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Reading Comprehension in French L2/L3 Learners: Does Syntactic Awareness Matter?

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Abstract: This study examines the contributions of syntactic awareness to reading comprehension, both within and across languages, in third-grade children learning French as a second (L2) or third language (L3). Participants were 72 non-francophone children enrolled in a Canadian French immersion program in which all academic instruction is in French. Children completed measures of reading comprehension, syntactic awareness, word reading, vocabulary, and reading-related control variables in both English and French. Regression analyses examining within-language relations revealed that French syntactic awareness made a significant unique contribution to French reading comprehension after controlling for nonverbal reasoning, language status (French as either L2 or L3), word reading, and vocabulary. Furthermore, French syntactic awareness contributed across languages to English reading comprehension, after accounting for English controls (word reading, vocabulary, syntactic awareness) in addition to nonverbal reasoning and language status. In sharp contrast, measures of English syntactic awareness made no unique contribution to reading comprehension in either English or French after the aforementioned controls. These findings add to theoretical models of reading comprehension by highlighting the importance of syntactic awareness in the language of instruction in supporting bilingual children's reading comprehension.

Keywords: syntactic awareness; reading comprehension; bilinguals

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1. Introduction

Learning in school hinges on children's ability to understand what they read, making reading comprehension the cornerstone of academic achievement. In order to successfully comprehend text, readers rely on a number of underlying metalinguistic capabilities (Kuo and Anderson 2008). Among these is syntactic awareness, or the capacity to attend to and manipulate the structure of sentences (Durgunoğlu 2002; Nagy 2007). Readers frequently encounter sentences in text that are more syntactically complex than those encountered in oral language (Perfetti et al. 2005); their task is to make sense of them. Syntactic complexity is a key determinant of text difficulty (Stenner and Swartz 2012) and is the feature of text that increases most dramatically across grade levels (Graesser et al. 2011). Accordingly, syntactic awareness impacts the ability to derive meaning from sentences in text (e.g., Tunmer et al. 1987). A growing body of work demonstrates that syntactic awareness plays a role in first language (L1) reading comprehension (e.g., Deacon and Kieffer 2018; Demont and Gombert 1996; Low and Siegel 2005; for a review, see Mackay et al. 2021). Currently, however, there is limited evidence attesting to the role of syntactic awareness in reading comprehension among children who are learning to read in a language that differs from their L1. Our study reports findings that contribute to this evidence base.

It is important to investigate the skills related to reading comprehension in children acquiring literacy in a language other than their L1 given their increasing numbers worldwide (Paradis et al. 2011). Included in this group of learners are the growing number of children enrolled in French immersion programs across Canada. French immersion is a means of

promoting proficiency in English and French, Canada's two official languages. French immersion classrooms reflect the cultural and linguistic diversity that is characteristic of the Canadian population. In large urban centres such as the one in which our study was conducted, they are made up of majority English-speaking children, for whom French is their L2, and minority language children from a range of L1 backgrounds, for whom English is their L2 and French their third language (L3).

In early French immersion programs, children receive all literacy instruction in French beginning in senior kindergarten or Grade 1. English language arts are typically introduced in the third or fourth grade; however, the majority of instruction continues to be offered in French (e.g., Ontario Ministry of Education 2013). Exposure to English during the early grades in French immersion occurs in informal contexts, for example, in interactions with peers on the school playground, with members of the broader community outside of school, and at home. Students must therefore acquire early language and literacy skills simultaneously through formal instruction in French, the L2/L3, with very limited, if any, exposure to French beyond the classroom.

A significant body of research reveals the influence that metalinguistic skills—most notably, phonological and morphological awareness—acquired in one language have on learning to read in another language (for a review, see Hipfner-Boucher and Chen 2016). This is known as 'transfer' and is key to explaining French immersion children's rapid progress in learning to read in English following initial instruction in French. Consequently, in examining the role of syntactic awareness on reading comprehension in our sample of French immersion children, we examined both within-language effects (i.e., French syntactic awareness on French reading comprehension, English syntactic awareness on English reading comprehension) and cross-language effects (i.e., French syntactic awareness on English reading comprehension, English syntactic awareness on French reading comprehension). We investigated these effects in Grade 3, a point at which children are beginning to tackle texts that are relatively complex from the perspective of syntax. Understanding the within and cross-language contributions of syntactic awareness to French and English reading comprehension among children in French immersion may serve to inform comprehensive models of reading comprehension, as well as educational policy, teacher training, and instructional practices intended to promote student reading outcomes in immersion settings.

1.1. Syntactic Awareness and Reading Comprehension within L1 and L2

Theories of reading comprehension point to the role of syntax in comprehending text (Kintsch 1998; Perfetti et al. 2005; Perfetti and Stafura 2014; Scarborough 2002). Within the Reading Systems Framework (Perfetti and Stafura 2014), syntax is hypothesized to play multiple roles. It is essential to the process of sentence parsing, a process shown in empirical studies to support reading comprehension (Deacon and Kieffer 2018; Gaux and Gombert 1999; Kuhn and Stahl 2003; RAND Reading Study Group 2002). Indeed, to derive meaning from text at the sentence level, readers may first parse complex sentences into more manageable "chunks" (e.g., noun or verb phrases) for processing purposes before recombining them to reconstitute the whole (Perfetti and Stafura 2014). This process is enabled by awareness of sentence structure (Deacon and Kieffer 2018). Consider, for example, this sentence taken from Chapter 4 of White's (1952, p. 28) children's novel, *Charlotte's Web*: "If there were something that was less than nothing, then nothing would not be nothing, it would be something—even though it's just a very little bit of something". Parsing this sentence into its four constituent clauses allows readers to derive its meaning more efficiently than attempting to process its 29 words as a whole. The reader may then recruit higher-order knowledge and skills (e.g., background knowledge, knowledge of story structure, inferencing skills) to integrate information within and across sentences to form a coherent and cohesive model of the passage in its entirety (Perfetti et al. 2005).

Because syntactic awareness enables the reader to parse a sentence into more 'digestible' chunks, it may also reduce the demands of complex sentences on working memory

(Perfetti et al. 2005). Indeed, studies on children's sentence comprehension and processing have found that increases in syntactic complexity are associated with greater working memory involvement (Caplan and Waters 1999; Montgomery et al. 2008). Going back to the complex sentence above, it is less cognitively burdensome to retain its constituent clauses in memory while processing meaning locally than it is to attempt to retain and process the sentence as a whole. Although they are related, syntactic skills and working memory are distinct, and both have been found to explain unique variances in reading comprehension (Poulsen et al. 2022).

