Investigating the Relationship between Narrative Microstructure and Reading Comprehension

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Abstract
Reading comprehension develops on a foundation of spoken language proficiency, including narrative ability. Despite broad links established in the literature, however, the relationship of narrative microstructure to reading comprehension is not well understood, even for narrative markers thought to be particularly associated with reading like literate language features (LLFs). The present study investigates the relationship of narrative microstructure to reading comprehension in school-age children in the US. Participants were 145 children in grades 1-4 who generated a spoken narrative and completed standardized subtests of decoding, vocabulary, and reading comprehension in English. Narratives were coded for proportion of LLFs and other markers of narrative microstructure. Regression analyses were conducted to evaluate which narrative measures best predicted reading comprehension in the presence and absence of the measures of decoding and vocabulary. Proportion of LLFs was the best narrative predictor of reading comprehension in the older children but not the younger children. No narrative measures predicted reading comprehension when decoding and vocabulary were included in the regression analyses. The results suggest LLFs may be limited in their utility as a marker of reading ability in school-age children and indicate narrative microstructure may not be as strong an index of reading readiness as previously believed. Further research is needed to identify whether any measure of narrative microstructure acts as an independent predictor of reading comprehension when working within a Simple View of Reading framework.

Keywords narratives, decoding, reading comprehension, vocabulary, literacy

1. Introduction
Development of reading comprehension is one of the chief linguistic challenges of school age. Accessing meaning from text depends on spoken language ability (e.g., Gardner-Neblet, Pungello, & Iruka, 2012; National Early Literacy Panel, 2008) and has a well-established relationship to specific aspects of linguistic proficiency like vocabulary (Proctor & Louick, 2018; Tunmer & Chapman, 2012). More recent research has established broad links between narrative ability and reading comprehension (Barton-Hulsey, Sevcik, & Romski, 2017; Suggate, Schaughency, McAnally, & Reese, 2018). However, the nature of the relationship between the two is not clear (e.g., Roth, Speece, & Cooper, 2002; Wellman et al., 2011) - partly due to

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poor specification of what is meant by “narrative ability.” Indices of narrative microstructure do not seem to predict additional variance in reading when controlling for potential confounding variables such as vocabulary knowledge (Gardner-Neblett & Iruka, 2015; Kieffer, 2012; Uchikoshi, Yang, & Liu, 2018), and narrative-focused interventions do not necessarily lead to gains in reading ability (Connor et al., 2018), raising the possibility that a child’s facility with narrative microstructure may not play any special role in developing reading comprehension. Surprisingly, the relationship between literate language features (LLFs) – a set of narrative measures claimed to be particularly tied to literacy (e.g., Greenhalgh & Strong, 2001) – and reading comprehension has not been directly evaluated. With measures of narrative microstructure used to identify children at-risk for reading difficulties (Allen, Ukrainetz, & Carswell, 2012; Griffin, Hemphill, Camp, & Wolf, 2004) and as targets to improve linguistic abilities supporting reading (Adlof, McLeod, & Leftwich, 2014; Phillips et al., 2016; Spencer, Kajian, Petersen, & Bilyk, 2013), it is important to answer the question of whether narrative microstructure is related to reading comprehension. The primary goal of the present study is to verify whether narrative measures, and in particular LLFs, concurrently predict reading comprehension when controlling for decoding ability and vocabulary knowledge in school-age children. A secondary goal is to evaluate whether any such relationship is stronger in more experienced readers vs. early readers.

1.1. The relationship of oral language to reading comprehension

The Simple View of Reading is a robust framework indicating reading comprehension is comprised of two components – decoding ability and oral language comprehension. (Catts, Herrera, Nielsen, & Bridges, 2015; Hogan, Bridges, Justice, & Cain, 2011). The decoding component involves converting the orthographic cypher into its spoken form (National Early Literacy Panel, 2008), and requires a discrete set of skills related to sound-spelling correspondences and phonological processing (Lonigan & Shanahan, 2009). As texts increase in linguistic sophistication, older children rely more on the broader set of skills supporting oral comprehension (Geva & Farnia, 2012). These skills include proficiency in a variety of domains, including morphological awareness (Kieffer, Biancarosa, & Mancilla-Martinez, 2013) and syntactic awareness (Leider, Proctor, Silverman, & Harring, 2013), although measures of vocabulary knowledge are often the best linguistic predictors of reading ability (Kieffer, 2012; Proctor & Louick, 2018; Tunmer & Chapman, 2012; Uchikoshi et al., 2018).

