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The simple view of reading in a transparent orthography: the stronger role of oral comprehension

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Abstract Comprehension is the ultimate goal of reading, but it is a very complex task consisting of multiple component skills. A number of studies have tested the simple view of reading (SVR; Gough & Tunmer, 1986) in opaque languages, but few investigations of the SVR components have been conducted on transparent languages. In the present study, we tested the SVR model in a sample of 1895 Italian children attending primary school, from first to fifth grade. An assessment battery was used, which included five different tasks: word and non-word reading, passage reading, reading comprehension, and oral comprehension. Hybrid models combining confirmatory factor analysis with path analysis were run separately for each grade. Results indicated that oral comprehension was always the best predictor of reading comprehension, whereas reading accuracy played a significant but minor role. Implications for research and practice are discussed.

Keywords Simple view of reading · Reading comprehension · Oral comprehension · Decoding · Transparent orthography

Introduction

Understanding a text is a complex task that necessitates both adequate decoding ability and linguistic comprehension skills: the simple view of reading (SVR) model (Gough & Tunmer, 1986; Hoover & Gough, 1990) is an influential model to

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conceptualize reading comprehension and is represented by a formula that describes reading comprehension (R) as the product of decoding (D) and linguistic comprehension (L). The decoding component refers to the ability to convert graphemes into phonemes and is usually evaluated with tasks of word and pseudo-word reading, using measures of accuracy and/or speed. The linguistic component involves the processing and comprehension of orally presented information, such as words, sentences, or discourses, and could be measured with listening comprehension tasks, in which children are presented with oral texts and are asked to answer some questions. Decoding and linguistic (or oral) comprehension are considered independent processes, for example because they show different patterns of predictors: decoding is robustly predicted, among others skills, by phonological awareness and rapid automatized naming (e.g., Moll et al., 2014), whereas literature reported that oral comprehension's predictors are vocabulary knowledge, elaboration of syntactic information, and working memory (e.g., Daneman & Merikle, 1996; Hagtvet, 2003; Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995). Furthermore, they are supported by distinct genetic and environmental influences (Keenan, Betjemann, Wadsworth, DeFries, & Olson, 2006).

The SVR has been widely tested for English orthography, making it a valid model to describe the development of reading comprehension (e.g., Kendeou, van den Broek, White, & Lynch, 2009; Kirby & Savage, 2008; Nation & Snowling, 2004; Oakhill & Cain, 2012), although additional factors, such as memory skills or naming speed, have been found to contribute to this process (Carretti, Borella, Cornoldi, & De Beni, 2009; Joshi & Aaron, 2000; Seigneuric & Ehrlich, 2005). The model accounts for approximately 40–80 % of the variance in reading comprehension for children and adolescents aged 6–16 years old (Dreyer & Katz, 1992; Joshi & Aaron, 2000; Kendeou et al., 2009; Savage, 2006). Globally, results for opaque orthographies like English showed that decoding is the strongest predictor of reading comprehension in the early stages of learning or for individuals with poor decoding abilities, whereas oral comprehension skills are better predictors in participants having more advanced skill in reading (Goff, Pratt, & Ong, 2005; Hoover & Gough, 1990; Vellutino, Tunmer, Jaccard, & Chen, 2007).

It has been shown that reading processes are related to orthographic transparency (Seymour, 2005; Seymour, Aro, & Erskine, 2003), and reading models developed and tested on a single language could be misleading (Share, 2008). It is therefore important to analyze the SVR model in languages that differ in orthographic depth. For this purpose, Florit and Cain (2011) presented a meta-analysis of 33 studies to analyze the validity of the SVR model in opaque (English) and more transparent (Dutch, Finnish, French, German, Greek, Italian, Norwegian, and Spanish) orthographies, in children who have received one through 5 years of schooling. They showed that for readers of transparent orthographies, oral comprehension was more influential than decoding accuracy, even for beginner readers (with 1–2 years of instruction). However, the measure of reading speed was more influential than oral comprehension in young readers. They confirmed that for the English orthography, decoding was more important than oral comprehension in the early stages of reading, but remained influential also after 3–5 years of reading instruction. Considering in particular reading speed, some studies on English orthography found a significant unique contribution to reading comprehension (Cutting & Scarborough, 2006; Joshi & Aaron, 2000), whilst others did not (Adlof, Catts, & Little, 2006; Conners, 2009; Neuhaus, Roldan, Boulware-Goodan, & Swank, 2006).

Only a few studies specifically analyzed the SVR model in the Italian orthography, which is very shallow, characterized by a high consistency of grapheme–phoneme correspondence and a consequently higher degree of accuracy in reading words and pseudo words at the end of first grade (e.g., 94 and 82 %, respectively, in Cossu, Gugliotta, & Marshall, 1995). For example, Florit, Levorato, and Roch (2008) assessed a sample of 74 Italian children for word reading speed (decoding measure), multiple choice reading comprehension, and open question oral comprehension. The strongest correlations were found between reading comprehension and reading speed in the third grade, and between reading comprehension and oral comprehension in the fifth grade. Their SVR model explained 44 and 37 % of the variance in reading comprehension, respectively. Carretti and Zamperlin (2010) involved a total of 305 children from first, third, fourth, sixth, and eighth grades to analyze the development of the relationship between decoding (reading speed), reading (multiple choice), and oral (multiple choice) comprehension. Results showed that oral comprehension was the stronger predictor of reading comprehension for all the grades considered; furthermore, reading speed was no longer statistically significant in secondary school. The model explained approximately 30–55 % of the variance in reading comprehension, depending on the school grade.