Lastly, syntactic awareness may play a role in comprehension monitoring (Bowey 1986; Gaux and Gombert 1999; Tunmer et al. 1987). Comprehension monitoring enables skilled readers to detect breakdowns in their understanding and to apply reparative strategies, such as rereading, questioning and clarifying, or reading ahead, to restore coherence in their understanding (Wagoner 1983; Wassenburg et al. 2015; Yang 2006). Children's awareness of syntactic structures may facilitate their recognition of comprehension errors, such as syntactic violations. For example, if a reader misreads the word *than* as *thank* in the example above, awareness of syntax could alert them to the syntactic violation that occurred wherein a preposition was replaced by a verb. Recent neuroimaging studies have demonstrated greater neural activation in certain regions of the brain (e.g., Broca's area) when readers are confronted with syntactic ambiguities (e.g., ambiguity about the main verb in a sentence, multiple syntactic interpretations) or conflict between syntactic and semantic information in text (see Baker et al. 2014 for a review). Although neural activation does not necessarily indicate awareness, the findings nevertheless suggest a link between syntactic challenges and the processing demands needed to comprehend a sentence.

Many empirical studies have demonstrated that syntactic awareness is related to L1 reading comprehension among English-speaking children (e.g., Deacon and Kieffer 2018; Low and Siegel 2005; Mokhtari and Neiderhauser 2013; Muter et al. 2004; Nation and Snowling 2000). This relation holds after controlling for a range of variables, including nonverbal reasoning, vocabulary, phonological awareness, decoding and word reading, short-term memory, and working memory. The effect has also been demonstrated to be robust in both concurrent and longitudinal analyses. For example, Deacon and Kieffer (2018) assessed syntactic awareness in English-speaking monolinguals in Grades 3 and 4. After controlling for nonverbal reasoning, phonological awareness, vocabulary, word reading, and morphological awareness, syntactic awareness uniquely predicted reading comprehension in each grade. Additionally, syntactic awareness measured in Grade 3 predicted gains in reading comprehension the following year after controlling for autoregressive effects (Deacon and Kieffer 2018).

Studies have also demonstrated the relation between syntactic awareness and reading comprehension in monolingual French children (Demont and Gombert 1996; Gaux and Gombert 1999; Plaza and Cohen 2003). For example, Plaza and Cohen (2003) assessed the contribution of syntactic awareness to a composite written language measure comprising various reading (and spelling) tasks, including sentence-level reading comprehension among Grade 1 students. They found that syntactic awareness was a significant predictor of the outcome variable when phonological awareness, short-term memory, and rapid naming speed were controlled for. In a study by Gaux and Gombert (1999), sixth-grade French speakers were assessed on syntactic awareness. After controlling for verbal and nonverbal reasoning, short-term memory, vocabulary, and listening comprehension, regression and path analyses showed that syntactic awareness was a direct contributor to reading comprehension.

On the other hand, studies that have examined French L2 children have revealed inconsistent results (Lefrançois and Armand 2003; Simard et al. 2014; Sohail et al. 2022). In a study involving 10-year-old Portuguese L1 children schooled in French in a predominantly French-speaking environment, Simard et al. (2014) found that syntactic awareness explained significant variance in L2 reading comprehension in a regression model that included age, vocabulary, syntactic knowledge, and phonological memory as simultaneous

predictors. In contrast, two other studies with French L2 learners found evidence of correlations between syntactic awareness and reading comprehension in French among children aged 6 to 11 years that did not remain after controls (Lefrançois and Armand 2003; Sohail et al. 2022). For example, Sohail et al. (2022) observed that French syntactic awareness was correlated with reading comprehension in French among English-speaking children enrolled in Grade 1 of French immersion, relations that did not remain after cognitive ability, vocabulary, and word reading controls. Children's degree of exposure to French may account for the inconsistency in findings between these studies. Although the Portuguese speakers in Simard et al. (2014) were French language learners, they were nonetheless exposed to French as the majority language since birth. In contrast, the participants in Sohail et al. (2022) and Lefrançois and Armand (2003) were in the early stages of acquisition. It is possible that syntactic awareness only begins to contribute to L2 reading comprehension as children develop greater L2 oral proficiency.

1.2. Cross-Language Transfer of Syntactic Awareness to Reading Comprehension

There is a theoretical basis for hypothesizing the cross-language transfer of syntactic awareness (Cummins 1979, 1980; Geva and Ryan 1993; Koda 2008). Cummins (1979, 1980) proposed that bilinguals' language and literacy skills in the L1 and L2 are interdependent. According to his *Linguistic Interdependence Hypothesis*, competencies acquired in one language can transfer to another insofar as there is adequate exposure and motivation to learn the language (Cummins 1981). Stemming from this framework, Geva and Ryan (1993) proposed the *Common Underlying Cognitive Processes* framework, arguing that common cognitive processes underlie parallel skills in the L1 and L2. In the more recent *Transfer Facilitation Model*, transfer is defined as the "automatic activation of well-established first-language competencies, triggered by second-language input" (Koda 2008, p. 78). According to Koda (2008), L1 transfer occurs continually throughout L2 development as a product of increased L2 input. The linguistic distance between L1 and L2 is believed to influence the relative ease with which transfer occurs. Languages that share many linguistic features presumably require fewer adjustments to transferred L1 competencies, and require less L2 input, before L2 metalinguistic awareness and related reading sub-skills can develop (Koda 2008). While this model describes the transfer of skills from L1 to L2 only, there is also evidence that transfer can occur in the reverse direction (Chung et al. 2019). According to the *Interactive Transfer Framework* (Chung et al. 2019), children's relative proficiency in the L1 and L2 influences the direction of transfer, with transfer occurring from the more proficient language to the less proficient one. In addition to proficiency, language complexity has been identified as a factor that influences transfer, in that bilinguals' heightened sensitivity to complex linguistic structures encountered in one language may facilitate transfer to another language (Chung et al. 2019). Although a growing body of evidence demonstrates that a range of L1 metalinguistic skills predicts L2 reading (see Chung et al. 2019 for a review), there remains a gap in our understanding of whether, how, and in what direction syntactic awareness contributes to reading skills across languages due to inconsistent findings in the literature.

