Evaluating an Implicit Measure of Phonological Awareness in Preschool Children

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BACKGROUND

Rationale

- Phonological awareness (PA) is a strong correlate and early indicator of reading and writing achievement in school-age children.
- Current paradigms can reliably evaluate PA skills at age 5 using explicit phonological manipulation tasks, as in:
  - Standardized measurements such as the Comprehensive Test of Phonological Processing (CTOPP -2) (Wagner et al., 2013).
  - Informal assessments of word blending and word segmenting
- However, it is difficult to use such explicit measures to assess PA at age 3.
- There are several well known correlates of PA including: vocabulary (expressive and receptive) and speech perception.
  - Speech perception skills and receptive vocabulary at age 4 explained much of the variance in PA measured at age 5 in children with diagnosed speech sound disorders (Rvachew, 2006).
- Edwards et al., 2004 proposed that the effect of phonotactic probability (PP) on nonword repetition accuracy can be used as an implicit index of higher phonological knowledge in children as young as 3.

Research Questions

1. Do expressive and receptive vocabulary development, nonword production accuracy, and speech perception assessed at age 3 predict PA performance at age 4 for children with typically developing language skills?
2. Does the effect of PP on nonword repetition accuracy at age 3 predict phonological awareness skills at age 4, as assessed by an explicit measure of PA?

METHODS

Minimal Pairs Task

Stimuli
- 15 minimal pairs of familiar words.
- Stimuli were recorded in both Mainstream American English (MAE) and African American English (AAE)
- Children were presented with the stimuli in their native dialect.

peas vs *keys*

Procedure
- On each trial, each of a pair of images presented and named by the computer before both images were presented at once while the target word was played.

Primary measure
- Percent correct for each child computed automatically

METHODS (cont.)

- A subset of children (24 of 200) from an ongoing longitudinal study.
- Ages: 3;0 (+/- 2 months) at time 1 and 4;0 (+/- 1 month) at time 2
- Monolingual English speakers with typical speech and language development.

Number of males/ females	Mean EVT-2 standard score at age 3 (SD)	Mean PPVT-4 standard score at age 3 (SD)	Mean Elision scaled score (SD) at age 4
11/13	119 (13)	118 (18)	12 (3)

Nonword Repetition Task

Stimuli
- Stimuli were 22 pairs of nonsense words adapted from Edwards et al., 2004.
- Each pair included a 2-phoneme sequence that contrasted in phonotactic probability (e.g. high frequency /ft/ versus low frequency /fk/)
- Stimuli were recorded in both Mainstream American English (MAE) and African American English (AAE)
- Children were presented the stimuli that matched their native dialect

Procedure
- Each target nonword was paired with a picture of an unfamiliar object in a picture-prompted auditory-word-repetition task.

"tweket"

- On each trial, the picture and audio stimulus were presented together and the child was asked to "Say what the computer said."

Primary measure
- The 2-phoneme target sequences were transcribed and scored as in Edwards et al., 2004 by counting the proportion of target features produced correctly and then adding a "prosody" point.

Analyses

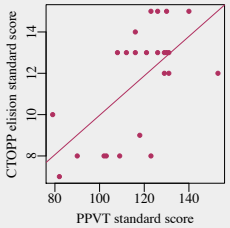
- The effect of phonotactic probability on nonword repetition accuracy (frequency effect) was quantified by:
  - Subtracting the mean scores for the low-frequency sequences from the mean scores for the high-frequency sequences.
- Linear regression was used to evaluate what measures predicted PA at age 4.
  - Dependent variable: CTOPP - 2 Elision scaled score
  - Independent variables: PPVT – 4 standard score, EVT -2 standard score, Minimal Pairs % correct, nonword repetition accuracy, the frequency effect.

RESULTS

Receptive Vocabulary

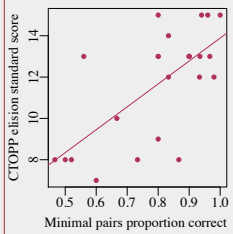
Figure 1: Phonological awareness (CTOPP-2 Elision) as a function of receptive vocabulary size.

Analysis 1: Children with higher receptive vocabulary scores at age 3 had higher PA at age 4 (adjusted $R^2 = .37$, $p < .001$; see regression curve in Figure 1).



Speech Perception

Figure 2: Phonological awareness as a function of speech perception (minimal pairs task).



Analysis 2: Children with more accurate speech perception at age 3 had higher PA scores at age 4 ($R^2 = .44$, $p < .001$; regression curve in Fig. 2).

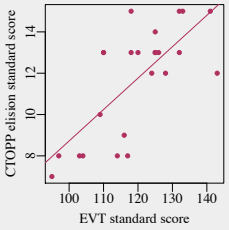
Analysis 3: In the combined regression with PPVT-4, PPVT-4 explained 5% of the variance over and above the 44% accounted for by Minimal Pair accuracy ($R^2 = .49$).

Expressive Vocabulary

Figure 3: Phonological awareness as a function of expressive vocabulary

Analysis 4: Expressive vocabulary at age 3 was a significant predictor of PA at age 4 ($R^2 = 0.50$, $p < 0.001$; regression curve in Fig. 3).

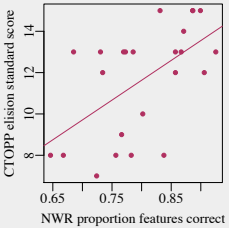
Analysis 5: In the combined regression with Minimal Pairs, Minimal Pair accuracy explained 12% of the variance over and above the 50% accounted for by EVT - 2 ($R^2 = .53$).



RESULTS (cont.)

Nonword Accuracy

Figure 4: Phonological awareness as a function of overall production accuracy (high- and low-frequency combined).



Analysis 6: There was no relationship between the frequency effect at 3 and PA at age 4.

Analysis 7: Instead, PA at age 4 was correlated with mean overall NWR production accuracy (adjusted $R^2 = .30$, $p < .01$; regression curve in Fig. 4).

Analysis 8: However, mean overall NWR repetition accuracy was *not* a significant predictor of PA when added to regression analyses with the other measures from age 3.

SUMMARY AND DISCUSSION

Summary of Results

- The results in analysis 6 suggest that we do not yet have an implicit measure of PA that can be used for children at age 3.
- A measure of speech perception (minimal pairs task) at age 3 accounted for a substantial proportion of the variance in PA at age 4.
- Previous studies have focused on receptive vocabulary as opposed to expressive vocabulary. This study showed that expressive – rather than receptive – vocabulary at age 3 predicted more of the variance in PA.

Discussion

- This study is the first to examine which measures of vocabulary skills, production skills, and perception skills at age 3 predict PA at age 4.
- The results suggest that improving speech perception skills at age 3 may result in better PA at age 4. We plan to explore this claim further using SEM when the remaining participants have been tested at age 4.

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