Therefore, results for the Italian orthography are contrasting. It has been confirmed that both decoding and oral comprehension are significant, at least for primary school, but the extent of their contribution to reading comprehension is not clear. Furthermore, these studies used reading speed as decoding measure because it is the most adequate indicator of decoding in transparent orthographies (e.g., Seymour et al., 2003; Wimmer, Mayringer, & Landerl, 1998). The use of reading speed makes it difficult to compare studies on opaque orthographies that usually consider decoding accuracy. In the present study, both reading accuracy and speed have been considered. This procedure allows, on one side, the analysis of the independent contribution of reading speed and reading accuracy for a transparent orthography and, on the other side, the comparison of the present results with past studies that considered only one of these variables. Taking into account the fact that some studies have found a significant unique contribution of reading speed (e.g., Carretti & Zamperlin, 2010) and some other did not (e.g., Adlof et al., 2006), the possibility to add a separate speed component to the SVR should be further tested. Furthermore, speed and accuracy were calculated as composite measures obtained by reading words, non-words, and text, in order to have a more reliable and stable index of children's performance, in accordance with previous studies (e.g., Adlof et al., 2006).

As specified by Florit and Cain (2011), more extensive studies on languages other than English are needed to conduct a more fine-tuned analysis of SVR model by year of reading instruction and for transparent orthographies. Finally, precise models of reading development inform reading instruction; therefore, an accurate knowledge of the extent of contribution of decoding and oral comprehension to reading comprehension, in relation to the orthography's characteristics, would help to identify features and good practices for good and poor comprehenders (e.g., Nation, Cocksey, Taylor, & Bishop, 2010; Nation & Norbury, 2005; Yuill & Oakhill, 1991), considering the Italian orthography and languages with similar characteristics.

Aim of the study

In the present study, we analyzed the role of reading speed, reading accuracy, and oral comprehension in predicting reading comprehension in first through fifth grade, considering the Italian transparent orthography. To analyze in-depth the influence of the skills considered during different stages of learning development, a large sample was involved, allowing separate analysis for each grade. Furthermore, to analyze the extent of contribution of different components of decoding, both reading accuracy and speed will be considered as separated factors.

This procedure allows to investigate the weight of the well established factors of decoding accuracy and oral comprehension (Hoover & Gough, 1990) in predicting reading comprehension in a transparent orthography, at different stages of learning (1st to 5th grade). These predictors are tested in accordance with past studies that found their significant contribution to reading comprehension in both opaque (e.g., Kendeou et al., 2009; Kirby & Savage, 2008; Nation & Snowling, 2004; Oakhill & Cain, 2012) and transparent (e.g., Droop & Verhoeven, 2003; Florit et al., 2008; Marx & Jungmann, 2000) orthographies. Furthermore, the model tested allows to verify the eventual independent contribution of a further variable, reading speed. In fact, its role in predicting reading comprehension is still controversial (Adlof et al., 2006; Carretti & Zamperlin, 2010; Florit & Cain, 2011). For these theoretical reasons, a direct path between oral comprehension, accuracy and reading speed, as potential concurrent predictors, and reading comprehension as the outcome variable, was tested.

Our hypotheses are as follows:

1. We expect to find a significant role of both decoding and oral comprehension during primary school, with a generally stronger effect of oral comprehension compared to decoding.
2. Considering the characteristics of the Italian shallow orthography, in which accurate reading of words and pseudo words is easy and early acquired (e.g., Cossu et al., 1995), we expect that the role of reading speed in predicting reading comprehension will be stronger compared to that of reading accuracy.

Method

Participants

The sample included 1895 children in first through fifth grade who were recruited from 16 primary schools in 6 Italian regions in the North (Emilia Romagna, Lombardia), Center (Molise, Marche), and South (Calabria, Puglia) of Italy. Children diagnosed with specific learning disorders or other types of disorders and disabilities were excluded from the study. Some of the participants (9.5 %) were L2 learners; this percentage corresponds to the national estimate of L2 children in Italian primary schools (Ministry of Education, Universities and Research, 2012). Three hundred-forty two children were in the first grade (54.39 % girls; mean age = 6.80 years, SD = .33), 345 in the second grade (47.54 % girls; mean age = 7.77 years, SD = .36), 353 in the third grade (45.04 % girls; mean age = 8.71 years, SD = .33), 415 in the fourth grade (52.05 % girls; mean age = 9.76 years, SD = .34), and 440 in the fifth grade (49.54 % girls; mean age = 10.78 years, SD = .40). Children in different grades did not differ significantly in proportions of gender $\chi^2(4) = 7.71$, $p > .05$ and number of L2 learners $\chi^2(4) = 5.37$, $p > .05$. In the Italian schooling system, children learn to read starting at the beginning of the 1st grade, and are able to reach a good level of decoding accuracy at the end of the year (Cossu et al., 1995), whereas reading speed keep improving in the following years of primary school (Brizzolara, 2001). Information about specific schooling system is important when discussing reading models as outlined by Florit and Cain (2011).

Materials

The battery for Assessment of Reading and Comprehension in Developmental Age (ALCE; Bonifacci, Tobia, Lami, & Snowling, 2014) is a standardized battery that evaluates reading and comprehension of oral and written language in children from first to fifth grade.

