Prosody Growth and Reading Comprehension: A Longitudinal Study from 2nd Through the End of 3rd Grade

João Lopes*, M. Madalena Silva*, António Moniz**,
Louise Spear-Swerling***, and Jamie Zibulsky****

*University of Minho, **University of Azores, ***Southern Connecticut University,
****Fairleigh Dickinson University

Abstract

Prosody is an important but not fully understood component of reading. In this longitudinal study with a sample of 98 Portuguese elementary school children, a multilevel growth model with four repeated measures over time showed steady progress in participants' reading prosody from the middle of 2nd to the end of 3rd grade. However, children's growth in this area varied across time points. Results also showed that individual differences in prosody's scores at baseline affect the performance of most but not of all students. Simple linear regressions showed that the prosody dimension "phrasing/expression" significantly predicted reading comprehension at all time points. Partial correlation analysis showed that when reading rate was accounted for, the unique contribution of prosody to reading comprehension was marginal, except at the third measurement

Keywords: Prosody, reading prosody, reading comprehension.

Resumo

A prosódia é uma importante mas nem sempre bem compreendida componente da leitura. Neste estudo longitudinal, com uma amostra de 98 estudantes do ensino primário, um modelo multinível com quatro medidas repetidas no tempo evidencia uma evolução estável da leitura prosódica dos participantes entre o 2.º e o 3.º ano de escolaridade. Contudo a evolução é desigual nos diversos momentos no tempo. Os resultados também mostram que as diferenças inter-individuais na linha de base da prosódia nem sempre condicionam o desempenho dos participantes. Regressões lineares simples revelam que nos quatro momentos de avaliação a dimensão construção frásica/expressividade prediz significativamente a compreensão da leitura. Análises de correlação parcial mostram que uma vez controlada a velocidade de leitura, a contribuição única da prosódia se torna residual.

Palavras-chave: Prosódia, leitura prosódica, compreensão da leitura.

Correspondence concerning this article should addressed to João Lopes, Escola de Psicologia, Universidade do Minho, Campus de Gualtar, s/n, 4710-057, Braga, Portugal. E-mail: joaols@psi.uminho.pt

JOÃO LOPES, M. MADALENA SILVA, ANTÓNIO MONIZ,
LOUISE SPEAR-SWERLING, AND JAMIE ZIBULSKY

Introduction

Prosody in language and reading

There are many skills that children need to develop to become successful readers. These skills include oral language comprehension, reading decoding, reading fluency and reading prosody, between others (Judge, 2013). Prosody, the ability to read with appropriate expression, intonation and phrasing in order to maintain text comprehension (Kuhn, Schwanenflugel, & Meisinger, 2010) is often overlooked, however. Yet a number of authors (Breen, 2014; Valle, Binder, Walsh, Nemier, & Bangs, 2013) stress the importance of prosody in language acquisition and development, and later in reading acquisition.

Prosody seems to serve semantic and pragmatic functions in the organization of verbal messages by transforming auditory inputs into structured patterns that organize and maintain information in working memory (Herold, Nygaard, & Namy, 2012). Tone and pitch, for example, two basic components of prosody, as well as the rhythmic structure and pauses of speech, underlie the grammatical, semantic and pragmatic functions of intonation in the organization of speech (Kehoe, 2013; Paulmann, Titone, & Pell, 2012).

Some authors (Dowhower, 1991; Kuhn & Stahl, 2003) emphasize that prosodic features support not only the understanding of oral language but also reading comprehension. In fact, intonation, reading stress and phrasing, have been associated both with reading fluency (Ardoin, Morena, Binder, & Foster, 2013; Schrauben, 2010) and reading comprehension (Arcand et al., 2014; Binder et al., 2013).

Prosody in reading is currently conceptualized as a multifactorial concept. Rasinski (1990, 2004) states that there are four main components of prosody in reading: (a) expressiveness, that refers to a kind of reading that sounds like natural language, with appropriate tone and volume; (b) phrasing, that denotes the reader awareness of phrase boundaries, the way he/she marks the end of sentences and clauses, etc.; (c) smoothness, that as to do with how the reader slides over the text; (d) and pace, that refers to the consistency and rhythm of reading along the text. For evaluation purposes, some of these components are sometimes combined in a single component (for instance phrasing/expressiveness) (Lopes, 2009).

To read fluently and to understand what is being read, the child has to make up for the lack of prosodic information in the text, focusing on morphological, syntactic and semantic signals as well as in punctuation (e.g., commas, signal pauses in speech) (Kim, Park, & Wagner, 2014). Otherwise reading will be slow, tentative, and inexpressive (Kim, Petscher, Schatschneider, & Foorman, 2010). Pro-

sodic reading requires the reader to incorporate the "voice" of the text's author and to set up text meaning from suprasegmental text features (Chafe, 1994). Whenever the text is read with prosody and expression, the reader's tone and pitch variations show that lexical and morphosyntactic features of the text were identified and interpreted (Ravid & Mashraki, 2007). Prosodic reading therefore usually indicates that the text is being understood.

