Reading Aloud to Children: Benefits and Implications for Acquiring Literacy Before Schooling Begins

DOMINIC W. MASSARO
University of California, Santa Cruz

Extensive experience in written language might provide children the opportunity to learn to read in the same manner they learn spoken language. One potential type of written language immersion is reading aloud to children, which is additionally valuable because the vocabulary in picture books is richer and more extensive than that found in child-directed speech. This study continues a comparison between these 2 communication media by evaluating their relative linguistic and cognitive complexity. Although reading grade level has been used only to assess the complexity of written language, it was also applied to both child-directed and adult-directed speech. Five measures of reading grade level gave an average grade level of 4.2 for picture books, 1.9 for child-directed speech, and 3.0 for adult-directed speech. The language in picture books is more challenging than that found in both child-directed and adult-directed speech. It is proposed that this difference between written and spoken language is the formal versus informal genre of their occurrence rather than their text or oral medium. The value of reading books aloud therefore exposes children to a linguistic and cognitive complexity not typically found in speech to children.

KEYWORDS: print, speech, reading, literacy, language acquisition, vocabulary, reading level, communication genre

The author has previously proposed that appropriate immersion in written language might allow children to learn to read in the same manner they learn spoken language (Massaro, 2012a, 2012b). One potential type of immersion is reading aloud to children, and there have been several renewed recommendations for this form of engagement (Reading Aloud, 2015a, 2015b, 2015c). Many reasons, such as the opportunity to stimulate language development, cognitive skills, and reading readiness, have been proposed. It is important to distinguish between language and cognitive competence from the mechanics of reading, which includes primarily letter and written word recognition but also how to navigate through a text. Reading skill depends not only on language and cognitive competence but also on reading mechanics.

It is not surprising that reading aloud to a child does not normally contribute to the child's mastery of the mechanics of reading. Picture books are the most popular books read to preschool children, and these have predominantly engaging pictures relative to their written text, which tends to be in complex fonts printed in a smaller size. A study tracked the eye movements of 4-year-old children during reading aloud sessions while sitting on the lap of the reader. A variety of picture books with several text configu-

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rations were chosen, including text at the bottom or top of the illustrations, text on the left side of the illustrations, and text presented in bubbles. They also included monocolor illustrations. The results were very striking because the children spent about 95% of the time looking at the pictures in the book rather than the words (Evans & Saint-Aubin, 2005). Thus, we cannot expect these children to learn about print when they are not looking at it.

Because reading aloud to a child does not normally promote the growth of most of the mechanics of reading (Massaro, 2015b), it is not obvious why this recommendation is so pervasive. The goal for the present research project has been to determine exactly what is available to the child in reading aloud that is not present in the other spoken language we direct to our children. How do popular picture books we read to children extend their linguistic and cognitive experience beyond what it usually achieved in their day-to-day spoken language exchanges? Addressing this question requires an analysis of the semantic and grammatical content of prototypical written and spoken language experienced by young children to determine why their linguistic and cognitive development should benefit more from written than spoken language.

In an extensive replication of Hayes's (1988) seminal study, I first assessed the vocabulary contained in databases of picture books, child-directed speech (CDS), and adult-directed speech (ADS). The major goal was to determine whether the vocabulary differed for these spoken and written language databases. Many more word types were found in the picture book samples than in the CDS database (Massaro, 2015b). To determine the properties of this additional vocabulary, the samples were assessed against the 5,000 most frequently used spoken and written words from the Corpus of Contemporary American English (COCA, 1990–2012). After words in the samples that overlapped with the most frequent words in the COCA database were eliminated, there were roughly three times as many rare word types in the picture book word corpus than in the CDS corpus.

This result means that children listening to a reading aloud of a picture book are roughly three times more likely to experience a new word type that is not among the most frequent words in the child's language. The additional word types found in picture books were not in the baseline of the 5,000 most frequent words and therefore consisted of relatively infrequent and challenging words. Table 1 gives a small sample of words that occurred in the picture book database but not in the CDS database. This advantage of a more extensive vocabulary with picture books relative to spoken language to children has also been recently documented by Montag, Jones, and Smith (2015).