The instrument includes the following tasks:

1. Word reading. A total of 60 words, increasing for length and decreasing for frequency (Burani, Barca, & Arduino, 2001), were presented in three lists with a total time limit of 120 s; each list was separated by a brief pause during which the timer was stopped. KR-20 reliability index, calculated on accuracy score for each word (0 or 1), was .89.
2. Non-word reading. Two lists of 15 non-words conforming to the rules of Italian orthography were administered. The time limit was 60 s. KR-20 value for this task was .96.

For word and non-word reading tasks, reading speed was measured in syllables per second (s/s), whereas a percentage of errors was calculated for the total number of words the children read.

3. Passage reading. Children were asked to read aloud two passages (described in the following paragraphs); they were told that some comprehension questions would follow. For each passage, reading speed (s/s) and total number of errors were recorded.
4. Reading comprehension. Children were asked to respond to ten comprehension questions on the passages they read aloud. Texts remained available for consultation and children were instructed that they could look back at information within the written passage. Two passages, one descriptive and

one narrative, were provided for each grade. The ten questions following each passage required an open answer. Five of the questions require text-based comprehension processes, therefore the child has to consider only information explicitly presented in the passages (local comprehension; Kintsch & Rawson, 2005). An example of local comprehension question is: “What is drawn on the flag of Ljubljana?” referred to the sentence in text: “The symbol of Ljubljana is a dragon, which is drawn on the city’s flag”. The other five questions require inferential reasoning (global comprehension; Kintsch & Rawson, 2005). An example of global comprehension question is: “Why Gianni said he found a treasure?”, referred to the paragraph in text: “Often Gianni wants to show to be the strongest and the bravest, and be admired by everyone. [He then pretends to find a treasure]”. For each question, a score of 0, 1, or 2 was given following fixed criteria. Comprehension total scores ranged from 0 to 20 for each passage; therefore, the range is 0–40 for Reading comprehension score, that included two passages. The scores on local and global comprehension for each passage were also recorded. Coefficients of reliability (Cronbach’s Alpha), calculated on the comprehension score for each passage, were from .74 to .83.

5. Oral comprehension. Participants listened to a narrative passage read aloud by the examiner, and then they were asked to answer ten comprehension questions; they were not allowed to look at the text. One narrative passage for each grade was provided; type of questions and scoring were the same as for the Reading comprehension task. Oral comprehension total score ranged from 0 to 20 and, also in this case, local and global comprehension scores were obtained. Cronbach’s Alphas calculated on the oral comprehension score for each passage ranged from .68 to .80.

T scores were obtained for each measure, based on the national norms by grade level presented in the test’s manual (Bonifacci et al., 2014).

Passages were written on purpose for the testing battery by experts in reading processes in collaboration with a primary school teacher, considering topics and characters appropriate for children’s age. They presented increasing semantic, syntactic and lexical complexity from grade 1st to 5th, as measured by the DylanBase index (Bonifacci et al., 2014; Dell’Orletta, Montemagni, & Venturi, 2011). Furthermore, the passages’ length increases progressively: 100–114 words for 1st grade, 149–164 for 2nd grade, 192–209 for 3rd grade, 234–252 for 4th grade, and 289–294 for 5th grade.

Procedure

Trained psychologists tested children individually, in a quiet room of their school. The testing session lasted around 40 min. The comprehension task order was balanced across participants: all children started with word and non-word reading tasks, then the following task was oral comprehension for half of them, and reading comprehension for the remaining children. Pauses were allowed if the child showed signs of getting tired. Informed consent for participating in the study was signed by parents.

Results

Descriptives statistics of raw scores for each grade are presented in Table 1; T scores have a mean score of 50 and a SD of 10 for all the variables. Pearson correlations among constructs, per each grade, are presented in Table 2.

A hybrid model (Goldberger & Duncan, 1973) combining confirmatory factor analysis (CFA) with path analysis was run applying a maximum-likelihood (ML) estimator. The model was performed on the T scores, separately for each grade; this procedure allows to work on measures coded in the same direction (avoiding optimization problems), and on variables' distributions that show lower values of asymmetry, compared to raw scores. The CFA identified reading speed, reading accuracy, oral comprehension and reading comprehension latent variables. The reading speed latent variable was obtained by combining measures of syllables for second, considering word, pseudo word, text 1, and text 2 reading tasks. The percentages or number of errors for the same tasks were combined to obtained the reading accuracy latent variable. Finally, oral comprehension and reading comprehension latent variables were obtained by combining the number of correct answers for local and global comprehension respectively for the orally presented passage and for the two texts presented in written form. A path analysis was used to examine the relationships between the dependent latent variable (reading comprehension) and the potential predictors (reading speed, reading accuracy, and oral comprehension). In particular, the independent contribution of these latent variables to reading

