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Informing the Science of Reading: Students' Awareness of Sentence-Level Information Is Important for Reading Comprehension

Elizabeth MacKay

Elise Lynch

Dalhousie University, Halifax, Nova Scotia, Canada

Tamara Sorenson Duncan

Carleton University, Ottawa, Ontario, Canada

S. Hélène Deacon

Dalhousie University, Halifax, Nova Scotia, Canada

ABSTRACT

The reading wars were fought over the importance of sentence- versus word-level information to students' reading. As the field considers new debates on the science of reading, we argue here that sustained empirical inquiry into the role of sentence-level information in students' reading skill is needed. These investigations could be particularly useful in identifying ways to support reading comprehension. In this article, we review theories pointing to this possibility, as well as key pieces of available empirical evidence. We also identify crucial gaps in knowledge, as the field must assess the mechanisms by which this relation functions, which will inform instruction, and potential changes in this relation across development and across aspects of this skill. Advancement in each of these areas will lead to a comprehensive understanding of the relation between sentence-level skills and reading comprehension, which can inform effective instruction in the classroom.

The "science of reading" debates rage over the focus of instruction in the classroom. In many ways, the intensity underlying this controversy is fueled by earlier reading wars, fought largely over the relative importance of sentence- versus word-reading-level information in young learners' reading development and instruction (e.g., Castles, Rastle, & Nation, 2018; Gough & Tunmer, 1986). Here, we advocate reigniting inquiry into the sentence, or syntactic, level. Within the broader construct of grammar, syntax is the way words and phrases are organized to form larger phrases and sentences (Dawson & Phelan, 2016). Scott (2009) suggested that syntax is "the vehicle, even 'workhorse', of meaning" (p. 185), with theories advocating a direct role of syntactic skills in reading comprehension (Perfetti, Landi, & Oakhill, 2005). This role makes sense: Texts, both academic texts and children's stories, contain far more complex sentences than oral language (Fang, 2006; Uccelli, Phillips Galloway, Barr, Meneses, & Dobbs, 2015). Consider this sentence from Beverly Cleary's (1981/2013) children's book *Ramona Quimby, Age 8*:

> Her stomach felt quivery with excitement at the day ahead, a day that would begin with a bus ride just the right length to make her feel a long way from home but not long enough—she hoped—to make her feel carsick. (pp. 1–2)

As grade level increases, the sentences in text become increasingly complex (Curran, 2020; Jagaiah, Olinghouse, & Kearns, 2020), and syntax has been widely suggested to be the strongest factor influencing text

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difficulty (e.g., Graesser, McNamara, & Kulikowich, 2011; Stenner & Swartz, 2012). Accordingly, research has identified that the contribution of syntactic skills to reading comprehension is similar in magnitude to that of vocabulary (Deacon & Kieffer, 2018; Shiotsu & Weir, 2007). Yet, in the face of its empirical, conceptual, and theoretical value, syntactic skills have not received the same empirical focus as word-level skills to date, an oversight that we hope to begin to rectify by identifying the most pressing open questions as to the role of syntactic skills in reading comprehension.

We identified these questions in the process of conducting a meta-analysis on the relation between syntactic skills and reading comprehension.[1] We are currently conducting statistical analyses on this relation for a report specifically on this meta-analysis, yet our detailed reading of this large set of articles laid bare for us a set of most crucial questions as to the nature of this relation. In the sections that follow, we describe each in turn, in the hope of pushing forward the conceptual discussions and empirical investigations that will answer these questions.

Syntactic Skills

Within the construct of syntactic skills, we delineate between two skills, likely overlapping but also separable: syntactic comprehension and syntactic awareness. We do so here in part because our literature review identified that research on each skill has occurred in parallel and yet largely in isolation from each other. For instance, there has been little cross-referencing between research on these two components (for an exception, see Brimo, Apel, & Fountain, 2017). This means that the already small body of knowledge is disconnected; in this article, we work to amend the divide between these domains, creating a bridge to better understand the relation between syntactic skills and reading comprehension.

