Modelling the relation between prosodic sensitivity and emergent literacy

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Abstract

A converging literature has demonstrated that prosodic sensitivity (the rhythmic patterning of speech) is related to literacy development and theoretical models of this relation have begun to enter the literature (see Holliman et al., 2014). It has been theorized that the observed relation between prosodic sensitivity and word reading and spelling might be partially mediated by children's vocabulary knowledge, phonological awareness, and morphological awareness; however, no study to date has tested this model with children in the earliest stage of reading development. In this study, four- to five-year-old English-speaking children (N = 101) who were identified as pre-readers completed a new test of prosodic sensitivity and were also assessed for their vocabulary knowledge, phonological awareness, and morphological awareness. One year later, participating children (N = 93) were assessed for their word reading and spelling. The new measure was found to be reliable, understood by children of this age, and sensitive to individual differences in prosodic sensitivity. It also correlated significantly with all other measures in this study. A path analysis indicated that the model proposed by Holliman et al. provided an adequate fit to our sample data; specifically, the results suggest that prosodic sensitivity in pre-literate children predicts word reading and spelling indirectly via its inter-relations with other emergent literacy skills. It is argued that prosodic sensitivity plays an important role in early literacy development.

Introduction

Prosodic sensitivity is a skill which develops in early infancy as part of a progressive attunement to one's first language (Jusczyk, 1999). Many recent studies have shown that prosodic sensitivity is implicated in successful reading acquisition (e.g., Goswami et al., 2009; Leong et al., 2011; Schwanenflugel et al., 2004), and in ways that are independent of segmental phonological awareness (e.g., Clin et al., 2009; Holliman et al., 2008, 2010a, 2010b, 2012; McBride-Chang, Lam et al., 2008; Whalley & Hansen, 2006; Wood, 2006). This represents a key theoretical development, as suprasegmental phonology is neglected in current models of reading acquisition (Wood et al., 2009; Zhang & McBride-Chang, 2010).

Wood et al. (2009) reviewed the available evidence and proposed a model that aims to explain the nature of the relation between prosodic sensitivity and early literacy development via three possible contributory pathways. In the first pathway, it was suggested that children are born with a periodicity bias (Cutler & Mehler, 1993) which allows them to 'tune in' to the rhythmic properties of speech in their environment. This allows them to bootstrap their way into spoken word recognition, which facilitates the development of vocabulary and in turn, phonological awareness (Walley, 1993). In the second pathway, it was argued in accordance with Chiat (1983) and Kitzen (2001) that prosodic sensitivity (to linguistic stress in particular) may facilitate the identification of phonemes in words (which are easier in stressed rather than unstressed syllables) and may also promote the identification of onset-rime boundaries given that the peak of loudness in a syllable corresponds to vowel location (Scott, 1998), which may support decoding skill via analogical reasoning (Goswami, 2003; Goswami et al., 2002). In the third pathway, it was argued that the relation between prosodic sensitivity and literacy may be explained via its link with morphological awareness in decoding multisyllabic words, which requires the additional skill of stress assignment (i.e., knowing to pronounce the word 'together' as toGEther, rather than TOgether, for example).

The first empirical test of the Wood et al. (2009) model provided by Holliman et al. (2014) found it necessary to also include inter-relations (pathways) between the so-called mediating variables (vocabulary knowledge, phonological awareness, and morphological awareness). This modified model provided an adequate fit to the sample data and provides some insight into the ways in which prosodic sensitivity connects to word reading and spelling. The Holliman et al. model was re-examined in the present study (see Figure 1, in due course) with younger children in the earliest stage of reading development.

There were two principal aims of this research:

- *to produce and validate an assessment of prosodic sensitivity that could be successfully administered to a sample of four- to five-year-old pre-readers in Reception Year (the UK equivalent of Kindergarten in the US), and;*
- *to examine the mechanisms by which prosodic sensitivity and other emergent literacy skills in four- to five-year-old pre-readers might interact to influence word reading and spelling one year later.*

Method

Participants

All participating children in this study were recruited from three primary schools in the West Midlands, UK. At Time 1, 101 four- to five-year-old English-speaking children (37 females) in Reception Year were available to take part: it was established that these children were 'pre-readers' in that they were unable to read a single word on a validated UK word reading test. Of these children, 93 (33 females) were available to take part at Time 2, one year later, by which time they were aged five- to six-years-old in Year 1. All children who took part had English as their first language.

