

# ***Asymmetric development in lexical encoding of L1-English L2-German front rounded vowels***

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# Overview

- basic speech processing theory
- dissociation of phonetic categories and lexical representations in L2 development
- DMAP (Direct Mapping of Acoustics to Phonology)
- previous study (AE L1 / French TL)
- brief summary
- current study (AE L1 / German TL)
- results of the German study
- discussion

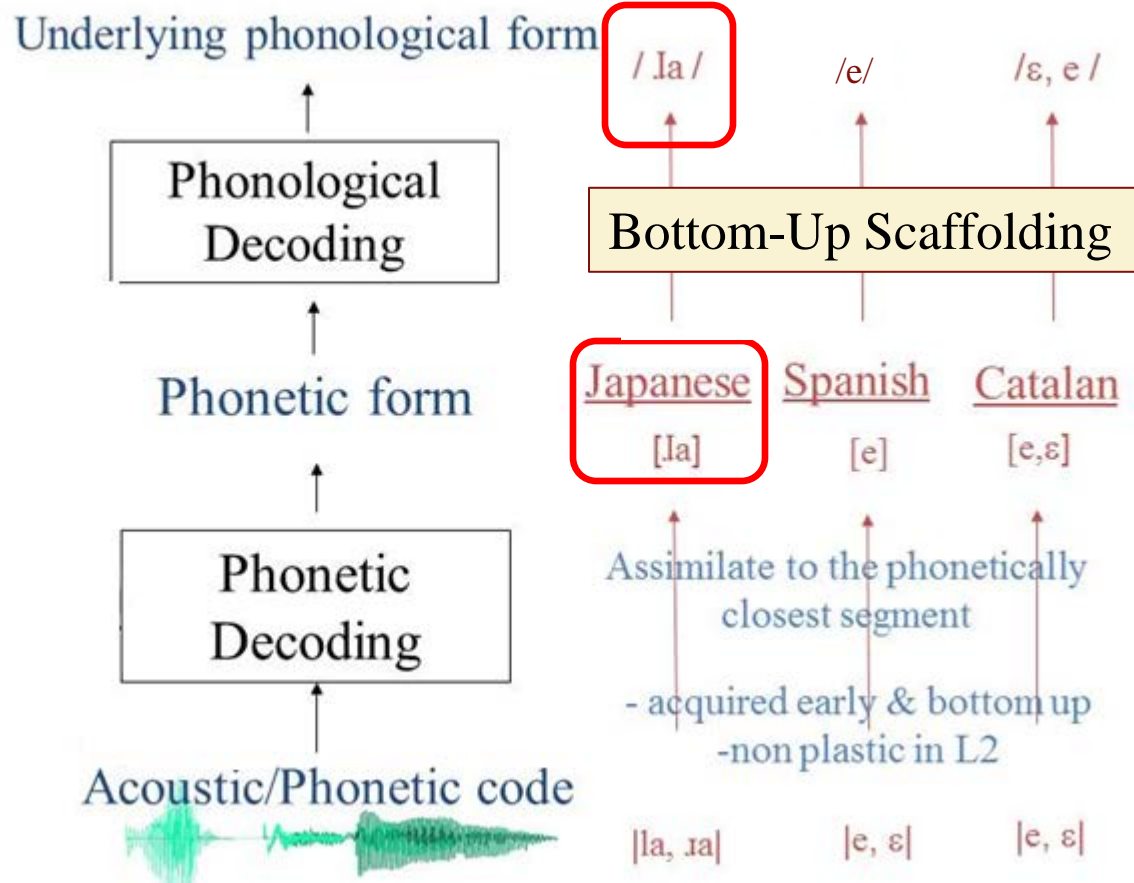


# Phonetic Decoding & L2 Lexical Encoding

Japanese/English:  
Sheldon & Strange (1982)

Spanish/Catalan:  
Pallier et al. (1997)  
Pallier et al. (2001)

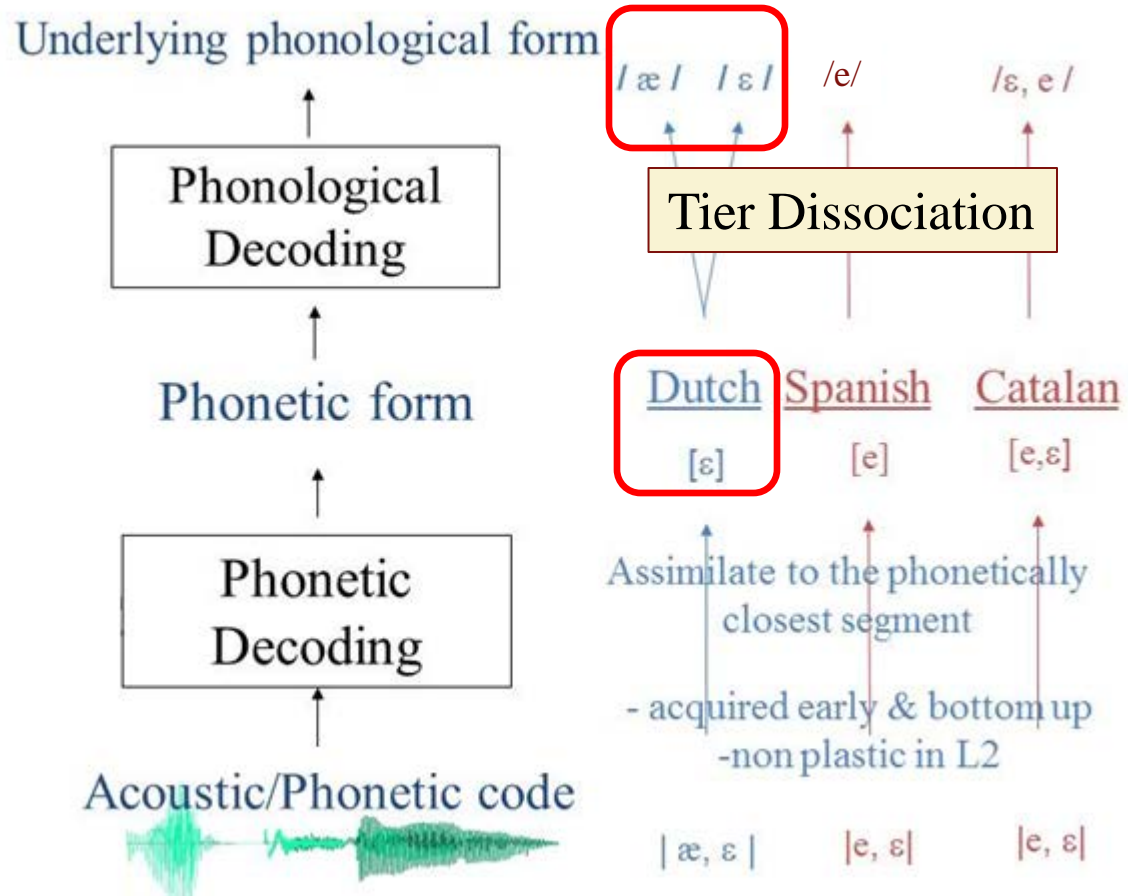
assimilation to the  
closest L1 Category:  
PAM-L2  
Best & Tyler (2007)