Picture books also had a more extensive vocabulary than found in the ADS corpus (Massaro, 2015b). The likelihood of finding a rare word not found in the 5,000 most frequently used words was 1.64 times greater in picture books than in ADS. Why does the vocabulary of books differ so dramatically from spoken language to either children or other adults? Until the recent onslaught of digital devices that encourage spontaneous instant messaging and texting, spoken and written language were inherently different. Spoken language communication was usually extemporaneous and final, whereas written language was deliberate and could be modified at will before being communicated. Nabokov (1980) viewed serious reading as rereading, and analogously we can presume

t ABl e 1. Small Sample of Words That Occurred in the Picture Book Database but Not in the Child-Directed Speech Database

agapanthus	gathering	pathological
alligator	gondola	perched
alphabet	grumbled	ponderous
amazement	hoisting	reproachfully
beginning	improvising	requirement
bewildered	ladle	scrambled
blooming	learning	shepherd
business	lightning	squawking
caressed	mathematical	squelched
chorus	meticulous	struggling
concentrate	moaned	teaching
dragonflies	murmuring	thundered
education	nervously	trample
emergency	occasionally	vexatiously
fireworks	opera	versatile

that serious writing requires rewriting. Spoken dialog, on the other hand, must be reasonably responsive in time and content, which favors familiar words and influences from the immediate context (Grice, 1975). These constraints necessarily diminish access of rare words in spoken dialog (Massaro, 2015b).

This previous research therefore provided one justification for the value of reading aloud to even the youngest children. The child will hear challenging words from picture books beyond those commonly found in the day-to-day speech of their caregivers. A word's experienced frequency will necessarily increase its familiarity, its understanding, and supposedly its productive use (Petrova, Gaskell, & Ferrand, 2011). An early age of acquisition is also important because the earlier a word is first heard, the more likely it is to be in the child's receptive and productive vocabulary (Massaro, 2016) and the better its memory and processing in adulthood (Kuperman & Van Dyke, 2013; Stadthagen-Gonzalez, Bowers, & Damian, 2004). Thus, a child benefits from reading aloud not only by hearing rare and challenging words but also by being acquainted with them early in life. Given the significant differences in vocabulary found in picture books and spoken language, it is important to assess other properties of spoken and written language because vocabulary alone does not measure the linguistic and cognitive complexity of language. To address this question, I carried out additional analyses on the same databases (Massaro, 2015b) to determine whether and how their linguistic and cognitive complexity differed.

METHOD

The essential properties of the databases are described here. Further details can be found in Massaro (2015b).

Picture Book Database

The picture book database was obtained from a shared picture book reading application called Read With Me! (2012). The text from 112 popular picture books was transcribed for the application (see Massaro, 2015b; Psyentific Mind, 2013). Given that the books were "story" books, any advantage in their vocabulary and linguistic and cognitive complexity would be expected to be even larger if "information" books were used. However, the genre of these picture books makes a reasonable comparison to the speech corpora, which were collected in an informal conversational setting.

Child-Directed Speech

This corpus consisted of a mother talking to her child in a play situation with toys (Massaro, 2015b). The play session lasted between 20 and 30 min. Individual recordings were made of 32 mothers and their infants in the study. As might be expected, conversations included a large variety of topics, including discussions of animals, body parts, cartoons, colors, cooking, clothes, eating, emotions, family members, family activities, moods, places to visit, shapes, and toys.

Adult-Directed Speech

The ADS was recorded with the same mothers from the CDS database. It included her speech as well as the experimenter's speech during a casual conversation (see Massaro, 2015b).

Corpus of Contemporary American English

A measure of common and rare words was obtained from the COCA (1990–2012). The corpus, balanced between spoken and written English, contains more than 450 million words from unscripted radio and TV shows, books of fiction, short stories, movie scripts, and popular magazines, newspapers, and academic journals. More than 150,000 samples contribute to the complete database.