Research suggests that the prosodic structure of texts is more accessible for fluent readers (Schrauben, 2010). Due to limitations in word recognition, beginning readers, as well as older poor readers, must focus their available cognitive resources on word decoding. Reading is therefore tentative and inaccurate, and children do not have a completely clear representation of the text (Miller & Schwanenflugel, 2006). On the other hand, the most experienced readers read the vast majority of words accurately and automatically, demonstrating reading prosody through appropriate intonation and pitch, as well as through an appropriate word reading rate (Rasinski, 1990, 2004). It also seems agreed upon that the development of reading competence is associated with expressive reading, and that the development of prosodic reading takes place largely after decoding becomes automatic (Herman, 1985; Kehoe, 2013; Kim et al., 2010; Miller & Schwanenflugel, 2006; Taylor, Meisinger, & Floyd,

2013). Additionally, language abilities influence the development of prosody (Eason, Sabatini, Goldberg, Bruce, & Cutting, 2013); for example, a child might be able to read the individual words in a text correctly and quickly, but still might read without good prosody because he or she does not comprehend the vocabulary of the text.

Prosody and reading comprehension

In spite of mounting empirical evidence that reading prosody increases with reading comprehension (Benjamin & Schwanenflugel, 2010; NICHD, 2000; Pinto & Navas, 2011) the research findings in this area are still equivocal. Some researchers report no significant relation between prosodic features and reading comprehension (Cowie, Douglas-Cowie, & Wichmann, 2002; Karlin, 1985; Schwanenflugel, Hamilton, Kuhn, Wisenbaker, & Stahl 2004), while others report strong evidence for this relation (Dowhower, 1991; Klauda & Guthrie, 2008).

Schwanenflugel and cols. (2004) tested the relationship between reading prosody and reading comprehension, asking children to read a syntactically easy text. Results showed a significant relation between decoding and reading comprehension. Miller and Schwanenflugel (2006) then studied some specific features of prosodic reading (pitch and intra- and inter-sentence

pauses) and found that pitch variations independently contribute to reading comprehension. However no significant relation between reading pauses and reading comprehension was found. Still later, the authors conducted a longitudinal study to investigate the relation between prosodic features and reading comprehension (Miller & Schwanenflugel, 2008) and found that: (a) the decrease of inappropriate pauses between 1st and 2nd grade predicted reading comprehension in 3rd grade; (b) children who read faster made fewer pauses, and pauses were smaller in relation to commas as well as at the end of sentences; (c) reading became more fluent and smooth with practice; (d) less fluent readers made longer and more inappropriate pauses, breaking the flow of the sentence, and making reading hesitant and choppy. The authors also found children who read with an intonation similar to the intonation of adults by the end of 1st grade, were better readers by the end of 3rd grade.

To the best of our knowledge, the work of Miller and Schawanenflugel (2008) is still the only longitudinal study about prosody and reading components. As the authors state, "A longitudinal analysis is necessary to determine how prosodic reading proceeds during the process of skilled reading acquisition"(p. 6). Also of note, according to Kuhn et al. (2010) an overwhelming majority of studies regarding prosody focus on English learners and most of the remaining studies focus on Germanic languages. There are almost no studies with other languages, namely with European Portuguese. These studies are of value because, as Kuhn et al. (2010) state, "prosody is not identical across languages" (p. 236) (the Portuguese is not as transparent as the Spanish but is much more transparent than the English. It is worth of note that most studies about differences in prosody between languages favor transparency as an explanatory variable over other variables such as the prevailing syntactic order).

The present study

A within-subject longitudinal design with four repeated measures over time was conducted with 98 Portuguese elementary school children. The study had the following objectives: (a) to study the growth trajectory of prosodic reading between 2nd and 3rd grade; (b) to study how baseline scores (intercepts) in prosodic reading model participants' prosodic performance growth curve (slopes); and (c) to study how prosody and reading rate over time affect reading comprehension performance at the end of 3rd grade.

Method

Participants

Ninety eight 2nd graders from a private school of the north of Portu-

gal participated in this study. These 98 students were divided by four classrooms of two different school centers of the same private school (two classrooms in each school center). The school centers are located in two different towns but they are only 20 miles distant from each other. The students, their teachers, their schools and theirs parents, volunteered for this study. Therefore, this is a convenience sample of participants. By the end of the study participants were completing 3rd grade. Fifty-one percent of the 98 participants were male and 49% were female. The mean age of participants at the beginning of the study was 7.5 years (SD = 3.5 months). One hundred thirty-seven participants began the study in 2nd grade. A subject attrition of 29% was found (2% of the students moved from school and 27% did not complete the minimum number of evaluations to participate in a longitudinal analysis). Only students who received permission from their parents participated in the study. Students with special education needs were not included in the study. All students are of a middle-high class socio-economic level and all of them are native Portuguese speakers.

Measures

The KING

The KING (Carvalho & Pereira, 2010) is a reading fluency performance measure. The B form of the test that includes a 281-word narrative fictional text entitled "The Naked King," was used in the present study to assess participants' reading rate and prosody in 2nd and 3rd grade. The KING measure is adequate for children from 2nd to 4th grade. The instrument shows a test-retest reliability of .94. Reading rate (the number of words read correctly per minute) was used as a measure of reading speed.