# In another case however, an apparent dissociation

Dutch/English:  
Weber & Cutler (2004)





# Direct Mapping of Acoustics to Phonology (DMAP)

- A. Rich Detection
- B. Economical Revisions of Feature Matrices
- C. IL-Dependent Lexical Representations
- D. Minimal IL Recategorizations

(Darcy et al. 2012: 14)



## DMAP (A): Rich Detection

(Darcy et al. 2012: 14-16)

- *L2 learners detect more acoustic cues in the raw percepts than what they use to perform a segmental categorization response.*
- learners detect correlates of phonological features in input & extract the relevant features
- lack of robust discrimination abilities does not mean that relevant features cannot be detected at all
- BUT: even if everything can be detected, not everything is meaningful for L1 segmental categorization; i.e., some information that is irrelevant or redundant for the L1 grammar will be disregarded in earlier stages of IL development
- e.g., acquisition of /y/–/u/ & /œ/–/ɔ/ contrasts requires detection of complex acoustic cues relevant to the features [back], [front], [high], and [round] (Fant, 1969)



## DMAP (B): Economical Revisions of Feature Matrices

(Darcy et al. 2012: 14-16)

- *Detected features trigger revisions of the interlanguage (IL) feature hierarchy in accordance with economy principles.*
- Early IL perceptual system detects correlates of {[front], [round]} combinations in L2 vowels
  - but if the phonological grammar initially does not know how to process this information, it fails to license them
  - they are ignored in lexical encoding at this stage
- At the beginning IL stages (for L1 English)
  - [round] is a redundant/enhancing feature for L1 back vowels
  - [front, round] vowels in L2 input are re-interpreted as [back, (round)]
  - thus target vowels /u/ and /y/ “merge” in the IL, perceived as one phone



## DMAP (C): IL-Dependent Lexical Representations

(Darcy et al. 2012: 14-16)

- *Phonological lexical representations consist of feature matrices dependent upon the IL feature hierarchy at the time of encoding.*
- Learners' lexical representations only make use of feature matrices that the IL feature system can interpret (license) when representations are encoded
- Initially, some target-language contrasts are merged
  - Leads to spurious homophony (i.e., minimal-pairs will be heard as the same)
- When {[front]/[back] + [round]} matrices (for the V in question) are acquired, rounded vowel contrasts can then be lexically encoded
- DMAP does not argue that IL lexical contrasts are represented by the same feature combinations across groups of learners with different L1s and at different proficiency levels





## DMAP (D): Minimal IL Recategorizations

(Darcy et al. 2012: 14-16)

- *Detection of novel phonological contrasts triggers minimal changes in phonetic category definitions.*
  - Definitions of phonetic categories must at least reflect phonological feature contrasts in order to support the establishment of lexical contrasts
  - Category definitions in the IL grammar need not attune to target-like phonetic category boundaries
  - Categorization is an important acquisition goal, but...
    - Initial task: detect **acoustic correlates of phonological features** in raw percepts
    - Not sufficient to completely overcome L1 category assimilations
  - IL inventories are established at 2 disjointed levels:
    - Development of phonological feature matrices (support for lexical encoding independent of attunement of phonetic categories)
    - Adjustments of phonetic category definitions and boundaries
- (Maye 2000; Maye et al. 2002, 2008)

