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## Suppression of L1 influence in L2 phonological processing: Cognitive abilities and individual variation

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## Why study individual differences?

- Observed in all domains of L2 acquisition
- Not well understood (cause /extent)
- Understand the link between basic cognitive abilities and phonological acquisition
- Determine the underlying characteristics of learners, both those who struggle with L2 phonological acquisition as well as those who gain excellent mastery of the L2 phonological system.

## Individual variation in L2 development

### Learning conditions:

- L1 background (e.g. Flege, Bohn, & Jang, 1997)
  - Age and length of L2 exposure (e.g. Flege, Yeni-Komshian, & Liu, 1999; Johnson & Newport, 1989)
  - Frequency or amount of L1/L2 use (e.g. Guion et al., 2000)
- when controlled, individual differences remain in L2 phonological development (e.g. Pallier et al., 1997)

### Cognitive abilities:

- Working memory (e.g. Atkins & Baddeley, 1998; Papagno & Vallar 1995)
  - Attention control (Guion & Pedersen 2007; Segalowitz 1997)
  - Processing speed (Salthouse 1996)
  - Lexical retrieval (Segalowitz 1997)
- Not well known: how these factors relate to **L2 phonological** development in perception and production

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## L2 Phonological development in perception

- Quantify suppression of L1-based processing at different levels

- L1 influences L2 phon. processing
- L2 acquisition ≈ processing becomes gradually more L2-like (and less influenced by L1)
- For L2 learners in our tasks: High accuracy = less L1-based processing
- E.g. Dupoux et al., 2008; Levy and Strange, 2008; Weber and Cutler, 2006

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## L2 Phonological development in perception

- Quantify suppression of L1-based processing at different levels
  - **Segmental** → ABX categorization task (consonant and vowel categories)
  - **Suprasegmental** → sequence repetition task (stress patterns)
  - **Phonotactic** → lexical decision task (onset-clusters in non-words)
- Correlate with cognitive abilities
  - **Working memory, attention control, processing speed, lexical retrieval**