Spoken narratives have received increasing attention in literacy research for two potential clinical applications: early identification of reading challenges (Allen et al., 2012; Gardner-Neblett & Iruka, 2015; Griffin et al., 2004) and subsequent remediation of those challenges (Adlof et al., 2014; Clarke, Snowling, Truelove, & Hulme, 2010; Spencer et al., 2013). Coarse relationships between overall narrative ability and reading comprehension have been identified previously (Miller et al., 2006), but these relationships are not well specified (Roth et al., 2002). One obstacle to clarifying the nature of the relationship is the broad use of “narrative ability” as a construct when, in reality, a child’s ability to produce a story taps multiple
skills. From a schematic perspective, there is knowledge of story grammar, as reflected by the ability to include specific narrative elements like setting, conflict, and resolution (Labov, 1972). This knowledge of narrative macrostructure facilitates a child’s ability to construct stories as well as her ability to understand them (Davies, Shanks, & Davies, 2004; Petersen, 2010), as reflected in studies showing that children receiving story grammar interventions (e.g., Spencer et al., 2013) show gains in reading comprehension (Fitzgerald & Spiegel, 1983; Gersten, Fuchs, Williams, & Baker, 2001).

The focus of the present study is on narrative microstructure. In contrast to macrostructure, microstructure is a broad category of linguistic indices, including lexical measures like number of different words in the story and morphosyntactic measures like the average number of words used per clause. While microstructure use is tied to the kinds of linguistic proficiency associated with oral comprehension (e.g., Justice, Bowles, Pence, & Gosse, 2010), it is less clearly related to reading ability (Barton-Hulsey et al., 2017; Wellman et al., 2011) than macrostructure is. The evidence linking linguistic proficiency in narratives to reading comprehension is suggestive, but tentative. For example, children with reading disorders typically score lower on narrative microstructure measures relative to age-matched peers with typical development (e.g., Catts, Adlof, Hogan, & Weismer, 2005; Westerveld, Gillon, & Moran, 2008) and children with language impairment generally have trouble with both narrative microstructure and reading comprehension (Catts, Bridges, Little, & Tomblin, 2008; S. L. Gillam & Gillam, 2016; Kaderavek & Sulzby, 2000).

The finding that children who struggle with reading also produce poor narratives implies a connection between the two domains. However, children with reading disorders and language impairment also both have vocabulary deficits, and vocabulary knowledge is correlated not only with reading comprehension but also with measures of narrative microstructure (e.g., Ebert & Scott, 2014). Thus, the narrative-reading relationship may be mediated by a child’s vocabulary ability (Gardner-Neblett & Iruka, 2015; Kieffer, 2012). This notion is reinforced in a study by Uchikoshi and colleagues (2018), which found measures of narrative microstructure and macrostructure in Spanish-speaking language learners to be significantly correlated not only with later reading comprehension, but also with vocabulary and decoding. When controlling for vocabulary and decoding ability, only the narrative macrostructure measure was a significant predictor of reading comprehension. Thus, one of the goals of this study is to investigate whether microstructural measures have a relationship to reading comprehension independent of potential confounding variables, like vocabulary knowledge.

Another consideration in evaluating the nebulous relationship between narrative measures and reading comprehension may be developmental. Early reading comprehension is highly tied to decoding (Vellutino, Tunmer, Jaccard, & Chen, 2007), so the influence of other aspects of linguistic knowledge (including narrative microstructure) may only be seen once children’s decoding skill is sufficiently established. Such developmental
effects are attested in the literature, as when total number of words produced in a narrative was correlated with reading comprehension in a group of 9-12 year-old children, but not a 6-8 year-old group (Ebert & Scott, 2014). Likewise, narrative quality and length concurrently predicted reading fluency (speed of reading connected text aloud) for children in second grade, but not in first (Reese, Suggate, Long, & Schaughency, 2010). One of the goals of the present (cross-sectional) study is to evaluate whether the relationships between narratives and reading comprehension appear to be stronger in older vs. younger children.