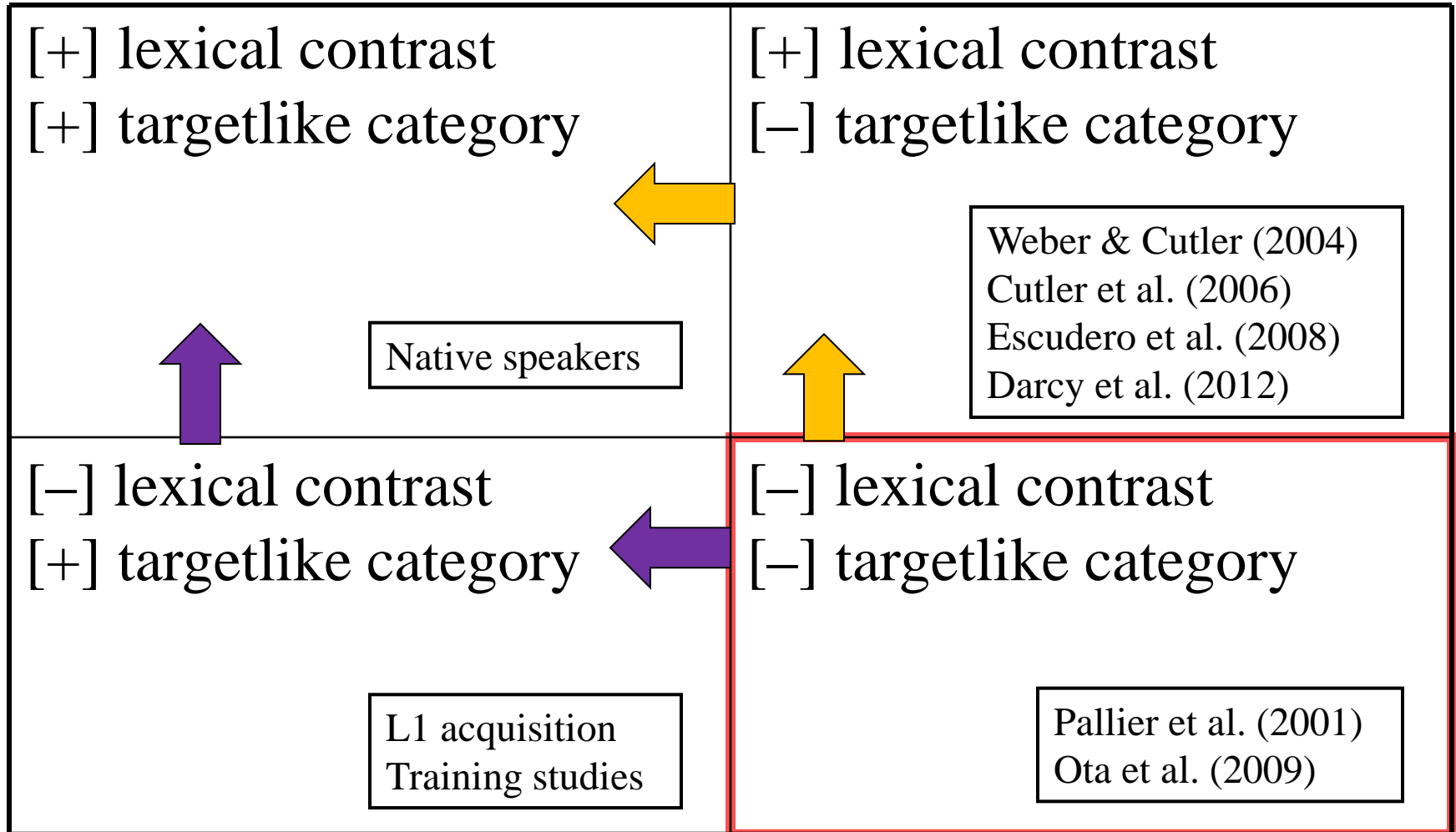


## Support for DMAP: L1 AE / TL French (Darcy et al. 2012)

- French has front rounded vowels /y/-/œ/, English doesn't
  - What do categories & lexical representations in learners' IL look like?
- **Intermediate Learners:**
  - categorization: mid V (/œ/) < high V (/y/)
  - lexical. repres.: mid-V fine, **spurious homophony for high V**
    - indicating front-back merger of high vowels in IL
- **Advanced Learners:**
  - categorization: mid V (/œ/) < high V (/y/)
  - lexical. repres.: mid-V fine, **no spurious homophony for high V detected**
    - confirming dissociation of phonetic categories & lexical representations  
(Weber & Cutler 2004; Cutler, Weber & Otake 2006)



## Development of phonetic categories and lexical representations





## Why German?

- crucial differences from French:
  - morphological load of front-back rounded vowel alternations  
plural: *Bruder-Brüder* ('brother', sg, pl), *Tochter-Töchter* ('daughter', sg, pl)  
strong subjunctive II: *fliegen-flog-flöge* ('fly', Inf., Pret., Subj.)
  - potential phonetic confound in French:  
collocation of /œ/ and /r/ (i.e., CVr, due to lexical gaps)
- similarity to French:
  - L2s with [front, round] vowels are numerous (Maddieson 1984)
  - not with as many L1 English learners  
control for L1 (AE) with sufficient number of learners



## The German Study: Participants

### categorization & lexical decision

21 Advanced (ADV)

55 Intermediate (INT)

18 Native (NS)

### categorization only

20 Naïve (MONO)

### age range:

INT: 18-29 (m = 20.5)

ADV: 21-38 (m = 27.2)

NS: 20-33 (m = 27.8)

MONO: 18-22 (m = 20)

### late learners of German

#### **advanced** learners:

- at least 8 semesters of German
- residency in Germany (6 mo. - 3+ years)

#### **intermediate** learners:

max. 6 semesters of German

spent no time in a German speaking country

### native speakers (control)

German (with knowledge of English)

### naïve speakers (control)

English monolingual (no experience with any  
L containing the target phonemes)



## The German Study: Methods & Stimuli (ABX)

- ABX-paradigm to test categorization abilities
- participants were asked to decide whether the 3<sup>rd</sup> item (X) matched the first (A) or the second (B) item
- A & B produced by a female speaker of German  
X produced by a 2<sup>nd</sup> female speaker of German
- stimuli presented in a block of 160 trials in total



## The German Study: Methods & Stimuli (ABX)

- items were non-words in German & English
- monosyllabic (CVC), 2 contexts (labial, coronal)

**target vowel pairs:**

**control vowel pairs**

[i: y:]

[u: y:]

[i a], [i o]

[ɪ ʏ]

[ʊ ʏ]

[e: ø]

[o: ø]

e.g. A-[po:m] B-[pøm] X-[pøm]

[ɛ œ]