Multidimensional Fluency Scoring Guide

The MFSG (Rasinski, Rikli, & Johnston, 2009) is an instrument that measures prosody or expressiveness in oral reading and can be used since the end of 1st grade. The instrument holds three dimensions: phrasing and expression, accuracy and smoothness and pacing. Specific behavioral indicators are available for each rating. Each dimension is rated on a 1 (minimum performance) to 4 (maximum performance) point scale.

The MFSG was submitted to a panel of five American experts for validity. The experts agreed that the MFSG assesses core features of prosodic reading. The instrument holds a test-retest reliability of .90. Inter-rater reliability is as high as .96 and .98 in prosodic reading in 3rd and 5th grade respectively.

In the present study, the MFSG was used for the assessment of children's prosody in the text "The

Naked King." Since there were 98 participants and four waves of assessment, a total of 392 recordings were examined. Two trained classifiers independently rated each recording in each dimension. An interrater reliability analysis using the Kappa statistic was performed to determine consistency among raters. Whenever disagreements occurred, a third blind rater was called upon as a tiebreaker (the original raters were blind relatively to the subject but they were aware of the evaluation wave). In every single case the blind tiebreaker agreed to one of the classifiers. Therefore, his classification was assumed for the particular subject.

Reading comprehension test

The TCL (Cadime, Ribeiro, & Viana, 2012) is an instrument designed to measure reading comprehension growth from 2nd to 4th grade. Statistical analysis derived from Rasch models allowed the development of a form of the test for each grade, 2nd through 4th (TCL-2, TCL-3, and TCL-4). Each form comprises a narrative text, presented in sequential parts. For each sequence there is an uneven number of multiple choice questions, with a total of 30 questions for each grade level.

The validity of the TCL was computed after submitting the instrument to a panel of five reading experts. The experts agreed that the TCL assesses core features of reading comprehension. The coefficients of internal consistency for TCL-2, TCL-3, and TCL-4 are .71, .79 and .80, respectively. Reliability coefficients of the Rasch models (*Person Separation Reliability*-PSR, and *Item Separation Reliability*-ISR) vary from 0 to 1 in every form of the test. The TCL-3 was used in the present study, taking into account the participants' grade level and age.

Procedure

The schools, the teachers and the students' parents were individually contacted to approve tests' administration. Parents signed an informed consent document allowing the participation of their children. Five families did not consent to participation in the study. Prosody data were individually gathered at four different time points, with a six-month period between every data collection period. Time 1 data collection happened in the middle of the second grade school year; Time 2 data collection occurred by the end of second grade; Time 3 happened in the middle of the third grade school year; and Time 4 data collection occurred by the end of third grade. Participants were asked to read aloud the text "The King," using a natural voice and reading as best as they could. The text was presented on an A4 format sheet of paper. The software Audacity was used to record subjects' reading performance.

The TCL-3 was administered only once, at the end of third grade. The test was administered in a group format, in the classroom, with no time limit. There was enough space between participants to avoid any possible cheating. Each participant received a test booklet and a test answer sheet. Participants were asked to fill out the identification data set at the top of the answer sheet.

Results

Prosodic reading throughout second and third grade

Table 1 shows the results for prosodic reading and for prosody components, across the four time points ($N = 98$). Results for reading speed and reading comprehension are also presented.

Since the prosody variables in the model are subject to learning over time, a random-coefficients approach was used to investigate individual change across the four evaluation waves. This approach provides considerably more flexibility in situations where there are missing data, varying occasions of measurement and more complex error structures (Heck, Thomas, & Tabata, 2010). We assumed that both the intercepts (starting points) and the slopes (performance path) of individual participants would vary in the model. However, because we did

Table 1

Means and Standard Deviations of the Variables in the Model

Evaluation Waves		Prosody	P/E	A/S	P	Reading Speed	TCL
1	*M*	5.90	1.97	1.95	1.98	83.85	
	SD	2.88	.96	.97	.99	23.79	
2	*M*	6.24	2.11	2.02	2.10	86.51	
	SD	2.70	.90	.90	.91	20.93	
3	*M*	7.54	2.52	2.48	2.56	92.95	
	SD.	2.71	.95	.91	.92	12.81	
4	*M*	8.60	2.97	2.83	2.81	97.66	58.68
	SD	2.49	.83	.92	.90	2.98	21.19
Total	*M*	7.07	2.39	2.32	2.36		
	SD	2.89	.99	.99	.98		

Note 1. P/E - Phrasing/Expressiveness; A/S - Accuracy/Smoothness; P - Pace.
Note 2. The value in Prosody equals the sum of P/E, A/S and P.
Note 3. The average interrater reliabity for evaluations in each dimension (P/E, A/S, P), and in each evaluation wave was found to be Kappa = .78 ($p < .001$).