Certainly, both syntactic comprehension and syntactic awareness involve knowledge of sentence structure; however, there is a fundamental difference between the two in how they are assessed, which is likely to have knock-on effects to instruction. Syntactic comprehension is the ability to understand spoken sentences and their syntactic components. As such, tasks assessing syntactic comprehension typically ask young learners to listen to sentences of varying complexity and demonstrate understanding of them (e.g., Poulsen & Gravgaard, 2016). Syntactic awareness is the metalinguistic ability to manipulate words in a sentence (Nagy, 2007; O'Grady & Archibald, 2016). Commonly used measures to assess syntactic awareness are word-order correction tasks (e.g., Bowey, 1986), in which students hear sentences with words in an incorrect order and then need to produce a syntactically plausible sentence. Both constructs are subsumed under the umbrella of syntactic skills, yet we think that this distinction is highly relevant to informing intervention; although explicit instruction is likely to be useful for both, the precise content and format of this instruction might differ. For example, Phillips (2014) trained learners in pre-K through grade 1 on comprehension of syntactic features by exposing them to different syntactic constructs and asking follow-up questions; awareness of syntactic features was trained by asking students to create their own sentences that followed certain syntactic rules. Together, this training improved syntactic skills. The relative effectiveness of these two approaches on the more lofty goal of improving reading comprehension remains to be established.

It is also important to highlight how syntactic skills, both comprehension and awareness, interact with other skills within the broader linguistic system. One clear connection is with morphology; within grammar, morphology governs word structure, and syntax is responsible for the organization of sentences and phrases. These two components of grammar are tightly interconnected, with subject–verb agreement operating at the interface between morphology and syntax. In line with this connection, in some past studies, these two have been tested simultaneously, with some sentences conceptualized as assessing syntactic awareness involving corrections of morphological errors (e.g., Bowey & Patel, 1988). Other researchers have critiqued this approach, encouraging a focus on what can be more cleanly described as syntactic (e.g., Deacon & Kieffer, 2018). Another clear connection lies with listening comprehension, particularly for syntactic comprehension. In distinguishing these, one needs to consider the fact that *syntax* refers to sentences in particular; listening comprehension entails "all of verbal ability, including vocabulary, syntax, inferencing and the construction of mental schemas" (Kirby & Savage, 2008, p. 76). Indeed, passages within listening comprehension tasks typically assess comprehension of larger chunks of language, such as passages, and often require inferencing and integration (e.g., Wechsler, 2009). Distinguishing syntactic effects from those of other language skills is key for identifying and creating explicit, systematic, and effective approaches to instruction, ones that optimally complement instruction in other aspects of language.

The Direct Relation Between Different Syntactic Skills and Reading Comprehension

Studies of syntactic comprehension and of syntactic awareness have identified a relation to reading comprehension. For instance, after controlling for vocabulary, word reading, and memory, syntactic comprehension was found to be related to reading comprehension in upper elementary school students (e.g., Poulsen & Gravgaard, 2016; Sorenson

Duncan, Mimeau, Crowell, & Deacon, 2021). Separate studies of syntactic awareness found statistically significant relations between measures of syntactic awareness and reading comprehension across the elementary years (e.g., Bowey, 1986; Foorman, Koon, Petscher, Mitchell, & Truckenmiller, 2015; Lesaux, Rupp, & Siegel, 2007). For example, Low and Siegel (2005) found that syntactic awareness was significantly related to reading comprehension in a model controlling for word reading, phonological awareness, and verbal working memory in sixth-grade students. Interestingly, in this study, syntactic awareness was the second-best predictor of reading comprehension, after word reading. These studies' findings suggest that syntactic comprehension and awareness are both related to reading comprehension, with the clearest evidence of a large effect for syntactic awareness.

One of the few studies to examine the relation of both syntactic comprehension and awareness to reading comprehension was conducted by Brimo and colleagues (2017) with students in grades 9 and 10 (see also Cain, 2007). In this study, syntactic comprehension was measured by asking participants to select a picture to best represent an orally presented complex sentence, and syntactic awareness was measured with a word-order correction task. The researchers found that syntactic comprehension made unique, direct contributions to reading comprehension beyond controls of vocabulary, word reading, and working memory. The contribution of syntactic awareness, in contrast, was fully mediated via syntactic comprehension. Findings of full mediation can be interpreted as potential overlap between the constructs of syntactic comprehension and awareness and/or the role of an underlying skill, such as parsing; further still, these results are likely to have been influenced by the relatively advanced age of the participants and their poor scores on the syntactic awareness task. As Brimo and colleagues noted, the syntactic awareness measure likely did not capture enough variance in reading comprehension to uniquely explain this construct. Thus, we may still expect syntactic awareness to make unique contributions to reading comprehension even when considering syntactic comprehension in the analysis, particularly for less advanced readers who may need to rely on the awareness of syntactic features to enhance their understanding of the entire text.