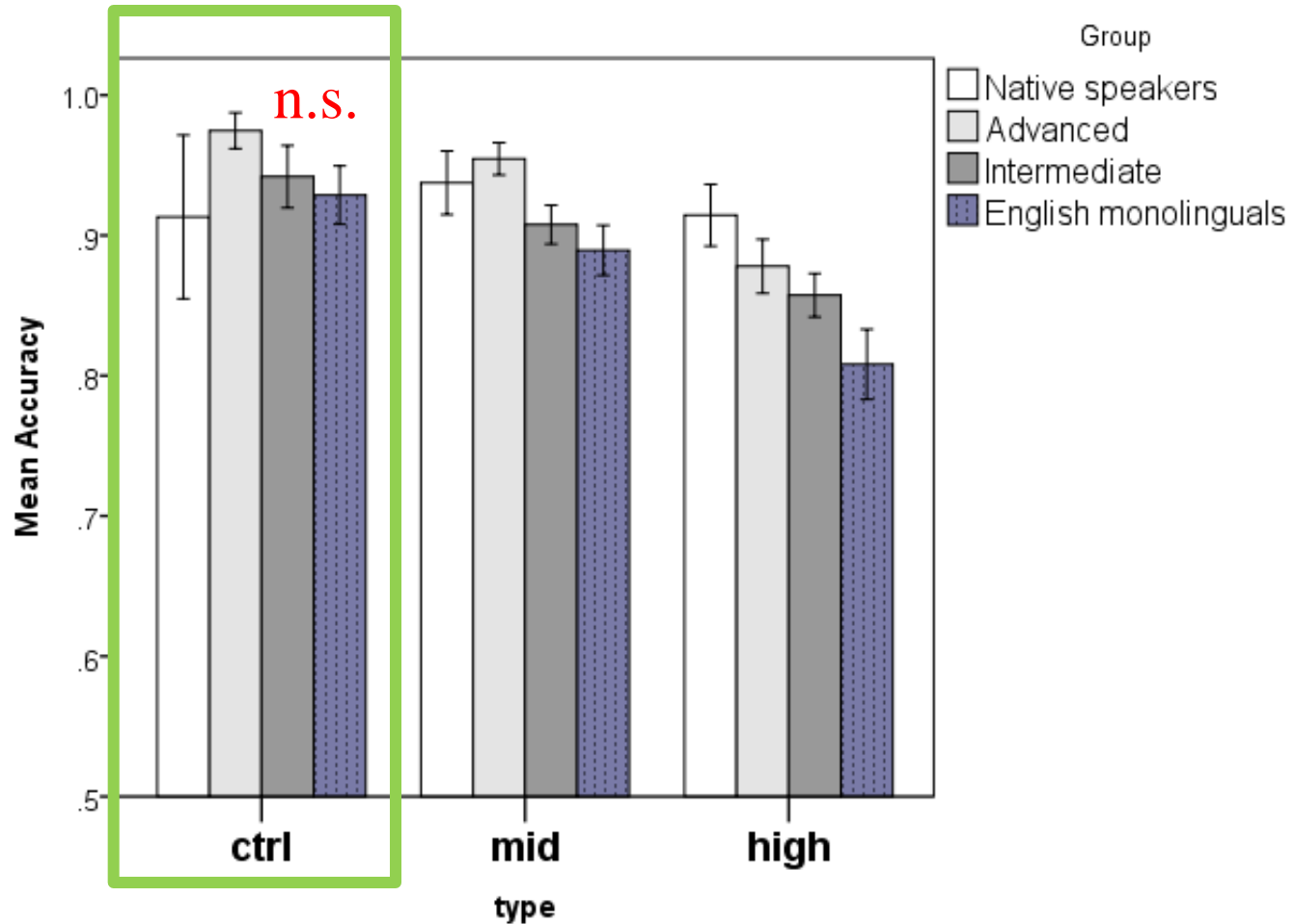
[ɔ œ]

A-[pe:m] B-[pøm] X-[pe:m]

front-front contrasts expected to be easier than front-back (according to PAM-L2 (Best & Tyler 2007))



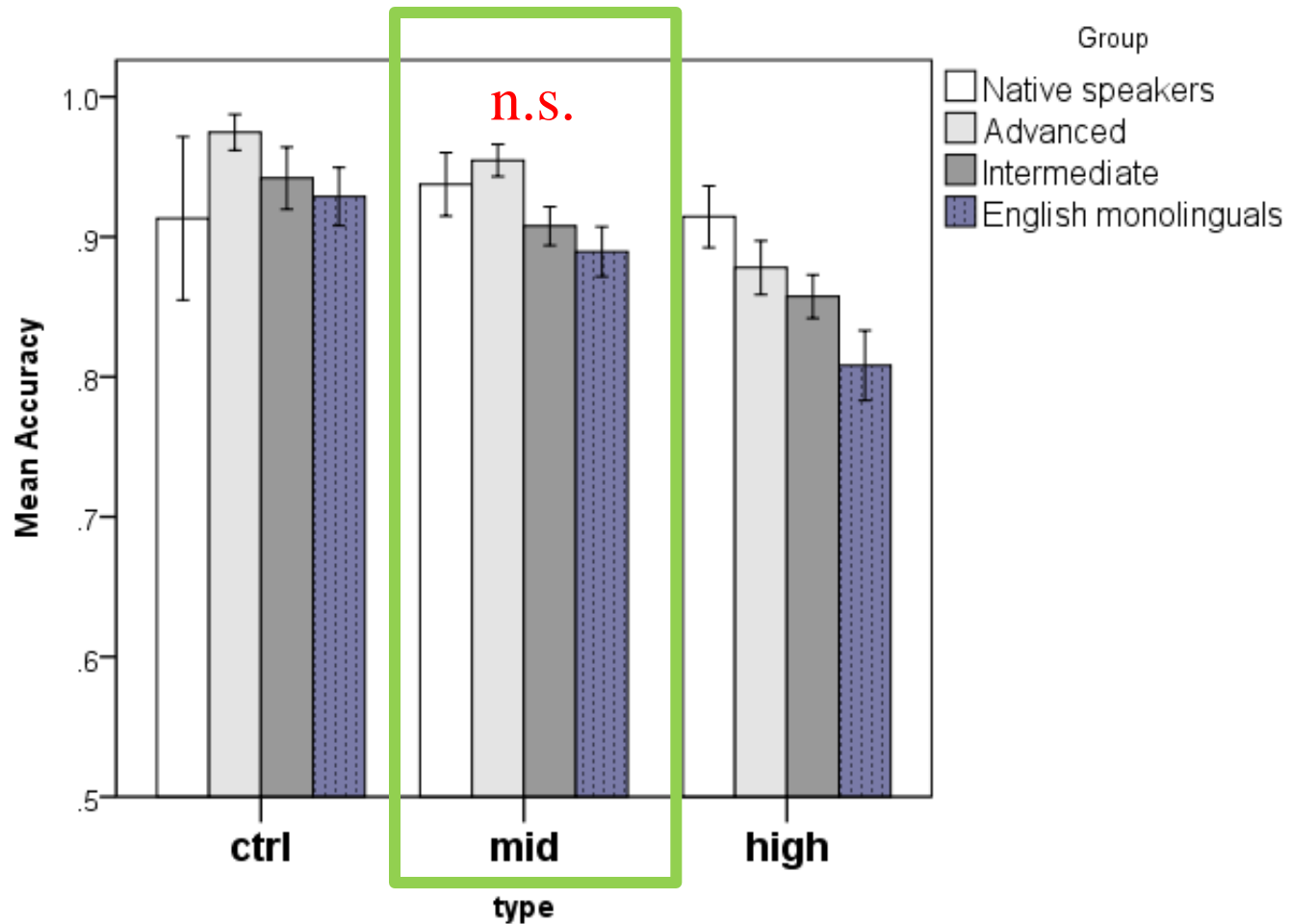
# The German Study: Results (ABX)