Table 1 Descriptives statistics of raw scores for each grade

	Raw scores mean (SD)				
	1st grade	2nd grade	3rd grade	4th grade	5th grade
Decoding					
Words s/s	1.19 (.66)	2.21 (.73)	2.86 (.86)	3.39 (.95)	3.75 (.88)
Words % errors	6.70 (8.68)	3.02 (3.52)	2.30 (2.79)	1.34 (1.83)	1.25 (1.96)
Non-words s/s	.89 (.40)	1.40 (.45)	1.69 (.51)	2.01 (.58)	2.21 (.59)
Non-words % errors	18.86 (15.95)	12.13 (10.83)	10.61 (9.98)	8.66 (8.18)	8.60 (8.16)
Text 1 s/s	1.23 (.69)	2.17 (.75)	2.92 (.88)	3.58 (1.00)	3.85 (.85)
Text 1 N errors	6.11 (6.37)	5.15 (4.76)	3.77 (3.79)	4.25 (4.79)	5.30 (4.64)
Text 2 s/s	1.43 (.75)	2.34 (.76)	2.98 (.88)	3.76 (.91)	4.42 (.90)
Text 2 N errors	4.05 (4.60)	3.34 (3.72)	4.31 (3.57)	3.34 (3.35)	3.16 (3.75)
Oral comprehension					
Local	7.21 (2.55)	5.61 (3.06)	6.53 (2.24)	6.14 (2.50)	7.23 (2.23)
Global	7.08 (2.13)	5.44 (2.97)	6.41 (2.50)	6.61 (2.50)	5.13 (2.23)
Reading comprehension					
Text 1-local	6.86 (2.31)	7.75 (2.27)	7.92 (1.93)	6.09 (2.16)	6.81 (1.94)
Text 1-global	5.48 (2.52)	5.06 (2.00)	6.20 (2.30)	4.85 (2.58)	5.17 (2.39)
Text 2-local	7.07 (2.06)	7.24 (2.05)	6.67 (2.46)	8.07 (1.67)	7.04 (1.51)
Text 2-global	6.55 (2.47)	6.45 (2.36)	5.24 (2.57)	6.51 (2.24)	5.53 (2.42)

Table 2 Pearson correlations between reading and comprehension measures, per each grade

	1. Words s/s	2	3	4	5	6	7	8	9	10	11	12	13
(*A*) *Grade* 1													
Decoding													
2. Words errors	.275**												
3. Non-words s/s	.856**	.185**											
4. Non-words errors	.345**	.493**	.283**										
5. Text 1 s/s	.883**	.216**	.785**	.280**									
6. Text 1 errors	.472**	.325**	.426**	.444**	.521**								
7. Text 2 s/s	.870**	.252**	.776**	.310**	.951**	.525**							
8. Text 2 errors	.462**	.369**	.461**	.440**	.497**	.737**	.546**						
Oral comprehension													
9. Local	.125*	.171**	NS	.215**	.130*	.287**	.120*	.264**					
10. Global	.129*	NS	NS	.150**	.115*	.198**	.119*	.203**	.571**				
Reading comprehension													
11. Text 1-local	.270**	.263**	.203**	.263**	.309**	.414**	.329**	.409**	.516**	.397**			
12. Text 1-global	.233**	.203**	.198**	.326**	.306**	.434**	.294**	.371**	.555**	.460**	.613**		
13. Text 2-local	.239**	.356**	.190**	.309**	.291**	.364**	.313**	.431**	.444**	.351**	.485**	.524**	
14. Text 2-global	.283**	.194**	.217**	.207**	.288**	.393**	.316**	.429**	.532**	.394**	.496**	.576**	.556**
Mean r	.256	.254	.202	.276	.298	.378	.313	.410	.512	.400	–	–	–
(*B*) *Grade* 2													
Decoding													
2. Words errors	.394**												
3. Non-words s/s	.763**	.293**											
4. Non-words errors	.331**	.441**	.239**										
5. Text 1 s/s	.878**	.390**	.704**	.251**									
6. Text 1 errors	.480**	.425**	.349**	.461**	.488**								

Table 2 continued

	1. Words s/s	2	3	4	5	6	7	8	9	10	11	12	13
7. Text 2 s/s	.890**	.392**	.736**	.310**	.905**	.503**							
8. Text 2 errors	.466**	.448**	.338**	.425**	.484**	.664**	.508**						
Oral comprehension													
9. Local	NS	NS	NS	NS	.153**	.156**	.143**	.159**					
10. Global	.113*	NS	NS	NS	.145**	.118*	.126*	.136*	.634**				
Reading comprehension													
11. Text 1-local	.236**	.259**	NS	.215**	.267**	.406**	.271**	.399**	.290**	.328**			
12. Text 1-global	NS	.144**	NS	NS	.171**	.290**	.157**	.278**	.385**	.428**	.485**		
13. Text 2-local	.214**	.189**	.115*	.199**	.227**	.269**	.260**	.287**	.267**	.370**	.485**	.406**	
14. Text 2-global	NS	.128*	NS	NS	.158**	.235**	.189**	.272**	.382**	.447**	.367**	.390**	.458**
Mean r	.163	.180	.055	.147	.206	.300	.219	.209	.331	.393	–	–	–
(*C*) *Grade* 3													
Decoding													
2. Words errors	.377**												
3. Non-words s/s	.801**	.261**											
4. Non-words errors	.322**	.449**	.298**										
5. Text 1 s/s	.828**	.354**	.698**	.295**									
6. Text 1 errors	.518**	.375**	.417**	.423**	.513**								
7. Text 2 s/s	.876**	.348**	.751**	.297**	.917**	.513**							
8. Text 2 errors	.471**	.434**	.372**	.448**	.419**	.629**	.452**						
Oral comprehension													
9. Local	.177**	NS	NS	NS	.217**	.212**	.229**	NS					
10. Global	.298**	.167**	.198**	.154**	.327**	.266**	.324**	.202**	.549**				
Reading comprehension													
11. Text 1-local	.326**	.173**	.217**	.134*	.368**	.288**	.352**	.228**	.384**	.323**			