Table 2

Performance Paths (estimates of fixed effects)

Dependent variable	Parameter	Estimates	Standard-Error	Df	T
Prosody	Intercept	7.68	0.89	252.77	8.61***
	Time	−3.24	1.27	197.23	−2.53*
	Time × Time	1.65	0.56	196.00	2.93**
	Time × Time × Time	−0.19	0.07	196.00	−2.63**
Phrasing / Expression	Intercept	2.31	0.34	240.80	6.67***
	Time	−0.66	0.50	196.96	1.31
Accuracy / Smoothness	Intercept	2.76	0.36	234.88	7.55***
	Time	−1.42	0.53	196.95	−2.65**
	Time × Time	0.69	0.27	196.00	2.92**
	Time × Time × Time	−0.08	0.03	196.00	−2.64**
Pace	Intercept	2.74	0.31	251.18	8.78***
	Time	−1.39	0.44	197.43	−3.10**
	Time × Time	0.71	0.19	196.00	3.63***
	Time × Time × Time	−0.09	0.02	196.00	−3.49***

Note. *$p < .05$.   **$p < .01$.   ***$p < .001$.

Table 3

Estimates of Covariance Parameters

Dependent variable	Parameter	Estimates	Standard-error	Wald Z
Prosody	Intercept	9.67	1.360	6.04***
	Intercept + Times	−1.15	0.29	−3.88***
	Slopes	0.30	0.07	4.09***
Phrasing / Expression	Intercept	1.08	0.19	5.71***
	Intercept + Times	−0.12	0.03	−3.51***
	Slopes	0.03	0.00	3.25***
Accuracy / Smoothness	Intercept	1.00	0.18	5.49***
	Intercept + Times	−0.11	0.03	−3.11**
	Slopes	0.03	0.01	3.24***
Pace	Intercept	1.14	0.19	6.00***
	Intercept + Times	−0.15	0.03	−3.96***
	Slopes	0.04	0.01	4.50***

Note. *$p < .05$.   **$p < .01$.   ***$p < .001$.

not know how intercepts and slopes would vary, a covariance structure that specifies a variance-covariance matrix was adopted (Field, 2009). Both an unstructured covariance structure (in this structure covariances are assumed to be completely unpredictable) and a heterogeneous autoregressive structure (often used in repeated measures studies) were tested. Since results were identical for both covariance structures, an unstructured covariance matrix was assumed.

Tables 2 and 3 show the results of reading performance growth in the framework of a multilevel model. In this repeated measures model, the time points represent level 1 and subjects represent level 2. Specifically the results of the tests of participants' performance paths in prosodic reading are shown in Table 2 (linear, quadratic and cubic) and the covariance estimates of intercepts and slopes are shown in Table 3.

Table 2 shows that a third-order (cubic) polynomial best fits data for global prosody, for accuracy/expression, and for pace. However a linear model best fits data for phrasing/expression. Therefore no further interactions effects are presented for this prosody component in Table 2. Results also show significant baseline (intercept) inter-individual differences both in global prosody and prosody components.

Table 3 shows that the slopes for participants' progress in proso-dic reading are significant, which means that subjects' performance significantly increased over time. There was also a significant negative relation between intercepts and slopes for prosody, phrasing/expression, accuracy/smoothness and pace. Therefore, the higher the subject's baseline performance, the smaller the progress in performance over time.

The correlations between T1 (Time 1) and T4 ($r = .71$), between T1 and T2 ($r = .92$), between T1 and T3 ($r = .78$), T2 and T3 ($r = .82$) and between T3 and T4 ($r = .81$), also show that there is a moderate to high stability of intra-individual changes in inter-individual differences between the evaluation moments (well above the required value for a trait or characteristic to show tracking: $r \geq .50$). The global intraclass correlation coefficient of .938 [CI 95% = .916; .956] suggests a very high global stability of individual's positions in the whole group. Nevertheless these results also show that the initial performance does not always affect the final performance.

Prosody and reading comprehension

A multiple regression analysis was conducted to study the relationship between prosody and reading comprehension. Table 4 shows that at each time point correlations between prosody components were

Table 4

Pearson Correlation Matrix between Reading Comprehension, Reading Comprehension Predictors, and Reading Rate

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
RC	—																
P/E 1	.56	—															
A/S 1	.51	.92	—														
P 1	.50	.94	.95	—													
RS 1	.59	.48	.46	.44	—												
P/E 2	.58	.92	.87	.88	.53	—											
A/S 2	.54	.86	.88	.85	.47	.94	—										
P 2	.57	.90	.88	.88	.52	.98	.95	—									
RS 2	.51	.58	.37	.36	.76	.43	.40	.42	—								
P/E 3	.60	.75	.70	.69	.58	.81	.74	.77	.47	—							
A/S 3	.62	.74	.71	.70	.55	.79	.74	.77	.49	.90	—						
P 3	.61	.79	.77	.76	.56	.83	.80	.81	.50	.92	.91	—					
RS 3	.50	.46	.46	.44	.81	.52	.49	.53	.71	.57	.55	.55	—				
P/E 4	.55	.66	.60	.61	.47	.67	.63	.65	.49	.68	.70	.72	.52	—			
A/S 4	.55	.68	.66	.63	.45	.69	.65	.65	.45	.71	.70	.75	.48	.83	—		
P 4	.55	.70	.66	.64	.61	.70	.65	.68	.56	.76	.76	.80	.66	.81	.81	—	
RS 4	.48	.37	.41	.39	.65	.46	.45	.47	.78	.54	.59	.56	.68	.45	.43	.50	—

Note. RC - Reading comprehension; P/E - Phrasing/Expressiveness; A/S Accuracy/Smoothness; P - Pace; RS - Reading Speed. All correlations significant, $p < .001$.