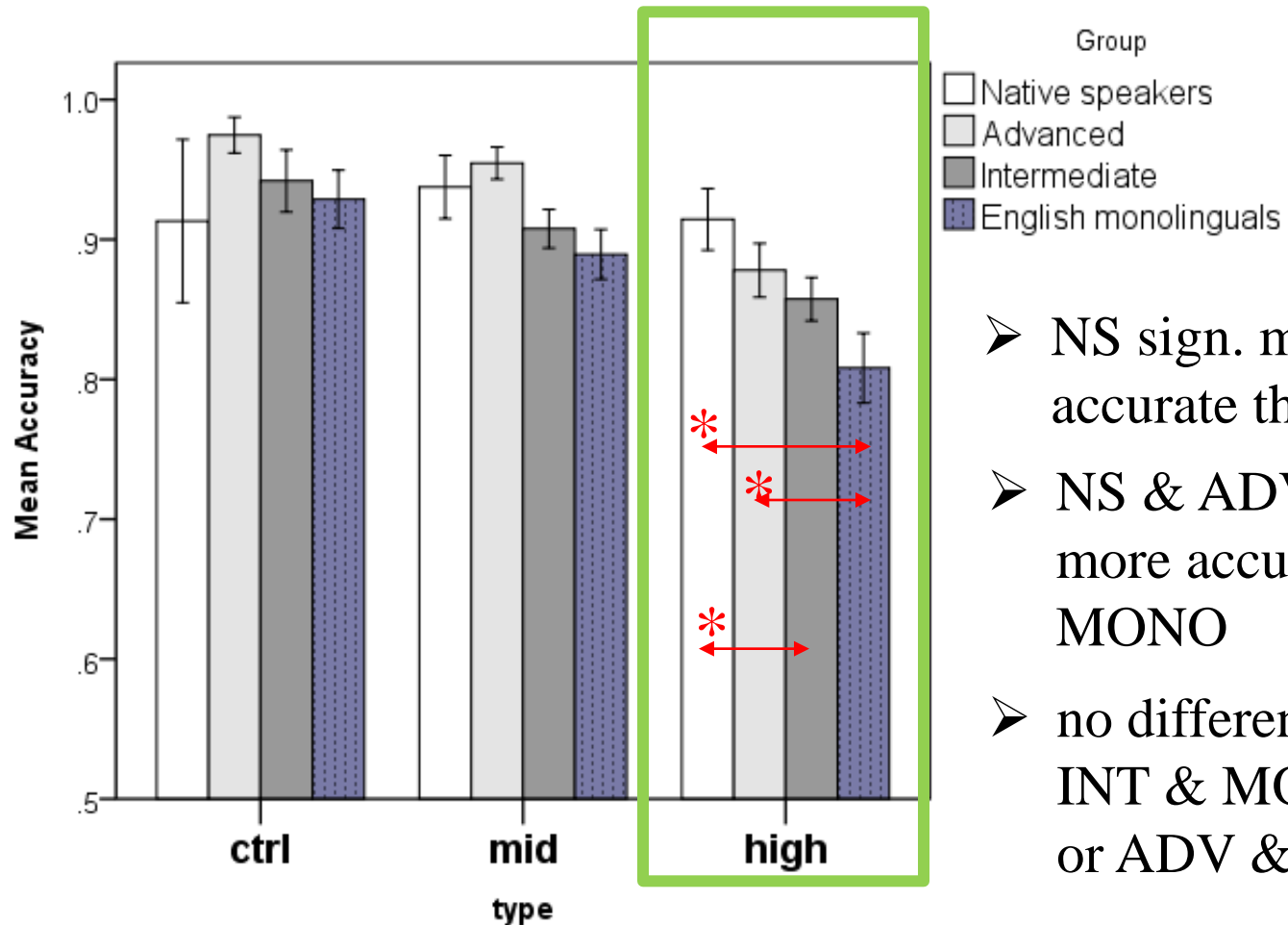


# The German Study: Results (ABX)





## The German Study: Results (ABX)



- NS sign. more accurate than INT
- NS & ADV sign. more accurate than MONO
- no difference btw. INT & MONO or ADV & NS



## **The German Study: Methods & Stimuli (Lexical Decision)**

- participants were asked to decide whether the item they heard was a German word or not and to press the corresponding button
- stimuli presented auditorily
- mono- or disyllabic stimuli
- 160 target item + 128 filler



## The German Study: Methods & Stimuli (Lexical Decision)

- 80 German words with the target vowels
- 80 corresponding nonwords

### target vowel pairs:

[i: y:] [u: y:]

[ɪ ʏ] [ʊ ʏ]

[e: ø] [o: ø]

[ɛ œ] [ɔ œ]