While few in number, studies examining the effect of L1 syntactic awareness on L2 reading comprehension have demonstrated evidence of transfer (Siu and Ho 2015, 2020; Sohail et al. 2022; Swanson et al. 2008). Among these is Sohail et al.'s (2022) study involving Grade 1 students in French immersion. Syntactic awareness in English, the children's L1, significantly contributed to French reading comprehension after controlling for age, nonverbal reasoning, phonological awareness, vocabulary, word reading, and within-language syntactic awareness. The authors suggested that these early French L2 learners were able to tap into syntactic awareness in their stronger language, English, in order to bolster reading comprehension in their developing L2. These results are corroborated by two studies involving Chinese-English bilinguals whose two languages are typologically distant (Siu and Ho 2015, 2020). In their study of English L2 learners in Grades 1 and 3, Siu and Ho (2015) found that Chinese syntactic awareness contributed to English reading

comprehension after controlling for age, nonverbal reasoning, vocabulary, word reading, and working memory (Siu and Ho 2015). This effect was also observed longitudinally in a recent investigation by the same authors: Chinese syntactic awareness, measured in the first and third grades, predicted English reading comprehension one year later (Siu and Ho 2020).

In contrast, studies examining the effect of syntactic awareness on reading comprehension among Latinx children in the USA found no evidence of transfer (Leider et al. 2013; Proctor et al. 2012; Swanson et al. 2008). In Swanson et al.'s (2008) study with third graders, L2 English syntactic awareness predicted L1 Spanish reading comprehension after controlling for phonological awareness and vocabulary in both languages, as well as Spanish syntactic awareness. Although Spanish syntactic awareness predicted English reading comprehension after controlling for Spanish phonological awareness and vocabulary only, the model was no longer significant when English controls were added (Swanson et al. 2008). The authors attributed their findings to instructional factors, arguing that because all academic instruction was in English, the L2, L1 Spanish skills had less opportunity to develop. L1 predictors, such as syntactic awareness, may therefore have been unable to contribute to L2 reading over and above the effects of L2 predictors. At the same time, two other studies involving Spanish-speaking children in Grades 2 to 5 in English-medium schools found either no significant cross-language effects (Proctor et al. 2012) or significant but negative cross-language effects (Leider et al. 2013). Taken together, these studies suggest a need for additional research examining the effect of syntactic awareness on reading comprehension among bilingual children to clarify the nature of transfer and the specific factors that facilitate it.

There are many similarities between English and French syntax that may facilitate cross-language transfer. For example, both languages follow a subject-verb-object word order (e.g., *I eat chocolate* and *Je mange du chocolat*), and in both languages, a noun is preceded by a definite or indefinite article (e.g., *a cat* or *the boy* and *un chat* or *le garçon*). However, there are also notable differences between the syntactic structures of the two languages. For example, word order in French switches to subject-object-verb when the object is a pronoun (e.g., *Je peins la maison* 'I am painting the house' versus *Je la peins* 'I [it] am painting'). While adjectives precede nouns in English (e.g., *a small bird*, *a red bird*) and may precede nouns sometimes in French (*un petit oiseau*), the reverse order also exists in French (e.g., *un oiseau rouge*). Thus, French allows for somewhat more variation in word order than English. From a theoretical perspective, the presence of structural similarities and differences between their languages may heighten English-French bilingual children's awareness of syntax. This hypothesis aligns with Kuo and Anderson's (2010, 2012) *structural sensitivity theory*, which contends that exposure to two languages increases the salience of linguistic structures among bilinguals and allows them to form more abstract representations of language. This bilingual advantage has been demonstrated in studies on children's syntactic awareness (e.g., Siu and Ho 2022).

1.3. The Present Study

In the present study, we examined the within- and cross-language relations between syntactic awareness and reading comprehension in children who were in their third year of French immersion. We examined Grade 3 students because it is around this age that oral language skills become increasingly important in facilitating children's reading comprehension (e.g., Gough and Tunmer 1986), as children are beginning to encounter complex sentences in the books they are expected to read. With almost three years of instruction in French, immersion students' experience with a variety of syntactic structures and rules is likely to have promoted robust development of syntactic awareness.

Our study addressed two research questions. Our first question examined whether syntactic awareness is related to reading comprehension *within* each of the children's two languages. Specifically, we asked if French syntactic awareness predicts French reading comprehension and if English syntactic awareness predicts English reading comprehension.

Given that our participants were in their third year of French immersion and had developed a degree of oral proficiency in French, we expected to find a link between French syntactic awareness and French reading comprehension. Although English was not the language of academic instruction, our participants were immersed in English outside of the classroom. We, therefore, hypothesized that a within-language relation between syntactic awareness and reading comprehension in English was likely.

Our second question examined cross-language relations between syntactic awareness measured in English or French and reading comprehension in the other language. Specifically, we sought to determine whether English syntactic awareness contributes to French reading comprehension and whether French syntactic awareness contributes to English reading comprehension through cross-language transfer. Findings from previous studies on the role of L1 syntactic awareness in L2 reading in bilingual populations have been mixed. However, there is a theoretical rationale for expecting the transfer of L1 syntactic awareness to L2 reading (e.g., Koda 2008). Likewise, given theoretical and empirical support for cross-language transfer from the L2 to L1 (Chung et al. 2019), we also expected to find transfer from French syntactic awareness to English reading comprehension. We based this prediction on the assumption that French immersion children in Grade 3 have developed a sufficient level of syntactic awareness in French to make a positive contribution to reading comprehension across languages. Notably, few studies on syntactic awareness have examined whether transfer occurs from L2 to L1. Clarifying the direction of transfer can advance our understanding of how emerging bilinguals leverage syntactic awareness across languages to facilitate reading comprehension, particularly in the context of instruction that is L2-based.

