

# Whole-word versus part-word phonotactic probability/ neighborhood density in word learning by children

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1

Semantic Representation



Lexical Representation

koff

Phonological Representation

k

ou

f

4

## What do children have to learn to “know” a word?

2

### Phonological Characteristic

- Phonotactic probability (Vitevitch & Luce, 1999)
  - Frequency of occurrence of individual sounds (i.e., positional segment frequency)
  - Frequency of co-occurrence of pairs of sounds (i.e., biphone frequency)
  - High probability advantage in recognition and production

5

Semantic Representation



Lexical Representation

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Phonological Representation

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3

### Lexical Characteristic

- Lexical neighborhood density (Luce & Pisoni, 1998)
  - Number of similar sounding words
    - Words that differ by only one phoneme in any word position
  - High density disadvantage in recognition
  - High density advantage in production and serial recall

6

## Relationship between Phonology and Lexicon

- Phonotactic probability correlated with lexical density (Vitevitch, et al., 1999; Storkel, 2004)
  - High probability ~ high density
  - Low probability ~ low density

7

## Does part-word probability/density affect word learning?

10

## Past Studies of Word Learning

- Children learned high probability/density novel words more rapidly than low (Storkel, 2001, 2003, 2004, Storkel & Rogers, 2000; Storkel & Maekawa, in press)
- Examined probability/density of the whole word

8

## Does the effect of part-word probability/density vary by age?

11

## Parts of Words Matter

- Onset density affects recognition and production by adults (Vitevitch, 2002; Vitevitch, Armbruster, & Chu, 2004)
  - e.g.: *mass – map, mad, man, pass*  
*sad – bad, fad, lad, sack*  
  
*mass* has many onset neighbors (few rhyme)  
*sad* has many rhyme neighbors (few onset)
- Words with many onset neighbors recognized more slowly than words with many rhyme neighbors (few onset)
- Words with many onset neighbors produced more quickly than words with many rhyme neighbors (few onset)

9

## Shift from Whole to Part?

- Lexical re-structuring model (Metsala & Walley, 1998)
  - Posits holistic representation that changes to fine-grain
- Evidence from classification tasks that:
  - Young children classify words by overall similarity
  - Older children classify words by parts
    - First, rhyme
    - Then, onsets

12

## Purpose

- Pit whole-word probability/density against part-word probability/density
- Examine effect across age because sensitivity to parts of words may increase with age

13

	Low CV/ Low VC	Low CV/ High VC	High CV/ Low VC	High CV/ High VC
CV probability	0.0004	0.0004	0.0046	0.0061
CV density	2	1	8	8
VC probability	0.0004	0.0030	0.0005	0.0057
VC density	1	8	1	10
Whole probability	0.001	0.003	0.005	0.012
Whole density	4	11	11	21

16

## Method

- 43 monolingual English-speaking children
  - 20 3-year-olds
  - 23 4- and 5-year-olds
- 16 CVC nonwords varying in whole-word and part-word phonotactic probability/neighborhood density
  - Low CV/Low VC      Whole = low
  - Low CV/High VC    Whole = medium
  - High CV/Low VC    Whole = medium
  - High CV/High VC    Whole = high

14

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17

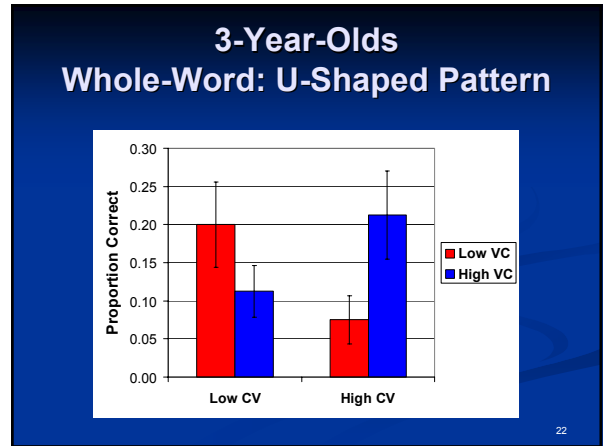
	Low CV/ Low VC	Low CV/ High VC	High CV/ Low VC	High CV/ High VC
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15