,grün' *green* – \*grun

,Mut' *bravery* – \*Müt

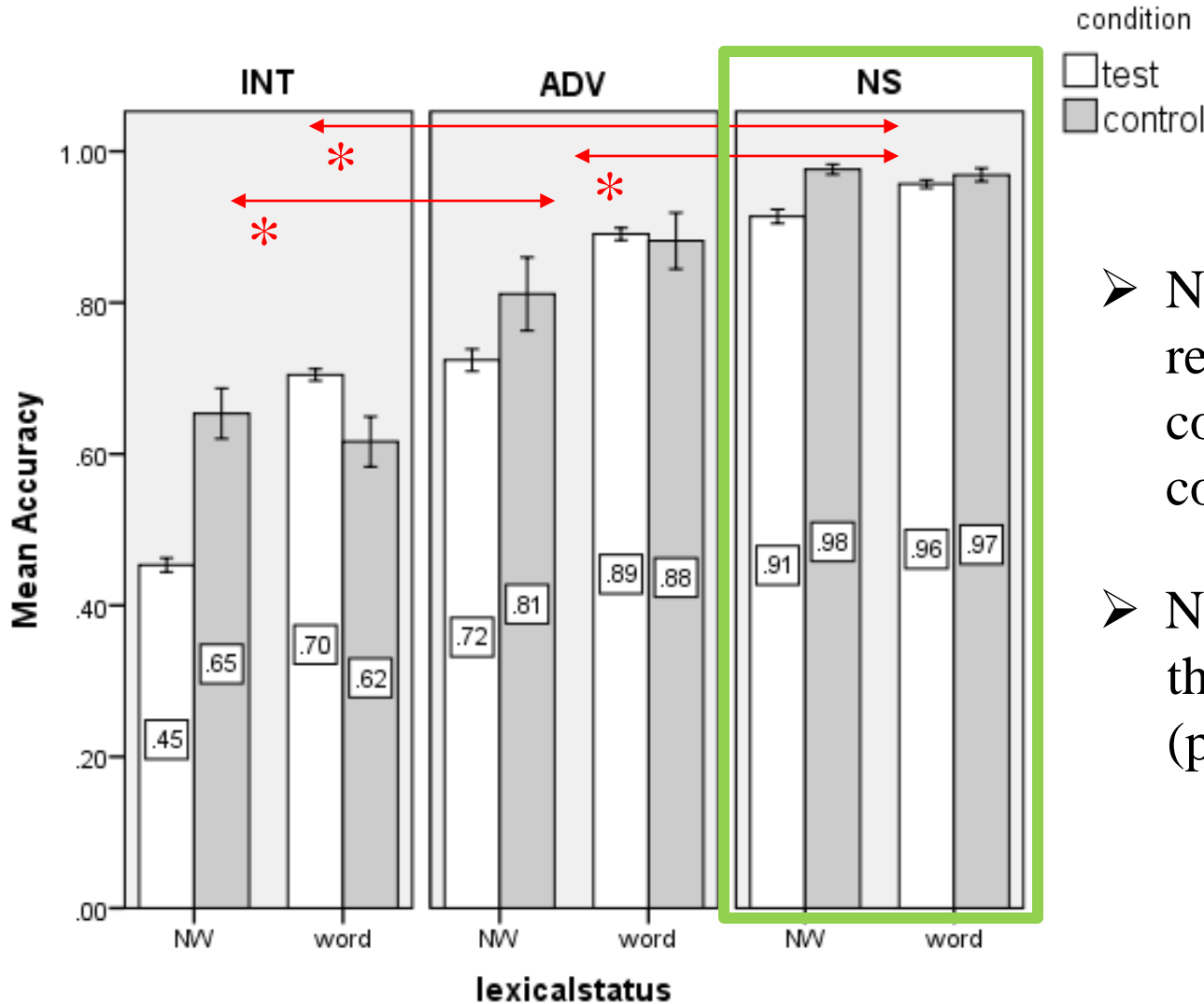
,Honig' *honey* – \*Hönig

,König' *king* – \*Konig



# The German Study: Results (Lexical Decision)

mean accuracy in test vs. control conditions

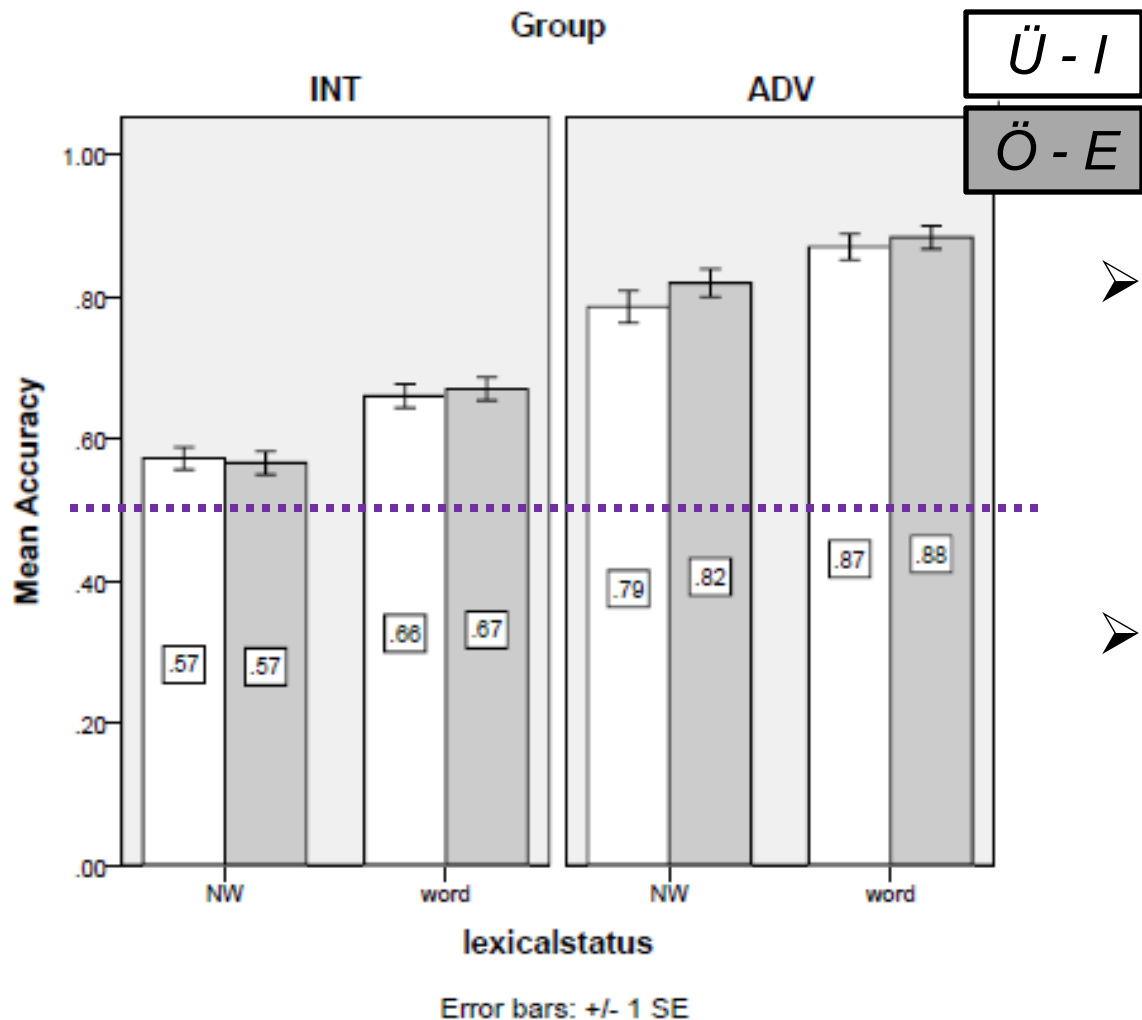


- NS accepted words & rejected nonwords correctly in every condition ( $p > .05$ )
- NS sign. more accurate than ADV & INT ( $p < .001$ )