2. Materials and Methods

2.1. Participants

Seventy-six third-grade students (53% females, Mage = 8 years, 2 months, *SD* = 4.3 months) attending a Canadian French immersion school participated in the study in the spring of Grade 3. All children had received academic instruction solely in French since Grade 1. Most of the participants (87%) were born in Canada; among the ten participants born outside of Canada, the mean age of immigration was two years. Regarding language background, no child spoke French as the L1. English was reported as the L1 for 58% (n = 44) of the participants (i.e., they had little to no exposure to a language other than English at home). For these children, French was the L2. The remaining 32 participants were exposed to a language other than English most often in the home (i.e., >50% of the time). This group was linguistically diverse (n = 17 for Russian, n = 4 for Chinese, n = 3 for Spanish and Hebrew, n = 2 for Serbian, and n = 1 each for Azerbaijani, Hungarian, and Korean). For these children, English was the L2 and French the L3. Background information collected at an earlier time point (Grade 1) within the context of a larger study indicated that 92% of mothers in the sample were at least college- or university-level graduates, and 72% of parents read daily with their children.

2.2. Measures

Participants were assessed on word reading, receptive vocabulary, syntactic awareness, and reading comprehension skills through parallel measures in English and French. All participants also completed a nonverbal reasoning measure. Each of the measures is described in detail below.

Nonverbal reasoning. Children's nonverbal reasoning was assessed in first grade using all four subtests of the Matrix Analogies Test (MAT; Naglieri 1985): Pattern Completion, Reasoning by Analogy, Serial Reasoning, and Spatial Visualization. Each subtest consisted of 16 items involving standard progressive matrices that were to be completed using one of the six choices provided for each item. Testing for each subtest continued until four consecutive errors were committed. The number of correct responses on all subtests was

summed to produce a raw score for the MAT. Cronbach's reliability alpha was 0.94 for this task.

Word reading. English word reading was assessed using the letter and word identification subtest of the Woodcock Johnson-III Test of Achievement (WJ-III; Woodcock et al. 2001). Participants were required to point to correct answers or read visually presented letters and words. There were 76 test items on this task and a discontinue rule of six consecutive errors within a single page. The total number of correct responses represented the raw score. For the English task, Cronbach's reliability alpha was 0.93.

French word reading was assessed via an experimental task designed by Au Yeung et al. (2015). The task consisted of 120 items of increasing difficulty. If a child produced fewer than five correct responses within a set of eight words, testing was discontinued. A raw score was obtained by summing the number of words that had been read correctly. Cronbach's reliability alpha for the French word reading task was 0.98.

Receptive vocabulary. Form A of the Peabody Picture Vocabulary Test-IV (PPVT-IV; Dunn and Dunn 2007) was used to assess children's receptive vocabulary in English. Participants were asked to point or verbally identify one of four pictures that best matched an aurally presented word. The PPVT contained two training items and 228 test items, divided into 19 sets of 12 items each, with a discontinuation rule of eight errors within a set. A raw score was obtained for each participant by subtracting the total number of errors from the ceiling item. Cronbach's reliability alpha was 0.95 for this measure.

French receptive vocabulary was assessed using Form A of the Échelle de Vocabulaire en Images Peabody (EVIP; Dunn et al. 1993). The test consisted of 170 items, and its task requirements paralleled the PPVT-IV. Note that, as the test is originally normed for native French speakers, we opted to test our participants from the first item rather than at the age-based starting point. The task was discontinued upon reaching six errors within eight consecutive items. The raw score for the EVIP was the number of correct responses provided by the participant. For the French vocabulary measure, Cronbach's reliability alpha was 0.97.

Syntactic awareness. Error-correction tasks were created in English and French to assess children's syntactic awareness (see Appendix A for the full tasks). Participants were presented with sentences containing syntactic errors and asked to "fix the sentence up so that it sounds right". All sentences were presented both aurally and visually. A raw score was computed for each language by summing the correct number of responses on each task. Items for the English task were adopted from an existing syntactic awareness measure designed by Deacon and Kieffer (2018). Participants received three practice items and 16 test items (e.g., "*The teacher the story read to the children*" to be corrected to "*The teacher read the story to the children*"). The French error-correction task involved a similar procedure. It included 2 practice items and 18 test items (e.g., "*On va à la maison très vite*" to be corrected to "*On va très vite à la maison*"). Cronbach's reliability alpha was 0.73 for the English measure and 0.64 for the French measure.

Reading comprehension. The comprehension subtests of Form 3 of Level C (48 items) of the Gates-MacGinitie Reading Tests Second Canadian Edition (GMRT-II; MacGinitie and MacGinitie 1992) were used to assess English reading comprehension. It was the only measure administered in a group session, albeit independently, with participants receiving 20 min to read passages and complete as many questions as possible. Each participant's raw score was the total number of correct answers. Cronbach's reliability alpha was 0.93 for this task.

French reading comprehension was tested using a parallel, experimental task. Form 4 of Level C of the Gates-MacGinitie Reading Tests Second Canadian Edition (GMRT-II; MacGinitie and MacGinitie 1992) was translated into French and administered following the same procedure as the English measure. The task consisted of 48 items. Cronbach's alpha was 0.82.

2.3. Procedure

Participants completed the nonverbal reasoning test in the fall of Grade 1. All other measures for the present study were administered in the spring of Grade 3. The order of task administration was randomized across participants. Trained graduate students administered the majority of measures individually to each participant, with the exception of the two reading comprehension tasks, which were administered in a small group setting. English-language tasks were preceded by instructions in English, while French-language tasks were preceded by instructions in both French and English to ensure children's comprehension of task requirements.

3. Results

Table 1 details the mean, range, standard deviation, and internal consistency reliability (i.e., Cronbach's alpha) for each of the measures. One univariate outlier was identified and removed from the sample. The English L1 children scored significantly above their English L2 peers on English receptive vocabulary ($p = 0.037$). However, the mean standard score for the English L2 group on this measure was 100.75, which is the expected mean score of the monolingual norm. *T*-tests also demonstrated that the two groups did not differ in performance on receptive vocabulary in French or on measures of syntactic awareness, word reading, and reading comprehension in French or English (all $p > 0.264$). Furthermore, a Box's *M* test detected no significant difference in variance-covariance patterns between the language groups on all measures (Box's $M = 47.28$, $F = 0.906$, $p = 0.652$). Given that the English L2 children were proficient in English and the two groups performed similarly on most measures, the two groups were combined in all remaining analyses.

Table 1. Means, Standard Derivations (SDs), and Cronbach's Alpha (α) of All Measures (n = 72).