Grade-Level Measures of Linguistic and Cognitive Complexity

There have been various approaches of assessing linguistic and cognitive attributes of oral language, including the functional grammar of Halliday (1970) and the construction-based analysis of Tomasello and his colleagues (Cameron-Faulkner, Lieven, & Tomasello, 2003). Given the difficulty of quantifying these metrics for the current databases, a more direct measure of linguistic and cognitive complexity was used. This measure, reading grade level, has been successfully used to characterize written texts (e.g., Benchmark Education, 2015; Readability-score.com, 2013), but as far as is known it has not used for either picture books or spoken utterances. Although not previously used, measures used to determine reading grade level appear to be equally appropriate for spoken and written language. There are several reading grade-level measures, but they are highly correlated with one another. Their similarity is expected be-

cause their measures use to varying degrees the number of characters relative to the number of words, the number of syllables relative to the number of words, and the number of words relative to the number of sentences. The readability formulas use these variables in different ways and weight them to different degrees, but they seem equally applicable to picture books and spoken language.

Five different readability formulas were used, and all give a score in terms of U.S. grade level, making it easier for teachers, parents, librarians, and others to judge the readability level of various books and texts. This grade-level measure is used here to provide a metric of linguistic and cognitive complexity.

The Flesch–Kincaid Grade Level Formula calculates grade level with the formula

$$GL = 0.39(TW/TS) + 11.8(TY/TW) - 15.59 \quad (1)$$

where GL is grade level, TW is the total number of words, TS is the total number of sentences, and TY is the total number of syllables.

The Gunning fog index gives a grade level with the formula

$$GL = 0.4(TW/TS) + 100(CW/TW) \quad (2)$$

where CW is the total number of complex words. In this formula, word complexity appears to be based more on the number of syllables than the difficulty of the word.

The Coleman grade level is determined by

$$GL = 0.0588(L) - 0.296(S) - 15.8 \quad (3)$$

where L is the average number of letters per 100 words and S is the average number of sentences per 100 words.

The SMOG index of grade level is calculated using the formula

$$GL = 1.0430 \times SQRT[(TP)(30/TS)] + 3.1291 \quad (4)$$

where SQRT[x] is the square root of x, and TP is the total number of polysyllabic words (containing more than three syllables).

The automated readability index (ARI) also produces an approximate representation of the U.S. grade level needed to comprehend the text.

$$GL = 4.71(TC/TW) + 0.5(TW/TS) - 21.43 \quad (5)$$

where TC corresponds to the total number of characters (letters and numbers).

All these measures were derived automatically by entering the appropriate database online (Readability-score.com, 2013). To determine the reasonableness of these readability grade-level measures, we also measured readability grade level from a story, "Manliness," from a fourth-grade McGuffey reader (McGuffey, 2014).

RESULTS

Given the continuous nature of the spoken conversations, it was not possible to divide the speech databases into separate sections corresponding to what might be considered individual books. Thus, it seemed appropriate to treat the spoken corpus as a single text. To create an appropriate contrast, the texts from the books were also combined into a single text. Given that the spoken database was smaller than the picture book database, we subsampled the picture book database. To compare the CDS and picture book "reading grade level," we used three samples of the picture book database to make comparisons about equal in size to the CDS database. The readability of these four databases was measured online by the five different readability formulas described in the Method section (Readability-score.com, 2013).

Table 2 lists the results of this analysis. The five grade-level measures are highly correlated with one another, each one giving roughly the same outcome. The CDS database averaged a 1.9 grade level, whereas the three samples of the picture book database averaged a 4.2 grade level. Thus, the readability measures indicate that the language of picture books is more complex than the language of CDS. This higher level of complexity of picture books is consistent with the larger uniqueness in vocabulary in picture books relative to CDS. The average readability grade level for the fourth-grade McGuffey reader was 4.5, which provides an acceptable independent check on our measures. It also allows us to conclude that the picture books measure of 4.2 can be interpreted as a fourth-grade reading level.

The readability grade level of the ADS database is also given in Table 2. As expected, the reading grade level of ADS was about one grade higher than that of CDS. However, it was still about a grade lower than that of the picture book database.

In summary, our analyses support our earlier findings of the differences in vocabulary between picture books and CDS. The linguistic and cognitive com-

plexity (as measured by standard readability measures) is greater in picture books than in the speech we direct to our preschool children and, to a lesser degree, how we talk to each other.