Table 2 continued

	1. Words s/s	2	3	4	5	6	7	8	9	10	11	12	13
12. Text 1-global	.313**	.167**	.149**	.157**	.326**	.351**	.332**	.315**	.401**	.478**	.395**		
13. Text 2-local	.328**	.140**	.151**	.163**	.396**	.320**	.366**	.304**	.408**	.460**	.408**	.475**	
14. Text 2-global	.357**	.235**	.268**	.188**	.391**	.351**	.378**	.305****	.390**	.504**	.338**	.467**	.563**
Mean r	.331	.179	.196	.160	.370	.327	.357	.303	.396	.441	–	–	–
(*D*) *Grade* 4													
Decoding													
2. Words errors	.390**												
3. Non-words s/s	.774**	.297**											
4. Non-words errors	.314**	.438**	.315**										
5. Text 1 s/s	.830**	.436**	.711**	.381**									
6. Text 1 errors	.506**	.427**	.397**	.466**	.542**								
7. Text 2 s/s	.757**	.414**	.632**	.339**	.900**	.533**							
8. Text 2 errors	.450**	.433**	.360**	.430**	.479****	.634**	.491**						
Oral comprehension													
9. Local	.140**	.134**	NS	.192**	.194**	.259**	.212**	.288**					
10. Global	.151**	.115*	NS	NS	.234**	.204**	.217**	.222**	.542**				
Reading comprehension													
11. Text 1-local	.172**	.134**	NS	.118*	.245**	.297**	.265**	.256**	.284**	.290****			
12. Text 1-global	.201**	.166**	NS	.164**	.268****	.320**	.301**	.313**	.340**	.281**	.432**		
13. Text 2-local	.181**	.138**	NS	.117*	.179**	.261**	.208**	.320**	.428**	.373**	.402**	.353**	
14. Text 2-global	.137**	NS	NS	.105*	.188**	.260**	.207**	.258**	.458**	.448**	.386**	.399**	.455**
Mean r	.173	.131	.072	.126	.220	.284	.245	.287	.377	.348	–	–	–
(*E*) *Grade* 5													
Decoding													
2. Words errors	.308**												

Table 2 continued

	1. Words s/s	2	3	4	5	6	7	8	9	10	11	12	13
3. Non-words s/s	.741**	.177**											
4. Non-words errors	.288**	.353**	.260**										
5. Text 1 s/s	.738**	.311**	.657**	.335**									
6. Text 1 errors	.414**	.462**	.297**	.463**	.505**								
7. Text 2 s/s	.729**	.320**	.614**	.315**	.908**	.485**							
8. Text 2 errors	.428**	.432**	.333**	.416**	.516**	.671**	.511**						
Oral comprehension													
9. Local	.193**	.164**	.096*	.108*	.290**	.273**	.314**	.239**					
10. Global	.101*	.100*	NS	NS	.169**	.206**	.191**	.202**	.571**				
Reading comprehension													
11. Text 1-local	.241**	.324**	.132**	.308**	.355**	.449**	.357**	.395**	.427**	.378**			
12. Text 1-global	.237**	.215**	.153**	.191**	.351**	.345**	.370**	.343**	.389**	.362**	.470**		
13. Text 2-local	.158**	.203**	.102*	.201**	.291**	.301**	.303**	.337**	.332**	.306**	.386**	.389**	
14. Text 2-global	.151**	.208**	NS	.187**	.242**	.305**	.292**	.314**	.407**	.371**	.373**	.405**	.401**
Mean r	.197	.237	.103	.222	.310	.350	.330	.347	.389	.354	–	–	–

* $p < .05$; ** $p < .01$

NS non significant

comprehension, at different stages of learning, was analyzed. The model also included a correlational link between reading speed and reading accuracy because these measures are obtained from the same tasks and are strictly connected, as showed by past studies (e.g., Zoccolotti, De Luca, Di Filippo, Judica, & Martelli, 2009).

Figures 1, 2, 3, 4 and 5 describes the models and the standardized parameters. All the models globally presented the same results: oral comprehension was the strongest predictor of reading comprehension, whereas reading accuracy played a significant but minor role, with the exception of 2nd grade for which oral comprehension and reading accuracy showed similar standardized parameters (.60 vs. .58). Reading speed was non-significant in all grades considered. These models accounted for 77–82 % of the variance, depending on the grade considered. All the models have good fit indices according to the requirements proposed by Hu and Bentler (1999). Correlations between the unique variances of some variables chosen using MPlus (Muthén & Muthén, 1998–2010) modification indices and following theoretical motivations were allowed. These correlations always involved the same measures recorded in different tasks (e.g., between s/s of Word and Non-word reading). Such minor structural modifications can improve model fit by increasing the proportion of explained variance without changing the key conclusions about the adequacy of a hypothesized structure in the description of the data (Bollen, 1989). The correlations suggested by the modification indices are reported in Figs. 1, 2, 3, 4 and 5.