Moving forward, it would be useful to confirm the distinction between syntactic comprehension and awareness with confirmatory factor analyses (for similar analyses in the orthographic domain, see Deacon, Pasquarella, Marinus, Tims, & Castles, 2019). Including reading comprehension in such a longitudinal study would also help paint a picture of the shared and unique contributions of each of these syntactic skills to reading comprehension. Further, such a design would inform developmental relations between the two syntactic skills and reading comprehension.

A Causal Connection for Syntactic Skills in the Development of Reading Comprehension?

Another key question lies in identifying the temporal order of relations, which requires developmental data. Only a few studies to date have taken this approach, and these have shown that syntactic awareness predicts the development of reading comprehension over time, effects demonstrated by including autoregressive controls. To our knowledge, these relations have yet to be confirmed for syntactic comprehension. In terms of syntactic awareness, Deacon and Kieffer (2018) showed that the direct contribution of syntactic awareness was as strong a predictor as word reading to students' gains in reading comprehension between grades 3 and 4. Similar evidence of the importance of syntactic awareness has come from studies of Chinese-speaking students: Tong and McBride (2017) reported that syntactic awareness at age 11 predicted gains in reading comprehension between ages 11 and 12 after controlling for reading-related cognitive skills. Thus, current evidence suggests that syntactic awareness is a strong predictor of gains in reading comprehension, with such evidence currently unavailable for syntactic comprehension.

The evidence base for the contribution of syntactic skills to reading comprehension is in dire need of studies with an intervention design, which are best suited to testing causal impacts of skills. We say this because in our review, we identified few studies with intervention designs, the majority of which were not uniquely focused on syntactic skills. Our observation was reinforced by a reading of a recent meta-analysis. Silverman, Johnson, Keane, and Khanna (2020) identified 43 studies in their meta-analysis on language comprehension interventions on reading comprehension. Seven of these studies included a syntactic component in the intervention, four of which had reading comprehension as an outcome (Connor et al., 2018; Morris et al., 2012; Proctor et al., 2011; Proctor, Silverman, Harring, Jones, & Hartranft, 2020). All of these studies included syntax as part of instruction along with other aspects of oral language (e.g., vocabulary, morphology, and/or phonics). Two of these four studies found that instruction that included syntax had positive effects on reading comprehension (Morris et al., 2012; Proctor et al., 2020). Yet, both studies also included teaching of known predictors of reading comprehension aside from syntactic skills, such as phonics (Morris et al., 2012) and morphology and vocabulary (Proctor et al., 2020). As such, these studies cannot tell us whether targeted instruction exclusively in syntax is effective. This is an important question given that other studies have shown that teachers find it more challenging to support syntax than other aspects of language,

such as academic vocabulary (Barnes, Oliveira, & Dickinson, 2019).

We identified a few intervention studies examining the effect of teaching syntactic skills in particular. Phillips (2014) designed a modular intervention aimed at improving both syntactic comprehension and awareness of 4–6-year-old learners at high risk for language impairment. She demonstrated that this intervention was effective at improving both syntactic skills in this population. We identified a single study, by Balthazar and Scott (2018), that took this a step further to test the effects of instruction specifically of syntax on reading comprehension. In a study with 10–14-year-old students with specific language impairment, Balthazar and Scott trained students once or twice a week on different clause types in three stages at each session. Students were first introduced to the new clause type and provided with several examples of this clause type in text. They then underwent metalinguistic training: Students were taught to isolate the subordinate clause from the main clause and to combine simple sentences into one complex sentence. Finally, students were instructued in how the main and subordinate clauses provide meaning to the sentences and overall text. This intensive instruction led to a numerical improvement from pre- to posttest in levels of reading comprehension, albeit not to a statistically significant degree. Clearly, there is much room for research determining whether, when, and how instruction on syntax is effective in supporting students' reading comprehension.