DISCUSSION

We found that the complexity of spontaneous spoken language to children pales in comparison to written language in children's picture books. As described in the previous study on vocabulary (Massaro, 2015b), this comparison should not be interpreted as an intrinsic difference between written language and spoken language. A comparison between picture books and CDS cannot be simply the written language modality because the children are actually hearing speech when the books are being read to them. Picture books and CDS differ in several ways, but an important difference is spontaneous versus prepared content. I interpreted this "genre" difference as informal versus formal language (Massaro, 2015a, 2015b).

Table 3 provides a taxonomy revealing the potential independence of language modality (spoken versus written) and formal (nonconversational) versus informal (conversational) dialog. As can be seen in Table 3, the genre of the linguistic content can be interpreted as independent of language modality. Picture books are a qualitatively different genre from the typical speech that parents address to their children. To provide a formal spoken language alternative to reading, parents and caregivers might actually deliver a prepared lecture to the child or narrate a true or fictional story. In this case, we might expect the linguistic and cognitive properties of these spoken utterances to be more similar to the picture books than the CDS. From this perspective, contrasting picture books with conversational speech is mostly a comparison between formal and informal language.

Table 2. Five Measures of Readability Grade Level of the Child-Directed Speech (CDS), Adult-Directed Speech (ADS), and 3 Equal-Sized Samples From the Picture Book Database

Readability formula	CDS	3 Picture book samples			ADS
Flesch–Kincaid readability tests (2015)	0.1	2.5	3.2	2.4	1.6
Gunning fog index (2015)	2.6	4.7	5.0	4.5	4.4
Coleman–Liau index (2015)	5.8	7.9	8.1	7.5	5.8
SMOG (2015)	2.3	3.8	4.1	3.7	3.6
Automated readability index (2015)	1.3	1.7	2.5	1.5	–0.2
Average	1.9	4.1	4.6	3.9	3.0

Table 3. Taxonomy and Example Instances Revealing the Potential Independence of Language Modality (Spoken Versus Written) and Formal (Nonconversational) Versus Informal (Conversational) Dialog

	Spoken language	Written language
Formal language	TED Talk	Book
	Lecture	Article
	Massive Open Online Course	Newspaper
Informal language	Face-to-face conversation	Texting
	TV dialog	Instant messaging
	Fiction films	Light fiction writing

Potential Limitations of the Readability Analyses

It is important to review several potential limitations of the current analyses. There are several other potential readability measures, but these could not be used. I did not perform a lexile analysis of the samples for several reasons: The Lexile Analyzer (2014) evaluates the frequency of its words and the lengths of its sentences, which correlates with the readability measures we are using, the Lexile Analyzer is not available for large corpora, and, most importantly, copyright restrictions preclude publication of any lexile results.

I was not able to include the Coh-Metrix analysis of the databases, which measures the "characteristics of the explicit text that play some role in helping the reader mentally connect ideas in the text" (Graesser, McNamara, & Louwerse, 2003). The Coh-Metrix measure is necessarily based on the complete text. In contrast, the transcriptions of the spoken language

database often recorded independent propositions. For example, two propositions were "there you go, see, you wanted the binky." and "do you like that boot?" These propositions were entered as separate sentences. A Coh-Metrix analysis would give a low score for mentally connecting these two propositions and therefore would be misleading for the spoken language database because it is based on multiple interactions between the mother and child. Similarly, the picture book database would not be appropriate because it was based on multiple books to make it comparable to the spoken language database. The only fair method to compare the spoken and written language databases is thus limited to the sentence level. The readability formulas that were used are all calculated at the sentence level.

As mentioned, determining the readability grade level of picture books is also new to the field. Although readability formulas have not been extended from "plain" texts to preschool picture books, it seems a natural extension because there is not a sharp discontinuity between them. Some regular books contain pictures, and some picture books have few pictures. We might expect that some of the text of picture books might be even more advanced than grade school readers. Picture books are aimed at adults reading to children, whereas grade school readers are targeted to children learning to read when the mechanics of reading are also essential for success.