Measure	Min	Max	*M*	*SD*	α
Nonverbal Reasoning	1	48	19.76	11.87	0.94
French Word Reading	37	119	83.47	21.89	0.98
French Vocabulary	0	121	80.07	26.20	0.97
French Syntactic Awareness	1	13	5.08	2.65	0.64
French Reading Comprehension	9	45	20.24	7.55	0.82
English Word Reading	35	71	53.27	8.05	0.93
English Vocabulary	92	164	141.28	14.93	0.95
English Syntactic Awareness	2	16	11.16	2.90	0.73
English Reading Comprehension	7	45	25.69	10.21	0.93

Due to observations of skew in the distributions of some variables, hierarchical regression analyses were conducted using the bootstrapping method embedded in SPSS, with a default bootstrap sample size of 1000. The bootstrapping method is a technique for deriving robust estimates for statistics such as significance tests, confidence intervals, and standard errors in the presence of any deviations from normality (Field 2009). A consistent pattern of results was obtained with and without the bootstrapping method; therefore, the results below are reported using raw data.

Bivariate correlations (i.e., Pearson correlations) between all measures are presented in Table 2. Syntactic awareness in each language was significantly correlated with all other variables. With respect to the within-language relations of interest, syntactic awareness and reading comprehension were moderately correlated with one another in French ($r = 0.54$) and in English ($r = 0.49$). Cross-linguistically, English syntactic awareness was moderately correlated with French reading comprehension ($r = 0.35$), and French syntactic awareness was moderately correlated with English reading comprehension ($r = 0.56$). English and French syntactic awareness were also moderately correlated ($r = 0.39$).

Table 2. Pearson Correlations Among All Measures (n = 72).

Measure	1	2	3	4	5	6	7	8
1. Nonverbal Reasoning	-							
2. French Word Reading	0.03	-						
3. French Vocabulary	0.34 **	0.30 **	-					
4. French Syntactic Awareness	0.27 *	0.38 ***	0.40 ***	-				
5. French Reading Comprehension	0.28 *	0.36 ***	0.41 ***	0.45 ***	-			
6. English Word Reading	0.40 ***	0.53 ***	0.28 **	0.33 **	0.41 ***	-		
7. English Vocabulary	0.47 ***	0.21	0.55 ***	0.39 ***	0.36 **	0.43 ***	-	
8. English Syntactic Awareness	0.38 ***	0.40 ***	0.50 ***	0.39 ***	0.35 **	0.48 ***	0.48 ***	-
9. English Reading Comprehension	0.40 ***	0.36 **	0.61 ***	0.56 ***	0.75 ***	0.50 ***	0.62 ***	0.49 ***

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

3.1. Within-Language Effects of Syntactic Awareness on Reading Comprehension

Hierarchical regressions were conducted to test the unique associations between syntactic awareness and reading comprehension after controlling for other known contributors to reading comprehension, including word reading and vocabulary (National Reading Panel 2000). The regression analyses with French and English reading comprehension as the dependent variables are displayed in Tables 3 and 4, respectively.

Table 3. Hierarchical Linear Regression Predicting Grade 3 French Reading Comprehension.

Steps and Predictors		French Reading Comprehension				
		B **(*SE*)**	***β***	***R*²**	**Adjusted *R*²**	**Δ*R*²**
1.	Nonverbal reasoning	0.08 (0.07)	0.12	0.08 **	0.06 *	0.08 *
2.	Language status	−0.09 (1.59)	−0.01	0.05	0.06	0.00
3.	French word reading	0.07 (0.04)	0.19	0.20 ***	0.17 ***	0.12 ***
4.	French vocabulary	0.05 (0.04)	0.19	0.26 *	0.22 *	0.06 *
5.	French syntactic awareness	0.73 * (0.34)	0.26 *	0.31 **	0.26 **	0.05 *
6.	English syntactic awareness	0.10 (0.34)	0.04	0.31	0.25	0.00

Note: *B* (*SE*) = unstandardized coefficient and standard error from the final model; *β* = standardized regression coefficient from the final model. Estimates of R^2, Adjusted R^2, and ΔR^2 from each step of the model. * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

As shown in Table 3, nonverbal reasoning, language status (French L2, French L3), French word reading, and French vocabulary were entered in steps one through four of the regression model predicting French reading comprehension. Together, these variables explained 24% of the variance in French reading comprehension. In the fifth step, French syntactic awareness was entered to determine its within-language effect on reading comprehension. French syntactic awareness constituted a significant and unique contributor, explaining approximately 9% of the additional variance. We computed an interaction term as the product of language status and French syntactic awareness and entered this interaction term in the final step. The interaction term was non-significant ($p > 0.363$), indicating that the variance contributed by syntactic awareness to French reading comprehension was not influenced by participants' language status (i.e., French L2/L3). Therefore, the original regression model without the interaction terms is reported.

Table 4. Hierarchical Linear Regression Predicting Grade 3 English Reading Comprehension.

Steps and Predictors		English Reading Comprehension				
		B **(*SE*)**	***β***	***R*²**	**Adjusted *R*²**	**Δ*R*²**
1.	Nonverbal reasoning	0.10 (0.08)	0.11	0.16 ***	0.15 ***	0.16 ***
2.	Language status	−2.09 (1.86)	−0.10	0.17	0.15	0.01
3.	English word reading	0.21 (0.12)	0.17	0.31 ***	0.28 ***	0.14 ***
4.	English vocabulary	0.18 * (0.07)	0.28 *	0.46 ***	0.42 ***	0.15 ***
5.	English syntactic awareness	0.19 (0.36)	0.06	0.47	0.43	0.02
6.	French syntactic awareness	1.55 *** (0.41)	0.37 ***	0.56 ***	0.52 ***	0.08 ***

Note: *B* (*SE*) = unstandardized coefficient and standard error from the final model; *β* = standardized regression coefficient from the final model. Estimates of R^2, Adjusted R^2, and ΔR^2 from each step of the model. * $p \leq 0.05$; *** $p \leq 0.001$.

