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Predictors of Successful Reading Comprehension in Bilingual Adults: The Role of Reading Strategies and Language Proficiency

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Abstract: The current study investigated the type of strategies that English–French bilingual adults utilize when reading in their dominant and non-dominant languages and which of these strategies are associated with reading comprehension success. Thirty-nine participants read short texts while reporting aloud what they were thinking as they read. Following each passage, readers answered three comprehension questions. Questions either required information found directly in the text (literal question) or required a necessary inference or an elaborative inference. Readers reported more necessary and elaborative inferences and referred to more background knowledge in their dominant language than in their non-dominant language. Engaging in both text analysis strategies and meaning extraction strategies predicted reading comprehension success in both languages, with differences observed depending on the type of question posed. Results are discussed with respect to how strategy use supports the development of text representations.

Keywords: reading comprehension; bilingualism; reading strategies; language proficiency; question type

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1. Introduction

There can be little doubt that, at its core, the goal of reading is comprehension. Skilled reading comprehension (RC) ability allows individuals to access a wealth of information (e.g., vocabulary and content knowledge) and supports both school and career achievement (August and Shanahan 2006). However, for numerous bilinguals around the world, reading comprehension often occurs in a second language (L2) context (Grosjean 2001). For these L2 users, less experience in that language can lead to poorer reading comprehension relative to their monolingual peers (Aarts and Verhoeven 1999; Geva and Farnia 2012). Not surprisingly, research has primarily focused on language-based skills that predict comprehension success (e.g., August and Shanahan 2006; Erdos et al. 2014), and recommendations are often based on improving language proficiency. Nonetheless, how L2 readers utilize strategies to deploy their resources may also uniquely predict reading comprehension success. The current study investigated which reading comprehension strategies are employed by bilingual adult readers in both of their languages. We further investigated whether these strategies predict reading comprehension performance on different types of questions beyond what is accounted for by language proficiency (i.e., receptive vocabulary and word reading fluency).

Importantly, theories of reading comprehension differ in the extent to which language proficiency and strategic behaviours are featured as important components of reading comprehension success. In the Simple View of Reading (Hoover and Gough 1990), RC is posited to be the product of decoding ability and language comprehension (D × LC = RC). Difficulties in either the ability to use spelling–sound correspondences to identify words (i.e., decoding) or the ability to access meaning from language (e.g., vocabulary knowledge, syntax, and discourse analysis) can each contribute to reading comprehension struggles.

Indeed, seminal work by Hoover and Gough with Spanish–English bilinguals found that decoding ability (i.e., word reading ability) and language comprehension were independent predictors of reading comprehension in Grades 1 through 4. The contributions of language skills to reading comprehension have been observed frequently in elementary school populations for both monolingual students (e.g., Catts et al. 1999; Nakamoto et al. 2008; Proctor et al. 2006; Storch and Whitehurst 2002) and bilingual students (e.g., Erdos et al. 2010; Geva and Farnia 2012; Gottardo et al. 2014). For adults, language comprehension is a stronger predictor of reading comprehension performance than word reading ability (see Garcia and Cain 2014, for a meta-analysis; Landi 2010). Additionally, the impact of language comprehension as a predictor is more robust when reading in a second language (Melby-Lervåg and Lervåg 2014).

Although the Simple View of Reading Model (Hoover and Gough 1990) includes discourse processing as a component of language comprehension, there is little mention of how readers use strategies to understand discourse. The Rope Model introduced by Scarborough (2001) addresses how language resources are deployed. In this model, the skills involved in word reading (e.g., phonological awareness, decoding, sight recognition) and language comprehension (e.g., vocabulary, verbal knowledge, literacy knowledge, background knowledge) work together to produce comprehension. As readers become more skilled, these pre-requisite components are better able to work together to support comprehension. Importantly, skills surrounding decoding become more automatic, whereas language comprehension skills are deployed strategically to produce greater comprehension. Indeed, for adult readers, word reading fluency can fail to predict reading comprehension success because for most adult readers decoding becomes automatic (Landi 2010).

Given the importance of oral language knowledge to reading comprehension success, it is not surprising that second language readers may struggle with reading comprehension. Although bilinguals' overall vocabulary knowledge is comparable to single language users (Oller et al. 2007), their second language vocabulary size is on average smaller than that of their monolingual peers in both childhood (e.g., Bialystok et al. 2010) and adulthood (e.g., Bialystok and Luk 2012). By necessity, less proficient second language readers tend to focus more on the surface form of the text relative to more skilled second language readers (Friesen and Jared 2007; Lin and Yu 2015). If second language readers' attention is on word meanings and syntactic relationships rather than on text meaning (e.g., gist extraction), then they will have more difficulty creating a comprehensive mental representation of the text.

The Construction–Integration Model (Kintsch 2005; Kintsch and Dijk 1978) explains the processes involved in creating a mental representation during reading. Key here is the interactive nature of using both bottom-up and top-down processes to construct meaning from the text. Bottom-up processing of the surface form of the text (i.e., linguistic components) enables the construction of a textbase (meaning-based representation in the form of propositions that include the main ideas of the text). As part of the construction of a text representation, readers use top-down processes to integrate the textbase with their background knowledge to form a situation model of the text. Thus, this new representation is not a direct reproduction of the text but the construction of its meaning that is integrated with previous knowledge (Kintsch 2005). Importantly, this model assumes that readers possess the necessary cognitive resources to engage both bottom-up and top-down processes simultaneously. For readers with less language knowledge and skills as outlined in both the Simple View of Reading model and the Rope model, generating a situation model can be challenging because attention may be focused primarily on bottom-up processing.

The impact of poor language proficiency may be offset by actively using reading strategies to create a mental text representation (Carrell et al. 1989; Kolić-Vehovec and Bajśanski 2007). Reading strategies are behaviours that are consciously selected to facilitate text comprehension (Nordin et al. 2013). Used effectively, strategies are associated with successful reading comprehension (e.g., Frid and Friesen 2020; McNamara and Scott 1999;

Pressley et al. 1988; Magliano et al. 1999). Some successful strategies in the monolingual literature include generating inferences (e.g., Oakhill and Cain 2012), predicting (e.g., Duke and Pearson 2009), questioning (e.g., Yopp 1988), visualizing (Pressley 2000; Erfani et al. 2011), and summarizing (e.g., Gillam et al. 2009). Readers also benefit from monitoring their comprehension of a text to determine when a strategy should be deployed (Cain and Oakhill 1999; Lin and Yu 2015; Oakhill et al. 2005) and from relying on their knowledge of text structure to create a scaffold upon which to insert relevant information (Oakhill and Cain 2012; Gernsbacher et al. 1990).

Graesser et al. (1994) highlight the fact that readers engage in strategic behaviours to extract meaning from text. First, readers seek out information that aligns with their goals, typically to extract content rather than surface form. Second, readers attempt to construct coherence in their understanding at both the local and global levels. For local coherence, understanding is generated by organizing elements, constituents, and referents of adjacent clauses or short sequences of clauses. For global coherence, local portions of information are organized into higher order chunks. Third, readers attempt to explain causal relationships between actions, events and elements in the text. Good comprehenders may generate explanations of why events and actions in the text occur. The importance of strategy use is integral to both coherence and explanation. Good readers should use strategies such as inferencing and summarizing (i.e., meaning-based strategies) to create coherence. They will also use strategies such as questioning, predicting and referring to background knowledge (McNamara 2012) to generate explanations.