1.2. The putative connection between LLFs and reading comprehension

There is a third, relatively unexplored, possibility for the tenuous findings of a connection between narratives and reading ability: the most appropriate microstructure measures may have not been evaluated. LLFs are a subset of narrative microstructural elements theorized to be particularly tied to reading comprehension (Greenhalgh & Strong, 2001; Westby, 1991). As such, it seems logical any relationship between narrative microstructure and reading comprehension would be seen most strongly with LLFs, although no research appears to have explored such a relationship.

LLFs, which include structures like elaborated noun phrases (“The deep, dark cave”) and conjunctions (“He ran because he was scared”), are associated with the literary register of stories but not typical of everyday speech (Greenhalgh & Strong, 2001). Because LLFs are common in written discourse but rare in conversation, facility with LLFs primarily develops in pre-literate children through hearing stories read aloud (Heath, 1982; Westby, 1991). This exposure to LLFs should prepare a child to understand such structures when encountering them in text (Greenhalgh & Strong, 2001; Roth et al., 2002; Roth, Speece, Cooper, & Paz, 1996). Indeed, facility with LLFs is suggested to be “critical for language, literacy, and academic success” (Curenton & Justice, 2004, p. 241).

While there is logic to the notion that hearing (or reading) stories makes it both easier to parse the linguistic structures common to prose and more likely to use those structures in one’s own stories, a review of the literature suggests the putative link between LLFs and reading comprehension (Garton & Pratt, 1989; Purcell-Gates, 1988; Tannen, 1982; Wallach, 1990; Westby, 1991) lacks empirical validation (e.g., Benson, 2009). This gap in the literature is significant, as the presumption that LLFs are a predictor of reading comprehension seems to be taken for granted elsewhere in the literature (Curenton, Craig, & Flanigan, 2008; Lemmon & McDade, 2013), with some studies implementing LLF interventions based on the assumption that they will support reading development (Dawkins & O’Neill, 2011; Petersen, Gillam, Spencer, & Gillam, 2010; Phillips et al., 2016). While LLFs are sensitive to development (Curenton & Justice, 2004; Eisenberg et al., 2008), and diagnostically relevant in distinguishing children with language impairments from children with typical development (Anderson, 2011; Greenhalgh & Strong, 2001), the notion that they are related to text comprehension appears untested. Empirically establishing a connection between LLFs and reading is important to address the gap in the literature.
and to provide empirical support for the clinical practice of assuming LLFs are predictive of reading comprehension.

1.3. The present study
The extant literature does not establish a clear relationship between measures of narrative microstructure and reading comprehension, and it is unclear to what extent the nature of the measures and the age of the children studied influence this relationship. The exploratory study described here uses a narrative generation paradigm to empirically validate the relationship between individual measures of narrative microstructure, including LLFs, and reading comprehension, while controlling for other predictors of reading ability. Older and younger children’s performance on reading-related and narrative measures were compared to address 3 specific research questions:

1. Does the relationship between narrative microstructure and reading comprehension change with age?

Previous work has established that relative contributions of code-based skills and other linguistic skills to reading comprehension shift with time. Some evidence suggests developmental changes affect how narratives relate to understanding text as well (Ebert & Scott, 2014; Reese et al., 2010). While the study presented here is cross-sectional, participants were recruited across multiple grade levels. Given that books for later readers are more linguistically complex and that previous studies have shown stronger relationships between narratives and reading in older children, it is expected that narrative ability will be a better predictor of comprehension for this group relative to novice readers. Specifically, microstructural measures are expected to better predict reading comprehension in older children relative to younger children.

2. Do LLFs have a stronger relationship to reading comprehension than other measures of narrative microstructure?

Research supporting links between narrative microstructure and reading is equivocal, as reviewed above. Given the theoretical basis for a connection between LLFs and literacy, it is hypothesized that LLFs will be a stronger predictor of reading comprehension than other narrative measures in regression analyses.

3. Do LLFs account for additional variance in reading comprehension beyond what is accounted for by typical predictors of reading ability?