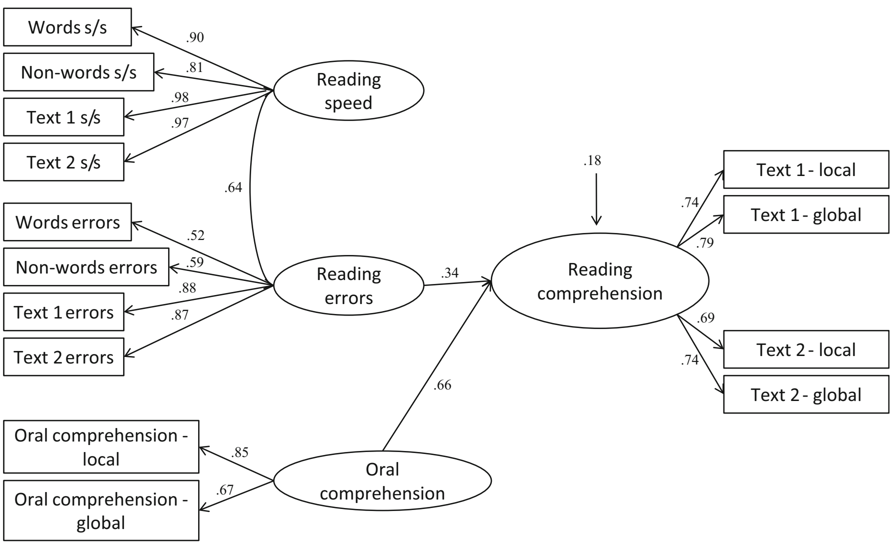

Fig. 1 Model predicting Reading comprehension for 1st grade. *Arrows* represent significant relationships at $p < .01$; missing *arrows* represent non significant relationships. The *arrow* above the “Reading comprehension” *circle* represents the residual variance for the dependent variable. Fit indices are as follows: RMSEA = .058 (90 % CI .045–.071); CFI = .975; TLI = .967; SRMR = .034. Correlations between unique variances suggested by modification indices: words s/s with non-words s/s; text 1 s/s with text 2 s/s

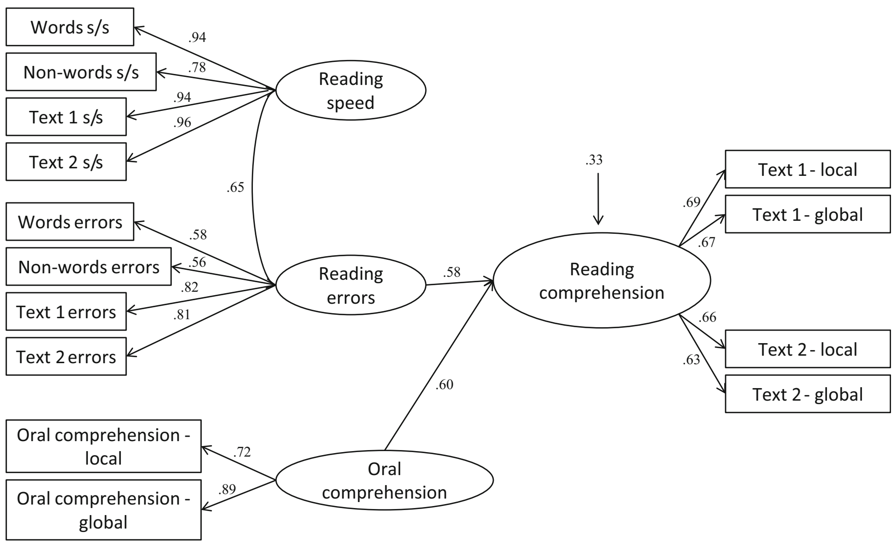

Fig. 2 Model predicting Reading comprehension for 2nd grade. Fit indices are as follows: RMSEA = .055 (90 % CI .042–.068); CFI = .973; TLI = .965; SRMR = .047

A comparable result was obtained using only the non-word reading task, as a pure measure of grapheme to phoneme decoding process, for calculating reading speed and accuracy. This alternative model was tested for two main reasons: first, because the majority of studies conducted on the SVR have considered word and/or non-word reading tasks to obtain the decoding factor (Florit & Cain, 2011) and, second, because passage reading would be more affected by contextual factors, linked to top-down semantic and syntactic processing of text.

Discussion

The present study aimed to test the SVR model on a large sample of Italian children in primary school, specifically analyzing the role of reading speed, accuracy, and oral comprehension in predicting reading comprehension separately for groups of children with 1–5 years of schooling. This research stems from the necessity, emphasized by Florit and Cain (2011), for more fine-grained studies that make the role of the SVR model's components in orthographies more consistent than English. Although previous studies analyzed the SVR model in the Italian orthography, their results are partially inconsistent: Florit et al. (2008) showed a stronger influence of reading speed than oral comprehension on reading comprehension in young readers (third graders), and an opposite pattern in fifth graders; Carretti and Zamperlin (2010) found that oral comprehension is the strongest predictor in first, third and fourth graders. Furthermore, only reading speed, and not reading accuracy, was used as a decoding measure in both studies, making it difficult to directly compare these studies with similar ones that considered reading accuracy as a decoding measure.