Table 5

Phrasing/Expression and Reading Comprehension

Variable	Moments	R^2 (R^2AJ)	$F (1.96)$	β	T
P/E	1	.32 (.31)	44.53***	.56	8.50***
	2	.34 (.33)	48.86***	.58	6.99***
	3	.37 (.36)	56.26***	.61	7.50***
	4	.30 (.29)	41.66***	.55	6.45***

Note. P/E - Phrasing/Expressiveness. ***$p < .001$.

Table 6

Correlations between Prosody, Reading Speed and Reading Comprehension

Variable	Zero order correlation (prosody / comprehension)		Prosody / comprehension controlling for reading rate	
	R	R^2	r	R^2
Prosody time 1	.534	.285***	.161	.026
Prosody time 2	.560	.313***	.130	.017
Prosody time 3	.632	.399***	.303	.092*
Prosody time 4	.589	.346***	.153	.023

Note. ***$p < .001$.   **$p < .01$.   *$p < .05$.

very high (above .80), which indicates that there is a significant multicollinearity effect between these variables.

Given the redundancy of predictors, four simple regression analyses (one for each evaluation moment) were conducted, using phrasing/expressiveness of oral reading as a predictor. Results are shown in Table 5.

The four models significantly predict reading comprehension. High results in phrasing/expression were associated with better results in reading comprehension at every moment in time.

Prosody, reading rate and reading comprehension

A partial correlation analysis was conducted to study the influence of prosody in reading comprehension when reading rate (correct words per minute) was controlled for. Correlations were computed taking into account reading rate results (Time 1: $M = 56$ cwpm, $SD = 20.9$; Time 2: $M = 94$ cwpm, $SD = 26.9$, Time 3: $M = 93$ cwpm, $SD = 23.2$; Time 4: $M = 105$ cwpm, $SD = 22.8$). Results are shown in Table 6.

Table 6 shows that when the reading rate is controlled for, prosody does not significantly predict reading comprehension (except on Time 3).

Discussion

The goals of our longitudinal investigation were: (a) to study the growth trajectory of prosodic reading between 2nd and 3rd grade; (b) to study how baseline scores (intercepts) in prosodic reading model participants' prosodic performance growth curve (slopes); and (c) to study how prosody and reading rate over time affect reading comprehension performance at the end of 3rd grade.

Prosodic reading trajectories over time

The results of this study suggest that all aspects of prosody develop gradually as children move through 2nd and 3rd grade. However, it is interesting to note that children did not make significant growth from Time 1 to Time 2, likely because —as beginning readers— they needed to allocate most cognitive resources to word decoding. Indeed, past research showed that reading in grades 1 and 2 is usually tentative and effortful, not leaving much room for prosody of reading (Kim et al., 2010; Taylor et. al., 2013).

From Time 2 to Time 3 there was a significant acceleration in participants' prosodic reading. This result suggests that decoding became more automatic, allowing children to allocate resources to the prosodic features of reading, the-

refore to text comprehension (Herman, 1985; Kehoe, 2013; Kim et al., 2010; Miller & Schwanenflugel, 2006). From Time 3 to Time 4 results show a non-significant hastening in the growth of phrasing/expression and also a non-significant slowdown in the growth of both accuracy/smoothness and pace. Ultimately these results may somehow reflect teachers' progressive emphasis on expressive reading over fast reading and the need to bring reading closer to human speech (Dowhower, 1991; Miller & Schwanenflugel, 2006; Schwanenflugel et al., 2004). Students may hence perceive that pace is no more important than expression. Unfortunately, the studies addressing the influence of teaching on reading changes over time are scarce (Lopes, 2009), making it difficult to draw any conclusions about this issue.

The multilevel modeling of prosodic reading growth confirmed that a third-order (cubic) curve best fit growth in accuracy/smoothness and pace, but that a linear function best fit growth in phrasing and expression. This finding suggests that at a certain time along the path to reading acquisition prosody rapidly progresses and becomes a component of successful reading. Growth in this area then seems to slow down eventually because prosody's development plateaus. Further evaluations (e.g., a fifth and a sixth evaluation in fourth grade) would ultimately clarify the path of prosody performance growth in our participants.

Baseline scores in prosodic reading and prosody growth over time

Results show significant individual differences at baseline both for overall prosody and for important components of prosody. Baseline differences may be related either to home variables (socioeconomic level, parents' expectations) or school variables (school, school class, teacher, school neighborhood), as well as to other factors. Yet baseline results do not always predict the performance of our participants over time. Indeed a number of participants performed poorly at baseline (moment 1) but their subsequent progress was nevertheless outstanding. Unfortunately we have no further data to explain why the performance growth of these subjects largely exceeds the mean growth of the whole group. Some individuals may have received some kind of extra-school support, whereas others might have engaged in reading for pleasure out of school, for example. Also, random motivational factors might have influenced reading engagement. Only a study of specific intra-individual factors (that is beyond the scope of this study), would enlighten this issue.

