“They sound the same, but I know they are different”

Dissociated mechanisms for phonetic and lexical learning in a second language

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L2 Learners often confuse words...
And that’s why...

<table>
<thead>
<tr>
<th>Pizza</th>
<th>Extras</th>
<th>Regular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pizza slice</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Large pie</td>
<td>35</td>
<td>25</td>
</tr>
<tr>
<td>XL pie</td>
<td>58</td>
<td>48</td>
</tr>
<tr>
<td>Salad for build</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Garlic bread</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Toppings:**
- paper/hot paper
- olives
- mushrooms
- onion
- tomatoes
- corns

**Special toppings:**
• Spoken word recognition and the L2 mental lexicon
  – phonetic perception and lexical encoding are related
  – L2 learners differ from native speakers in lexical behavior

• Experiment series 1: Merged L2 lexical representations?

• Experiment series 2: Fuzzy or not fuzzy? Two hypotheses about the form of words in the L2 lexicon

• Discussion
SPOKEN WORD RECOGNITION
Stages in perception

- Acoustic code
- Prelexical code
- Phonetic Decoding
- Lexical Selection & Retrieval

Conceptual, syntactic, orthographic codes
Stages in perception

Consonants & vowels

Acoustic code

Prelexical code

Phonetic Decoding

Lexical Selection & Retrieval

Conceptual, syntactic, orthographic codes
Stages in perception

Conceptual, syntactic, orthographic codes

Lexical Selection & Retrieval

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Consonants & vowels

Acoustic code
Stages in perception

**Conceptual, syntactic, orthographic codes**

**Prelexical code**

**Phonetic Decoding**

**Acoustic code**

**Word Forms**

**Consonants & vowels**

- /lɑk/
- /luːk/ 
- /lɪk/ 
- /lək/ 
- /lɑk/
- /lək/
- /lɪk/
Spoken word recognition

Recognizing words in L1

- Cohort model
  - Activation, competition
  - Selection
    - (Marslen-Wilson, 1987)
- Input is perceived reliably
- Lexical representations are accurate
- Error free and fast recognition

Recognizing words in L2

- Much more complex
  - Competition from both lexicons
    - (Ju & Luce, 2004; Marian & Spivey, 2003; Spivey & Marian, 1999; Costa & Santesteban, 2004)
- Spoken input perception is less reliable (Sebastian-Galles, 2005)
  - More competitors (unnecessarily) activated (Broersma, 2012)
- Lexical representations might be fuzzy
- Slower and less efficient recognition
Stages in non-native perception

- **Conceptual, syntactic, orthographic codes**

- **Lexical Selection & Retrieval**

- **Prelexical code**

  - **Phonetic Decoding**

  - **Consonants & vowels**

  - **Acoustic code**

- **Arabic**
  - [b]
  - - Assimilate to the phonetically closest segment
  - - acquired early & bottom up
  - - not very plastic in L2

- **Spanish**
  - [e]

- **Catalan**
  - [e, ε]
Lexical encoding for L2 words

**Conceptual, syntactic, orthographic codes**

**Word Forms**

**Lexical Selection & Retrieval**

**Prelexical code**

**Phonetic Decoding**

**Acoustic code**

- Arabic
  - [$b$]
- Spanish
  - [e]
- Catalan
  - [e, e']

- Pallier et al., 2001
- Ota et al., 2009

Consonants & vowels

Consonants & vowels

Lexical encoding for L2 words

Conceptual, syntactic, orthographic codes

Word Forms

Lexical Selection & Retrieval

Prelexical code

Phonetic Decoding

Acoustic code
Segmental “deafness”


[e] vs [ε] classification

Lexical decision: repetition priming

<table>
<thead>
<tr>
<th>netə</th>
<th>...</th>
<th>netə</th>
</tr>
</thead>
<tbody>
<tr>
<td>netə</td>
<td>...</td>
<td>netə</td>
</tr>
</tbody>
</table>
Lexical decision with repetition priming

- Speeded auditory Lexical decision („real word?“)
- Word pairs separated by 8 – 20 items in between
- Repetition effect: faster decision on an item presented a second time
  - With lexical decision, or other types of decision
  - Task „taps“ lexical level, because the facilitation (priming) effect is observed only on words, not for non-words
- Facilitation (RT) on conditions „same“ vs. „minimal pair“

**SAME**
Beach --- Beach
Priming, faster RT

**MINIMAL PAIR**
Beach --- Peach
No priming, same RT
Lexical decision with repetition priming

• Speeded auditory Lexical decision („real word?“)
• Word pairs separated by 8 – 20 items in between
• Repetition effect: faster decision on an item presented a second time
  – With lexical decision, or other types of decision
  – Task „taps“ lexical level, because the facilitation (priming) effect is observed only on words, not for non-words
• Facilitation (RT) on conditions „same“ vs. „minimal pair“

This is the case ONLY if lexical representations are different for beach and peach. If both are the same (e.g. for L1 Arabic), they will likely prime each other as if they were repetitions (see Pallier et al., 2001).
Segmental “deafness”


[e] vs [ε] classification

Lexical decision: repetition priming

| neɛ | ... | neɛ |

| neɛ | ... | nɛɛ |
Repetition priming for minimal pairs

Spanish-Catalan bilinguals (AoL: age 4) (Pallier et al., 1997, 2001)

[e] vs [ɛ] classification

Lexical decision: repetition priming
But Weber & Cutler (2004) found an asymmetry in lexical activation...