In both the CI model (Kintsch 2005) and Graesser et al. (1994) framework, the ability to generate inferences is an important underlying process in creating a mental model of the text. Here the reader is required to identify information that is implied from the text but not explicitly stated (Kendeou et al. 2016). Necessary inferences are required to maintain coherence (Cain 2010). For example, in the sentence, "Bob's teeth hurt after his trip to the dentist's office", a reader needs to infer that the dentist worked on Bob's teeth to understand the sentence. Elaborative inferences, in contrast, enrich the mental representation of the text but are not necessary for comprehension (Cain 2010). For example, we might infer that Bob had a root canal. Barnes et al. (1996) examined necessary and elaborative inference making in monolingual children from 6 to 15 years old. They found that the number of inferences increased with age and more necessary inferences were made than elaborative inferences across all ages. Cain (2010) suggested that inference making ability emerges early in reading comprehension development but continues to develop as readers become more skilled. Nonetheless, readers differ in their ability to generate inferences and these individual differences in inference ability have been found to be associated with reading comprehension performance in adults (e.g., Cromley and Azevedo 2007), adolescents (e.g., Ahmed et al. 2016) and children (Cain et al. 2001; Eason et al. 2012).

Discussion of inferencing behaviours is particularly warranted given that reading comprehension measures typically include questions that require readers to make inferences to answer correctly. Unfortunately, it is often the case that studies and assessments do not distinguish between different types of questions, likely because standardized measures of reading comprehension typically provide a single score (Eason et al. 2012). This is problematic because different types of questions may draw on different sources of knowledge and different processes. The studies that have examined question type have typically found that literal questions are easier to answer than inferential questions (e.g., Brandão and Oakhill 2005; Geiger and Millis 2004; Spencer et al. 2019; however, see Eason et al. 2012). For literal questions, information can be found directly in the text and likely does not require further processing. In contrast, integration processes are necessary for inference questions.

Cain et al. (2001) examined why comprehension failure occurs on both necessary inference questions and elaborative inference questions in a group of 7- and 8-year-old readers. Overall, if comprehension failure occurred on inference questions, it was due to an inability to integrate relevant textual premises. For elaborative inferences, in particular,

readers generated more incorrect inferences and retrieved more incorrect textual premises. Work by Eason et al. (2012) further found that different underlying skills predicted performance on literal questions relative to inferential questions in 10- to 14-year-old readers. For literal questions, language knowledge (word-level skills and semantic awareness) predicted performance, whereas for interpretation questions (where reading between the lines is necessary), background knowledge and inferential skills predicted performance. Importantly, different types of questions draw on different abilities and may be better served by using different strategies to consolidate information for later retrieval.

To our knowledge, no work to date has examined how online strategy use predicts dominant language and non-dominant language reading comprehension performance in bilingual adults, either on an overall reading comprehension score or broken down by question type. Ideally, educators would benefit from knowledge about what type of online strategy use is related to subsequent performance on a comprehension test and more specifically which strategies are associated with which types of questions. This information would allow educators to both assess whether readers are using effective strategies during reading and to consider what strategies likely need to be taught to improve responses on different types of questions.

Think-aloud protocols provide educators and researchers with insight into online strategy use (Pressley and Hilden 2004; Seipel et al. 2017) that can then be linked to comprehension. Here the researcher or educator is afforded the opportunity to examine active strategy use by asking readers to report what they are thinking during reading (Myers and Lytle 1986). Although concerns exist regarding participants' ability to accurately articulate their thought processes and whether the process itself changes comprehension, rich descriptive data are recorded about online strategy use that could not be otherwise be captured (Uhl-Chamot and El-Dinary 1999). This approach is a more nuanced technique than asking students to self-report their strategy use in questionnaires (Lin and Yu 2015). However, systematic reviews of the literature on strategy use in L2 adult reading have highlighted the large variability in methodologies across studies, making comparisons between studies challenging (Alkhaleefah 2016; Brantmeier 2002). Many studies also focus solely on strategy use in the L2 (e.g., Alkhaleefah 2017; Uhl-Chamot and El-Dinary 1999; see Brantmeier 2002 for an early review) or use self-report questionnaires (e.g., Brantmeier 2000; Hong-Nam and Page 2014; Padrón and Waxman 1988). Here we briefly review findings from recent adult studies on reading strategies in the L2.

The majority of the recent work on reading strategies in bilingual adults has employed self-report questionnaires. Hong-Nam and Page (2014) compared skilled bilingual L2 readers with less skilled L2 readers. They found that more successful bilingual readers reported that they placed greater value on top-down strategies such as using metacognitive/global approaches than poorer L2 comprehenders. Likewise, Nordin et al. (2013) found that high achieving L2 adult readers reported spending more time on post-reading activities intended to consolidate information (e.g., summarizing the text, posing questions, and seeking additional resources) than less skilled bilingual readers. Such findings are consistent with the literature on monolingual strategy use (e.g., Duke and Pearson 2009; McNamara 2012).

Research has also examined strategy selection differences as a function of overall language proficiency in both languages (rather than reader skill). In a study using self-report questionnaires, Tsai et al. (2010) examined strategy preferences across languages for skilled and less skilled adult L2 users. They found that readers who were highly proficient in each language reported using similar and more meaning-based strategies in both their L1 and their L2. In contrast, less skilled L2 users evaluated the text more in their L1 than in their L2 and resembled the skilled readers only in their L1. Similarly, in a think-aloud study, Lin and Yu (2015) found that more proficient L2 adults engaged in more effective and varied strategies that were aimed towards comprehension in their L2, whereas less proficient L2 users were focused on language-oriented strategies. More proficient L2 readers asked more questions, paraphrased more, translated more and used more contextual cues than the less

proficient bilingual readers. Taken together, these findings are consistent with an earlier review by Brantmeier (2002), who found that successful L2 readers tend to favor using top-down strategies such as integrating information, using text structure, and linking text to background knowledge, whereas less successful readers used more bottom-up strategies such as rereading, looking up unknown words and identifying lexical problems.

There are a couple of concerns about how adequately this literature can inform our understanding of the relationship between strategy use and reading comprehension success. The first concern is that most of these studies determine their participants' skill level (either reading comprehension or language proficiency) to form their groups and then these groups are compared on strategy use. However, it is unclear whether and how these reported strategies contribute to reading comprehension success. For example, Brantmeier (2000) did not finding a significant relationship between self-reported strategy use and reading comprehension performance in a study with L2 adult Spanish speakers. Thus, it is not clear that strategy use data provided independently of a comprehension measure are informative about which strategies are related to performance on that comprehension measure.

The second concern is that it is not clear whether the observed differences in strategy use are primarily a function of differences in language proficiency or reading strategy ability. Lin and Yu (2015) indicated that language proficiency appeared to be closely related to strategy selection, suggesting that more proficient language users will be more effective strategy users. However, given the findings reported in the monolingual literature, there should be variability in the ability to select effective strategies that is independent of language knowledge. Recently, Frid and Friesen (2020) examined the relative contributions of strategy use and language proficiency to reading comprehension success in emerging bilinguals in Grades 4 and 5. They found that in both the dominant- and non-dominant language, inferencing behaviours and text analysis (e.g., identifying text structure and making connections to earlier parts of the text) accounted for unique variance in reading comprehension performance beyond language knowledge. These findings demonstrated an independent contribution of strategy selection to reading comprehension performance.

The Current Study

The current study examined the relationship between strategy use and reading comprehension performance in adult bilingual readers. The goal was to understand whether strategy selection can explain unique variance in reading comprehension performance beyond vocabulary knowledge and word reading fluency in each of a bilingual's languages. Previous research has separately examined language comprehension ability as a predictor of reading comprehension (Erdos et al. 2010; Geva and Farnia 2012; Gottardo et al. 2014) and differences in L2 strategy use as a function of language proficiency (e.g., Lin and Yu 2015). However, no work with adults to date has investigated the contributions of both language proficiency and online strategy selection in both of a bilingual's languages to reading comprehension performance.