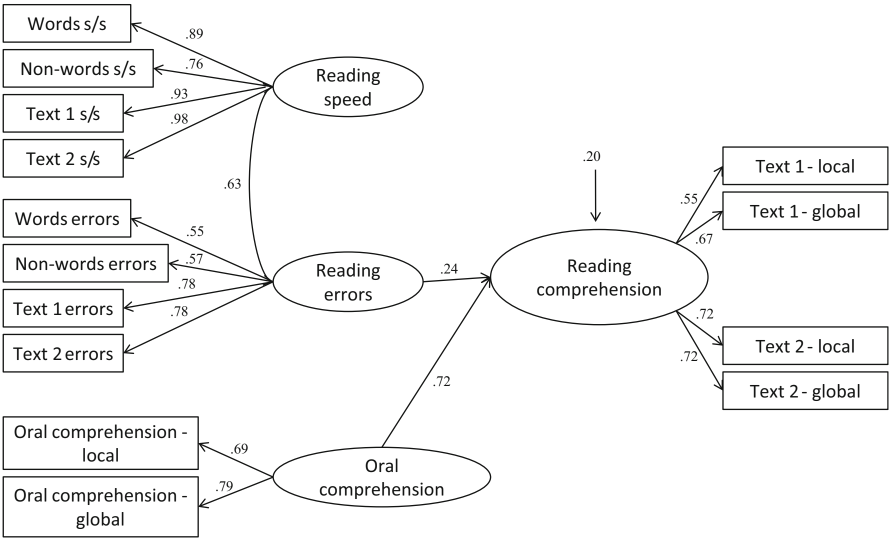

Fig. 3 Model predicting Reading comprehension for 3rd grade. Fit indices are as follows: RMSEA = .054 (90 % CI .041–.067); CFI = .974; TLI = .967; SRMR = .040. Correlations between unique variances suggested by modification indices: words s/s with non-words s/s

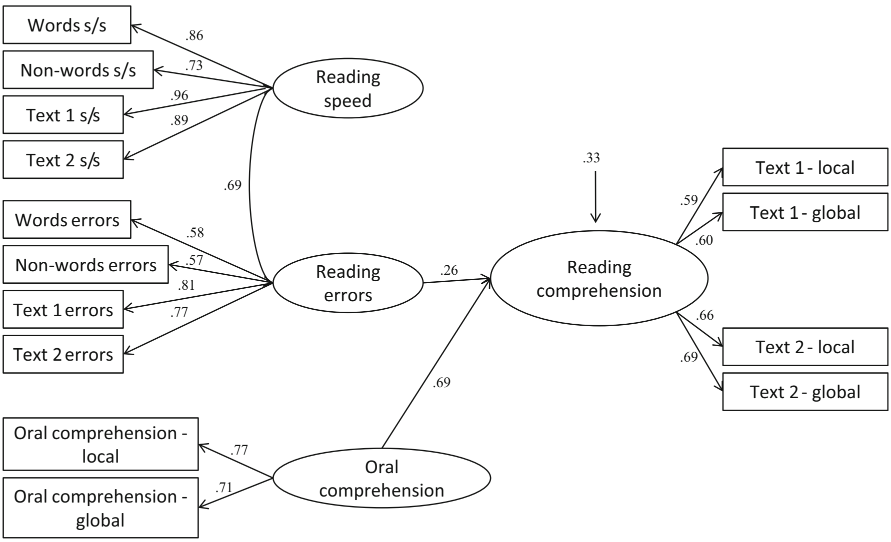

Fig. 4 Model predicting Reading comprehension for 4th grade. Fit indices are as follows: RMSEA = .053 (90 % CI .042–.065); CFI = .972; TLI = .964; SRMR = .044. Correlations between unique variances suggested by modification indices: words s/s with non-words s/s; text 1 s/s with text 2 s/s

In the present study, the models tested produced statistically significant and good fit indices for all the grades considered, suggesting that it is theoretically viable. In fact, oral comprehension and decoding accuracy formed distinct clusters within

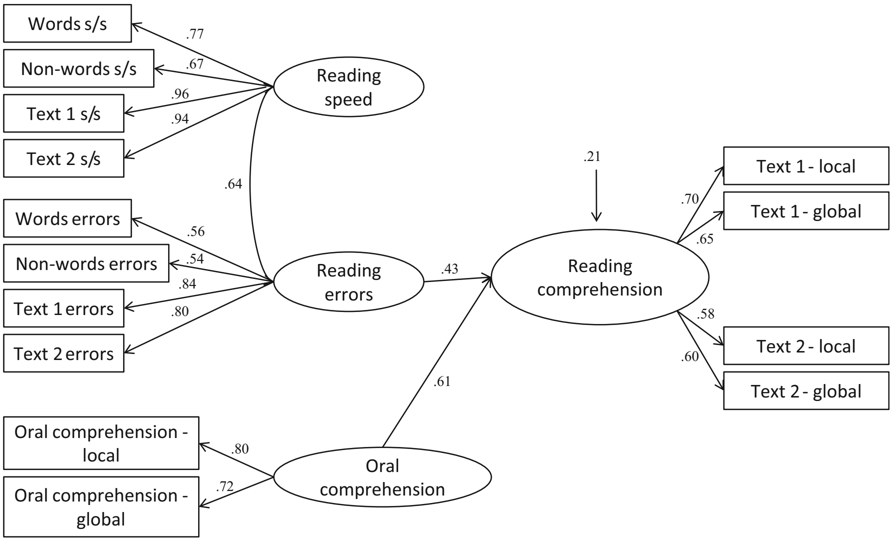

Fig. 5 Model predicting Reading comprehension for 5th grade. Fit indices are as follows: RMSEA = .034 (90 % CI .020–.047); CFI = .988; TLI = .984; SRMR = .038. Correlations between unique variances suggested by modification indices: words s/s with non-words s/s

each grade group, and together explained a high proportion of variance of reading comprehension. This finding confirms that the SVR model is a valid framework to theorize reading comprehension for transparent orthographies (Florit & Cain, 2011).