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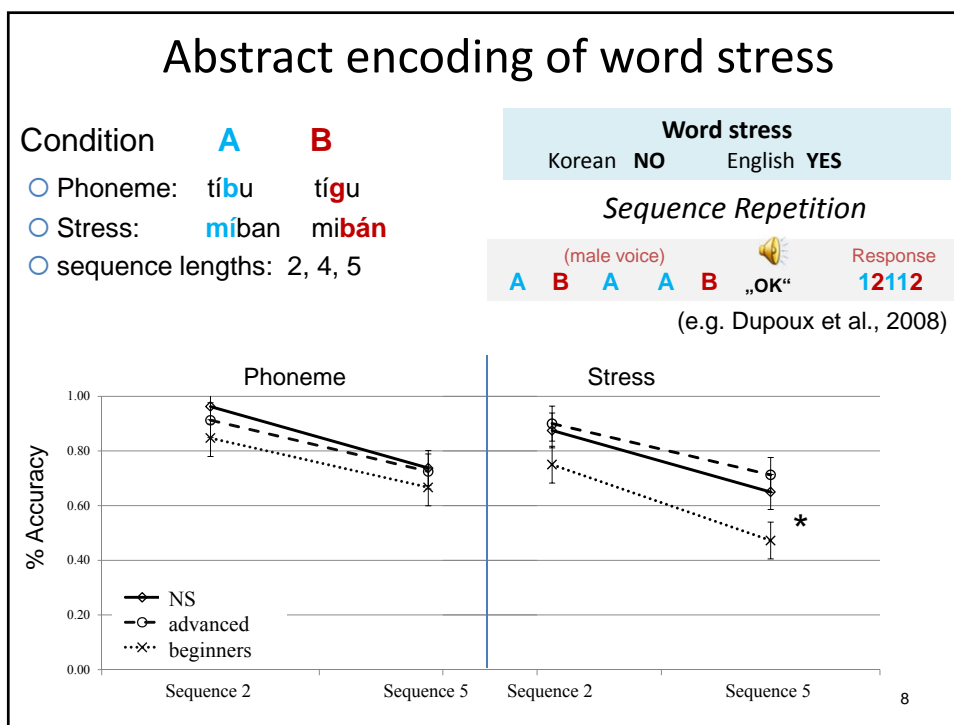
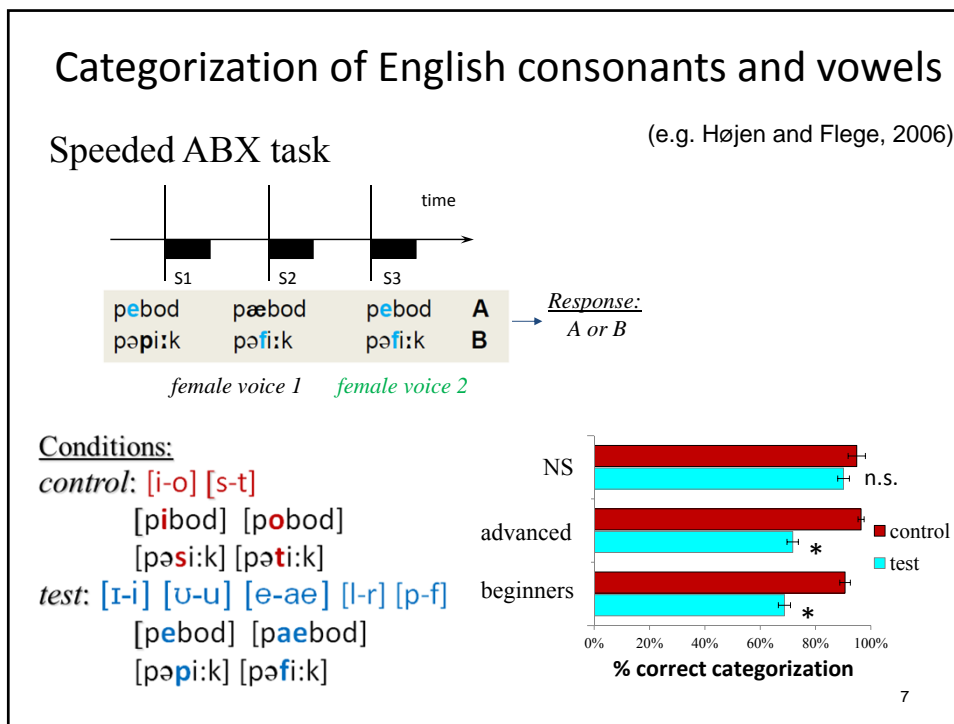
## Participants