Our research questions were: (1) Do bilinguals recruit similar strategies in both of their languages? (2) Do language proficiency and strategy selection each uniquely predict reading comprehension success in each language? As an exploratory question, we also examined: (3) Do the type of strategies that predict RC performance differ depending on the type of question (literal, necessary inference or elaborative inference)? With these aims, we asked English–French bilingual adults to perform think-alouds while reading texts in both their languages. They were asked to answer three open-ended comprehension questions after each text. The Peabody Picture Vocabulary test (PPVT-III) and the Test of Word Reading Efficiency (TOWRE-II) were administered as measures of receptive vocabulary and word reading fluency, respectively. The think-aloud data were coded for strategy use (see Appendix A).

We expected language proficiency to impact our pattern of results. Our participants were highly proficient in both English and French. They were in training to be French

immersion teachers. Nonetheless, they considered English to be their dominant language, and lived in a primarily Anglophone community. Since bilinguals were not equally proficient in each language, we would also expect overall different strategy recruitment in English and French. That is, based on findings from Lin and Yu (2015) and Tsai et al. (2010), we predicted greater reliance on bottom-up strategies that focused on the wording and meaning of the text when reading in the non-dominant language (e.g., summarizing and referring to vocabulary). We also expected that in the dominant language, participants would exhibit more evidence of top-down strategies (generating elaborative inferences, predicting, reference to background knowledge, making connections) relative to their non-dominant language.

With respect to our second research question, we predicted that receptive vocabulary knowledge would be a stronger predictor of reading comprehension performance than word reading fluency (c.f., Landi 2010) in both languages, but particularly in bilinguals' less dominant language (c.f., Melby-Lervåg and Lervåg 2014). In both languages, there should also be individual differences in strategy selection such that overall greater comprehension success should be associated with the greater use of strategies associated with building a cohesive mental representation (e.g., generating inferences, making connections, reference to background knowledge). Nonetheless, with respect to our third research question, the relationship between strategy use and reading comprehension is likely to depend on the type of question. Based on Eason et al.'s (2012) findings in the monolingual literature, we would expect that inferencing behaviours (i.e., necessary inferences and elaborative inferences) would be related to success on inferential questions. In contrast, more bottom-up strategies (e.g., noticing vocabulary and summarizing) should be related to performance on literal questions.

2. Materials and Methods

2.1. Participants

Thirty-nine English–French bilingual adults (33 females; Mean age = 23.7, SD = 4.5), living in Ontario Canada, participated in this study. Thirty-six participants indicated that English was the first language they learned and three identified French as their first language. However, all but one participant indicated that English was their best known language. Reported age of language acquisition, English and French proficiency ratings and current language use ratings are found in Table 1.

Table 1. Means and Standard Deviations on Self-Report Language Use and on Language Measures.

	English	**French**
	Mean (SD)	**Mean (SD)**
Self-Report		
Age of Acquisition	1.2 (1.6)	5.8 (4.0)
Current Use (%)	81.1 (12.3)	17.8 (12.2)
Current Reading Ability (out of 10)	9.7 (0.8)	8.0 (1.4)
Language Measures		
Reading Comprehension (max. 36)	22.4 (5.4)	20.3 (6.4)
Receptive Vocabulary (raw scores, max 204)	181.7 (6.1)	168.9 (16.7)
Word Reading Fluency (max. 104)	95.3 (10.7)	86.8 (12.6)
Non-Word Reading Fluency (max. 63)	52.1 (7.6)	54.6 (8.4)

2.2. Instruments

2.2.1. Language Experience Questionnaire

Self-report measures of English and French language proficiency and language use were obtained with the Language Experience Questionnaire (LEQ). Participants reported their age of acquisition for each language (AoA), which language they knew best, the proportion of time they used each language and in which contexts. Participants also rated

their current level of fluency in listening, speaking, reading and writing in both French and English on a ten-point scale, from one (none) to ten (native-like).

2.2.2. Reading Comprehension Task

Texts from the Gray Oral Reading Test-4th Edition. (Wiederholt and Bryant 2001) were adapted for use in the current study. Six stories from Form A were used to measure strategy use and comprehension in English (stories: 7, 8, 10, 11, 13, 14). Six comparable stories from Form B (stories: 7, 8, 10, 11, 13, 14) were used to measure strategy use and comprehension in French. Form B had been translated to French and back-translated to English in a study for Jared et al. (2011). Texts increased in length. For each text, three open-ended comprehension questions were created for the purpose of this study: one literal question, one necessary inference question and one elaborative inference question. For example, there was a text about the problems that farmers face. Answers to the literal questions were found directly in the text (e.g., what did the famers do to protect their crops?). Necessary inference questions required readers to interpret/infer information not found in the text but were necessary to understand the text (i.e., create cohesion; e.g., why were the famers concerned about their crops?) and answers to elaborative inference questions required participants to make inferences beyond what is stated or directly implied in the text but that reasonably could be generated from the text (e.g., how do you think the farmers feel?).

Texts were presented on a Dell computer screen using Eprime2 software (Psychology Software Tools, Pittsburgh, PA, USA). Texts were revealed two sentences at a time. When participants were finished reading the sentences, they pressed the spacebar. A beep sounded to cue them to say what they were thinking in whichever language they preferred. When they finished their "think-aloud", participants pressed the spacebar again and the next two sentences appeared on the screen. The earlier sections of text remained on the screen. When they completed their last think-aloud, participants responded aloud to the three comprehension questions, presented one at a time on the computer screen. Readers did not have access to the texts when they completed the comprehension questions. Participants were presented with a practice text before both the English and French texts. In the practice texts, think-aloud exemplars were provided from an audio file. Readers were invited to complete the last think-aloud in the example texts and then asked if they had any questions about the procedures before completing the experimental texts.[1]

2.2.3. Vocabulary and Word Reading Measures

Two language measures were administered in both English and French: the Peabody Picture Vocabulary Test-III (PPVT; Dunn and Dunn 1997) and the Test of Word Reading Efficiency, both word and non-word reading (TOWRE; Torgesen et al. 1999). The PPVT is a measure of receptive vocabulary. On each trial, four pictures and an auditory word are presented. The task requires participants to match the correct picture to the word. Items increase in difficulty until a stop rule is applied. Form A was used to assess English knowledge and Form B was translated to French. For all measures, total scores were used in the analyses since absolute level of language knowledge was relevant for predicting RC success rather than age-normed scores.

The English TOWRE (Torgesen et al. 1999) is a measure of word reading fluency. Participants read aloud as many items as possible in 45 s. Four versions were administered: English word reading (max score: 104); French word reading (max score: 104); English non-word reading (max score: 63); and French non-word reading (max score: 63). The French versions are not standardized measures, and were originally developed and used in Jared et al. (2011). In English, the alternative forms have a reliability of 0.93 for the word subtest and 0.94 for the non-word subtest. The French version had a single form and therefore

[1] Half of the participants also received a prompt sheet with sentence starters (e.g., This means that . . . , I imagine that . . . This story is about . . .) and half did not. However, adult participants rarely referred to the sheet or used the sentence starters. The patterns of strategy use were comparable between groups and no differences emerged on comprehension; thus, the groups were collapsed in this study. Presumably, adults had sufficient ideas about what to say in their think-alouds that additional support was unnecessary.

no alternative form reliabilities are available. Split-half reliabilities are not appropriate for speeded tests (Allen and Yen 1979; Torgesen et al. 1999). However, inter-rater reliability was calculated on a subset of participants (30%). Agreement was 99% (English words), 96% (English Non-words), 99% (French words), and 98% (French non-words) on total scores.

2.3. Procedure

Participants began by filling out the language experience questionnaire. Then they completed the English or French language tasks (Reading Comprehension, PPVT, TOWRE); the language order was counterbalanced across the experiment. The tasks were part of a larger test battery that took approximately 2 h total to complete. The study (ID# 108374) was approved by the Non-Medical Research Ethics Board of the University of Western Ontario.

