<td></td>
<td>Intermediate [o-oe]</td>
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<th>Intermediate [u-y]</th>
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<td>L1 acquisition</td>
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L2 phonological acquisition

- Proceeds differently from first language phonological acquisition
- Converging evidence towards dissociated mechanisms:
  - Category acquisition
  - Formation of contrastive lexical representations
- Lexical contrast does not always result in a benefit at the level of categories in L2 acquisition
- What are the mechanisms that allow development of lexical contrast in absence of robust sound categorization?
Current models

Underlying phonological form

Phonological Decoding

Phonetic form

Phonetic Decoding

American pronunciation: /u/

|y, u|

Acquired early, not very plastic in L2, shape L2 perception

stress

phonotactics

metalinguistic knowledge

orthographic codes

Current models

Lexical selection and access

words forms

Phonological grammar

Consonants & vowels

Underlying phonological form

conceptual level, syntactic level

Phonetic Decoding

Phonological Decoding

lexically selected words

phonological forms

acoustical representation

oral production

underlying phonological form

Phonologic form

Phonetic Decoding

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Phonetic Decoding

[|y, u|] Americans

Phonotactics

stress

Acquisition at the lexical level is constrained by acquisition at the segmental level

Consonants & vowels

|u|

[|u|]
Lexical encoding

Lexical selection and access

Phonotactics

Stress

Phonotactics

Stress

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Phonological grammar

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Consonants & vowels

Americans [y, u]

Acquisition at the lexical level is constrained by acquisition at the segmental level

Orthographic codes

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Conceptual level, syntactic level

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Americans [u]

Lexical selection and access

Conceptual level, syntactic level

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conceptual level, syntactic level

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Americans

/y/ /u/

/\u/ /\u/

phonotactics
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Phonetic form

Acquisition at the lexical level is constrained by acquisition at the segmental level

Consonants & vowels

/y, u/
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[y, u]
Acquisition at the lexical level is modulated by the phonological grammar.
Underlying phonological form

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[y, u]

Consonants & vowels

Americans

[u]

[y, u]
References


Maddieson 1984