# The German Study: Results (Lexical Decision)

[front, rounded] – [front, unrounded] contrast

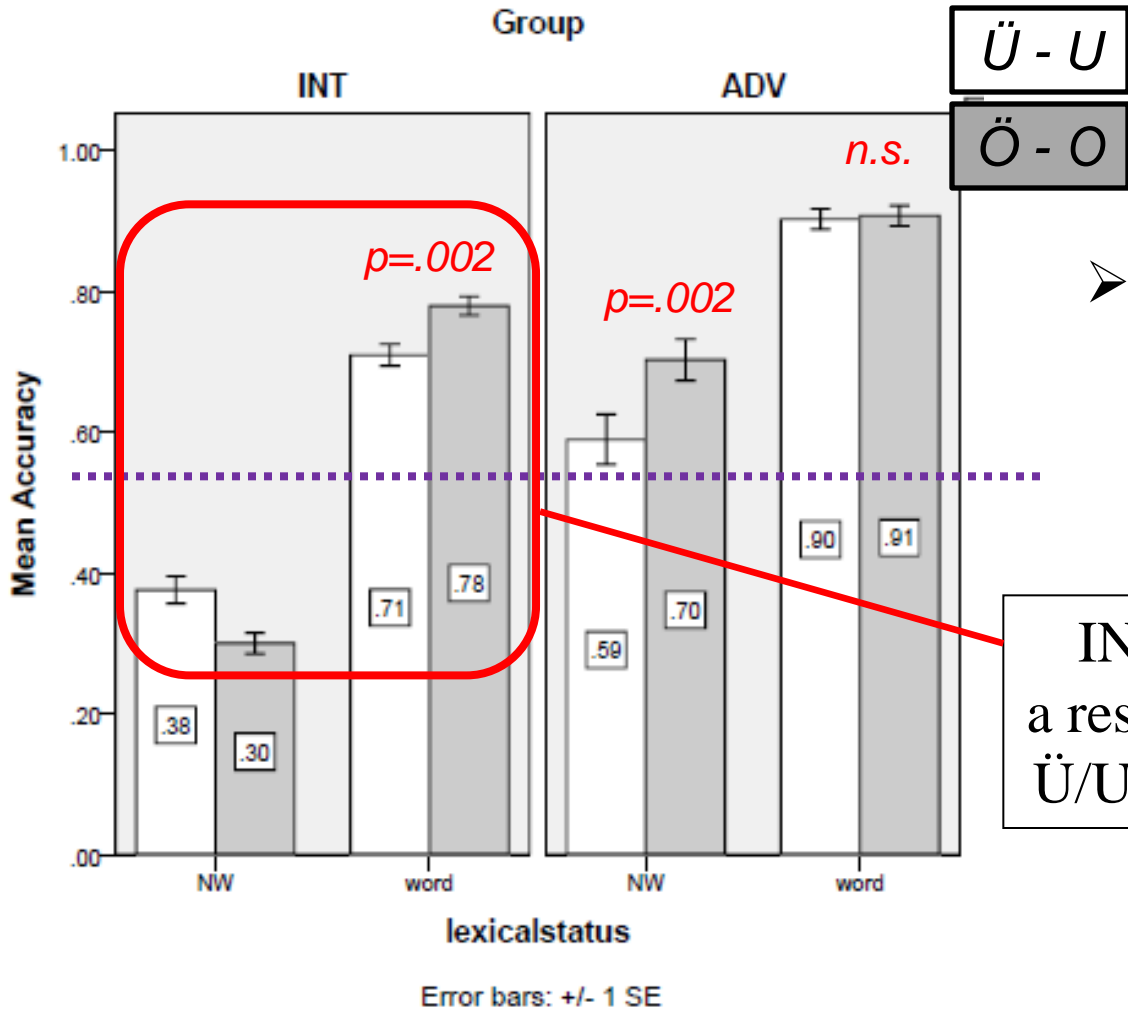


- ADV learners show no sign. difference between both conditions (/Ü-I/ & /Ö-E/)
- INT learners: same



# The German Study: Results (Lexical Decision)

## [front] - [back] contrast



➤ ADV learners exhibit sign. fewer correct rejections of NWs in the Ü/U-contrast compared to Ö/O-contrast

INT skewing is likely due to a response bias toward accepting Ü/U & Ö/O nonwords as words



## Discussion: English learners of German

- no clear evidence for dissociation has been found

~~[+] lexical contrast  
[-] targetlike category~~

- learners categorize German vowel contrasts accurately (in particular the mid vowels)
- but learners have difficulty rejecting NWs (though accuracy is higher on mid-vowel NWs first)

DMAP-B:

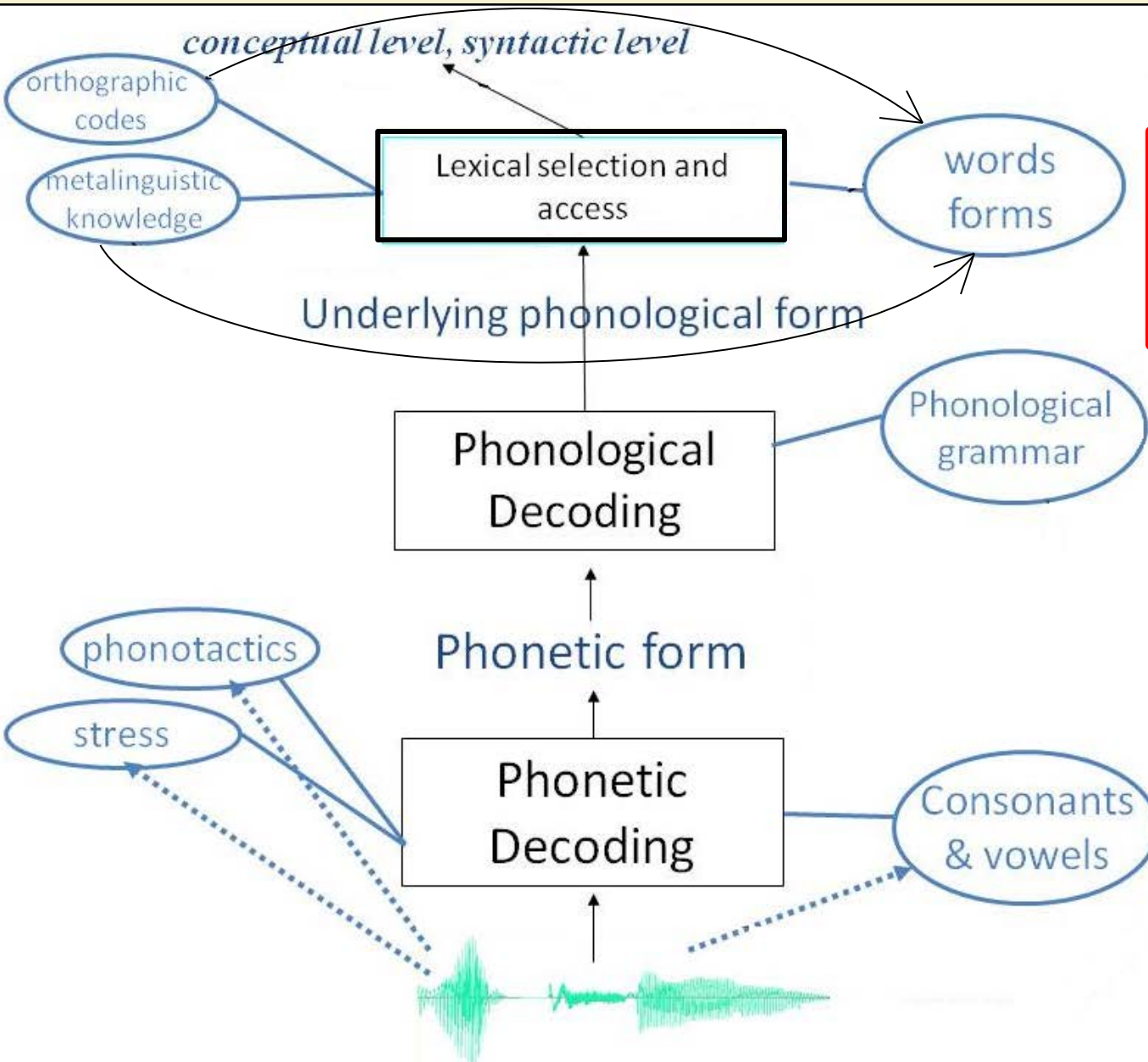
*detected features trigger revisions of the IL feature hierarchy in accordance with economy principles. (Economical Revisions)*