The benefits of optimizing such instruction might be especially important for academic success. Indeed, Karasinski (2016) demonstrated that skill in evaluating syntax was uniquely related to understanding science texts, beyond other aspects of language skills. Similarly, instruction in syntax combined with that in scaffolding text structure was connected to improved understanding of academic texts (Reynolds, 2021).

Building on this support for its effectiveness, research on instruction in syntax is vital given that teachers seem to already be implementing it. As a case in point, the well-trafficked teacher and parent resource website Reading Rockets features a handful of articles highlighting the importance of syntactic comprehension and awareness to understanding texts. Such articles advocate and offer ways to teach sentence-level information (e.g., Center for Effective Reading Instruction, n.d.; Shanahan, 2020b). Similarly, syntax is included on Laura Candler's Teaching Resources, a website designed for teachers and visited by 95,000 people in September 2020 alone. This site recommends instruction in understanding the parts of sentences, toward an end of correcting fragments and run-on sentences and creating more complex sentences (Candler, n.d.). Finally, a popular learning application, ABCmouse.com Early Learning Academy, features games that teach the underlying skill of syntactic awareness through, for example, asking children to turn statements into questions (e.g., Age of Learning, 2021). We could not identify any empirical studies either testing or citing these resources, demonstrating a disconnect between teacher resources (and potentially instructional practice) and available knowledge of effectiveness.

It seems, then, that syntax-based interventions are already being used in classrooms, at least to some extent and possibly with some difficulty (Barnes et al., 2019), with little accompanying evidence to determine whether these interventions are effective. This mismatch resonates with Shanahan's (2020a) recent point distinguishing the science of reading from the science of reading instruction. Although the science of reading—basic research investigating the skills that contribute to reading comprehension—may support the use of sentence-level information to bolster reading comprehension, we are sorely limited in our knowledge of whether this conclusion applies to the actual instruction of reading. Thus, to determine the most effective ways to improve reading comprehension, we need to test interventions in the classroom. Building on longstanding advocacy for teachers to "use direct, systematic, explicit, structured…methods" (Moats, 2010, p. 16) to teach language to optimize reading outcomes (see also Wolf, 2018), we think that instruction in how, when, and to whom to teach syntax is vital in enabling teachers in doing so. Relatedly, identifying how to most effectively combine instruction in syntax with that in other language skills, such as the closely allied skill of morphology, will bridge the gap between the science of reading and the science of reading instruction (e.g., Shanahan, 2020a).

The Mechanism(s) by Which Syntactic Skills Improve Reading Comprehension

Instruction could be further informed by exploring the mechanisms through which syntactic skills contribute to reading comprehension. There are several possible mediators through which syntactic skills could contribute to reading comprehension; here, we highlight three that, given theorietical and empirical predictions, we feel are particularly relevant to this discussion.

First, Tunmer (1989; see also Verhoeven & Perfetti, 2008) proposed the idea that syntactic awareness might support reading comprehension through word reading, with awareness of sentence structure providing syntactic and semantic context to support a student in reading a word correctly, which in turn supports understanding of the entire text. As an example, if a student reads the first part of the sentence "The boy reads the m…," without being able to decode the final word, awareness of sentence structure is one method that could help the student work

out that the final word should be a noun instead of a verb (e.g., *magazine* rather than *moving*), narrowing the range of possible words that could finish this sentence. We view this process as different from contextual guessing: whereas syntactic awareness allows for a structured approach to reading a word, contextual guessing does not necessarily offer the same structure. For example, instead of using their awareness of syntactic rules to determine that an unknown word must be a noun, students using contextual guessing may not have any clues for the word in question, making the option list considerably more daunting.

Although we acknowledge that there is likely a role for semantics in this process—we will not know the role of syntactic skills and of semantic skills until we have developed tests that can adequately differentiate between them—we argue that syntactic skills provide additional structure to support word reading. Support for this concept comes from the large evidence base describing the syntactic bootstrapping effect in learning words' meanings (e.g., Babineau, de Carvalho, Trueswell, & Christophe, 2021; Naigles, 1990); a similar effect may exist for learning how to read words. Similarly, syntactic skills have also been argued to facilitate prediction of words and text by providing contextual clues (e.g., Mimeau, Laroche, & Deacon, 2019). To date, these word-reading mediation predictions and accompanying empirical evidence have been explored solely with syntactic awareness, rather than comprehension; this needs to be addressed moving forward, again with the goal of fully understanding how syntactic skills influence reading comprehension.