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18

CV	VC		Referent			
	High	Low	Item 1	Item 2	Item 3	Item 4
High	pid	kouf				
						
Low	yak	gib				
						



### Procedure


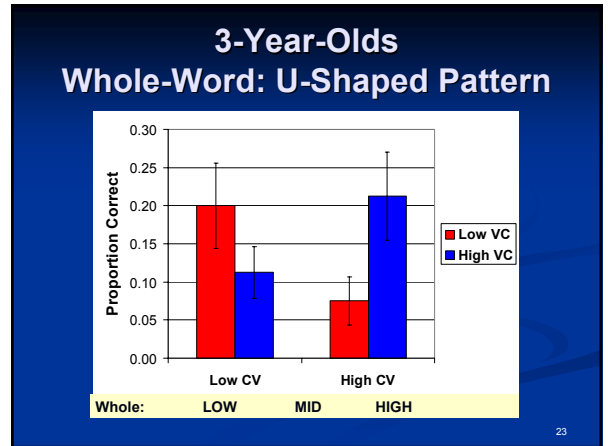
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 Episode 1 Episode 2 Episode 3  
 8 exposure 8 exposures 8 exposures  
 8 stimuli 8 stimuli 8 stimuli

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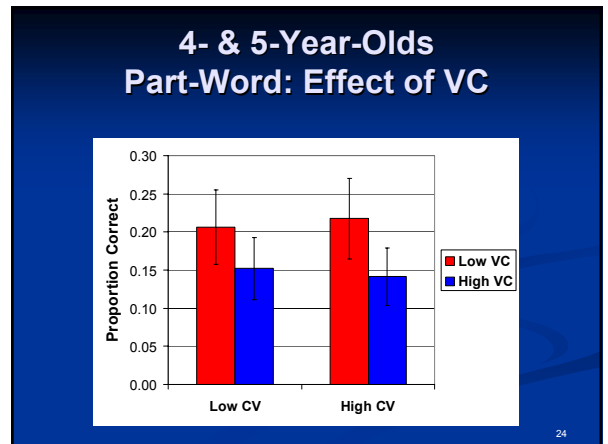
Test 0 Story 2 Test 1 Story 2 Test 2 Story 2 Test 3 Test 4  
 Episode 1 Episode 2 Episode 3  
 8 exposure 8 exposures 8 exposures  
 8 stimuli 8 stimuli 8 stimuli

- Picture Naming

### Results

- 2 CV x 2 VC x 2 Age mixed ANOVA
- Significant 3-way interaction of CV x VC x Age
  - $F(1, 41) = 6.14, p = 0.02$
- Analyze each age separately



## Summary

- 3-year-olds
  - Effect of whole-word probability/density
  - Low & High advantage over Mid
- 4- & 5-year-olds
  - Effect of part-word probability/density
  - Low VC advantage over High VC

25

## Interpretation: Development

- Effect of whole vs. part changes with development
- Supports shift from holistic to fine-grain processing
  - Coincides or precedes emergence of phonological awareness of the rhyme?

28

## Interpretation: “U” for Whole-Word

- Low = High > Mid
- Low advantage = unique
  - Sequence is novel and must be learned
- High advantage = cohesive, predictable
  - Easier to hold in memory
  - Easier to create a lexical representation
- Mid = not unique and not predictable

26

## Taken together, parts of words seem to influence word learning for older, but not younger, children

Emergence of the influence of part-words may be an important milestone

29

## Interpretation: Part-Word

- Low > High rhyme
  - Again, advantage for uniqueness
- Rhyme characteristics more influential than onset

27

## Thank you!

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30