Measures

Time 1

- Brenda's Animal Park – new measure of prosodic sensitivity (see below)
  - Compound nouns
  - Word stress
  - Intonation
  - Phrase stress
- British Picture Vocabulary Scales III (Dunn et al., 2009)
- Primary Inventory of Phonological Awareness – two subtests (Dodd et al., 2000)
  - Rhyme awareness
  - Phoneme isolation
- Morphology Completion subtest of TLD: Primary (Newcomer & Hammill, 2008)

Time 2

- *British Ability Scales III Word Reading subtest (Elliot & Smith, 2011)*
- *British Ability Scales III Spelling subtest (Elliot & Smith, 2011)*

Brenda's Animal Park

During the task, children are introduced to the main character, Brenda, who works on an animal park. Brenda encounters four different kinds of problems on the animal park, which can be thought of as four subtests measuring slightly different aspects of prosodic sensitivity. A composite measure of prosodic sensitivity can be constructed by combining the scores on each individual subtest:

- Compound Nouns: Children had to decide whether a pre-recorded utterance took the form of a compound noun (e.g., 'butterfly') or a noun phrase (e.g., 'butter…fly').
- Word Stress: Children had to decide whether a pre-recorded word was correctly stressed (e.g., 'CROcodile') or incorrectly stressed (e.g., 'croCOdile').
- Intonation: Children had to decide whether a pre-recorded utterance sounded like a question (e.g., '/the farmer gets up early') or a statement (e.g., '\the farmer gets up early') implied by a rise or fall in intonation.
- Phrase Stress: Children had to decide which of two pre-recorded utterances (e.g., 'apple pie' [strong-weak-strong] and 'tomatoes' [weak-strong-weak]) matched the 'Ba-Ba' phrase (e.g., BA-ba-BA).

The task was administered on a laptop using a Microsoft PowerPoint Presentation with audio files. For each subtest there were six practice trials where corrective feedback was provided and 14 test trials. The task was administered in the order presented above to maintain a coherent story that would be understandable to children of this age. A total score out of 56 was obtained.

Results

It was first important to demonstrate that the new measure of prosodic sensitivity was suitable for four- to five-year-old children who were identified as pre-readers. Results revealed that the measure was: not prohibitively difficult; able to detect individual differences in prosodic sensitivity; and sound in terms of psychometric properties given that all four sub-tests loaded strongly onto a single internally and externally consistent higher-order factor of prosodic sensitivity. Since there was no cause for concern regarding the new measure of prosodic sensitivity its interaction with other emergent literacy skills and its influence on word reading and spelling was then examined.

Bivariate correlations (Pearson) between the key variables in this study are presented in Table 1.

Table 1. *Correlation matrix between prosodic sensitivity, vocabulary, phonological awareness (composite), morphological awareness (Time 1 variables using raw scores), word reading and spelling (Time 2 variables using ability scores)*

Variable	1	2	3	4	5
1: T1: Prosodic Sensitivity					
2: T1: Vocabulary	.384***				
3: T1: Phonological Awareness	.367***	.266**			
4: T1: Morphological Awareness	.313**	.345***	.320**		
5: T2: Word Reading	.259*	.294**	.449***	.282**	
6: T2: Spelling	.222*	.266*	.452***	.232*	.893***

*p<.05; **p<.01; ***p<.001

It can be seen from the bivariate correlations that prosodic sensitivity was significantly correlated with all other measures in this study.