Evidence of indirect relations between syntactic awareness and reading comprehension via word reading have been found in studies of younger but not older readers; this pattern emerged in the few studies to date that we identified in our comprehensive meta-analysis that examined indirect effects. An early study testing this idea did so by measuring the role of nonword decoding, an imperfect proxy for mediation by word reading. Tunmer and colleagues (Tunmer, 1989; Tunmer, Herriman, & Nesdale, 1988) found that syntactic awareness contributed indirectly to reading comprehension by means of nonword decoding in first- and second-grade students. Conversely, with third- and fourth-grade students, Deacon and Kieffer (2018) found no indirect contribution through word reading of syntactic awareness on reading comprehension, only a direct relation. Perhaps the most plausible explanation for these differing results lies in the developmental level of the students examined. Specifically, younger (and/or less capable) readers may rely on supports from sentence context in their word reading (see Tunmer et al., 1988; Tunmer & Hoover, 1992; Tunmer, Nesdale, & Wright, 1987), with knock-on effects to reading comprehension, an effect that may diminish as reading skill improves, leaving an entirely direct relation between syntactic awareness and reading comprehension. Indirect relations in younger readers may also be connected to the high correlations between word reading and reading comprehension at this level (e.g., Gough, Hoover, & Peterson, 1996).

A second, not mutually exclusive, possibility is that syntactic skills contribute to reading comprehension through an oral language mediator, such as vocabulary. For example, Nagy and Scott (2000) speculated that students may use syntactic awareness skills to uncover the meanings of words, thereby improving their reading comprehension. Nagy (2007) made a similar prediction: Students can use the context of a sentence, uncovered through awareness of syntactic cues, to determine the meaning of a word, which has downstream effects to text comprehension. Although we were not able to identify any work that specifically explored mediation pathways among syntactic skills, vocabulary, and reading comprehension in children, one study showed a mediated effect of vocabulary on syntactic skills and reading comprehension in English-speaking adults (Guo, Roehrig, & Williams, 2011). Further, theoretical accounts have advocated that lexical and grammatical systems can be considered separate (e.g., Pinker, 1998). These predictions suggest that vocabulary might truly mediate the relation between syntactic skills and reading comprehension instead of measures of vocabulary and syntactic skills representing the same underlying contructs. In line with this prediction, there is empirical evidence of the separability of syntactic skills and vocabulary (e.g., Tomblin & Zhang, 2006), particularly among older readers. We explore this developmental pattern in more detail in the next section as we consider relations between syntactic skills and the broader construct of oral language.

Finally, syntactic comprehension may mediate the contributions of syntactic awareness in supporting reading comprehension. We expect to see this mediated effect in younger readers, who are developmentally predicted to need support in understanding syntactically complex sentences. Converging with this hypothesis, Brimo and colleagues (2017) found that the relation between syntactic awareness and reading comprehension was fully mediated by syntactic comprehension, suggesting that students' abilities to understand a syntactically complex sentence underlie the power of students' capabilities to use syntactic cues to enhance their reading comprehension. Ultimately, these mediation pathways all require exploration and consideration through a developmental lens.

Developmental Patterns in the Relation of Syntactic Skills and Reading Comprehension

A final overarching issue that applies to each of the previous questions raised is whether there are changes across

reading development in how syntactic skills, both comprehension and awareness, impact reading comprehension. Understanding the developmental relations between these syntactic skills and reading comprehension is crucial so the field can provide specific instruction recommendations for different ages, grades, and reading levels.