Think-Aloud Data Coding

Audio recordings of the reading comprehension think-alouds were translated into English (if necessary), transcribed and coded for ten pre-determined strategies (see Appendix A). Two raters independently coded a few think-aloud protocols. They met with the first author to identify exemplars of each strategy and to evaluate the fit of the coding scheme to the dataset. Raters identified any concerns and resolved any inconsistencies that arose in coding and the coding scheme was refined. Each rater was assigned half of the think-alouds to code. All coding was verified by the first author, and through discussion, consensus was reached on the final coding. Any statements that were repeated during the think-alouds were discarded and were not included in the final count. Any behaviours that were outside the coding scheme were counted as "other" and discarded. These strategies consisted mainly of opinions, emotional reactions and comprehension failure statements. This amounted to 7.1% of the observations in the English task and 10.4% in the French task.

To create an individual profile of strategy use in each language, the number of times each strategy was used was summed for each participant. The first author re-coded 28% of the data and reliability on the strategy profiles was calculated using total count inter-observer agreement (Cooper et al. 2007), which is the percentage of agreement for each strategy divided by the total number of times that strategy was observed (agreement ÷ (agreement + disagreement)). These agreements were then averaged across participants. Overall agreement was 78% for English, and 76% for French. Additionally, because we were primarily interested in ensuring that the relative use of each strategy among participants was captured in each set of ratings, we performed Pearson correlations on each strategy and found an average correlation of 0.89 in English and 0.88 in French.

Reading comprehension responses were scored separately out of 2 (0 being incorrect, 1 being partial correct answer, 2 being a completely correct answer). A scoring key was used to code each response. Since elaborative questions by definition were more open-ended, a range of responses were deemed acceptable. Answers had to logically follow from the text. For example, since the passage about farmers outlined their problems, the answers to "How do you think the farmers felt?" had to express a negative emotion. To achieve a score of 2 on this question, participants had to provide a logical reason for their answer (e.g., because they cannot control the weather's impact on their crops, they must feel frustrated). Answers to the same question were compared directly to each other to ensure similar responses were assigned the same scores and checked by two raters. Disagreements were discussed and resolved. Given there were 6 stories and 3 questions per story, readers could receive a maximum score of 36 in each language.

3. Results

3.1. Descriptive Statistics

In addition to the self-report measures, the means and standard deviations of the objective language measures are reported in Table 1. As expected, overall, the English–French bilinguals were more proficient in English than in French. Scores were significantly

higher on the PPVT, t(38) = 5.58, $p < 0.001$, on the TOWRE word fluency, t(38) = 6.28, $p < 0.001$ and on reading comprehension questions, t(38) = 2.50, $p < 0.05$. In contrast, on the TOWRE non-word fluency, more items were read correctly in French than in English, t(38) = 2.84, $p < 0.01$.

3.2. Strategy Recruitment

Table 2 reports both the mean and median values of the frequency (total number of times) that each strategy was used in English and French. Based on the Shapiro–Wilk test, eight of the strategy-type distributions violated assumptions of normality in both languages, *p*s < 0.05, with the exceptions of summarizing and generating necessary inferences. Consequently, a Friedman non-parametric test was conducted with observations from each strategy type in each language. Analyses revealed the presence of at least one significant difference in the total number of strategies used between strategy types, χ^2 (19) = 501.20, $p < 0.001$. Therefore, to investigate where strategy use differed across languages (e.g., use of summarizing in English vs. French), Bonferroni-corrected Wilcoxon Signed-Ranks Tests were conducted on each of the ten strategies. More necessary inferences, Z = 3.44, $p = 0.01$, more elaborative inferences, Z = 4.36, $p < 0.001$ and more reference to background knowledge, Z = 3.21, $p = 0.01$, were observed in English than in French. No behaviours were observed significantly more often in French than in English.

Table 2. Mean (with Standard Deviations) and Median Totals of Strategy Use as a Function of Text Language.

Strategies	English		French	
	Mean (SD)	**Median**	**Mean (SD)**	**Median**
Vocabulary	3.5 (3.9)	3.0	4.7 (5.2)	4.0
Text Structure	6.0 (5.9)	3.0	3.8 (3.4)	3.0
Summarizing	22.9 (9.9)	24.0	26.2 (8.9)	27.0
Necessary Inferences	23.6 (9.5)	24.0	18.0 (5.9)	18.0
Connecting	2.8 (2.1)	2.0	1.7 (1.5)	1.0
Elaborative Inferences	16.3 (9.0)	16.0	9.2 (6.3)	8.0
Questioning	4.3 (5.0)	3.0	2.3 (3.2)	1.0
Visualizing	1.1 (2.2)	0.0	0.3 (0.9)	0.0
Background Knowledge	4.3 (4.8)	3.0	2.3 (3.1)	1.0
Prediction	1.3 (2.0)	0.0	1.6 (2.2)	1.0

Note. Totals are based on adding the number of times each strategy was used across six texts in each language.

A subsequent set of Friedman non-parametric analyses were conducted to examine strategy use within each language. The analyses revealed that the frequency of strategy use differed within both English, χ^2 (9) = 236.95, $p < 0.001$, and French, χ^2 (9) = 246.14, $p < 0.001$. In English, four homogeneous subsets were produced, meaning that strategies within each set did not differ from each other in use and that at least one strategy in the subset differs significantly from the next subset of strategies. Generating necessary inferences and summarizing were the first subset and used more than any other strategy (the sole exception being there was no significant difference between summarizing and elaborative inferences). Generating elaborative inferences was ranked next and was produced more than the subset of text structure, background knowledge, questioning, vocabulary and connecting. Finally, the least used strategies were visualizing and predicting; all other strategies were used significantly more than these two strategies. In French, six homogeneous subsets emerged. Summarizing was used more often than all other strategies. Generating necessary inferences was used more than the rest of the strategies, followed by elaborative inferences as third most used strategy. Reference to vocabulary and text structure were the next most utilized strategies. Questioning, reference to background knowledge, connecting and predicting were next and their use did not differ from each other, Finally visualizing was the least used strategy (although its use did not differ significantly from predicting).

3.3. Predictors of Reading Comprehension Success

Table 3 reports the bivariate correlations of reading comprehension with both the language measures and reading strategies. For both languages, the PPVT score and reading comprehension score had a moderate to strong positive correlation depending on the language. Word and non-word reading fluency were not significantly correlated with reading comprehension performance. With respect to reading strategies, in both languages when readers generated elaborative inferences, referred to background information, and referred to text structure, they also had greater reading comprehension success. Additionally, there were some differences across languages. Predicting was only significantly correlated with reading comprehension performance in English, whereas visualizing, necessary inferences and connecting were significantly correlated to reading comprehension in French, but not in English.

Table 3. Correlations of Language Measures and Strategy Use with Reading Comprehension Scores in Both English and French.

Variable	English	French
Language Measures		
Receptive Vocabulary	0.43 **	0.57 ***
Word Reading Fluency	0.16	0.23
Non-word Reading Fluency	0.26	0.23
Strategies		
Reference to Vocabulary	0.21	0.28 $^{+}$
Text Structure	0.50 **	0.37 *
Summarizing	0.24	−0.07
Necessary Inferences	0.26	0.69 ***
Elaborative Inferences	0.42 **	0.64 ***
Connecting	0.30 $^{+}$	0.32 *
Questioning	0.28 $^{+}$	0.18
Visualizing	−0.10	0.38 *
Background Knowledge	0.40 *	0.53 **
Prediction	0.35 *	0.31 $^{+}$

Note. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Cohen (1988) states that an r value of 0.1 to 0.3 is a weak correlation, 0.3 to 0.5 is a moderate correlation and r > 0.5 is a strong correlation.

