Exploring the relationship between prosodic sensitivity and emergent literacy in a sample of pre-readers: A one-year longitudinal study

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Abstract

A growing literature has demonstrated that prosodic sensitivity (sensitivity to the rhythmic patterning of speech) is related to reading development; however, research investigating the relationship between prosodic sensitivity and reading development in the period prior to reading instruction is sparse. Moreover, few measures of prosodic sensitivity are suitable for children of this age and there is a paucity of longitudinal research in this area. In this study, four- to 5-year-old English-speaking children (N = 101) from three Primary Schools in the West Midlands, UK who were identified as being pre-readers completed a new test of prosodic sensitivity and were also assessed for their non-verbal IQ, vocabulary knowledge, phonological awareness, and morphological awareness at Time 1 (concurrently). At Time 2 (one year later) children (N = 93) were reassessed on these measures (not reported here) and also completed a word reading and spelling assessment. Bivariate correlation analyses revealed that children's prosodic sensitivity was significantly related to their vocabulary knowledge, phonological awareness, and morphological awareness (concurrently) and their word reading and spelling (one year later). However, in a series of multiple regression analyses, the only variable found to make a significant unique contribution to word reading and spelling one year later was phonological awareness. These preliminary findings indicate that prosodic sensitivity is unable to 'directly' predict early reading development beyond its association with other emergent literacy skills (e.g., phonological awareness).

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 relationship 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 relationship 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). While this final proposed pathway has been speculated on in the recent literature, few studies have assessed this.

In this study, a new assessment of prosodic sensitivity was developed and its relationship with measures of vocabulary, phonological awareness, and morphological awareness (concurrently) and word reading and spelling (one year later) was explored. There were two major research questions in this study:

Q1. *What is the bivariate relationship between prosodic sensitivity, vocabulary, phonological awareness, and morphological awareness (taken at Time 1, concurrently) and word reading, and spelling (taken at Time 2, one year later)?*

Q2. *Can any of the variables measured at Time 1 (and prosodic sensitivity in particular) make a 'unique contribution' (beyond the influences of the other predictors) to 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. These schools were comparable in terms of locality, proportion of males to females, and percentage of pupils with additional education requirements. At Time 1 (N = 101, 64 males) children were aged between 4 years 3 months and 5 years 2 months (mean age 4 years 8 months) and were in Reception year. These children were identified as 'pre-readers' in that they were unable to read a single word on the British Ability Scales III Word Reading subtest (Elliot & Smith, 2011). At Time 2 (N = 93, 60 males) children were aged between 5 years 3 months and 6 years 5 months (mean age 5 years 9 months) and were in Year 1. All children who took part had English as their first language.

Measures

Time 1

- *Matrices subtest of the British Ability Scales III (Elliot & Smith, 2011)*
- *British Picture Vocabulary Scales III (Dunn, Dunn, Styles, & Sewell, 2009)*
- *Primary Inventory of Phonological Awareness – four subtests (Dodd et al., 2000)*
- *Morphology Completion subtest of TLD: Primary (Newcomer & Hammill, 2008)*
- *Brenda's Animal Park (Holliman et al., in preparation, described below)*

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 an utterance took the form of a compound noun (e.g., 'butterfly') or a noun phrase (e.g., 'butter…fly'). Cronbach's α reliability coefficient was .6.
- Word Stress: Children had to decide whether a word was correctly stressed (e.g., 'CROcodile') or incorrectly stressed (e.g., croCOdile'). Cronbach's α reliability coefficient was .68.
- Intonation: Children had to decide whether an 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. Cronbach's α reliability coefficient was .75.
- Phrase Stress: Children had to decide which of two utterances (e.g., 'apple pie' [strong-weak-strong] and 'tomatoes' [weak-strong-weak]) matched the 'Ba-Ba' phrase (e.g., BA-ba-BA). Cronbach's α reliability coefficient was .68.

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. The four subtests loaded onto a single factor and explained 88.8% of the variance (factor loadings ranged from .934 to .956). Test-retest reliability was found to be good (r = .786) and the internal reliability was found to be impressive (Cronbach's α = .91).

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Results

Table 1 shows the mean and standard deviation scores on measures of general ability, morphology, phonological awareness (PA), prosodic sensitivity (PS), word reading, and spelling.

Task	Mean	Std. Deviation
Time 1		
Matrices (Max = 51)	6.02	2.05
Vocabulary (Max = 168)	52.3	8.69
PA: Syllable Segmentation (Max = 12)	1.13	2.2
PA: Rhyme Awareness (Max = 12)	3.52	2.72
PA: Phoneme Isolation (Max = 12)	7.46	3.88
PA: Letter Knowledge (Max = 32)	15.74	6.66
Morphology (Max = 38)	7.96	5.12
PS: Compound Nouns (Max = 14)	8.39	2.75
PS: Word Stress (Max = 14)	8.34	2.96
PS: Intonation (Max = 14)	8.72	3.28
PS: Phrase Stress (Max = 14)	7.65	3.03
Time 2		
Word Reading (Max = 90)	20.2	15.73
Spelling (Max = 75)	11.4	4.9

Table 1. Summary statistics for children on the core assessments in this study.