As discussed above, decoding ability and vocabulary knowledge are robust predictors of reading comprehension, and the latter may mediate relationships between narrative ability and reading comprehension. Based on the purported strength of the relationship between understanding text and LLFs, it is hypothesized that LLFs will be a significant independent predictor of reading comprehension even when accounting for decoding and vocabulary skill in the regression.
2. Methodology

The methodology of the research should be detailed very clearly referring to relevant theories.

2.1. Participants

As part of a larger study approved by an Institutional Review Board, 148 children from grades 1-4 were recruited from three schools (mean age 8.4 years; 78 female) in southern California. All children whose parents or caregivers consented for them to be in the study were included save those with a history of speech and language disorders, cognitive impairment, or learning disability (as reflected in school records or parent report). The children in the sample approximated the demographic background of the local community. To address the research question regarding the influence of age on narrative-reading relationships, children were split into two groups based on grade: a group of early readers (grades 1-2) who were expected to still be consolidating their decoding skills and a group of older readers (grades 3-4) who were predicted to be more experienced decoders.

2.2. Data collection and processing

2.2.1. Reading-related measures

The standardized testing battery included three subtests from the Woodcock-Johnson 3 Tests of Achievement (Woodcock, McGrew, & Mather, 2001). The non-word decoding subtest (“Word Attack”) was used as the decoding predictor. The non-word subtest was chosen over the word decoding subtest (“Letter Word Identification”) as it reduces potential confounding with vocabulary found in decoding tests using real words. On this task, children read invented words aloud (e.g., knoink) from a pre-printed list. If the word was mispronounced or not said smoothly it was marked as incorrect. In keeping with previous studies (Kieffer, 2012; Proctor, Carlo, August, & Snow, 2005), vocabulary knowledge was assessed using an expressive vocabulary subtest (“Picture Vocabulary”), where children labelled color pictures (such as corn or screwdriver). Finally, the reading comprehension subtest (“Passage Comprehension”) was administered to evaluate understanding of text. On the earliest items of this subtest, children match icons to pictures. As children progress through the test, they are asked to provide a missing word to complete a sentence or paragraph (e.g., Please answer the phone in the kitchen – it has been _____ (ringing) for some time). While the paradigm used in this subtest differs from those where children answer multiple-choice questions based on passages, the Passage Comprehension subtest appears to be the most commonly used in studies evaluating narrative-reading relationships (Barton-Hulsey et al., 2017; Miller et al., 2006; Uchikoshi et al., 2018; Wellman et al., 2011). Using three subtests from the same testing battery also improved comparability across the standardized measures, as they were developed in tandem.

All subtests were administered according to the published protocols. Average split-half reliabilities were .91, .74, and .91 for the decoding, vocabulary, and reading comprehension subtests (Woodcock et al., 2001), respectively. Items were scored dichotomously as correct or incorrect. To better facilitate
comparisons with the (unstandardized) narrative measures, the raw scores from the subtests were used.

2.2.2. The narrative task
Narratives were generated using two color picture sets (“Shipwreck” and “Late for School”) from the Test of Narrative Language (R. B. Gillam & Pearson, 2004) that depict challenges a child has on their way to school. Children viewed one of the picture sets and created a story that went with the pictures. Narratives were audio recorded for later transcription. To ensure fidelity, two trained graduate students independently transcribed the audio files. A third student identified discrepancies between the transcripts and resolved them by listening to the original audio file.

2.2.3. The coding schema
Trained graduate assistants coded narratives by hand for a variety of microstructural indices (for a sample of a coded transcript, see Appendix). Total number of words (TNW) was used as a gauge of overall productivity and number of different words (NDW) provided an index of lexical diversity. Syntactic complexity was measured through proposition density – mean length of proposition in words. Propositions are a unit of measure similar to a clause defined as a main verb and its arguments (Reilly, Wasserman, & Appelbaum, 2013). There were two indices of accuracy: proportion of lexical and morphosyntactic errors, respectively. Lexical errors were defined as problems of word selection relative to the picture reference or sentence context (e.g., The mom and son were making a plane when the picture shows a boat). Morphosyntactic errors were grammatical violations including errors of verb tense (Mom help Jonathan; The boat broke), pronoun use (Him made a boat; A little boy was with her mom), and word omissions (He went to *the bus; His teacher *was looking at him).