Table 4 reports the correlations between each strategy in each language. To reduce the number of predictors of English RC performance, an exploratory principal component factor analysis was performed on the ten strategies. This analysis determines which variables group together. A varimax rotation was used to find an orthogonal solution that allows us to visualize how variables load on to a resulting factor. Composite regression scores were computed based on resulting factors to use in a subsequent regression analysis. Initial eigenvalues above 1 indicated that four factors were extracted and accounted for 31.4%, 18.8%, 16.3% and 10.7% of the variance, respectively, for a total of 77.2% of the variance accounted for by the factor analysis. Extracted communalities were all above 0.4 and can be found in Table 5 along with factor loadings. Factor loadings operate like correlations. Higher factor loadings indicate that the variable is strongly associated with the composite factor. Variables with factor loadings greater than 0.5 or less than −0.5 were deemed to load on to the corresponding factor.

Table 4. Correlations between Strategy Types for Both English (Unshaded) and French (Shaded).

	1	2	3	4	5	6	7	8	9	10
1. Summarizing	–	0.02	−0.07	−0.26	0.05	−0.38 *	−0.39 *	−0.18	−0.23	−0.16
2. Necessary Inferences	0.37 *	–	0.54 **	0.29 +	0.27	0.09	0.34 *	0.31 +	0.36 *	0.52 **
3. Elaborative Inferences	−0.09	0.38 *	–	0.08	0.26	0.16	0.54 **	0.11	0.37 *	0.25
4. Predicting	0.18	−0.10	0.07	–	0.04	0.16	0.32 *	0.58 **	0.39 *	0.52 **
5. Visualizing	−0.32 *	−0.12	0.50 **	−0.23	–	0.00	0.21	0.11	0.29 +	0.03
6. Questioning	−0.45 **	−0.30 +	0.26	0.02	0.21	–	0.45 **	0.22	0.37 *	0.22
7. Background Knowledge	−0.34 *	−0.06	0.43 **	0.23	0.28 +	0.59 **	–	0.40 *	0.48 **	0.42 **
8. Vocabulary	−0.26	−0.06	0.24	0.02	0.29 +	0.64 **	0.56 **	–	0.54 **	0.56 **
9. Connecting	0.18	0.14	0.12	0.57 **	−0.26	−0.15	0.15	−0.17	–	0.55 **
10. Text Structure	−0.12	−0.08	−0.03	0.19	−0.03	0.59 **	0.40 *	0.39 *	−0.01	–

Note. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$. Cohen (1988) states that an r value of 0.1 to 0.3 is a weak correlation, 0.3 to 0.5 is a moderate correlation and >0.5 is a strong correlation. The same is true for negative values.

Table 5. Rotated Factor Loadings and Communalities for Each Strategy Used in English Think-Alouds.

Strategies					
	Text Analysis	**Extrapolating beyond the Text: Inferencing**	**Cohesion and Integration**	**Meaning Extraction**	**Communalities**
Questioning	**0.84**	0.18	−0.06	−0.30	0.82
Vocabulary	**0.77**	0.26	−0.11	−0.06	0.67
Text Structure	**0.83**	−0.24	0.07	0.03	0.75
Background Knowledge	**0.66**	0.46	0.31	−0.14	0.76
Elaborative Inferences	0.16	**0.87**	0.08	0.29	0.87
Visualizing	0.05	**0.76**	−0.26	−0.28	0.73
Prediction	0.13	−0.16	**0.86**	−0.04	0.79
Connecting	−0.12	0.05	**0.88**	0.15	0.82
Summarizing	−0.24	−0.32	0.15	**0.69**	0.66
Necessary Inferences	−0.06	0.22	−0.03	**0.90**	0.86

Note. Bolded values denote variables that load onto that factor.

Each factor was examined to better understand the relationships between variables that loaded onto the factor. Based on these identified variables, each factor was named. The first factor was called Text Analysis and included reference to text structure, reference to vocabulary, questioning and reference to background knowledge. Here metacognitive strategies were utilized by identifying key textual elements and by questioning both the text's form and content in the context of prior knowledge. The second factor was named Extrapolating beyond the Text and included elaborative inferences and visualizing. Here the strategies were less grounded in either the form or meaning of the text itself but rather readers were discussing ideas that were more loosely related to the core ideas of the text. The third factor was Cohesion and Integration with predicting and connecting as the strategies. Here, readers were both anticipating upcoming information and connecting to previous information to create a more cohesive understanding of the text. Finally, summarizing and generating necessary inferences constituted the fourth factor, Extracting Meaning, where readers were focused on main themes or understanding the underlying message of the text.

Subsequently, four multiple regression analyses were conducted on reading comprehension performance with English receptive vocabulary (i.e., PPVT score) and the four strategy factors as independent predictors. If a reader had a high score on a strategy factor (e.g., extracting meaning), it means they tended to utilize strategies that loaded positively on that factor (e.g., summarizing and necessary inferencing). Since word reading fluency measures were not significantly correlated with reading comprehension, they were not entered in the models. The first multiple regression used the total English reading comprehension score as the dependent measure. The next three multiple regressions used comprehension scores on the literal questions, necessary inference questions and elaborative inference questions, respectively, as the dependent measure. See Table 6 for all four

analyses. In each analysis, scores on the English vocabulary measure were entered in the first step followed by all four of the strategy factors using the stepwise method. Results of the overall comprehension analysis produced a significant regression model, R = 0.75, $F(4, 34) = 10.59$, $p < 0.001$, that accounted for 56% of the variance in reading comprehension performance. Extracting Meaning, Text Analysis and Cohesion and Integration each explained unique variance and had positive regression weights, indicating that higher scores on these factors were associated with better overall reading comprehension scores.

For performance on the literal questions, the significant regression model, R = 0.44, $F(2, 36) = 4.53$, $p < 0.02$, accounted for 20% of the variance on RC performance. English vocabulary knowledge and Meaning Extraction produced positive regression weights that accounted for unique variance in performance. In the case of necessary inference questions, both Meaning Extraction and Text Analysis were significant positive predictors, R = 0.62, $F(3, 35) = 7.43$, $p < 0.01$, accounting for 39% of performance. Finally, for elaborative inferences questions, Meaning Extraction, Cohesion and Integration as well as Text Analysis served as significant predictors, R = 0.67, $F(4, 34) = 6.87$, $p < 0.001$, accounting for 45% of the reading comprehension scores.

Table 6. Coefficient Table of English Variables That Predict Successful English Reading Comprehension.

Predictors	b	SE	B	*t*	Sig.
Overall					
Constant	−11.05	20.12		−0.55	0.59
PPVT	0.18	0.11	0.21	1.66	0.11
Meaning Extraction [1]	2.13	0.62	0.39	3.44	<0.01
Text Analysis [2]	2.19	0.66	0.41	3.35	<0.01
Cohesion and Integration [3]	1.71	0.65	0.32	2.66	0.01
Literal					
Constant	−13.51	9.89		−1.37	0.18
PPVT	0.12	0.05	0.33	2.19	0.04
Meaning Extraction [1]	0.67	0.33	0.30	2.01	0.05
Necessary Inference					
Constant	−1.96	7.82		−0.25	0.80
PPVT	0.50	0.04	0.16	1.16	0.26
Text Analysis [2]	0.87	0.26	0.46	3.31	<0.01
Meaning Extraction [1]	0.61	0.25	0.32	2.42	0.02
Elaborative Inference					
Constant	−7.57	10.26		−0.74	0.47
PPVT	0.08	0.06	0.20	1.44	0.16
Meaning Extraction [1]	0.84	0.32	0.34	2.67	00.01
Cohesion and Integration [3]	0.87	0.33	0.35	2.65	00.01
Text Analysis [2]	0.74	0.33	0.30	2.21	0.03

Note. [1] Meaning Extraction here consists primarily of summarizing and necessary inferences; [2] Text Analysis here consists of text structure, vocabulary, questioning and background knowledge; [3] Cohesion and Integration here consists of predicting and connecting.