Readability grade level is being used to measure the linguistic and cognitive characteristics of the spoken and written corpora. One potential problem is that when the readability measure is limited to written text in the picture books, the contribution of the pictures to readability of the picture books is not accounted for. Given that pictures accompanying text can improve text comprehension (Levin, Anglin, & Carney, 1987), a given readability grade level of just the text in a picture book might assign it a more advanced grade level than appropriate. That is, pictures could make a text somewhat more readable than implied by its assigned grade level based on just the text. By this logic, measuring readability from just the text would mean that this readability measure of picture books might overestimate their actual difficulty of the text and therefore the child's understanding. This overestimation might also occur in evaluating the propositions of child directed speech, however, because the child also has supporting context interacting with caregivers. Thus, the readability measures of print and speech that consider only the text or the speech appear to be reasonable and comparable to one another given similar contextual support in both speech and reading contexts.

Finally, limiting the grade-level measures to the sentence level cannot be expected to capture all the cognitive and linguistic complexity of spoken and written language. Sentences occur in the context of other sentences, and some analysis that includes their relationship would be an improvement. Our current databases did not contain this information, but future research should find or build databases to allow implementing this type of analysis.

Learning Reading Mechanics

The print in children's picture books is not usually appropriate for a child learning the mechanics of reading. As mentioned, the designs of picture books encourage children to focus on the pictures rather than the words in shared reading-aloud situations (Evans & Saint-Aubin, 2005; van Kleeck, 2003). With these constraints, most shared book reading cannot easily support parental teaching about reading. However, there are many other opportunities along with more formal instructional situations in which parents are able to teach their children reading mechanics.

There is also some evidence that children can learn some reading mechanics in shared picture book reading. Piasta, Justice, McGinty, and Kaderavek (2012) documented some very important findings relating to early reading. As part of Project STAR (Sit Together And Read), they carried out a randomized clinical trial to test the impact associated with emphasizing print during reading to 4-year-old preschool children in the classroom (see also Justice, McGinty, Piasta, Kaderavek, & Fan, 2010; McGinty, Breit-Smith, Fan, Justice, & Kaderavek, 2011). Their comprehensive study involved more than 300 children in 85 classrooms. The children in the study came from low-income homes and started with below-average language skills. Two groups of children had four reading sessions with one book per week for 30 weeks. The books were selected to have print-salient features.

The important difference between the groups was whether print was emphasized in the book reading.

Emphasizing print in reading directs the children to pay attention to the printed letters and words. Teachers in the manipulation group were trained to make specific print references while reading. For example, they could point to a letter and ask the child what it was or ask the child to point to the words as they were read. Teachers in the comparison group were told to read as they normally would. The results revealed that the children who were encouraged to pay attention to print had better word reading, spelling, and comprehension skills than did children in the comparison group. This was true even 1 or 2 years after the intervention of print emphasis in shared reading. The effects might have been even larger if the intervention were one-on-one reading aloud rather than a single teacher with several children. These results are very important because the authors observed, as have others, that teachers, parents, and caregivers do not normally ask the child to attend to the print of picture books. Other results indicate that print salience encourages the use of print referencing (Dynia, Justice, Pentimonti, & Piasta, 2013).

To promote learning more about the mechanics of reading during shared picture book reading, we created an Apple iPad app called Read With Me! The application displays salient text from popular picture books in an easy-to-read format and allows the child to learn to read easily seen words during shared picture book reading. The caregiver and the child choose one of their favorite books from the app's library of more than 100 popular books. The caregiver reads the book to the child, both of them enjoying the rich sharing of emotion and adventure. (It is necessary to have the physical book to use the app.)

Read With Me! adds to this experience by presenting written words from the book on the iPad screen. The app uses automated speech recognition: The caregiver simply touches the screen to start and stop dictating a complete sentence from the book. Knowing which book is being read limits the input to a small set of sentence alternatives, which allows accurate automatic speech to text translation. In systematic evaluations, we have found that this format allows the system to perform almost perfectly, even in noisy family situations and with non–native English talkers. The dictated sentence is recognized and then presented in large, easy-to-read written text on the iPad screen.

The application allows the caregiver and child to share attention between the picture book and the text presented on the iPad screen. The child should have a good view of the screen, and the caregiver should attract the child's attention to the screen if necessary. To keep the child's attention on the iPad screen and to eliminate the need for eye movements, the successive words are sequentially presented using a rapid serial visual presentation method on a single line in a fixed window frame. Literate people can read this presentation mode just as efficiently and accurately as a typical document format (Yu et al., 2007). In fact, Kwon et al. (2007) found that reading speed using this method was actually significantly faster than traditional reading speed for third graders through adulthood. The iPad can be held by the caregiver, placed on a table, or placed inside a transparent holder sewn into a shirt that the caregiver would wear. This experience allows the child to learn to read naturally in the same manner that they learn to understand what you say.