LLFs were analyzed using Greenhalgh and Strong’s (2001) schema to ensure consistency with other studies (Anderson, 2011; Curenton & Justice, 2004; Lemmon & McDade, 2013; Woolpert, 2016). Under this schema, LLFs comprise coordinating and subordinating conjunctions, adverbs, mental/linguistic verbs (e.g., think, say), and elaborated noun phrases. Elaborated noun phrases included those with two modifiers (e.g., a little boy), prepositional phrases (a project for his school), and relative clauses (e.g., a young boy who was late for school). The total number of LLFs across categories was summed and divided by the number of propositions to yield a proportion that controlled for length differences. The author coded 10% of the transcriptions independently. The Pearson correlation coefficient for agreement between the two coders was 0.99, indicating excellent reliability between the coders. All proportion-based measures were log transformed before analysis.

2.3. Data analysis
Initial relationships between the measures of interest were identified through simple correlations. Stepwise regression analyses were used to address the research questions.
3. Findings

Three children did not progress beyond the earliest items of the reading comprehension subtest (i.e., the picture-matching section); their data were excluded from analysis. Group means were imputed for four children who lacked complete data. Imputation did not substantially alter the results.

Descriptive statistics for the standardized and narrative measures are located in Table 1, disaggregated by age group. The partial correlations between reading comprehension and the other study measures are presented in Table 2, disaggregated by grade grouping. Due to concerns with alpha escalation, a false discovery rate (FDR) procedure (Benjamini & Hochberg, 1995) was used, with the FDR set at 0.10. Decoding and vocabulary were both strongly correlated with reading ability for the younger and older groups of children, as predicted by the SVR. Proposition density was moderately correlated with reading comprehension in the younger group ($r = .34$, $p < .01$). In the older group, proportion of LLFs was moderately correlated with reading comprehension ($r = .40$, $p < .01$), followed by NDW and TNW.

Table 1

*Means and standard deviation for age and scores from standardized measures for the entire sample disaggregated by group.*

<table>
<thead>
<tr>
<th></th>
<th>Younger ($n = 62$)</th>
<th>Older ($n = 83$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Age</td>
<td>7.36</td>
<td>0.62</td>
</tr>
<tr>
<td>NW Decoding***</td>
<td>14.31</td>
<td>7.37</td>
</tr>
<tr>
<td>Vocabulary***</td>
<td>19.00</td>
<td>3.78</td>
</tr>
<tr>
<td>Reading Comp***</td>
<td>19.77</td>
<td>5.84</td>
</tr>
<tr>
<td>TNW</td>
<td>57.34</td>
<td>56.40</td>
</tr>
<tr>
<td>NDW</td>
<td>33.06</td>
<td>19.78</td>
</tr>
<tr>
<td>Proposition density</td>
<td>5.51</td>
<td>1.02</td>
</tr>
<tr>
<td>Lexical errors</td>
<td>0.15</td>
<td>0.19</td>
</tr>
<tr>
<td>Morph errors</td>
<td>0.13</td>
<td>0.18</td>
</tr>
<tr>
<td>LLFs**</td>
<td>0.22</td>
<td>0.17</td>
</tr>
</tbody>
</table>

*Note: $n =$ number of participants. SD = standard deviation. NW = Non-word. TNW = Total number of words. NDW = Number of different words. Morph = morphological. LLFs = literate language features.*

** Significant difference between the younger and older groups ($p < .01$).

*** ($p < .001$).
Stepwise regression analyses (see Table 3) were used to identify how well narrative and reading-related measures predicted reading comprehension. To address the question of whether LLFs are more strongly associated with reading than other narrative measures, a pair of regressions were carried out using narrative measures only (Models 1A and 1B). For the younger group, Model 1A was significant ($R^2 = 0.19$, $F(1,59) = 6.83$, $p < 0.01$) with two predictors, indicating that proposition density ($B = 1.98$, $t(1,59) = 2.96$, $p < 0.01$) and proportion of morphological errors ($B = -1.12$, $t(1,59) = -2.31$, $p < 0.05$) are the only narrative measures that predict reading comprehension in the younger children. The model accounted for 19% of the variability in reading comprehension in the younger group. For the older group, Model 1B was significant ($R^2 = 0.21$, $F(1,78) = 10.07$, $p < 0.001$) with two predictors, indicating that proportion of LLFs ($B = 1.52$, $t(1,78) = 3.45$, $p < 0.01$) and NDW ($B = 0.07$, $t(1,78) = 2.07$, $p < 0.05$) account for 21% of the variability in reading comprehension in the older children.
Table 2

