Exploring Reading Strategy Use in Native and L2 Readers

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Abstract

Research comparing the reading strategy use of native and second language (L2) readers has often relied on self-report measures and has, at times, been conducted without measures of reading proficiency. In the present study, we used regression and Bayes' factors to explore how L2 reader status and reading proficiency relate to self-report reading strategy use and the use of situated text processing strategies (i.e., paraphrasing, bridging, elaboration). Data were collected from a South-Central community college district as part of an ongoing study. L2 status did not predict self-reported strategy use, bridging, or elaboration, but was associated with increased paraphrasing (in the regression analysis only). Reading proficiency was negatively associated with self-reported use of support strategies, but positively predicted the use of all situated processing strategies. Results have important implications for L2 learning and instruction and provide insights into aspects of assessment for L2 readers.

Exploring Reading Strategy Use in Native and L2 Readers

Research in reading has focused on the extent to which different processes and strategies support text comprehension (Graesser, Singer, & Trabasso, 1994; Kintsch, 1988; McNamara & Magliano, 2009; Pressley & Afflerbach, 1995; Trabasso & Magliano, 1996). Comprehension requires that readers construct a coherent mental model that reflects how ideas conveyed in the text are related to one another and how relevant background knowledge can be used to elaborate upon the explicit content (Graesser et al., 1994; Kintsch, 1988; van Dijk & Kintsch, 1983; Zwaan, Magliano, & Graesser, 1995). The strength and the elaboration of these connections helps determine the degree to which a reader comprehends the text (Allen, Jacovina, & McNamara, 2016; Graesser, McNamara, & Louwerse, 2003; McNamara, Kintsch, Songer, & Kintsch, 1996). A large amount of research has shown that the use of various reading and text-processing strategies have a strong bearing on comprehension outcomes (e.g., Magliano, Trabasso, & Graesser, 1999; McNamara, 2007; Nokes & Dole, 2004).

While substantial research has focused on the processes through which native English speakers comprehend texts, research on second language (L2) readers[1] has received less attention (Horiba, 1990, 1996; Mokhtari & Reichard, 2004; Zwaan & Brown, 1996). With more and more L2 students enrolling in college (e.g., Witherell & Clayton, 2014), understanding the processes and strategies that L2 readers use in comprehending texts is becoming increasingly important (Fitzgerald, 1995). Understanding such processes may provide insights into what makes certain

[1] Like others, we define "L2 reader" broadly to mean any reader whose self-reported primary language was not English (e.g., Ferris, Brown, Liu, & Stine, 2011).

L2 readers more successful and may have important implications on L2 learning and instruction (Anderson, 2005; Mokhtari & Reichard, 2004).

Several researchers have noted that students reading in a second language face unique challenges in building a mental representation of a text during reading (e.g., Anderson, 1991; Horiba, 1990; Ghahari & Basanjideh, 2017; Zwaan & Brown, 1996). For example, L2 readers are often forced to maintain a mental representation of a text while simultaneously dealing with surface level constraints (e.g., decoding, syntactic knowledge). This can lead to an increased working memory load (i.e., the amount of information one can keep active in memory), which may impair comprehension by reducing the available mental resources (Ghahari & Basanjideh, 2017; Just & Carpenter, 1992; Perfetti, 1993). Furthermore, students learning in a second language have varying levels of background knowledge and limits to lexical knowledge that affect comprehension processes (Bonk, 2000; Chang, 2006; Garcia, 1991; Laufer, 1992; Mecartty, 2000; Perfetti & Stafura, 2014). Take, for example, the following sentence: "Immediately after he was crowned, Louis repealed some of the most oppressive taxes…" If L2 readers read this sentence, it is plausible that they may not know the meaning of the word "repeal." As a result, they may be forced to use cognitive resources to attempt to decode and deduce the meaning of the word while, at the same time, trying to build and maintain a mental representation of the text. This may impact their ability to comprehend the text, as readers are forced to allocate resources to sentence-level processes rather than deeper, meaning-making processes, such as making connections between sentences (i.e., bridging). In light of the potential text processing challenges that L2 readers face, a portion of research in L2 reading has focused on strategy use as a potential compensatory mechanism (cf. Alsheikh & Mohktari, 2011; Anderson, 2005; Carrell, Pharis, & Liberto, 1989; Jimenez, Garcia, & Pearson, 1995, 1996). In

this study, we investigated the extent to which self-report strategy use and behavioral data reflecting strategy use are predicted by reading proficiency (in English) and L2 reader status.

Broadly speaking, a reading strategy is any mental procedure used by a reader before, during, or after reading, that aids them in their understanding of the text (Alexander & Judy, 1988; Ghahari & Basanjideh, 2017; Pressley & Afflerbach, 1995). For example, while engaging with a text, a reader might preview a section, re-read a given sentence, highlight key points, or summarize what was read. Thus, reading strategies help readers to plan, control, and evaluate their reading behaviors (Karbalei, 2010; Pressley & Afflerbach, 1995; Shoerey & Mokhtari, 2001).