The second hierarchical regression model, with English reading comprehension as the outcome variable, paralleled the first model and is presented in Table 4. Nonverbal reasoning, language status, English word reading, and English vocabulary comprised the first four steps. Together, these variables accounted for 43% of the explained variance. English syntactic awareness was entered into the model next. It explained no unique variance to the outcome variable. An interaction term between language status and English syntactic awareness was not significant ($p > 0.162$) when it was entered in the final step. As such, the model without the interaction is reported.

Commonality analyses were conducted to explore the different patterns that emerged in each language regarding the unique contributions of syntactic awareness to reading comprehension. A commonality analysis supplements regression analyses by decomposing the regression effect into its unique and common effects (Nimon and Reio 2011), making it possible to determine the unique and shared contributions of syntactic awareness to reading comprehension in each language. A commonality analysis was performed to examine the possible combinations of predictor variables—nonverbal reasoning as well as word reading, vocabulary, and syntactic awareness in French—and the percentage of the total variance in French reading comprehension they explain. In predicting French reading comprehension, 41.08% of the regression effect was uniquely explained by these four predictors. Among these, French syntactic awareness explained the largest proportion, contributing a unique 16.30% to the model. Its common effect with the other variables was smaller, sharing 11.96%, 8.26%, and 4.22% of the variance, respectively, with each of French word reading, vocabulary, and nonverbal reasoning. The common effect of the three French predictors—syntactic awareness, word reading, and vocabulary—together was 12.84%. The common effect of all four variables was 4.31%.

We also performed a commonality analysis examining English reading comprehension. The results indicated that 35.42% of the regression effect was uniquely explained by the three English predictors, with the largest proportion (24.35%) accounted for by English vocabulary. English syntactic awareness contributed a unique 3.59% to the model. Among the common effects, English syntactic awareness shared 8.75%, 4.68%, and 0.37% of the variance, respectively, with English vocabulary, English word reading, and nonverbal reasoning. Together, the three English variables—syntactic awareness, vocabulary, and word reading—contributed a common effect of 11.37%. With nonverbal reasoning added, the four variables had an additional common effect of 15.98%. The large amounts of

variance shared with co-predictors might explain why, despite its strong correlation with the outcome variable, syntactic awareness did not emerge as a unique within-language contributor to reading comprehension in English.

3.2. Cross-Language Effects of Syntactic Awareness on Reading Comprehension

To determine whether syntactic awareness contributes to reading comprehension across languages, the cross-language syntactic awareness variable was entered as a sixth and final step into each of the aforementioned hierarchical regression models (see Tables 3 and 4). It therefore followed the control variables of nonverbal reasoning, language status, and within-language word reading, vocabulary, and syntactic awareness. Partialling out the effects of within-language syntactic awareness was important in determining the unique contribution, if any, of syntactic awareness measured in the other language.

Results for the model examining French reading comprehension showed that English syntactic awareness made no additional contribution to French reading comprehension, over and above the variance explained by the controls in French. On the other hand, French syntactic awareness, entered as the final variable in the regression model, contributed a significant 9% of unique variance to the overall model of English reading comprehension. With French syntactic awareness included, the regression model explained a total of 53% of the variance in English reading comprehension.

Again, we tested the interaction between language status and cross-language syntactic awareness in each regression model. The interaction term was not significant in either model (all $p > 0.254$). Since the relation between syntactic awareness and reading comprehension did not vary by participants' language status, the models without the interaction terms are reported.

4. Discussion

This study focused on the effects of syntactic awareness on reading comprehension among children in French immersion who were either majority English-speakers, for whom French is the L2, or minority language children from a range of L1 backgrounds, for whom English is the L2 and French the L3. We investigated whether the relation between syntactic awareness and reading comprehension exists within each of English and French, as well as across the two languages. Regarding within-language effects, our results indicated that French syntactic awareness made a significant contribution to children's reading comprehension in third grade after controlling for nonverbal reasoning, word reading, and vocabulary. Across languages, French syntactic awareness also emerged as a significant contributor to English reading comprehension, above and beyond the variance explained by controls and English syntactic awareness. English syntactic awareness, on the other hand, did not contribute significantly to English or French reading comprehension beyond relevant controls.

The finding that French syntactic awareness contributes to within-language reading comprehension in Grade 3 among L2 and L3 learners of French is consistent with the results of studies involving native francophone children in Grades 1 and 6 (Gaux and Gombert 1999; Plaza and Cohen 2003) and extends them to third-grade learners of French as an additional language in an immersion setting. The finding is also consistent with a study that involved Portuguese L1 fifth graders learning French as an L2 in a majority French-speaking environment (Simard et al. 2014). The present study extends the Simard et al. findings to a French immersion population for whom exposure to French was restricted to the classroom. These results suggest that, at least for third-grade French immersion students, French language instruction promotes a level of proficiency in French syntactic awareness that is sufficient to support within-language reading comprehension.

From a theoretical perspective, our French-language findings align with expectations regarding the role of syntax in reading. As part of the linguistic system, syntax is directly involved in comprehension processes (Perfetti and Stafura 2014). Awareness of word order is theorized to be critical to readers' ability to parse complex sentences into smaller, more

manageable "chunks", which are then recombined to form text-level representations (Deacon and Kieffer 2018; Perfetti and Stafura 2014). The ability to parse complex sentences may also reduce the cognitive load associated with reading, increasing a text's comprehensibility and the reader's ability to monitor comprehension (Perfetti et al. 2005; Tunmer et al. 1987). At the same time, our finding that French syntactic awareness predicted within-language reading comprehension diverges from previous studies involving non-native French speakers that have found no significant relationship between syntactic awareness and reading comprehension in French. These include Lefrançois and Armand (2003) and Sohail et al. (2022), who examined 11-year-olds and 6-year-olds, respectively. In both of these previous studies, however, children were non-francophones in the early stages of French acquisition who had been enrolled in French language programs for under 10 months. In contrast, the French L2/L3 third graders in the present study and the French L2 fifth graders in Simard et al. (2014) were children who had been attending school in French over a period of years and can be expected to have achieved a greater degree of French language proficiency. We argue that this relatively advanced proficiency—both in French oral language and in French reading—enabled these readers to draw on syntactic awareness developed in French to facilitate text comprehension. Our findings suggest that it may take a certain level of proficiency and experience with a language, such as experience with different sentence structures, before syntactic awareness emerges as a significant contributor to reading comprehension. Future studies using a longitudinal design are needed to reveal developmental changes in the relation between syntactic awareness and reading comprehension at varying levels of language and reading proficiency.