*Intercorrelation matrix between the reading-related measures and the narrative measures.*

<table>
<thead>
<tr>
<th></th>
<th>Reading Comp</th>
<th>Decoding</th>
<th>Vocab</th>
<th>TNW</th>
<th>NDW</th>
<th>Props</th>
<th>Prop Density</th>
<th>Lex Errors</th>
<th>Morph Errors</th>
<th>LLFs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading Comp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Decoding</td>
<td>.45**</td>
<td>-</td>
<td>.40**</td>
<td>.09</td>
<td>.14</td>
<td>.07</td>
<td>.21</td>
<td>-0.09</td>
<td>-0.16</td>
<td>.25*</td>
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<tr>
<td>Vocabulary</td>
<td>.46**</td>
<td>.22*</td>
<td>-</td>
<td>.18</td>
<td>.29*</td>
<td>.15</td>
<td>.24*</td>
<td>-0.01</td>
<td>-0.20</td>
<td>.15</td>
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<tr>
<td>TNW</td>
<td>.30**</td>
<td>.31**</td>
<td>.14</td>
<td>-</td>
<td>.96**</td>
<td>.99**</td>
<td>.32**</td>
<td>-0.08</td>
<td>0.00</td>
<td>.28*</td>
</tr>
<tr>
<td>NDW</td>
<td>.33**</td>
<td>.33**</td>
<td>.17</td>
<td>.97**</td>
<td>-</td>
<td>.94**</td>
<td>.38**</td>
<td>-0.07</td>
<td>0.02</td>
<td>.33**</td>
</tr>
<tr>
<td>Propositions</td>
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<td>.21*</td>
<td>.12</td>
<td>.89**</td>
<td>.87**</td>
<td>-</td>
<td>.18</td>
<td>-0.11</td>
<td>-0.01</td>
<td>.23*</td>
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<tr>
<td>Proposition Density</td>
<td>.26*</td>
<td>.43**</td>
<td>.12</td>
<td>.51**</td>
<td>.49**</td>
<td>.09</td>
<td>-</td>
<td>.22*</td>
<td>0.03</td>
<td>.55**</td>
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<td>Lex Errors</td>
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<td>.07</td>
<td>-.16</td>
<td>.05</td>
<td>.08</td>
<td>.00</td>
<td>.09</td>
<td>-</td>
<td>.20</td>
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<td>Morph Errors</td>
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<td>-.17</td>
<td>.06</td>
<td>.08</td>
<td>.00</td>
<td>.09</td>
<td>.25*</td>
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<tr>
<td>LLFs</td>
<td>.40**</td>
<td>.29**</td>
<td>.42**</td>
<td>.34**</td>
<td>.33**</td>
<td>.20*</td>
<td>.43**</td>
<td>-.07</td>
<td>-.05</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note:* Values above the diagonal are for the early readers (grades 1-2) and values below are the later readers (grades 3-4). Read Comp = reading comprehension. Vocab = vocabulary. TNW = total number of words. NDW = number of different word. Props = propositions. Lex = lexical. Morph = morphosyntactic errors. LLFs = literate language features. * = p < .05; ** = p < .01.
The stepwise regressions were re-run to evaluate whether narrative measures predicted unique variance in reading comprehension beyond what was accounted for by decoding and vocabulary (Models 2A and 2B). Results were similar for both regressions: decoding and vocabulary both entered as predictors, and with that variance accounted for, none of the narrative measures were significant predictors of reading comprehension (see Table 3, Models 2A and B). In the younger group, the model was significant ($R^2 = 0.66$, $F(1,59) = 56.18$, $p < 0.001$), with decoding ($B = 0.48$, $t(1,59) = 7.28$, $p < 0.001$) and vocabulary ($B = 0.53$, $t(1,59) = 4.13$, $p < 0.001$) accounting for 66% of the variability in reading comprehension. In the older group, the model was significant ($R^2 = 0.38$, $F(1,78) = 23.47$, $p < 0.001$), with decoding ($B = 0.32$, $t(1,78) = 4.57$, $p < 0.001$) and vocabulary ($B = 0.52$, $t(1,59) = 3.99$, $p < 0.001$) accounting for 38% of the variability in reading comprehension.