## Discussion: English learners of German

- ADV learners show an asymmetry between mid and high vowels (mid > high)
- the difference was expected
  - in DMAP, mid vowels are assumed to be unmarked for this type of inventory and should be acquired earlier
- our data support this assumption
- Nonetheless, the frequency of vowel occurrence in German could still explain these data for the ADV learners (*input-driven* acquisition)

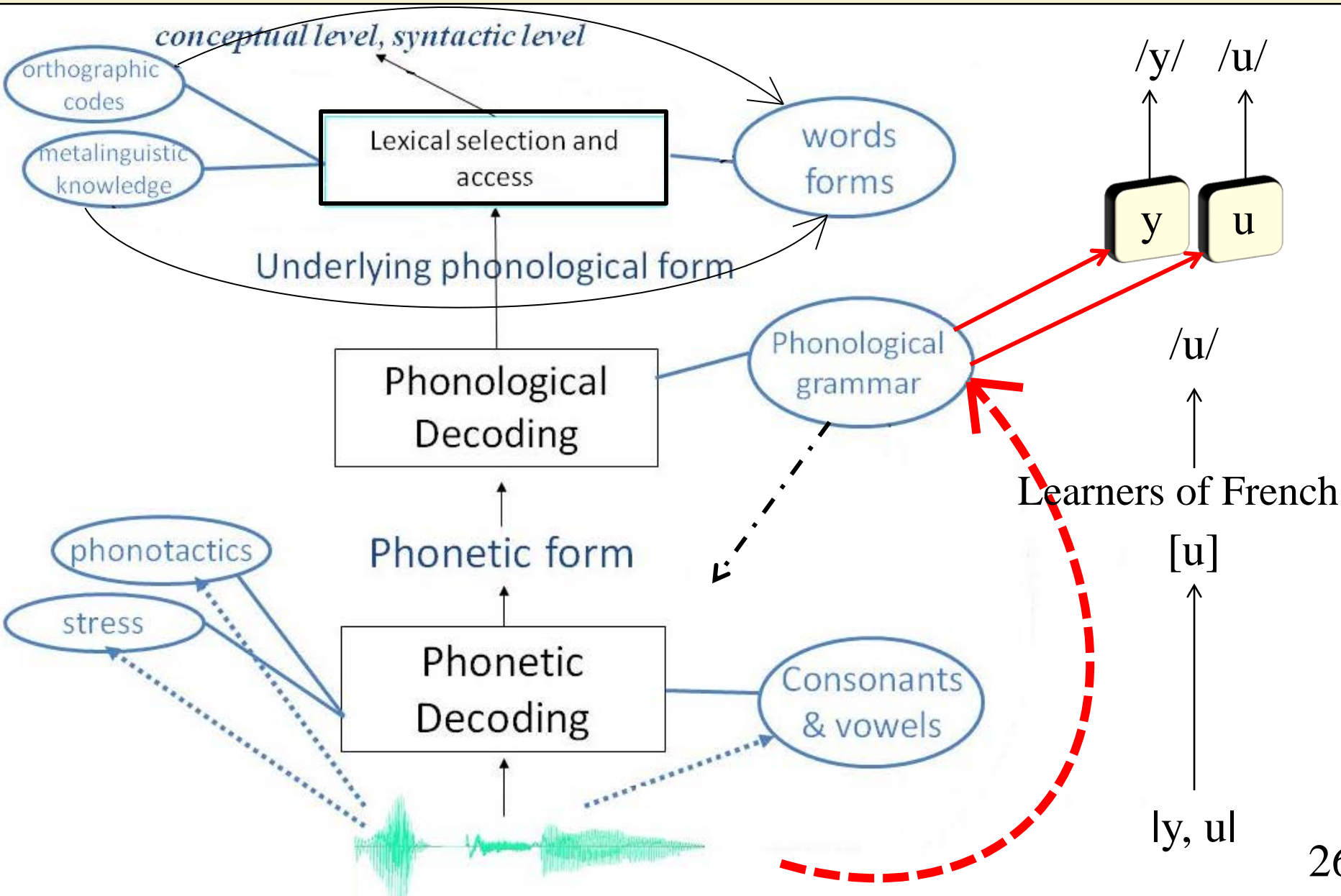


acquisition at the lexical Level is constrained by acquisition at the segmental level

⋮ ⋮

Learners of German

[y] [u]  
 ↑ ↑  
 |y| |u|





## **Discussion – learners of French vs. learners of German**

- dissociation shown in learners of French
- no dissociation shown in learners of German

Both the data from AE-French study & AE-German study can be explained with DMAP.

Without DMAP, we would need different approaches of L2-acquisition to explain these divergent results.



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