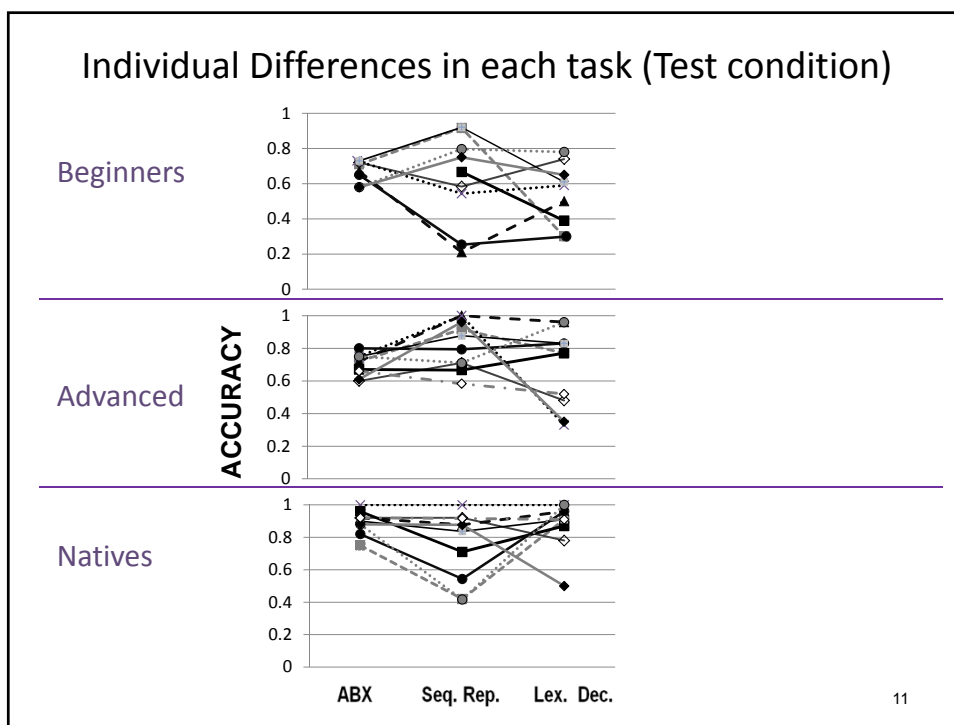
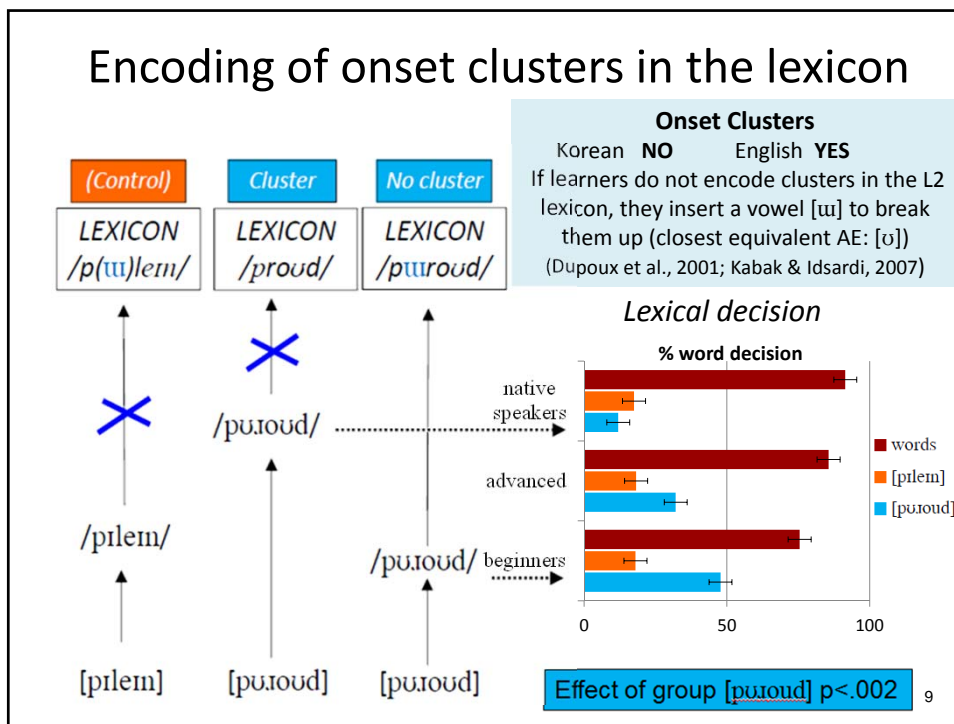
**Korean L2 learners** N = 20

N	Length of Residence (months)	current age (yrs)	age of arrival (yrs)	current L2 use (%)	average motivation (1-11)
<b>"Advanced": 10</b>	<b>49.5</b> (21-100)	<b>30.5</b> (23-47)	<b>25.6</b> (17-41)	<b>56.5</b> (5-80)	<b>8.9</b> (7.3 – 10.4)
<b>"Beginners": 10</b>	<b>4.0</b> (2-10)	<b>24.0</b> (20-37)	<b>23.3</b> (20-36)	<b>39.0</b> (10-90)	<b>8.4</b> (7.5 – 10.4)
P (2-tailed t-test) :	<b>0.0001</b>	<b>0.034</b>	<b>0.40</b>	<b>0.10</b>	<b>0.32</b>