The current literature is equivocal regarding the developmental changes in the relations between syntactic comprehension and awareness and reading comprehension. The studies we identified as part of our meta-analysis supported a strong relation between syntactic comprehension and reading comprehension in younger readers (e.g., Cain & Oakhill, 2006). Yet, the relation between syntactic awareness and reading comprehension in this group was mixed, with some studies showing a unique relation (e.g., Foorman, Herrera, Petscher, Mitchell, & Truckenmiller. 2015) and others not (e.g., Bowey & Patel, 1988). Conversely, all 14 studies included in our meta-analysis that investigated the relation between syntactic awareness and reading comprehension in upper elementary school students revealed a positive relation (e.g., Deacon & Kieffer, 2018). A similar trend emerged for syntactic comprehension, wherein 88% of identified studies found a positive relation (e.g., Kieffer, Petscher, Proctor, & Silverman, 2016). However, because syntactic comprehension and awareness have not been simultaneously investigated in a developmental study, it remains unclear how such skills concurrently contribute to reading comprehension at different developmental timepoints. Considering the earlier emergence of linguistic than metalinguistic skills (e.g., Gombert, 1992), we may expect that syntactic comprehension is more important than syntactic awareness for reading comprehension in younger readers. In the same vein, it is possible that syntactic awareness accounts for more variance in reading comprehension than does syntactic comprehension in older readers. To test these predictions requires comprehensive task administration and a longitudinal design.

A second inquiry brings us back to the mediated relations discussed earlier. Here, it is worth highlighting the suggestions that syntactic skills might be an inseparable part of a general oral language construct in young readers (Foorman, Herrera, et al., 2015), with separability emerging later (Tomblin & Zhang, 2006); this shift in the structure of oral language across development is likely to impact mediated relations. It is possible that there is an indirect relation between oral language and reading comprehension via word reading in young readers, with direct and unique relations of syntactic skills emerging later. That said, separability from oral language has not yet taken into account the distinction between syntactic comprehension and awareness. For instance, many studies examining the structure of oral language have employed sentence repetition (e.g., Foorman, Herrera, et al., 2015), a task requiring no explicit sentence manipulation. Investigating the intersection between these different syntactic skills and developmental period is a critical next step in understanding mediated relations. Thus, research needs to investigate the developmental point when a mechanism by which syntactic skills contribute to reading comprehension might emerge.

How Different Sentence Types Contribute to Reading Comprehension

A final consideration is how the types of sentences influence reading comprehension, a question on which we identified only four studies. Two of these studies, both with students in grade 5, yielded diverging results. Poulsen and Gravgaard (2016) and Sorenson Duncan et al. (2021) investigated how students' processing of basic (i.e., active and subject-relative clause) and difficult (i.e., passive and object-relative clause) sentences influence reading comprehension. Poulsen and Gravgaard found that response times to difficult, but not basic, sentences made unique and direct contributions to reading comprehension. In contrast, Sorenson Duncan and colleagues found that accuracy in understanding basic, but not difficult, sentences uniquely predicted reading comprehension. Slight differences in methods make these conflicting findings difficult to reconcile, yet it is vital that we do so to provide evidence that can optimally focus instruction.

Building on this idea, these effects might change across developmental periods. The other two studies we identified examined how the complexity of the sentences students read impacted their understanding of them. Écalle, Bouchafa, Potocki, and Magnan (2013) studied second- through ninth-grade French-speaking students and found that they had greater difficulty in understanding more complex sentences; these effects decreased with age. The same pattern emerged in an early study by Richek (1976) with English-speaking third- to fifth-grade students, again with stronger effects in younger readers. It seems that sentence complexity is indeed an important factor to consider, and effects might diverge in whether one is exploring the complexity of the sentences students read versus the oral language skills they bring to reading.

This line of inquiry might also initiate and address theoretical concerns. Sentence complexity has inspired one of the explanations for a possible role for syntactic skills in reading comprehension. In the Cleary (1981/2013) quote provided at the outset of this article, the sentence is easier to process if it is divided into its clauses:

> Her stomach felt quivery with excitement at the day ahead, | a day that would begin with a bus ride | just the right length to make her feel a long way from home | but not long enough | —she hoped— | to make her feel carsick. (pp. 1–2)

Each of these clauses conveys a particular event, and understanding each event is essential to understanding the full sentence or text (Perfetti & Stafura, 2014). Thus, being able to divide a sentence into smaller chunks has been suggested to be important for reading comprehension (Deacon & Kieffer, 2018). Sentence complexity might be one way to get at this mechanism; again, any detail clarified in empirical work could refine the appropriate target for instruction about sentences.