The main findings of the present study are related to the stronger concurrent predictive power of oral comprehension on reading comprehension through primary school. These results strengthen suggestions by Carretti and Zamperlin (2010) about the major role of oral comprehension in predicting reading comprehension in transparent orthographies throughout primary school years. Furthermore, our results suggest that oral comprehension is a stronger predictor of reading comprehension than both reading speed and accuracy, from the first grade onward. This is partially in contrast with previous findings that suggested a primary role of decoding (measured with reading speed) in the first years of schooling for transparent orthographies (Florit & Cain, 2011; Florit et al., 2008). In the present cross-sectional design, accuracy resulted as a globally secondary but significant predictor of reading comprehension in all classes considered. However, it could be observed that oral comprehension and reading accuracy presented similar standardized parameters in 2nd grade, and that reading accuracy showed a score moderately larger in 5th grade, compared to 1st, 3rd, and 4th grades. This variations could be due to some differences in the texts difficulty, in terms, for example, of lexical properties. The increasing in text difficulty and the higher number of low frequency words, may have lead to reading errors which would affect reading comprehension, leading to a major role of reading accuracy in 5th grade. Finally, it was showed that decoding speed was never significant. This last result suggests that the component of reading speed should not be added to the SVR model.

These findings may seem difficult to reconcile with the evidence that accuracy reaches a ceiling early in transparent orthographies (e.g., Cossu et al., 1995; Seymour et al., 2003), whereas decoding speed is considered the strongest marker of reading impairment in transparent languages (e.g., Wimmer et al., 1998). However, this is a sample of typically developing children, and variability in reading speed, particularly for passage reading, might be an indicator of a specific reading strategy. If reading is aimed at comprehension, speediness is not necessarily an advantage. Conversely, reading accuracy is significantly related to lexical access, and it is known that vocabulary is one of the primary predictors of reading comprehension (Nation et al., 2010). Thus, a high number of reading errors would impair comprehension, and this may explain why reading accuracy is more important than speed in predicting reading comprehension.

In interpreting the present findings, it would be useful to refer to Keenan, Betjemann, and Olson (2008), who specified that different methodologies developed to assess reading comprehension could measure different skills. In particular, they showed that reading comprehension tasks involving silent reading and cloze or multiple-choice answers are mostly associated with decoding abilities, whereas reading comprehension assessed through open questions and reading aloud (as with the task used in the present study) is strongly associated with oral comprehension. Furthermore, they also showed that the influence of decoding skills on reading comprehension is stronger when short passages (one–three sentences) are involved. Keenan et al. (2008) suggested that decoding problems are likely to be more problematic in short passages than in longer passages, which would allow the children to use the context to determine the correct decoding and the global meaning. This interpretation supports our findings.

In this framework, a possible constraint of the present study might be oral comprehension and reading comprehension involving similar tasks (answering open questions). However, the two tasks differed in the input modality (reading versus listening) and in the possibility of having or not having the passage available for consultation. Thus, the two tasks can be considered as measures of different cognitive processes. Moreover, as suggested by Hoover and Gough (1990) and supported by Florit and Cain's meta-analysis (2011), the use of parallel materials to assess linguistic and reading comprehension is recommended.

A limitation of the present study might refer to the cross-sectional design, which makes it difficult to identify reliable, causal relationships between the variables considered. Furthermore, we did not explore other processes that may contribute to explaining reading comprehension (e.g., memory skills, naming speed); however, the amount of variance explained was relatively high.

Considering our initial hypothesis, the main conclusions are as follows:

1. Both decoding accuracy and oral comprehension are significant predictors of reading comprehension from first through fifth grade in primary school whereas reading speed does not contribute significantly to the dependent variable. Furthermore, oral comprehension is the strongest predictors for all five grades considered.

2. In contrast with our hypothesis, reading speed was not significant in concurrently predicting reading comprehension, independently of the grade considered. Despite the central role of reading speed as a measure of reading proficiency in transparent orthographies, such as Italian (e.g., Tobia & Marzocchi, 2013; Zoccolotti et al., 1999), it is not a determining variable when analyzing reading comprehension.

The present findings have some implications for teaching strategies and for intervention programs. Considering the first point, our results show the importance of oral comprehension skills throughout primary school. Therefore, activities using oral language skills should be included in educational programs from first through fifth grade. Exercises aimed to enlarge children's vocabulary, to comprehend orally presented passages, to explore non-literal language, and to train narrative ability are some examples, and should be accompanied with text level activities and metacognitive strategies.

With regard to interventions aimed to improve reading comprehension abilities in children with specific difficulties, the present findings suggest that intervention programs that specifically work on oral language abilities should lead to notable improvements. The efficacy of oral language training was demonstrated in a sample of poor English readers (Clarke, Snowling, Truelove, & Hulme, 2010; Clarke, Truelove, Hulme, & Snowling, 2013), who presented statistically and educationally significant long-term improvements.

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