We then examined the relations between prosodic sensitivity and word reading and spelling using a path analysis of the conceptual path model proposed by Holliman et al. (2014). Models were estimated using MLR and assessed using a number of fit statistics in-line with accepted criteria (e.g., Hu & Bentler, 1998, 1999). For the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI), models were considered to adequately fit the data at values ≥.90 (Bentler & Bonett, 1980) with values >.95 preferred (Hu & Bentler, 1998, 1999). For the Standardised Root Mean Square Residual (SRMR) (Spence, 1997) and Root Mean Square Error of Approximation (RMSEA) (Browne & Cudeck, 1993), models were considered to adequately fit the data at values of ≤.08, with values ≤.05 preferred (Hu & Bentler, 1998, 1999).

The direct test of the conceptual model proposed by Holliman et al. (2014) used variables measured at Time 1 (Prosody, Vocabulary, Rhyme, Phoneme, and Morphology) and Time 2 (Word Reading and Spelling). The model with standardized parameter estimates is presented in Figure 1. The model was found to provide an adequate fit to the data (χ^2 = 2.403, df = 4, p = .662, CFI = 1, TLI = 1.037, RMSEA = 0, SRMR = .029) accounting for 25.4% of the variance in Word Reading scores and 22.5% of the variance in Spelling scores. No modification indices were suggested.

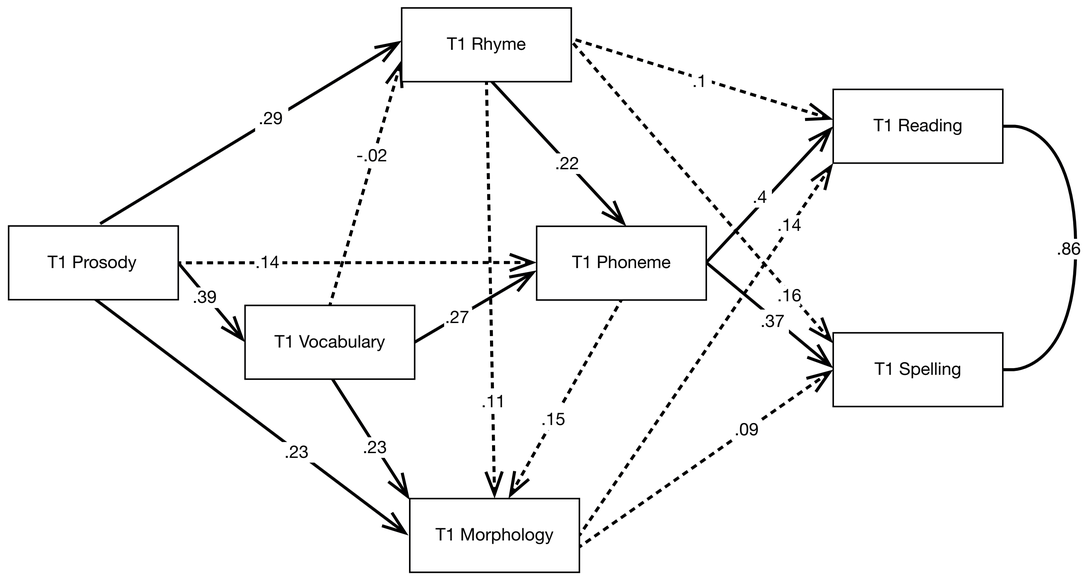

Figure 1. Path analysis results for the conceptual model proposed by Holliman et al. (2014). Non-significant paths are represented by dashed lines.

Conclusion

The new measure of prosodic sensitivity proved to be a valid and sensitive measure for four- to five-year-old children who were identified as pre-readers. Moreover, path analysis results revealed that the conceptual model proposed by Holliman et al. (2014) provides an adequate fit to our sample data, demonstrating that prosodic sensitivity in pre-readers predicts word reading and spelling indirectly via its inter-relations with other emergent literacy skills. Specifically, prosody appears to act through vocabulary, rhyme, and morphology to further influence phoneme which directly predicts both word reading and spelling one year later.

This work has been funded by the Nuffield Foundation but the views expressed are those of the author and not necessarily those of the Foundation. More information is available at www.nuffieldfoundation.org