As the prosodic sensitivity measure involved a forced choice procedure, it was important to demonstrate that performance on this task was significantly above that expected by chance. A chi-square analysis indicated that a significant number of participants were performing above chance on all subtests: Compound Nouns, $\chi^2(1, N = 101) = 12.129$, $p < .001$; Word Stress, $\chi^2(1, N = 101) = 16.644$, $p < .001$, Intonation, $\chi^2(1, N = 101) = 13.554$, $p < .001$; and Phrase Stress, $\chi^2(1, N = 101) = 10.782$, $p = .001$.

Q1. What is the bivariate relationship between prosodic sensitivity, vocabulary, phonological awareness, and morphological awareness (taken at Time 1, concurrently) and word reading, and spelling (taken at Time 2, one year later)?

Table 2 shows the bivariate correlations (Pearson) between measures of age, general ability, vocabulary, phonological awareness (PA, composite), morphological awareness (morphology), prosodic sensitivity (prosody, composite), word reading, and spelling. Note: to rectify some non-normal distributions and to also produce a single estimate of phonological awareness and prosodic sensitivity, a composite measure for these constructs was obtained by calculating z-scores for each of the phonological and prosodic subtests (respectively) and adding them together.

Variable	1	2	3	4	5	6	7
1: Age							
2: Matrices	.06						
3: Vocabulary	.22*	.34**					
4: PA (composite)	.11	.29**	.35***				
5: Morphology	.2	.44***	.35***	.31**			
6: Prosody (composite)	.19	.25*	.39***	.44***	.31**		
7: Word Reading	1	.2	.32**	.51***	.3**	.27*	
8: Spelling	.14	.23*	.27*	.45***	.2*	.26*	.64***

Table 2: Correlation matrix between all core assessments in this study.
$^*p < .05$; $^{**}p < .01$; $^{***}p < .001$

It can be seen from Table 2 that the composite measure of prosodic sensitivity correlated with measures of vocabulary, phonological awareness, and morphological awareness (concurrently) and with word reading and spelling (one year later).

Q2. Can any of the variables measured at Time 1 (and prosodic sensitivity in particular) make a 'unique contribution' (beyond the influences of the other predictors) to word reading and spelling one year later?

Table 3 shows two standard multiple regression analyses predicting word reading and spelling (at Time 2) from general ability (matrices), vocabulary, phonological awareness composite (PA), morphological awareness (morphology), and prosodic sensitivity composite (prosody).

	Reading			ΔR^2	Spelling			ΔR^2
Predictor	B	$SE\ B$	β		B	$SE\ B$	β	
Matrices	-.233	.860	-.028	.001	.195	.281	.076	.004
Vocabulary	.223	.181	.129	.013	.049	.059	.091	.006
PA	2.817	.686	.434	.140***	.740	.224	.367	.100**
Morphology	.437	.327	.143	.015	.023	.107	.024	.045
Prosody	-.050	.445	-.012	.013	.053	.146	.041	.001

Table 3: Multiple regression analyses predicting word reading and spelling one year later.
$^*p < .05$; $^{**}p < .01$; $^{***}p < .001$

It can be seen from Table 3 that in predicting word reading, once the other variables in the model had been controlled for, prosodic sensitivity was unable to account for any additional variance, R^2 change = .013, $F(1, 85) = .013$, $p = .91$. General ability, vocabulary, and morphological awareness were also unable to make a unique contribution to word reading. However, phonological awareness was able to account for an additional 14% of the variance, R^2 change = .140, $F(1, 85) = 16.880$, $p < .001$. Similarly, in predicting spelling, once the other variables in the model had been controlled for, prosodic sensitivity was unable to account for any additional variance, R^2 change = .013, $F(1, 85) = .135$, $p = .715$. General ability, vocabulary, and morphological awareness were also unable to make a unique contribution to spelling. However, phonological awareness was able to account for an additional 10% of the variance, R^2 change = .100, $F(1, 85) = 10.883$, $p = .001$.

Conclusion

These findings add to the growing literature demonstrating that prosodic sensitivity is a significant correlate of vocabulary knowledge, phonological awareness, and morphological awareness (concurrently) and of word reading and spelling (one year later). These preliminary findings indicate that prosodic sensitivity is unable to 'directly' predict early reading development beyond its association with other emergent literacy skills (e.g., phonological awareness).

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