As with the English think-alouds, an exploratory principal component factor analysis was performed on the ten strategies in French. A varimax rotation was used to find an orthogonal solution. Composite regression scores were computed on resulting factors to use in the subsequent regression analyses. Initial eigenvalues above 1 indicated that three factors were extracted and accounted for 37.9%, 14.9%, and 12.8% of the variance, respectively, for a total of 66% of the variance accounted for. Extracted communalities were all above 0.4 and can be found in Table 7 along with factor loadings.

The factor structure of the strategies used in the French differed from the English Factor structure. The first factor consisted of reference to both text structure and vocabulary as well as predicting and connecting. It was a combination of Text Analysis and Cohesion and Integration and consequently was named Text Analysis and Cohesion/Integration. Factor 2 consisted primarily of necessary and elaborative inferences. Visualizing also loaded on this factor. Given the presence of both inferencing strategies, this variable was called

Extracting Meaning: Inferencing. Finally, the third factor consisted of questioning and background knowledge, however summarizing loaded negatively onto this variable. Given that summarizing loaded negatively and neither questioning nor reference to background knowledge was directly grounded in the text, this variable was called Extrapolating beyond the Text: Questioning.

Table 7. Rotated Factor Loadings and Communalities for Each Strategy Used in French Think-Alouds.

Scheme				
	Text Analysis, Cohesion and Integration	**Meaning Extraction: Inferencing**	**Extrapolating beyond the Text: Questioning**	**Communalities**
Vocabulary	**0.83**	0.06	0.15	0.71
Text Structure	**0.81**	0.22	0.11	0.71
Predicting	**0.81**	−0.06	0.14	0.68
Connecting	**0.57**	0.41	0.34	0.61
Necessary Inferences	0.45	**0.68**	−0.10	0.68
Elaborative Inferences	0.05	**0.83**	0.21	0.73
Visualization	−0.01	**0.64**	−0.07	0.42
Background Knowledge	0.31	0.49	**0.62**	0.72
Questioning	00.11	0.08	**0.79**	0.64
Summarizing	−0.13	0.14	**−0.79**	0.66

Note. Bolded values denote variables that load onto that factor.

The same four multiple regression analyses were performed for the French reading comprehension measures (i.e., on overall reading comprehension, literal questions, necessary inference questions and elaborative inference questions) with French PPVT and the three strategy factors serving as predictors. In each analysis, scores on the French receptive vocabulary measure were entered in the first step followed by all three of the strategy factors using the stepwise method. See Table 8 for all four analyses.

Table 8. Coefficient Table of French Variables That Predict Successful French Reading Comprehension.

Predictors	**b**	**SE**	**β**	***t***	**Sig.**
Overall					
Constant	−4.83	6.35		−0.76	0.45
PPVT	0.15	0.04	0.39	3.98	<0.001
Meaning Extraction [1]	3.76	0.62	0.59	6.12	<0.001
Text Analysis and Cohesion and Integration [2]	1.46	0.61	0.23	2.41	0.02
Literal Question					
Constant	1.62	3.65		0.44	0.66
PPVT	0.03	0.02	0.21	1.56	0.13
Meaning Extraction [1]	1.38	0.35	0.51	3.90	<0.001
Text Analysis and Cohesion and Integration [2]	0.72	0.35	0.27	2.08	<0.05
Necessary Inference					
Constant	−1.77	2.86		−0.62	0.54
PPVT	0.05	0.02	0.40	3.18	<0.01
Meaning Extraction [1]	1.04	0.28	0.46	3.69	<0.01
Elaborative Inference					
Constant	−6.01	2.78		−2.17	0.04
PPVT	0.07	0.02	0.46	4.26	<0.01
Meaning Extraction [1]	1.31	0.27	0.52	4.80	<0.01

Note. [1] Meaning Extraction here consists primarily of necessary and elaborative inferences; [2] Text Analysis here is only reference to text features (Vocabulary and Text Structure).

Results of overall French comprehension analysis produced a significant regression model, R = 0.83, $F(3, 35) = 26.50$, $p < 0.001$, that accounted for 69% of the variance. Extracting Meaning: Inferencing and Text Analysis, Cohesion and Integration each accounted for significant unique variance, indicating that higher scores on these factors were associated with better overall reading comprehension scores. For performance on the literal questions, the significant regression model, R = 0.67, $F(3, 35) = 9.26$, $p < 0.001$, accounted for 44% of the variance. French vocabulary knowledge, Meaning Extraction: Inferencing, and Text Analysis/Cohesion and Integration produced positive regression weights that accounted for unique variance in performance. For necessary inference questions, French vocabulary knowledge and Meaning Extraction: Inferencing were significant positive predictors, R = 0.68, $F(2, 36) = 15.71$, $p < 0.001$, accounting for 47% of variance in performance. Finally, for elaborative inferences questions, French vocabulary knowledge and Meaning Extraction: Inferencing served as predictors, R = 0.78, $F(2, 36) = 27.32$, $p < 0.001$, accounting for 60% of the reading comprehension scores.

4. Discussion

The current study examined the types of strategies employed by bilingual adults in both their languages and how these strategies explained bilinguals' reading comprehension performance. Bilingual adults read texts in both English and French while reporting what they were thinking. These think-alouds were coded for strategy use and were combined into factors and these factors were used to predict reading comprehension performance. Several important findings emerged. First, although bilinguals were highly proficient in both languages, subtle differences existed in their reported online strategy use in each language. Strategies also loaded differently into underlying factors such that in English four factors emerged, whereas in French, there were three underlying factors. Nonetheless, similar patterns arose for the strategy factors that supported successful reading comprehension in each language. When readers engaged in text analysis, meaning extraction and created cohesion/integration, they had greater reading comprehension success. These factors accounted for unique variance in reading comprehension performance beyond the variance accounted for by vocabulary knowledge.

The novel approach taken by the current study was to examine bilingual adults' online reading behaviours in both their dominant and non-dominant languages. The majority of studies that have examined strategy use in bilingual populations have limited the scope of their investigation to their non-dominant language, typically the L2 (e.g., see reviews in Alkhaleefah 2016; Brantmeier 2002). Additionally, in the adult literature, most studies have used questionnaires to report strategy use (e.g., Hong-Nam and Page 2014; Nordin et al. 2013; Tsai et al. 2010). Here, we have examined online reading strategies with think-alouds and have observed differences in strategy selection across languages. Adult readers engaged in more inferencing and connecting to background knowledge in their stronger language. Using a similar design with 10-year-old French immersion students, Frid and Friesen (2020) also reported more inferencing behaviours and reference to background knowledge in the more proficient language than in the less proficient language. These results suggest the possibility that some differences that emerge early during bilingual reading development can remain constant as readers become more skilled in each language, presumably when one language remains dominant.

In both the current study and Frid and Friesen (2020), participants read progressively more challenging texts, which may account for similar patterns in child and adult readers. Indeed, Droop and Verhoeven (1998) reported that L2 readers in third grade were able to utilize background knowledge to support comprehension when reading texts that were linguistically simple. However, once text difficulty was challenging given their language ability, accessing metacognitive strategies online was diminished. Reliance on different strategies across languages in the current study demonstrates that although readers have a large arsenal of strategies to choose from, their language proficiency may limit which strategies they can successfully utilize. For example, despite overall similar patterns of

strategy use in each language, in French, the most used strategy was summarizing followed by inferencing behaviours. In English, participants used summarizing and necessary inferencing equally often, suggesting that they were better able to extract the implicit information in their dominant language and use this knowledge to create a cohesive textbase. Additionally, greater reliance on background knowledge suggests that when reading in English, participants were able to link the textbase to long-term memory, thereby creating a better situation model in their dominant language.