Still, group results suggest that intra and inter-individual performance changes over time are stable, which means that independently of individual performance growth, participants tend to hold their relative

positions in the group. This result is similar to those found in other studies showing that children who are poor readers at the end of 1st grade tend to be underperformers in later grades, and that good readers will likely be good readers in later grades (in this latter case, however, the trend is less predictable) (Judge, 2013; Juel, 1988).

Results also show that participants who received higher scores at baseline made more moderate progress over time, whereas those participants who received lower prosody scores at the beginning of the study made more progress over time. Given the fact that there does seem to be a ceiling to prosody development and assessments, this result is not surprising. Some participants showed a very high level of prosodic reading just from the first time point. An early ceiling effect in the MFSG scale was therefore found for these subjects.

Prosody, reading rate and reading comprehension

When we analyzed the predictive power of prosody in relation to reading comprehension, a significant multicollinearity effect between prosody components emerged (for this reason we used only phrasing/expressiveness as a reading comprehension predictor). The multicollinearity between prosody components suggests that the MFSG scale has a unifactorial, not a multifactorial structure. This

may happen either because prosody components are not sufficiently defined, or because the evaluation of any prosody component contaminates the evaluation of the others components, bringing evaluators to estimate the three dimensions the same way.

Phrasing/expressiveness in times 1, 2, 3 and 4 significantly predicted reading comprehension by the end of 3rd grade. This finding suggests that reading skills like visual word recognition, syntactic phrasing, semantic and syntactic disambiguation, etc., are both involved in prosody and in reading comprehension (Allbritton, McKoon, & Ratcliff, 1996; Breen, 2014; Snedeker & Trueswell, 2003). Kuhn et al. (2010) contend that reading prosody may support reading comprehension although the directionality of the effect is not clear. If reading prosody has causal value to improve reading comprehension, prosodic training will be useful for reading comprehension; if instead, prosodic reading simply reflects high decoding and high comprehension skills, prosody training not address underlying reading difficulties (Kuhn et. al., 2010; Miller & Schwanenflugel, 2008).

Prosody, reading speed and reading comprehension

The finding that the effect of reading prosody over reading comprehension, once controlling for

reading speed, turns out to be residual at almost all time points measured in the study (the exception is time 3) is highly relevant for both theory and practice. From a theoretical point of view, this finding seems to support the models of reading comprehension that disregard reading prosody as a variable of value for the development of reading comprehension (Schwanenflugel et al., 2004). This result also suggests that reading speed is core to reading comprehension and that prosody will emerge once reading speed is sufficient. If this is so, the training of automaticity might be prerequisite to or much more useful than the training of prosody. This does not mean that prosody is irrelevant for reading comprehension. However the need for specific prosody instruction might be questioned (Schwanenflugel et al., 2004).

Limitations

This study has several limitations. Our multilevel model is a two-level model (time and participants) but it does not include some important variables such as demographic (sex and socio-economic level) or educational (e. g. class, school) variables in the analysis of prosodic reading over time. The number of participants, however, prevents such analysis.

The measurement of prosodic reading in our study may also be considered problematic. For example, we found that the MFSG scale does not work as a three-dimensional instrument for our participants (European Portuguese speakers). On the other hand, there is some controversy regarding whether rating scales and spectrographic measures must be competitors or complementary in reading prosody studies or what is the best measure. Also of concern is whether ratings scales like the MFSG (Rasinski, 2004), or even spectrographic measures of prosody, can add much to simple measures of reading rate and accuracy. Kuhn et al. (2010) contend anyway that even with limitations, current prosody measures are the right direction for the measurement and study of prosody.

The repetition of the same text passage may also be considered a limitation because of practice effects. However the linear pattern of growth of prosody does not seem to support such claim. Also, the use of different passages would have raised other problems and potential confounds, such as the need to equate passages for difficulty level.

Finally a two-year longitudinal study (2nd and 3rd grade) of reading prosody may not be sufficient for the study of reading prosody growth, taking into account that unlike our study other studies found significant correlations between prosodic reading and reading comprehension in 6th grade students (Tindal & Martson, 1994).

Conclusion

Overall our study suggests that however important prosody is for reading comprehension, reading speed explains a substantially larger proportion of the variance in reading comprehension. Taking into account that decoding precedes (and makes possible) reading with expression (prosody) the direct teaching of reading prosody may not be useful before the student reaches a fair level of word decoding in text. Although this finding does not imply that reading prosody is irrelevant, how and when to teach prosody effectively is an issue that needs much further research.

Nevertheless the results show that high results in prosody are associated with better results in reading comprehension in any of the four evaluation waves. As Rasinski (2004) states, the overarching concept of reading fluency, which includes automaticity (reading speed), expressiveness (prosodic reading) and accuracy (Rasinski, 2004) shows that all these skills are necessary for proficient reading and none is expendable.

References

Allbritton, D. W., McKoon, G., & Ratcliff, R. (1996). The reliability of prosodic cues for resolving syntactic ambiguity. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22*, 714-735.