**Native speakers** N = 10 (average age: 24 years)

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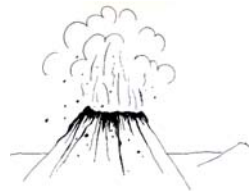
## Working memory (both in L1 and L2)

- Forward/backward digit span;
    - Simple span (storage capacity)
      - List length 3-10;
  
  - Sentence repetition with last word recall (Daneman & Carpenter 1980)
    - Complex span
      - Repeat and judge each sentence as true/false;
      - List length 2-7
      - After block ends, recall the last word of each sentence in that list
1. Bakers make pastries. True
2. There are three days in a week. False
- Last words in correct order: **pastries, week**

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## Other measures

- **Processing speed** (in L1)
  - Naming all three features (2 sizes, 4 colors and 3 shapes) of 30 geometric forms as quickly as possible in **30 seconds** (Korkman et al., 2007)
    - e.g. Big Red Square, Small Blue Triangle
  
- **Lexical retrieval** (in L1 and L2)
  - Boston Naming task (Kaplan et al., 2001) : accuracy and speed for 30 items



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## Comparisons on cognitive tasks

L1 Working Memory	digit span (/208)	recall (mx 54)		
Americans	74	41		
Koreans (advanced)	<b>93</b> (68-125)	<b>33</b> (22-44)	→ Both learner groups have a similar distribution in all measures, except for L1 simple span.	
Koreans (beginners)	<b>71</b> (36-90)	<b>31</b> (25-44)		

L2 Working Memory	digit span (/208)	recall (mx 54)	processing sp. (acc./60)
Americans	<b>66</b>	<b>33</b>	<b>46</b>
Koreans (advanced)	(28-126)	(20-47)	(28-60)
Koreans (beginners)	(24-100)	(17-50)	(35-60)





  

Lexical retrieval & Naming speed	Accuracy L1 (%)	Accuracy L2 (%)	Naming speed: L1	Naming speed: L2
Americans	92	<b>59</b>	1035	
Koreans (advanced)	(73-88)	(50-70)	<b>1129</b>	<b>1689</b>
Koreans (beginners)	(73-96)	(27-77)	<b>1231</b>	<b>1615</b>

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## Attention control (in L2)

- Speeded decision task
- Shift attention to a specified dimension of the auditory stimuli (e.g. „Male Voice?“ or „Real word?“) (stimuli vary in voice and lexical status)

Question	Auditory stimulus	Response
Male voice?	word (female) 	NO
Word?	word (male) 	YES
Word?	non-word (male) 	NO
Male voice?	word (female) 	NO

- Measure: accuracy and latency on **No-change (baseline)** vs. **Shift** conditions

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## Attention task

- „no change“ (baseline) vs. „shift“ condition

	Average accuracy (%)		Average RT (ms)	
	baseline (sd)	shift (sd)	baseline (sd)	shift(sd)
Native speakers	93 (4)	90 (9)	<b>911</b> (122)	<b>973</b> (120)
Koreans (long-LOR)	83 (4)	80 (7)	<b>783</b> (90)	<b>830</b> (97)
Koreans (short-LOR)	81 (9)	79 (10)	<b>919</b> (156)	<b>987</b> (163)