Looking Ahead: Meta-Analyses

Whereas a handful of meta-analyses has investigated the relation between oral language and reading comprehension (e.g., Rogde, Hagen, Melby-Lervåg, & Lervåg, 2019; Silverman et al., 2020), there has been only one published meta-analysis on syntactic skills and reading comprehension. Brimo, Lund, and Sapp (2018) identified studies that compared syntactic skills of students with poor reading comprehension against those of typically developing students. Collating across the 14 studies identified, there was evidence of stronger performance on syntactic comprehension for students with good reading comprehension in comparison with those with poor reading comprehension; there were no such differences for syntactic awareness. These results support the idea that poor reading comprehension may be more clearly attributable to deficits in syntactic comprehension than deficits in awareness, at least in students with specific difficulties in reading comprehension.

The meta-analytic approach could be usefully applied to studies of individual differences by examining relations in unselected samples. We applied this approach in our work partly because it enables a far wider catchment of available data. Further, such an approach can quantify the relation between syntactic comprehension and reading comprehension and between syntactic awareness and reading comprehension, including whether one or both change across reading development. Building on this, further meta-analyses could be informed by earlier analyses on oral language more broadly. For example, Hjetland, Brinchmann, Scherer, and Melby-Lervåg (2017) used meta-analytic techniques to determine which preschool variables, including grammatical knowledge (i.e., both morphology and syntax) predicted later reading comprehension. In a meta-analytic structural equation model, Hjetland and colleagues demonstrated that grammatical knowledge had a moderate direct relation to reading comprehension, one that appeared to function within a larger language comprehension construct (see also Jeon & Yamashita, 2014; Quinn & Wagner, 2018). This modeling technique combined with meta-analysis has the potential to offer valuable insight into the contribution of the specific construct of syntax, specifically when it is assessed in a way that is unconfounded with morphology.

In this review, we described theoretical predictions and empirical evidence that syntactic skills are uniquely important for reading comprehension development (e.g., Deacon & Kieffer, 2018). Based on a systematic review as part of a meta-analysis, we also pointed to key questions that need answers so the field can fully exploit the power of this skill in classrooms. Specifically, understanding which, when, and how syntactic skills contribute to reading comprehension development is critical to inform theory and, most important, educational practices. Developing efficient and powerful interventions will hopefully support and bolster reading comprehension, which is crucial given that it is the core end goal of reading development and instruction (e.g., Oakhill, Cain, & Elbro, 2015; RAND Reading Study Group, 2002).

NOTES

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[1] Searches were conducted in four major databases: PsycInfo, ERIC, Medline, and Embase. These searches included the following search terms: reading OR text*; comprehension OR ability; AND syntax OR syntact* OR sentence OR gramm*; awareness OR comprehend* OR knowledge. Search terms were limited to the title and abstract. These terms and guidelines were developed with the help of a librarian specialized in systematic literature searches. The search was first conducted on December 14, 2017, and last updated on December 8, 2019.

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ELIZABETH MACKAY is a doctoral student in the Department of Psychology and Neuroscience at Dalhousie University, Halifax, Nova Scotia, Canada; email e.mackay@dal.ca. Her primary research focuses on metalinguistic skills, with a particular concentration on syntactic skills, that contribute to the development of reading comprehension in elementary-age children.

ELISE LYNCH (corresponding author) is an undergraduate student in the Department of Psychology and Neuroscience at Dalhousie University, Halifax, Nova Scotia, Canada; email elise.lynch@dal.ca. Her interests lie in language and literacy development.

TAMARA SORENSON DUNCAN is an assistant professor in the School of Linguistics and Language Studies at Carleton

University, Ottawa, Ontario, Canada; email tamara.sorensonduncan@carleton.ca. Her research program investigates language and literacy development in diverse populations; to date, this work has included children from immigrant and refugee backgrounds, children with developmental language disorder, and children with autism spectrum disorder.

S. HÉLÈNE DEACON is a professor in the Department of Psychology and Neuroscience at Dalhousie University, Halifax, Nova Scotia, Canada; email helene.deacon@dal.ca. Her research focuses on understanding how children learn to read and write, both for children learning to read in English and for bilinguals.