



Predicting Phonetic Accuracy in Three- to Seven-Year-Old Children

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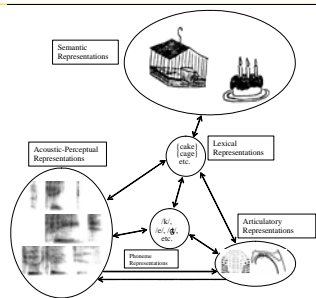
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What Supports Accurate Speech Production?

- To produce speech accurately, we need to know...
 - How words ought to sound
 - How to configure our articulators to produce those sounds
 - A store of items to produce.
 - The ability to access those items from long-term memory and to phonologically encode them in real time

Figure: Mary Beckman (Taken from Munson, Beckman, & Edwards, 2005)



Purpose

- Previous studies have shown that children with less-accurate speech production differ from ones with more-accurate production in nearly all of these abilities.
- The purpose of this poster: to determine which of these abilities uniquely predict phonetic accuracy in a heterogeneous cohort of children, including children both with and without phonological disorder, and to determine whether experimental measures of lexical access, phonological encoding, and speech perception predict unique portions of variance in phonetic accuracy, beyond what is accounted for by traditional clinical measures.**

Measures

Phonetic Accuracy

- Arcsine-transformed percent phonemes correctly produced in the sounds-in-words subtest of the *Goldman-Fristoe Test of Articulation-2* (Goldman & Fristoe, 2000).
 - Included all sounds, not just those targeted on that test

How Words ought to Sound

- Two measures of speech perception
 - Accuracy in a minimal-pair identification task (Baylis, Munson, & Moller, 2008).
 - Children were presented with pictures representing two words differing in one phoneme, along with an audio recording of one of the words. They then pointed to the picture corresponding to the word
 - Priming magnitude in a long-term auditory repetition priming experiment.
 - Children listened to a set of nonwords, then engaged in a distracter task, then repeated nonwords, including some of the old nonwords and some new nonwords.

Measures, Continued

How to Configure our Articulators

- Maximum alternating syllable repetition rate
 - Maximum production rate for strings of [pʌtʌkʌ].

A Store of Items to Express

- Estimates of receptive and expressive vocabulary size from the *Peabody Picture Vocabulary Test-III* (Dunn & Dunn, 1997) and the *Expressive Vocabulary Test* (Williams, 1997).

The Ability to Access them in Real Time

- Naming response time, taken from an experiment examining lexical access. In that experiment, children named pictures after a pre-specified delay interval. Only the responses from the 0 ms delay interval were used in this analysis.
- An estimate of phonological encoding ability, taken from a cross-modal picture-word interference experiment in which children named pictures while listening to spoken words over headphones.

Kids

- 36 Children from a study on cognitive-linguistic and perceptual-motor processing in speech production
- Ages: 3-7 years
- 18 with Phonological Disorder, 18 with typical phonological development
- Age-appropriate receptive and expressive vocabulary, nonverbal intelligence, and hearing

Regression Analysis: 1

Dependent Measure: Rationalized Arcsine Transformed (RAT) Percent Phonemes Correct

First Variable: Age

Second Block of Variables: Minimal-pair identification accuracy, Long-term repetition priming magnitude, Maximum syllable repetition rate, receptive vocabulary, expressive vocabulary, naming speed, phonological encoding magnitude

- Entered stepwise if they accounted for a significant proportion of variance ($\alpha < 0.05$) beyond what was accounted for by the variable(s) entered on the previous step(s)

Results:

- Age accounted for 20% of the variance
 - Older children were more accurate
- Naming speed accounted for 30% of the variance
 - Children with faster naming speed were more accurate
- PPVT-III score accounted for 16% of the variance
 - Children with larger-sized receptive vocabularies were less accurate than those with smaller ones
- Prime magnitude accounted for 6% of the variance
 - Children with more-accurate speech production showed greater susceptibility to priming effects in the long-term repetition priming experiment
- In the final regression, everything except age had significant β coefficients

Regression Analysis: 2

Dependent Measure: RAT Percent Phonemes Correct

First Variable: Age

Second Block of Variables: Minimal-pair identification accuracy, maximum syllable repetition rate, receptive vocabulary, expressive vocabulary

- Entered stepwise if they accounted for a significant proportion of variance ($\alpha < 0.05$) beyond what was accounted for by the variable(s) entered on the previous step(s)

Third Block of Variables: Long-term repetition priming magnitude, naming speed, phonological encoding magnitude

- Entered stepwise if they accounted for a significant proportion of variance ($\alpha < 0.05$) beyond what was accounted for by the variable(s) entered on the previous step(s)

Results:

- Age accounted for 20% of the variance
 - Older children were more accurate
- EVT accounted for 23% of the variance
 - Children with larger-sized expressive lexicons were more accurate
- Minimal-pair identification accuracy accounted for 9% of the variance
 - Children with more-accurate identification were more accurate
- Naming speed accounted for 16% of the variance
 - Children with faster naming speed were more accurate
- In the final regression, everything but age had significant β coefficients

Discussion

Regardless of the order in which the variables were ordered, we found three skill sets that predicted unique proportions of variance in speech-production accuracy:

- A measure of **perception** (either minimal pair identification or priming magnitude). Likely reflects the fact that auditory targets are the goals in speech production. Children with better-developed auditory targets produce speech more accurately than those with poorer targets.
- A measure of **vocabulary size** (receptive or expressive). Perhaps reflects the reciprocal relationship between vocabulary growth and the development of higher-level phonological knowledge (Beckman, Munson, & Edwards, 2007)
- Naming speed**. Somewhat surprising. One somewhat uninteresting possibility: the inverse correlation between naming RTs and less-accurate speech production reflects children's tacit awareness of the mismatch between the intended target and their productions, and this association merely reflects the fact that production accuracy and awareness develop in tandem.

Importantly, measures of each of these three types of knowledge predicted *unique* portions of variance in speech-production accuracy.

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