Turning to English reading comprehension, the absence of within-language effects of syntactic awareness on reading comprehension was unexpected. Although significantly correlated, we found that English syntactic awareness failed to account for variance in English reading comprehension once nonverbal reasoning, word reading, and vocabulary were accounted for in the regression model. Our result differs from previous findings of significant within-language relations reported in studies involving English monolingual speakers of similar ages (e.g., Deacon and Kieffer 2018) and among L2 learners of English (e.g., Farnia and Geva 2013; Lesaux et al. 2006, 2007; Low and Siegel 2005; Tong et al. 2021). Instructional factors provide a possible explanation for the discrepant results; in the early elementary years, French language and literacy skills are a primary focus of instruction in French immersion, with instruction delivered entirely in French. English language arts (i.e., instruction in English reading, writing, oral communication, and media literacy) are not introduced until a later grade, meaning that English proficiency is developed in less formal—and less linguistically complex—interactions outside of school (Cummins 2008). One can expect, then, that the children had limited exposure to the more linguistically challenging (i.e., syntactically complex) English featured in the reading materials typically introduced in school and in the measure we used to assess reading comprehension. We argue that, because of limited experience with syntactically complex text in English, the result of French-only instruction, children may not yet have learned to rely on English syntactic cues available to them when reading in that language.

Notably, English syntactic awareness was observed to have some effect on English reading comprehension in combination with other predictors, despite the fact that it did not emerge as a unique predictor. It is plausible that, due to the lack of formal English language arts instruction, English syntactic awareness in these students was undifferentiated from other within-language skills, such as word reading and vocabulary, with which it shared large amounts of variance in the model predicting English reading comprehension. The argument that language skills are largely undifferentiated in the early stages of acquisition is supported by empirical evidence (Foorman et al. 2015). As a result, its unique contribution was very small (3%). This contrasts strikingly with the results of the commonality analysis in French, which demonstrated a much larger unique contribution of French syntactic awareness (16%) to French reading comprehension.

As for cross-language transfer, results revealed a significant crossover effect of French syntactic awareness on English reading comprehension after controlling for cognitive and within-language predictors. Our findings reveal that, in Grade 3, children in French immersion rely more heavily on French syntactic awareness when reading for meaning in English than on the parallel skill in English. This may seem surprising, since English is the stronger of the children's two languages. Indeed, we note the children's higher mean performance on our measure of English versus French syntactic awareness (i.e., 69.8% and 28.2% correct responses, respectively), suggesting stronger awareness of syntax in English than in French. At the same time, English syntactic awareness in Grade 3 did not predict French reading comprehension beyond relevant controls that included French predictors. This finding corroborates that of Swanson et al. (2008), who found no evidence of cross-language transfer of L1 (Spanish) syntactic awareness to L2 (English) reading comprehension among Grade 3 Spanish-English bilinguals, but contrasts with the prior finding of transfer of English (L1) syntactic awareness to French (L2) reading comprehension in a study involving French immersion students in Grade 1 (Sohail et al. 2022). Thus, in the present study, we report reverse transfer (i.e., transfer from the weaker to the stronger language) of French syntactic awareness to English reading comprehension in the absence of the contribution from English to French reported in Sohail et al. (2022). This shift in direction may be reflective of a gradual development of L2 syntactic awareness in French immersion students over the elementary school years. Notably, a similar shift in the direction of transfer from L1 to L2 in the earlier primary grades to L2 to L1 in later grades was observed in a longitudinal study on morphological awareness involving French immersion students in Grades 1 to 3 (Deacon et al. 2007). We hypothesize that by the time French immersion students reach Grade 3, they have acquired substantial language and literacy skills in their L2 through instruction. It is therefore plausible that syntactic awareness in French eclipsed the same skill in English in contributing to French reading comprehension.

Overall, our results may best be interpreted through the lens of the RAND Reading Study Group's "heuristic for thinking about reading comprehension" (RAND Reading Study Group 2002, p. 12). The heuristic considers the influence on text processing of the reader's purpose for reading and the context within which reading occurs. Within this framework, the externally imposed requirement to read academic texts in French in school for the purpose of demonstrating understanding is expected to require the reader to deploy higher-order, strategic processing skills, including syntactic awareness, to satisfy task demands. This contrasts sharply with the degree of processing that may be deployed when reading for an internally generated purpose, such as reading a self-selected book for pleasure. Reading for pleasure outside of school is an activity that children in French immersion would likely choose to do in English since reading in French remains an arduous task, even in Grade 3. We speculate that when the children found themselves in the English testing situation, in which their purpose for reading was externally imposed, children drew on skills and knowledge acquired in French within the familiar context of school to assist them in meeting task demands that were largely inconsistent with their experience of reading in English.

The current findings, together with the results reported by Deacon et al. (2007) and Sohail et al. (2022), lead us to further speculate that cross-language transfer of metalinguistic skills may initially be enabled by reader-level factors such as language proficiency (specifically, the discrepancy in levels of L1 and L2 proficiency), but that it gradually comes under the influence of contextual factors (purpose for reading, motivation for reading, expected consequences of reading) as L2 proficiency increases as a result of instruction. At this point, the direction of transfer may shift. Research following French immersion children into the middle elementary grades, the point at which they begin formal instruction in reading and writing in English, is needed to further explore the patterns and direction of transfer of metalinguistic skill to L1/L2 reading comprehension. We expect that when reading for the purpose of demonstrating understanding in English is required of children,

and school instruction offers them the means to achieve this end, cross-language effects from French to English may diminish to the point that comprehension in both languages is largely predicted by within-language effects. That said, our current findings are noteworthy because they support the mutual facilitation of English and French in French immersion and suggest that receiving instruction in French enables children to be more strategic about English reading.

The present findings bear implications for theoretical models of cross-language transfer. They concur with theories of transfer proposed by both Cummins (1979, 1981) and Koda (2008) in that syntactic awareness is a metalinguistic skill that may transfer between languages despite surface-level differences between English and French. Importantly, our findings extend the *Transfer Facilitation Model* by demonstrating cross-language transfer from L2 to L1 and challenging its unidirectional (L1 to L2) hypothesis. In this regard, our results are consistent with the *Interactive Transfer Framework*, which contends that contextual factors (e.g., instruction) influence the direction of transfer in young bilinguals (Chung et al. 2019). It is possible that this pattern of results is specific to educational settings where L1 instruction is absent, as was the case in the French immersion context of this study. Again, future studies are recommended to examine within- and cross-language patterns in the relationship between syntactic awareness and reading comprehension once English language instruction is introduced.