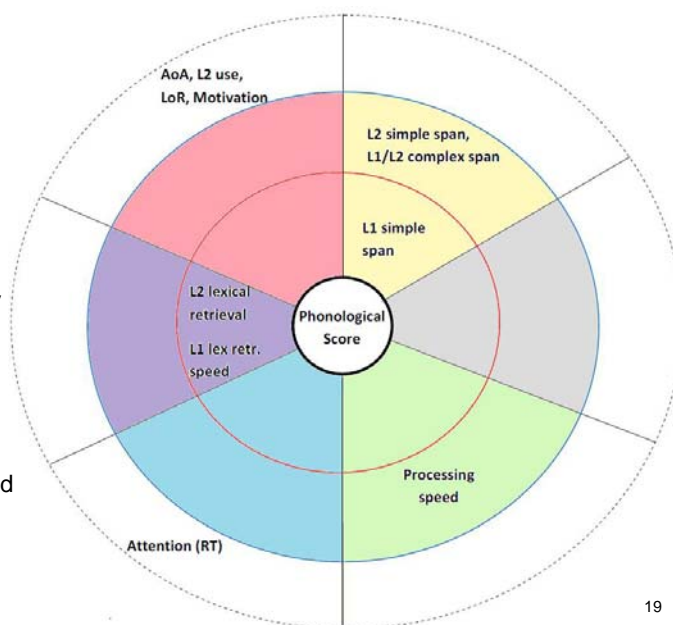
$t(28) = 2.0, p < .03$                        $t(28) = 3.9, p < .001$

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## Correlations with phonological score

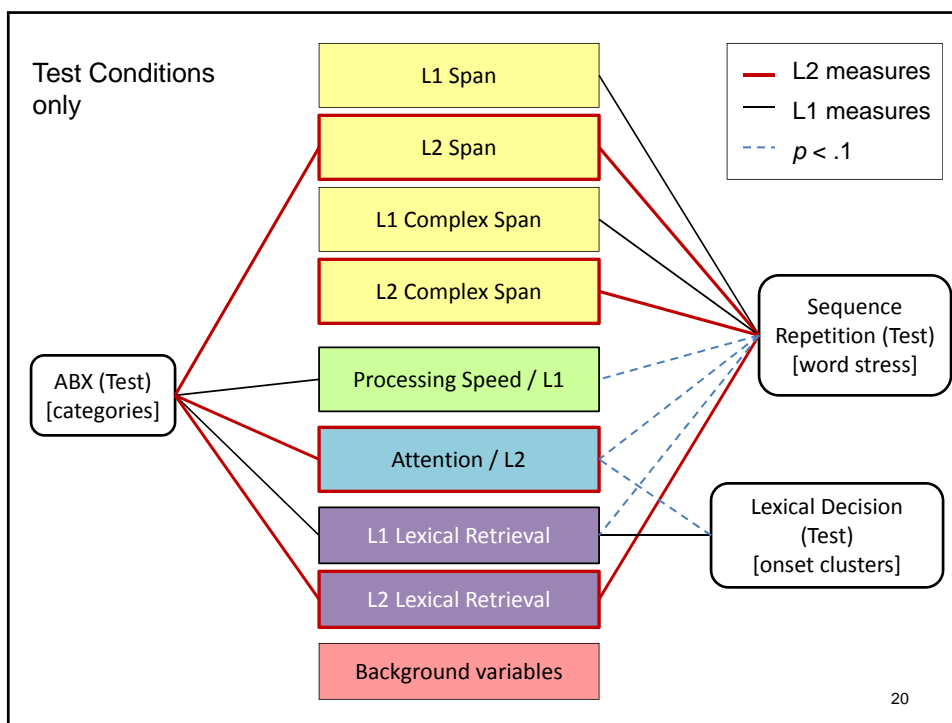
Pearson correlations  
N = 18  
Learners

- working memory
- background var.
- lexical retrieval
- attention
- processing speed



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## Take-home messages

- 1) **Large individual differences**
  - But little consistency across tasks: performance in one task does not predict performance in another (and overall accuracy is not correlated between tasks)
- 2) **Three major areas of cognitive abilities correlate with phonological score, going beyond LOR differences**
  - **working memory (both L1 and L2)**
  - **processing speed (L1)**
  - **lexical retrieval (acc and speed)**
- Specific task scores correlate independently with specific cognitive measures
  - a mix of cognitive abilities underlie better phonological acquisition
  - too early to tell which phonological domain is more strongly connected to a specific cognitive domain (task effects)

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