The Read With Me! app facilitates the presentation of print without being highly dependent on the caregiver's or teacher's ability or desire to provide explicit instruction in prereading skills. Surveys have revealed that many teachers tend to have limited knowledge of or motivation to teach appropriate literacy skills. Thus, increasing children's experience of appropriate written language can help bootstrap their reading in the same manner that hearing speech aids spoken language acquisition.

In the Read With Me! app, parents and caregivers are able to control the presentation rate, whether speech occurs with the written words, the male or female voice, and which words from a recorded sentence will be displayed. For example, fewer words and a slower presentation rate might be selected for younger readers, whereas older readers would be presented with more words at a faster rate.

Reading Mediated by Speech

A persistent belief about reading is that it is necessarily mediated by speech, which is sometimes called phonological mediation. However, evidence for orthographic processing rather than phonological mediation in reading comes from a variety of research findings, such as the substitution errors made in reading (Kolers, 1970; Weber, 1970). Substitution errors are usually syntactically or semantically consistent

with the context or involve substitutions that are visually similar to the actual word. Furthermore, the reader does not interpret the meaning of a word (e.g., *dear*) as that of its homophonic equivalent (e.g., *deer*). Whitford (1966) gave roughly 1,000 English words with homophonic equivalents. If the meaning of a word is retrieved on the basis of its sound, homophonic confusions should be prevalent in reading, but they are not. Smith (1971) and Cohen (1972) pointed out that readers stumble over sentences such as *The nun tolled hymn she had scene a pare of bear feat in hour rheum*, although there is a direct phonemic-to-semantic correspondence.

I propose that print can be learned without being mediated by speech, and there is now a growing body of literature showing that beginning readers learn about properties of print that cannot be explained by its relationship to speech. In one study, second-grade children read aloud target homophonic pseudowords in the context of real stories (Cunningham, 2006; Cunningham et al., 2001, 2002). Prompted to recall the target homophones several days later, the second graders were able to distinguish between the original target spelling and the spelling of a homophonic alternative (i.e., *yait* and *yate*).

Pollo, Kessler, and Treiman (2009) selected Portuguese and English native speakers between 3 years 7 months and 6 years 0 months who were described as prephonological; that is, they did not have phonological awareness in terms of understanding component segments of spoken language and how they map into written language. The prephonological children were asked to spell both words and nonwords. These children without knowledge of phonics must have used a strategy based on what they knew about spelling in their language. The word and nonword spellings produced by these children reflected the orthographic properties of their native written language. The frequency of occurrence for both single letters and bigram combinations in their written responses mirrored the orthographic properties of the text the children had experienced.

Finally, my view of learning to read through written language immersion does not challenge the view of reading that has emerged concerning the centrality of decoding and does not advocate a "sight word" or "whole language" approach. These previous proposals did not consider the potential power of introducing written language immersion long before schooling, nor did they consider the affordances possible with the newest technologies. There is a significant amount of orthographic structure in alphabetic writing systems, which the child would seem to be capable of learning, and thus it is not dependent on "holistic sight word" reading (Massaro & Jesse, 2005).

Conclusion

My conclusion is that the language and content of prototypical picture books are more extensive in vocabulary, grammar, and content and therefore more cognitively challenging than their counterparts in prototypically spoken language. One readily apparent implication is that we should spend more time reading these books to our children. A less apparent implication is that in the near future children might also be capable of reading these books independently. The distinction between language skill and skill in reading mechanics is central to this possibility. Young children have little problem with understanding picture books, which means they have the necessary language skill. Acquiring the appropriate reading mechanics would be sufficient for them to read the books themselves, which would expose them to more language complexity than is typically found in spoken language.

NOTES

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Address correspondence about this article to Dominic W. Massaro, Department of Psychology, Social Sciences 2, University of California, Santa Cruz, Santa Cruz, CA 95064 (e-mail: massaro@ucsc.edu).

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