In addition to between-language differences, there were individual differences in strategy recruitment within languages. Although the trends in the correlations within each language were similar, there were more significant correlations in French than in English (20 vs. 14). This finding suggests that reading behaviours in French were clustering together more tightly. That is, if readers could use more complex strategies in French, then they did so in conjunction with other elaborative strategies. However, for some French readers, the need to rely on more text-adjacent strategies such as summarizing meant that there were fewer cognitive resources available to access more elaborative strategies. This interpretation is consistent with the findings of Tsai et al. (2010), who reported that less proficient L2 adult speakers were less skilled in evaluating texts in their L2 than in their L1. Likewise, Lin and Yu (2015) reported that more proficient L2 users utilized more varied strategies that were focused on generating meaning, whereas less skilled users were focused on language strategies. These behaviours may serve as a marker of being very dependent on the surface form of the text and consequently, a less well-developed understanding of the text (Friesen and Jared 2007; Lin and Yu 2015).

Another unique aspect of the current study was that it examined how reading strategies were correlated with reading comprehension performance in both languages. Previous research has identified skill groups and then described their strategy behaviour without directly linking strategies to the resulting comprehension outcomes (e.g., Hong-Nam and Page 2014; Nordin et al. 2013; Tsai et al. 2010). This is potentially problematic given that it is not clear that strategy use reported offline is directly related to comprehension success (Brantmeier 2000). By taking a more direct approach, the current study found that that predictors of reading comprehension performance also differed subtly in each language.

Participants were assessed on both receptive vocabulary knowledge and word/non-word reading fluency. As expected, word reading fluency was not significantly correlated with reading comprehension performance in English given that the readers were skilled adults (c.f., Landi 2010). However, it was somewhat surprising that word reading fluency was not correlated with reading comprehension performance in French, given that French was participants' less dominant language. One possibility is that since the reading comprehension task had no time limit, participants could re-read the text if needed, minimizing the need for a faster reading speed. As expected, receptive vocabulary knowledge was significantly correlated with reading comprehension performance in both languages, with a stronger correlation in French (e.g., Melby-Lervåg and Lervåg 2014). Interestingly, although English receptive vocabulary was initially a significant predictor, it was no longer significant in the final model, suggesting that variance was better explained by readers' immediate strategy use on the reading comprehension task itself. However, for French, both vocabulary and strategy use each accounted for unique variance on reading comprehension, highlighting the contributions of both foundational language knowledge and strategy use in explaining reading comprehension performance in the non-dominant language.

Factor analyses were performed to decrease the number of predictors in the reading comprehension regression models. These factor analyses confirmed that different relationships between strategies existed in English and French. In English, four factors that emerged from the factor analysis and were named Text Analysis, Meaning Extraction, Cohesion and Integration, and Extrapolating beyond the Text, respectively. The three factor structure in the French analysis verified that the strategies were more tightly clustered in the non-dominant language. Text Analysis and Cohesion and Integration were a single factor and the other two factors were named Meaning Extraction: Inferencing

and Extrapolating beyond the Text: Questioning. It is worth noting that the strategies that underlie these factors differed across languages. Yet, similar factors predicted overall reading comprehension success in each language. Text Analysis, Meaning Extraction and Cohesion and Integration all accounted for unique variance in reading comprehension performance.

In English, the Text Analysis factor included reference to text structure, reference to vocabulary, questioning and reference to background knowledge. Here, the same readers would discuss the structure of the text and ask questions that demonstrated their understanding of the content. These questions often drew on relevant background knowledge or questioned the motives of the author. In French, Text Analysis also included reference to text structure and vocabulary, but not questioning or background knowledge. Of note, previous research with children has highlighted the importance of understanding text structure for text comprehension. For example, Oakhill and Cain (2012) reported that knowledge of story grammar in narrative texts at ages 7 and 8 predicted reading comprehension success at ages 10 and 11. However, in their approach they measured knowledge of story grammar in an offline task; here we demonstrate its importance during online reading. Similarly, Block (1986) demonstrated that reference to text structure is a predictor of reading comprehension success among post-secondary English as a second language students. Gernsbacher et al. (1990) note that readers lay a foundation with initial information, then relate incoming information to previous information, and shift to a new substructure if the incoming information is inconsistent with already existing structures. The ability to understand text structure likely contributes to successful comprehension by guiding readers in both encoding and retrieving relevant information (Cain 2010; Meyer and Freedle 1984).

Interestingly, in French, questioning and reference to background information formed their own factor. It was named Extrapolating beyond the Text because summarizing behaviour loaded negatively on the variable suggesting that in French, readers who were engaging in these strategies were posing questions and discussing their own knowledge rather than paraphrasing the text. Importantly, overall, the nature of questioning in the weaker language was less sophisticated than in the stronger language and did not correlate significantly with reading comprehension. Readers in French were more likely to ask questions that demonstrated a lack of understanding of the text (e.g., I wonder what is happening?), rather than build on their knowledge of the text itself. Indeed, although questioning is important for effective reading comprehension, the nature of the questioning appears to be critical (Joseph et al. 2016). Of note, although background knowledge loaded onto this factor, it was a significant bivariate predictor of reading comprehension, suggesting reference to background knowledge is a good indicator of reading comprehension success but did not account for additional variance beyond those factors already in the model.

The Cohesion and Integration factor consisted of the predicting and connecting variables; it accounted for unique variance in reading comprehension in both English and French. Note that in French, they were part of a larger variable that included Text Analysis, whereas in English they were their own variable. Nonetheless, here readers are both anticipating content and then incorporating new content into old content. The importance of creating cohesion and integration are integral to both the Construction–Integration Model (Kintsch 2005) and Graesser et al.'s (1994) principles. Making predictions and connections strengthens the reader's creation of the textbase by both priming upcoming information and reinforcing previous units of meaning. Additionally, making these connections allows for readers to generate necessary inferences from the text (Graesser et al. 1994). Presumably forming a good textbase by reinforcing ideas, enables readers to answer questions posed when the text is no longer present.

Importantly, predicting and connecting strategies work together to increase comprehension. In our dataset, we observed weak or marginal correlations with reading comprehension when each variable was considered independently. However, when these

variables are considered together, they are a good predictor of reading comprehension success. In Frid and Friesen's (2020) work with 4th and 5th grade students, predicting by itself was actually a negative predictor of reading comprehension success in English. Here, readers were predicting quite a bit without confirming their predictions. Indeed, previous research has suggested that in order to be effective, predictions should be followed by a subsequent evaluation of the prediction as reading continues (Duke and Pearson 2009).

The final significant factor that predicted reading comprehension performance in both English and French was Meaning Extraction. However, the composition of the Meaning Extraction factor differed in English and French. For English, meaning extraction behaviours were summarizing and generating necessary inferences. For French, generating necessary inferences was still a key variable, but elaborative inferences loaded onto this factor as well as visualizing. As noted above, in French, summarizing was the main strategy that everyone utilized, perhaps for different purposes. Consequently, it did not distinguish good comprehenders from poor comprehenders in the non-dominant language. However, in English, readers tended to provide a summary statement of the text as the foundation for a necessary inference. In work with monolingual children, Gillam et al. (2009) reported that Grade 4 students who accurately paraphrased texts during a think-aloud also responded more accurately to comprehension questions. By grounding necessary inferences to meaning units from the text, readers can build coherence in their text representation.