Finally, although our focus was on the transfer of syntactic awareness to reading comprehension, our study provides evidence of transfer at the construct level. Syntactic awareness in English and French were moderately correlated ($r = 0.39$), lending support to the *Common Underlying Cognitive Processes* framework proposed by Geva and Ryan (1993), which argues that common cognitive proficiencies underlie performance on parallel skills across languages and account for the observed correlations among higher-order L1–L2 skills (Geva 2014). Interpreted within this framework, our results indicate that syntactic awareness may represent a language-general process that, once developed in a language, can be leveraged in an additional language to facilitate reading (Geva 2014).

At the same time, our findings provide evidence of language-specific processes. The moderately strong correlations suggest some, but not complete, overlap between the constructs in English and French. Additionally, contributions emerged from French syntactic awareness to English reading comprehension after controlling for English syntactic awareness; however, there were no contributions in the reverse direction. This pattern of transfer suggests that children are also tapping into language-specific awareness of syntactic structure to support reading comprehension. Whereas phonological awareness is a metalinguistic skill that is recognized as a language-general construct (Geva and Ryan 1993), syntactic awareness may be defined by both language-general and language-specific features that influence biliteracy.

Some methodological limitations to the present study must be considered. First, our results are correlational and restricted to a single time point, and, as such, causational relations between syntactic awareness and reading comprehension cannot be determined. Second, the Cronbach's alpha reliability of our French syntactic awareness measure was below ideal levels. Despite this, it emerged as a significant variable in both within- and cross-language analyses, suggesting the robustness of this skill. Third, the participants of this study came from relatively high socioeconomic status (SES), as is common among students in French immersion programs. This narrow SES range may preclude generalizations of results to bilingual students in lower SES contexts, and future studies involving bilingual populations should recruit participants from across a broader range of SES backgrounds.

Nonetheless, our findings offer educational implications for bilingual students, particularly in light of the reading comprehension challenges faced by additional language learners (e.g., Verhoeven 2000; Farnia and Geva 2013). The findings of our study suggest that helping bilingual students gain awareness of sentence structure in their L2 may benefit reading comprehension in each of their languages. As such, it is important to target instruction specifically for the development of syntactic awareness. Within the context of

immersion education, such instruction would ideally be embedded in authentic learning tasks that support its communicative goals. Importantly, a limited number of studies have demonstrated the effectiveness of syntactic interventions (see Mackay et al. 2021 for a review). Our study is also relevant for educators, parents, and researchers who are concerned that the French immersion curriculum may negatively impact students' English development. Our findings indicate that, in Grade 3, children draw on French metalinguistic skills to support not only French reading comprehension, but English reading comprehension as well. This is consistent with the program's aim of promoting additive bilingualism (Swain and Lapkin 2005).

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Appendix A

Table A1. Practice and Test Items on the English Syntactic Awareness Task.

Sentence Presented	Correct Response
Practice Items	
The girl the door opened.	The girl opened the door.
The boy is playing with he.	The boy is playing with him.
Test Items	
The boy jumped over log.	The boy jumped over the log.
He cleaned him shoes.	He cleaned his shoes.
The boy found the book what you lost.	The boy found the book that you lost.
What the girls are doing?	What are the girls doing?
John gave the crayon for Mary.	John gave the crayon to Mary.
Peter goes sometimes to church.	Peter sometimes goes to church *or* Peter goes to church sometimes.
I wonder how old is he.	I wonder how old he is.
The boy forgot his uniform who plays baseball.	The boy who plays baseball forgot his uniform *or* The boy who forgot his uniform plays baseball.
The teacher the story read to the children.	The teacher read the story to the children.
She will be angry if you will break it.	She will be angry if you break it.
Herself likes to dress Celina.	Celina likes to dress herself.
Found in the ocean are whales.	Whales are found in the ocean.
Interested in music Mary wasn't.	Mary wasn't interested in music
She swims not.	She doesn't swim.

Table A1. *Cont.*

Sentence Presented	Correct Response
Were eaten by the dog the cookies.	The cookies were eaten by the dog.
With Alex the girl is going to the party.	The girl is going to the party with Alex *or* The girl is going with Alex to the party.

Table A2. Practice and Test Items on the French Syntactic Awareness Task.

Sentence Presented	Correct Response
Practice Items	
La fille ouvre le porte.	La fille ouvre la porte.
Mon maman est gentille.	Ma maman est gentille.
Test Items	
Ce crayon est mon.	Ce crayon est le mien.
Il a donné le cadeau à lui.	Il lui a donné le cadeau.
Marie a fait un gâteau puis elle a mangé le.	Marie a fait un gateau, puis elle l'a mangé.
J'ai voyagé sur un train.	J'ai voyagé en train.
En automne, j'aime regarder les rouges feuilles.	En automne, j'aime regarder les feuilles rouges.
Je dois laver mes mains.	Je dois me laver les mains.
Nous allons à le parc ce matin.	Nous allons au parc ce matin.
Elle pas fait son travail.	Elle ne fait pas son travail *or* Elle n'a pas fait son travail.
La jupe est vert.	La jupe est verte.
Le garçon a regardé à mon livre.	Le garçon a regardé mon livre.
L'enfant est triste qui a perdu son chat.	L'enfant qui a perdu son chat est triste.
L'ami de moi a un chien.	Mon ami a un chien.
Quoi avez-vous fait aujourd'hui?	Qu'avez-vous fait aujourd'hui? *or* Qu'est-ce que vous avez fait aujourd'hui?
Tout mangé as-tu?	As-tu tout mangé? *or* Est-ce que tu as tout mangé?
L'école que je vais est loin de la maison.	L'école où je vais est loin de la maison.
Elle a vu le roi et reine.	Elle a vu le roi et la reine.
Je ne sais pas qu'est-ce qu'il veut.	Je ne sais pas ce qu'il veut.
On va à la maison très vite.	On va très vite à la maison.

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