Arcand, M. S., Dion, E., Lemire-Théberge, L., Guay, M. H., Barrette, A., Gagnon, V., … Fuchs, D. (2014). Segmenting texts into meaningful word groups: Beginning readers' prosody and comprehension. *Scientific Studies of Reading, 18*(3), 1-16. doi: 10.1080/10888438.2013.864658

Ardoin, S. P., Morena, L. S., Binder, K. S., & Foster, T. E. (2013). Examining the impact of feedback and repeated readings on oral reading fluency: Let's not forget prosody. *School Psychology Quarterly, 28*(4), 391-404. doi: 10.1037/spq0000027

Benjamin, R. G., & Schwanenflugel, P. J. (2010). Text complexity and oral reading prosody in young readers. *Reading Research Quarterly, 45*(4), 388-404. doi: 10.1598/RRQ.45.4.2

Binder, K. S., Tighe, E., Jiang, Y., Kaftanski, K., Qi, C., & Ardoin, S. P. (2013). Reading expressively and understanding thoroughly: An examination of prosody in adults with low literacy skills. *Reading and Writing, 26*(5), 665-680. doi: 10.1007/s11145-012-9382-7

Breen, M. (2014). Empirical investigations of the role of implicit prosody in sentence processing. *Linguistics and Language Compass, 8*(2), 37-50. doi: 10.1111/lnc3.12061

Cadime, I., Ribeiro, I., & Viana, F. L. (2012). *TCL - Teste de Compreensão da Leitura*. Lisboa: Cegoc-Tea Edições.

Carvalho, A., & Pereira, M. (2010). Teste de avaliação da fluência e precisão da leitura «O Rei». *Actas do 7.º Encontro Nacional (5.º Internacional) de Investigação em Leitura, Literatura Infantil e Ilustração* (2008), 1-12. Braga: Universidade do Minho.

Chafe, W. (1994). *Discourse, consciousness and time*. Chicago, IL: The University of Chicago Press.

Cowie, R., Douglas-Cowie, E., & Wichmann, A. (2002). Prosodic characteristics of skilled reading: Fluency and expressiveness in 8-10-year-old readers. *Language and Speech*, *45*(1), 47-82.

Dowhower, S. L. (1991). Speaking of prosody: Fluency's unattended bedfellow. *Theory Into Practice*, *30*, 165-175.

Eason, S. H., Sabatini, J. P., Goldberg, L. F., Bruce, K. M., & Cutting, L. E. (2013). Examining the relationship between word reading efficiency and oral reading rate in predicting comprehension among different types of readers. *Scientific Studies of Reading, 17*(3), 199-223. doi: 10.1080/10888438.2011.652722

Field, A. (2009). *Discovering statistics using SPSS, 3rd edition*. Sage: London.

Heck, R. H., Thomas, S. L., & Tabat, L. N. (2010). *Multilevel and longitudinal modeling with IBM SPSS*. New York: Routledge.

Herman, P. A. (1985). The effect of repeated readings on reading rate, speech pauses, and word recognition accuracy. *Reading Research Quarterly*, *20*(5), 553-565.

Herold, D. S., Nygaard, L. C., & Namy, L. L. (2012). Say it like you mean it: Mothers' use of prosody to convey word meaning. *Language and Speech, 55*(3), 423-436. doi: 10.1177/0023830911422212

Judge, S. (2013). Longitudinal predictors of reading achievement among at-risk children. *Journal of Children and Poverty, 19*(1), 1-19. doi: 10.1080/10796126.2013.765629

Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first through fourth grades. *Journal of Educational Psychology, 80*(4), 437-447.

Karlin, A. (1985). Intonation in oral reading and reading comprehension. *Reading Horizons*, *25*(3), 169-175.

Kehoe, M. (2013). *The development of prosody and prosodic structure*. Hauppauge, New York: Nova Science.

Kim, Y. S., Park, C. H., & Wagner, R. K. (2014). Is oral/text reading fluency a "bridge" to reading comprehension? *Reading and Writing, 27*(1), 79-99. doi: 10.1007/s11145-013-9434-7

Kim, Y. S., Petscher, Y., Schatschneider, C., & Foorman, B. (2010). Does growth rate in oral reading fluency matter in predicting reading comprehension achievement? *Journal of Educational Psychology, 102*(3), 652-667. doi: 10.1037/a0019643

Klauda, S. L., & Guthrie, J. T. (2008). Relationships of three components of reading fluency to reading comprehension. *Journal of Educational Psychology*, *100*(2), 310-321.

Kuhn, M. R., Schwanenflugel, P. J., & Meisinger, E. B. (2010). Aligning theory and assessment of reading fluency: Automaticity, prosody, and definitions of fluency. *Reading*

Research Quarterly, 45(2), 230-251 doi: 10.1598/RRQ.45.2.4

Kuhn, M. R., & Stahl, S. A. (2003). Fluency: A review of developmental and remedial practices. *Journal of Educational Psychology*, *95*(1), 3-21. doi: 10.1037/0022-0663.95.1.3

LaBerge, D., & Samuels, S. J. (1974). Toward a theory of automatic information processing in reading. *Cognitive Psychology*, *6*(2), 293-323.