In the current study, we have demonstrated the importance of online inferencing behaviours for reading comprehension performance. Previous research has assessed inferential skills offline and demonstrated that these skills are related to reading ability (Ahmed et al. 2016; Cromley and Azevedo 2007). For French, Meaning Extraction was the strongest predictor of reading comprehension performance. Not surprisingly, this fact was true when necessary inferences and elaborative inferences were considered individually. Interestingly, these two behaviours also distinguished performance in English and French, implying that the better reading comprehension performance in English may be partly attributable to our readers' overall ability to generate more inferences in their dominant language. Indeed, Magliano et al. (1999) reported that more necessary inferences are generated by above average readers relative to below average readers. Given that the ability to generate inferences improves as readers mature (Barnes et al. 1996; Cain 2010), it is reasonable that our readers exhibited more inferential skills in English where they have both greater language proficiency and reading experience.

The current study also investigated whether strategy use predicts performance on questions that require different types of information (i.e., literal, necessary inferences, elaborative inferences). In English, there was good alignment between the type of information required by the question and the strategies that predicted success. For literal questions, reliance was on a text-based factor: Meaning Extraction. For both types of inferential questions, readers were drawing on Meaning Extraction and Text Analysis. In addition, elaborative inference questions, which required moving beyond the text, were further supported by engaging in Cohesion and Integration behaviours. Presumably, readers who can engage in behaviours that create a solid foundation in their mental models of the text were better able to make inferential leaps from the text. These findings are relatively consistent with those of Eason et al. (2012) who found that for 10- to 14-year-old readers, language knowledge predicted literal questions, whereas inferential skills and background knowledge predicted performance on inference questions. In the non-dominant language, the strongest predictor of reading comprehension performance on each type of question was Meaning Extraction, followed primarily by receptive vocabulary knowledge. Since Meaning Extraction here was both inferencing behaviours, it stands to reason that the ability to generate inferences from texts enables readers to respond to questions that rely on inferential knowledge. Surprisingly, it was only for literal questions that Text Analysis and Cohesion and Integration was a significant predictor. Perhaps, a greater focus on the text itself enabled readers to recall specific content found directly in the text more accurately.

Nonetheless, the importance placed on generating inferences suggests that this ability was not common across all readers, with language knowledge as a potentially limiting factor.

The results of our study have important implications for educators. First, it is important to reiterate the degree of explanatory power that the use of strategies has on reading comprehension performance as well as the variability of effective strategy selection even among adults. This finding suggests that even in adulthood, a focus on improving the effective use of strategies is warranted in both languages. The second key implication is that educators should recognize that different types of questions may rely on different strategies. An understanding of which strategies are more effective for different question types may enable educators to target the strategies that are necessary to consolidate information for later retrieval. This knowledge will also help them understand why readers may perform differently depending on the assessment or question type. Educators should also be mindful of the alignment between the type of assessment activities and the original learning context. That is, are readers being asked to retrieve information that was the focus of the reading exercise or the nature of the strategy instruction? With respect specifically to second language educators, a starting point in strategy instruction may be to teach second language adults how to explicitly generate inferences in order to "read between the lines", since inferencing ability was by far the strongest strategy predictor of reading comprehension performance and inferencing is often a focus of comprehension questions. By focusing on how to explicitly extract meaning from text, emphasis is placed on the expectation that individuals should not only understand what they have read in the moment but that they also retain the information for later retrieval. This approach may improve reading comprehension performance across all question types in L2 courses.

The results of our study should be interpreted in light of its limitations. First, given the correlational nature of our study, the direction of the relationship between strategy use and reading comprehension performance is unclear. It may be that the strategies reported were indicative of the underlying comprehension or it may be that the strategies themselves enabled a more comprehensive mental text representation to be constructed. We favor an explanation that is bidirectional in nature such that readers must have an understanding to report strategies, but that articulating these strategies helps readers to retain information in memory for subsequent comprehension questions. It is also worth noting that the use of think-aloud protocols may fundamentally change both how strategies are used and how comprehension is achieved by consolidating information more readily. Future research should use an intervention to teach individuals strategies that are used by skilled readers during think-alouds to determine whether strategy instruction in effective self-talk improves reading comprehension in both L1 and L2.

A second potential limitation of the current study is that readers' strategy use and comprehension performance was assessed on the same measure, thereby examining a proximal relationship between these two constructs. Future research should examine the relationship between performance on a standardized comprehension measure and an independent measure of strategy use in order to examine generalizability. However, a consideration with this approach is that there is currently no agreed upon gold standard in reading comprehension assessments and issues arise about what skills are being measured by each test. Indeed, Spencer et al. (2019) found only moderate correlations between different test formats (e.g., multiple choice, free recall). Pursuing this question will likely necessitate including multiple measures of reading comprehension. As a starting point here, we considered how educators would benefit from understanding the relationship between strategy use and comprehension within the same text.

5. Conclusions

In conclusion, the current study found that reading strategies accounted for unique variance beyond receptive vocabulary knowledge in each language. Indeed, in the dominant language, when reading strategies were included in the regression model, vocabulary knowledge was no longer a significant predictor. In the non-dominant language, vocab-

ulary knowledge remained a significant predictor, but reading strategies also accounted for unique variance in reading comprehension performance. Such findings suggest that improvement in language knowledge does not necessarily translate to the use of more effective reading comprehension strategies even in adult readers. Consequently, a dual-prong approach to reading comprehension instruction is warranted such that both language knowledge and effective strategy deployment should be targeted.

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Appendix A

Table A1. Strategy Descriptions and Examples.

Strategies	Description	Examples
Vocabulary	Referring to a vocabulary word because it was difficult to understand. The reader may also refer to the vocabulary word to discuss its significance.	"They use the word homage and verbiage" "fanciful looks like a fake word but I'm going to take it as fancy"
Text Structure	Referring to the layout of the text (i.e., text genre). Mentioning the intent of the author or commenting on how ideas are expressed (e.g., figurative language).	"Ah this seems to be taken from some story." "It's very poetic, the way that it's written."
Summarizing	Paraphrasing the text by identifying the main ideas of the text. Re-stating information that is explicitly found in the text.	"So, this is just saying that farmers have many difficulties with their crops" "It says his family they didn't ever have a fixed place where they lived."
Necessary Inferences	Generating information that is needed to understand the text but is not explicitly stated: reading between the lines.	"so most likely wild animals because it says feral." "because weather conditions are impossible to predict, it makes me think that maybe pests are easier to deal with cuz you can kind of figure out what might happen."

Table A1. *Cont.*

Strategies	Description	Examples
Elaborative Inferences	Going beyond the text and identifying new information that is not necessary to understand the text. (e.g., commenting on the personality traits of a character).	"So from this I'm taking it that the new inhabitants were quite welcomed in the town because there was a lot of thought being put into these new Italian villas" "but the fact that she kept doing that, must have meant that she was very courageous and very brave."
Visualizing	Forming a mental image of information from the text.	"the idea that was coming across- has just allowed me to form a picture in my head about these so-called Italian villas" "I am picturing this worker who is working with this dangerous type of bee that comes from Africa."
Questioning	Questioning the information in the text. Questions that use who, what, where, when and how.	"I'm wondering if like legends are like the world's greatest fake stories." "I don't know if she's counting the horses or maybe it's not horses."
Predicting	Making guesses on what might occur next in the text.	"which I predict . . . the story will either speak about how to get rid of the insects . . . " "this story's going to be about a park ranger's discovery of some sort of animal or something disrupting the park"
Connecting (within text)	Referring to an earlier part of the text. Referring to content from a previous think-aloud (e.g., evaluating a prediction).	"It's what I was predicting before about some kind of endangered or declining population." "So what we can see here is that yes, she was a slave from the South and she escaped"
Background Knowledge	Referring to information previously learned or information that is related to their life experiences.	"I relate it to propaganda and stuff," "I've heard wild horses are endangered so it might be that."

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