• When Dutch hear \( |pæn...| \), they activate both „pencil“ and „panda“

• When Dutch hear \( |pɛn...| \), they do not look at the „panda“

• /ɛ/ is the vowel closest to a Dutch category => „dominant“

So, lexical separation is possible despite perceptual problems
Lexical encoding for L2 words

- Conceptual, syntactic, orthographic codes

Word Forms

Lexical Selection & Retrieval

Prelexical code

Phonetic Decoding

Consonants & vowels

Acoustic code

Dutch: /æ/, [e]
Spanish: /e/, [e]
Catalan: /e, e/
Is there a dissociation between category and lexical learning in L2?

EXPERIMENT SERIES I
Stimuli:  
FRONT ROUNDED VOWELS
Participants and stimuli

**L2 French**

- Front/Back rounded vowels
- [front rounded] is new: [œ] [y]
- [back rounded] is familiar: [ɔ] [u]

**L1 English**

- **Intermediate** [max. 4 semesters, N = 19]
- **Advanced** [> 6 months in France, 8 semesters, N = 19]

**French Native Speakers**

- [N = 8]

**L1 English (no French)**

- [N = 13]
### ABX

**Lexical Decision w. repetition priming**

<table>
<thead>
<tr>
<th>L2 French</th>
<th>Word</th>
<th>Word</th>
<th>Non Word</th>
<th>Non Word</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test</strong></td>
<td>/u-/y/</td>
<td><em>sourd</em></td>
<td><em>sure</em></td>
<td><em>choupe</em></td>
</tr>
<tr>
<td></td>
<td>/ɔ/-œ/</td>
<td><em>lors</em></td>
<td><em>leur</em></td>
<td><em>blove</em></td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>/i-/y/</td>
<td><em>vie</em></td>
<td><em>vue</em></td>
<td><em>nir</em></td>
</tr>
<tr>
<td></td>
<td>/e/-œ/</td>
<td><em>père</em></td>
<td><em>peur</em></td>
<td><em>lef</em></td>
</tr>
<tr>
<td><strong>Fillers</strong></td>
<td></td>
<td><em>bague, homme, neige</em></td>
<td></td>
<td><em>chane, bromme, dière</em></td>
</tr>
</tbody>
</table>
RESULTS

ABX: Categorization
Lexical Decision with repetition priming
High vowels: High segmental accuracy but repetition priming!

English-French bilinguals (AoL : after 10) *(Darcy et al., 2012)*

[u] vs [y] categorization (ABX)  
Lexical decision: repetition priming

Accurate perception (around 10% error for either L2 group)
Mid vowels: Lower accuracy, but NO repetition priming

English-French bilinguals (AoL: after 10) (Darcy et al., 2012)

[ɔ ] vs [œ] categorization (ABX)  Lexical decision: repetition priming

Less accurate perception (around 35% error for both L2 groups)
Summary

Accurate categorization of high vowels \textit{[u-y]}
Less accurate for mid vowels \textit{[ɔ-œ]}
Advanced are \textit{not} significantly more accurate than intermediates, both are not target-like

Minimal Pair condition
\textit{[u-y]} : for Intermediates, priming! => \textit{merged} representations!
\textit{[u-y]} : for NS and Advanced, no priming => \textit{separate} representations
\textit{[ɔ-œ]} (and \textit{[i-y]}): for all groups, no priming => \textit{separate} representations
L2 phonological acquisition

• Might proceeds differently from L1 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?
What about the phonological form of L2 lexical representations?
To what extent are lexical representations in L2 target-like?
Stages in perception

Conceptual, syntactic, orthographic codes

Word Forms

Consonants & vowels

Prelexical code

Lexical Selection & Retrieval

Phonetic Decoding

Acoustic code

/lɑk/

/luːk/ /liːk/ /lɪk/ /lɑk/ /ræk/ /?ɑk/
PHONETIC CATEGORIZATION

LEXICAL REPRESENTATIONS

HYPOTHESES
“old” and “new” sounds

• German vowels: /o/ and /ø/
• Only /o/ exists in English
• For English L1 listeners:

[o] is old

[ø] is new

/o/ is the vowel closest to an English category => “dominant”
PHONETIC DECODING DEFICIT
PHONETIC DECODING DEFICIT

**Conceptual, syntactic, orthographic codes**

**Prelexical code**

**Lexical Selection & Retrieval**

**Consonants & vowels**

**Acoustic code**

Word Forms

* Not necessarily target-like, but not fuzzy

/honɪç/  /kønɪç/

* [honɪç]  * [kønɪç]  [kønɪç]  [honɪç]

hard “no”  easy “no”  hard “yes”  very easy “yes”

* [hønɪç]  * [kønɪç]  [kønɪç]  [honɪç]
LEXICAL ENCODING DEFICIT
LEXICAL ENCODING DEFICITS

Conceptual, syntactic, orthographic codes

Word Forms

Lexical Selection & Retrieval

Prelexical code

Phonetic Decoding

Consonants & vowels

Acoustic code

Makes reference to L1 category, fuzzy

/no mismatch/

[kɔ?nɪç] *[hønɪç] *[konɪç]

[kɔnɪç] [honɪç]

[relat. easy “no”]

[hard “no”]

[easy “yes”]

[very easy “yes”]
Predictions for lexical decision

**NO**
- **Non Word**
  - hard
  - easy
  - New
  - Old

**YES**
- **Word**
  - hard
  - very easy
  - New
  - Old

**NO**
- **Non Word**
  - relat.
  - easy
  - hard
  - New
  - Old

**YES**
- **Word**
  - easy
  - very easy
  - New
  - Old

Accuracy
- [new]
EXPERIMENTS
Participants and stimuli

L2 German

Front/Back rounded vowels
[front rounded] is new [ø] [y]
[back rounded] is old [o] [u]

L1 English

Intermediate [third-year, N = 55]
Advanced [> 6 months in Germany, N = 21]

German Native Speakers [N = 18]
**L2 German**

<table>
<thead>
<tr>
<th></th>
<th>Word</th>
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<th>Word</th>
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**Lexical decision**

<table>
<thead>
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<th>Word</th>
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<th>Word</th>
<th>Non Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>L2 German</td>
<td>Honig</td>
<td>*Hønig</td>
<td>König</td>
<td>*Konig</td>
</tr>
<tr>
<td></td>
<td>Old</td>
<td>New</td>
<td>New</td>
<td>Old</td>
</tr>
<tr>
<td>Control</td>
<td>Kanne</td>
<td>*Blanne</td>
<td>Pflaume</td>
<td>*Pfeude</td>
</tr>
</tbody>
</table>
RESULTS

ABX: Categorization
Lexical Decision
Interaction between “group” and “condition”: more errors on the test condition

Higher error rate for high vowels /y/ over mid vowels /ø/; Overall: high accuracy despite small statistical differences

Darcy, Daidone & Kojima (2013)
L2 German

Accuracy rate
Lexical decision
(test condition)

If lexical representations are fuzzy →

Darcy, Daidone & Kojima (2013)

• No interaction for native speakers
• Significant interaction for Intermediates
SUMMARY AND CONCLUSIONS
Lexical representations can be fuzzy

- Fuzzy yet separate
  - Of course, learners might have merged representations, as we saw with experiment 1

- New categories make reference to L1
  - Advanced learners show signs of recovery

- Independent of phonetic perception
  - Persistent lexical issues co-occurs with highly accurate phonetic perception, and vice-versa
  - Acquisition of L2 phonetic categories is neither a prerequisite nor a guarantee for target-like lexical encoding
L2 lexical representations are hard to build

• **Good part**: Don’t feel bad (and there is hope!)

• **Distressing part**: Perceptual learning gives no guarantee
  – Task-induced? Too easy categorization tasks? How do we define „accurate perception“?

• **Bad part**: We don’t know what’s going on
  – Role of orthography (e.g. Showalter & Hayes-Harb, 2013; Escudero et al. 2008)
  – Phonological licensing like DMAP (Darcy et al., 2012) ...

• **Interesting part**: What can we do about it? (can we teach it?)
Bright future for research...

• Understand in which case orthography helps and in which it doesn’t
  – Chung-Lin Yang, Ph.D. work, in progress
  – Cate Showalter, Ph.D. work, in progress

• Understand how this works for non-segmentals (e.g. tones)
  – Vance Schaefer, Ph.D. work, in progress
  – Chisato Kojima, Ph.D. work, in progress

• Understand what happens when both categories are “new” or when there is no “dominant” category
  – Danielle Daidone, Ph.D. work, in progress

• Understand how L2 learners update the phonological form of their lexical entries
  – At once? Word by word? By frequency bands? Lexical diffusion?
  – Danielle Daidone, Ph.D. work, in progress
Thanks to

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• Chisato Kojima

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Thank you!

comments welcome!
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Selected References