Table 3
Results of stepwise regression models for the narrative measures alone (1A and 1B) and the narrative measures and the SVR measures (2A and 2B).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1A</th>
<th>Model 1B</th>
<th>Model 2A</th>
<th>Model 2B</th>
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<tr>
<td></td>
<td>$B$</td>
<td>$t$</td>
<td>$B$</td>
<td>$t$</td>
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<tr>
<td>Intercept</td>
<td>5.76</td>
<td>1.43</td>
<td>25.54</td>
<td>15.03**</td>
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<td>Narrative Measures</td>
<td></td>
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<tr>
<td>TNW</td>
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<td>NDW</td>
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<td>1.37</td>
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<tr>
<td>Proposition Density</td>
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<td>2.96**</td>
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<td>.92</td>
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<tr>
<td>Lexical Errors</td>
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<td>.26</td>
<td>-0.02</td>
<td>-.19</td>
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<tr>
<td>Morphological Errors</td>
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<td>-2.31*</td>
<td>-0.03</td>
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<tr>
<td>Lit. Lang. Features</td>
<td>0.15</td>
<td>1.10</td>
<td>1.39</td>
<td>3.06**</td>
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<td>SVR Measures</td>
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<tr>
<td>Non-Word Decoding</td>
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<td>7.28***</td>
<td>.32</td>
<td>4.57***</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>.53</td>
<td>4.13***</td>
<td>.52</td>
<td>4.08***</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.19</td>
<td>0.21</td>
<td>0.66</td>
<td>0.38</td>
</tr>
<tr>
<td>$df$</td>
<td>59</td>
<td>80</td>
<td>59</td>
<td>80</td>
</tr>
</tbody>
</table>

Note: TNW = Total number of words. NDW = Number of different words. Lit. Lang. = Literate language. SVR = Simple View of Reading. *** (p < .001).
4. Discussion and Conclusions

The nature of the relationship of narrative microstructure to comprehension of text in school children is not well specified in the literature. This exploratory study sought to empirically validate the relationship between reading comprehension, LLFs, and other microlinguistic measures of narrative competence. Research questions concerned 1) whether age affected the narrative-reading relationship, 2) whether LLFs were a stronger concurrent predictor of reading than other microlinguistic indices, and 3) whether any narrative measure uniquely predicted reading comprehension when accounting for decoding and vocabulary ability.

For the first research question, it was hypothesized that the increasing reliance on higher-order language skills in older children (Geva & Farnia, 2012; Vellutino et al., 2007) would be reflected in a stronger relationship between the narrative measures and reading comprehension in the older group relative to the younger group. The hypothesis was partially supported. Proportion of LLFs, NDW and TNW were all significantly correlated with reading comprehension in the older group, while only one narrative measure (proposition density) was significantly correlated in the younger. In addition, narrative measures accounted for 2% of extra variance in reading comprehension in the older children (Model 1B) relative to the younger children (Model 1A). This result parallels previous studies that have found narrative measures to better predict reading comprehension in older children relative to younger children (Ebert & Scott, 2014; Reese et al., 2010). Future research should evaluate whether other microstructure measures (such as proposition density, the best narrative predictor of reading in the younger children) are better early indicators of reading comprehension problems in a longitudinal paradigm, or whether more conventional vocabulary measures are best-suited to this task (Gardner-Neblett & Iruka, 2015; Kieffer, 2012; Uchikoshi et al., 2018).