Lopes, A. L. (2009). *Comportamento, aprendizagem e "ensinagem" na ordem e desordem da sala de aula*. Braga: Psiquilíbrios.

Miller, J., & Schwanenflugel, P. J. (2006). Prosody of syntactically complex sentences in the oral reading of young children. *Journal of Educational Psychology, 98*(4), 839-853. doi: 10.1037/0022-0663.98.4.839

Miller, J., & Schwanenflugel, P. J. (2008). A longitudinal study of the development of reading prosody as a dimension of oral reading fluency in early elementary school children. *Reading Research Quarterly*, *43*(4), 336-354. doi: 10.1598/RRQ.43.4.2

NICHD (2000). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: Reports of the subgroups* (NIH Publication No. 00-4754). Washington, DC: U.S.Government Printing Office.

Paulmann, S., Titone, D., & Pell, M. D. (2012). How emotional prosody guides your way: Evidence from eye movements. *Speech Communication, 54*(1), 92-107. doi: 10.1016/j.specom.2011.07.004

Pinto, J. C., & Navas, A. L. (2011). Effects of reading fluency stimulation with emphasis on prosody. *Jornal da Sociedade Brasileira de Fonoaudiologia, 23*(1), 21-26. doi: 10.1590/S2179-64912011000100007

Rasinski, T. V. (1990). Investigating measures of reading fluency. *Educational Research Quarterly*, *14*(3), 37-44.

Rasinski, T. V. (2004). *Assessing reading fluency*. Honolulu: Pacific Resources for Education and Learning.

Rasinski, T., Rikli, A., & Johnston, S. (2009). Reading Fluency: More than automaticity? More than a concern for the primary grades? *Literacy Research and Instruction, 48*, 350-361. doi: 10.1080/19388070802468715

Ravid, D., & Mashraki, Y. E. (2007). Prosodic reading, reading comprehension and morphological skills in Hebrew-speaking fourth graders. *Journal of Research in Reading*, *30*(2), 140-156. doi: 10.1111/j.1467-9817.2007.00340.x

Riedel, B. W. (2007). The relation between DIBELS, reading comprehension, and vocabulary in urban first-grade students. *Reading Research Quarterly*, *42*(4), 546-567. doi: 10.1598/RRQ.42.4.5

Schrauben, J. E. (2010). Prosody's contribution to fluency: An examination of the theory of automatic information processing. *Reading Psychology, 31*(2), 82-92. doi: 10.1080/02702710902753996

Schwanenflugel, P. J., Hamilton, A. M., Kuhn, M. R., Wisenbaker, J. M., & Stahl, S. A. (2004). Becoming a fluent reader: Reading skill and prosodic features in the oral reading of young readers. *Journal of Educa-*

tional Psychology, 96(1), 119-129. doi: 10.1037/0022-0663.96.1.119

Snedeker, J., & Trueswell, J. C. (2003). Using prosody to avoid ambiguity: Effects of speaker awareness and referential context. *Journal of Memory and Language, 48*, 103-130.

Taylor, C. D., Meisinger, E. B., & Floyd, R. G. (2013). Variations in directions and overt timing on oral reading accuracy, fluency, and prosody. *School Psychology Review, 42*(4), 437-447.

Tindal, G., & Martson, D. (1994). Technical adequacy of alternative reading measures as performance assessment. *Exceptionality, 4*, 201-230.

Valle, A., Binder, K. S., Walsh, C., Nemier, C., & Bangs, K. E. (2013). Eye movements, prosody, and word frequency among average and high-skilled second-grade readers. *School Psychology Review, 42*(2), 171-190.

João Lopes, Ph.D. in Psychology, is a hired Professor in the School of Psychology of the University of Minho. His research interests focuses in the areas of learning disabilities, reading instruction, classroom behavior problems and classroom management. He wrote more than a dozen books on these subjects (e. g. "Behavior problems, learning problems and teaching problems", 2009).

Maria Madalena Silva is a licensed psychologist currently working in an institution for adult mentally handicapped persons. She holds a Master in Educational Psychology from the University of Minho. Her research interests focuses in the area of reading learning and instruction, particularly in prosody learning and development.

António Vargas Moniz, Ph.D., is Professor of the Department of Sciences of Education of the University of Azores. His doctoral dissertation is titled "Word recognition and Reading comprehension: development and validation of the word recognition test (T.A.R.P.E.)".

Louise Spear-Swerling, Ph.D., is Professor of Special Education at Southern Connecticut State University in New Haven CT, USA. She has prepared teachers of reading for over three decades. Her research interests include literacy acquisition, reading difficulties, and teacher education. She has published numerous peer-reviewed journal articles and book chapters on these topics, as well as several books, including (with Robert Sternberg) *Off Track: When Poor Readers Become "Learning Disabled."*

Jamie Zibulsky, Ph.D., is an Assistant Professor of Psychology at Fairleigh Dickinson University. As a school psychologist, she focused on collaborating with teachers and parents to support children's reading acquisition. Her current research focuses on the interaction between early reading skills and behavioral development, as well as teacher professional development efforts in the area of literacy.