With regard to the second research question, there was qualified support for the hypothesis that LLFs better predicted reading than other narrative measures. For the older children, use of LLFs and reading comprehension were moderately correlated (see Table 2), and the former was the best narrative predictor of the latter (Table 3, Model 1B). LLF use was not significantly correlated with reading comprehension in the younger children, and proposition density and proportion of morphological errors were the only significant narrative predictors of reading comprehension in this group (Table 3, Model 1A). It is noted that older children used significantly more LLFs in their narratives than younger children (Table 1), reinforcing the notions that they are sensitive markers of developmental changes in linguistic ability (Curenton & Justice, 2004) and may be useful for identifying language disorders (Greenhalgh & Strong, 2001). If they are primarily present only in the narratives of children who are already experienced readers, however, that casts doubt on their utility for identifying children at-risk of reading challenges (e.g., Lemmon & McDade, 2013).

For the third question, the hypothesis was that LLFs would be unique predictors of reading comprehension even when decoding and vocabulary were entered into the regression. This hypothesis was not supported by the data. Consistent with previous studies and the SVR framework, decoding
and vocabulary were significant predictors of reading comprehension in both age groups, and no narrative measure was a significant predictor of reading comprehension when controlling for these two components. This finding raises questions about the specific use of narrative microstructure as an area to assess for identifying reading difficulties and to target in remediation of those difficulties, particularly in younger children, where decoding and vocabulary accounted for 66% of the variance in reading comprehension. The results suggest the evidence base for interventions targeting LLFs as a means to improve reading outcomes (Petersen et al., 2010; Phillips et al., 2016) needs expanding, especially as a recent study showed such interventions may not generalize to improved reading (Connor et al., 2018).

In sum, the results did not provide strong evidence of a connection between reading comprehension and microstructure using a narrative generation paradigm. While the nature of the standardized reading comprehension test may have something to do with the outcomes seen, findings of a narrative-reading relationship were likewise limited in the study by Ebert and Scott (2014), which used a multiple-choice test of reading comprehension. It is also possible use of LLFs would have had a stronger relationship with reading comprehension in a retell paradigm (e.g., Greenhalgh & Strong, 2001) vs. a generation paradigm. Further work is needed to evaluate whether the relationship between narratives and reading comprehension is limited to knowledge of narrative macrostructure (Uchikoshi et al., 2018; Wellman et al., 2011), or whether there is a role for narrative microstructure as well.

While the use of a composite measure of LLFs vs. separate indices is a limitation of the current study, it mirrors the convention in the literature to consider LLFs as a “set of linguistically specific features of discourse” (Anderson, 2011, p. 110, emphasis added). Future studies should examine relationships between narrative microstructure and reading comprehension, particularly with regard to individual LLF measures, to add further specificity to claims of broad relationships that may not be empirically supported. Such research would seem necessary to support inclusion of narrative microstructure targets for the specific purpose of treating reading problems (Adlof et al., 2014; Phillips et al., 2016; Spencer et al., 2013). Doubtless there is value in the ability to tell a well-formed story in and of itself, but that is a separate issue from whether interventions targeting microstructure will improve reading outcomes. In the meantime, speech-language pathologists and other school-based professionals may wish to support children with reading challenges by targeting phonological skills supporting decoding (Ehri et al., 2001; Ryder, Tunmer, & Greaney, 2008), vocabulary and background knowledge more directly tied to comprehension (Clarke et al., 2010; Wallach & Ocampo, 2017), and knowledge of story grammar (Davies et al., 2004; Petersen, 2010).
References


Appendix
This is a coded transcript from one of the third-grade children in the study broken up by proposition. LLFs are italicized, and errors are in bold.

1. **His mom and him** were building a boat as a project
2. and his mom waved goodbye
3. and he wasn’t looking
4. he was just walking
5. and he fell into *this little lake*
6. and he and his project got dirty
7. and he came back to school
8. and the teacher *said* what happened?
9. no, he fixed it
10. and then he *told* her that
11. he *accidentally walked* into a puddle with his project.

Total number of words / number of different words: 69 / 45
Morphosyntactic errors: 1 (“his mom and him”)
Lexical errors: 1 (“little lake” – should be “puddle”)
Literate language features: 4 (1 elaborated noun phrase, 2 mental/linguistic verbs, 1 adverb)