One common way to measure reading strategies use is through self-report. Although a variety of self-report measures have been used, the Metacognitive Awareness of Reading Strategies Inventory (MARSI; Mokhtari & Reichard, 2002, 2004) is, arguably, among the most common (e.g., Guo, 2018; Karimi & Shabani, 2013; Maasum & Maarof, 2012; Mohktari & Reichard, 2004; Shoerey & Mohktari, 2001). MARSI measures three subtypes of strategies: global (e.g., summarizing), problem-solving (e.g., repair), and support strategies (e.g., taking notes). MARSI and other self-report strategy measures assume that reading strategies can be metacognitive in nature; that is, they assume that readers have knowledge of the strategies and an awareness of when and how to use them to regulate reading behavior/cognitive activity (Flavell, 1979; Veenman, Van Hout-Wolters, & Afflerbach, 2006). However, metacognitive strategies need not always be conscious (Veenman, Prins, & Elshout, 2002). Thus, while some reading strategies may require a large degree of conscious metacognitive awareness, others may not, depending on one's skill and experience. For example, early on, a less-skilled reader might have to use conscious and deliberate effort to connect what they are currently reading with outside

knowledge. However, over time this process may become routine and may eventually be performed with little to no conscious effort (Cromley & Azevedo, 2011; McNamara & Magliano, 2009; Veenman et al., 2002). While readers may not be fully aware of all the strategies they engage in, Cromley and Azevedo (2006) suggest that they should still be able to report and recognize them when prompted to do so (see also Ericsson & Simon, 1998).

A plethora of research has shown that reading strategy use is closely linked to reading comprehension outcomes (Magliano et al., 1999; McNamara, 2009; McNamara, O'Reilly, Boonthum, & Levinstein, 2007; Rastegar, Kermani, & Khabir, 2017). Specifically, better readers are those who can flexibly utilize a wide variety of strategies to reach their reading goal (Auerbach & Paxton, 1997; Cromley & Azevedo, 2006; Pressley & Afflerbach, 1995). Research in L2 populations has yielded similar results wherein more successful L2 readers tend to report using more strategies than less successful L2 readers (e.g., Anderson, 1991; Dreyer & Oxford, 1996; Ghavamnia et al., 2013). For example, Karimi and Shabani (2013) showed that highly proficient L2 readers reported using more of each MARSI strategy subtypes (i.e., global, problem-solving, support) while reading technical texts than low proficiency readers. Additionally, there is now a growing body of work demonstrating the importance of teaching reading strategies in L2 contexts. In a recent meta-analysis, Plonsky (2011) concluded that strategy instruction appears to be an important aspect of reading in a second language.

While there is a large, growing body of work on strategy use in L2 populations, research is often limited in a number of ways. First, only a relatively small portion of research has compared strategy use across native and L2 populations. Comparing native and L2 readers may reveal important differences in how L2 readers approach a text. In one study, Shoerey and Mokhtari (2001) assessed self-report strategy use among native English-speaking college

students and compared it to the strategy use of L2 students from the same university using a modified version of the MARSI (Mokhtari & Reichard, 2002). While L2 and non-L2 students reported using similar levels of global and problem-solving strategies, L2 students reported using significantly more support strategies. Furthermore, students who rated themselves as having higher reading ability also reported using more strategies across all three categories than those who rated themselves as having lower reading ability. In a similar study, Mohktari and Reichard (2004) compared native English readers and L2 college readers (from the US and Morocco, respectively) on their use of strategies, as measured by MARSI. They found that, while both native and L2 readers used remarkably similar patterns of strategies (i.e., a preference for certain strategies over others), L2 readers (Moroccans) reported using significantly more strategies in general (i.e., more global, problem-solving, and support strategies). The authors concluded that adults with a university-required reading proficiency level might be more similar to each other than they are different in terms of the strategies they are aware of and that L2 readers may even report being aware of more strategies than native readers; however, additional research is needed to examine this proposition in depth.

A second limitation in the existing literature is that a portion of the research has not specifically examined the use of important coherence building processes that occur *while* readers engage with a text. For example, the use of inferencing (e.g., bridging) has been shown to be critical in comprehension as it creates intra-textual connections that help establish coherent mental models (Graesser et al., 1994; Singer, Andrusiak, Residorf, & Black, 1992). Additionally, readers utilize elaborative processes in which they bring in extra-textual information based on prior knowledge to establish and support their mental model (Graesser et al., 1994; Whitney, Ritchie, & Clark, 1991). Here, we highlight important differences between general self-report

strategies and important text processing strategies (whether consciously or unconsciously employed) that occur while one reads a text. While we recognize that some self-report measures attempt to measure aspects of these coherence building processes, we argue that a more direct measure of these strategies, situated in a specific reading context, may provide greater insight into what readers are doing *while* they process a text. Additionally, we argue, as have others (Anderson, 1991; Cromley & Azevedo, 2006, 2011; Paris, Cross, & Lipson, 1984), that there is an important distinction between declarative strategy knowledge (e.g., being able to recognize good strategies/differentiate between good and poor strategies) and procedural strategy knowledge (e.g., knowing when and how to use specific strategies). It, therefore, behooves researchers to explore additional measures of strategy use that capture strategy use in the context of a specified reading situation to complement self-report measures.

One way in which research has explored reading strategies during reading is through the use of think-aloud procedures (e.g., Horiba, 1990; Karimi & Shabani, 2013; Zwaan & Brown, 1996). For example, Horiba (1996) had native and L2 readers think aloud while reading texts that differed in causal coherence. Horiba found that native readers engaged in more coherence building processes by making more bridging inferences and generating more elaborations. Moreover, native readers adapted their strategy use based on the causal coherence of the text. In contrast, L2 readers spent more time focused/commenting on lower-level processing and did not adapt their strategy use to changes in causal coherence. Importantly, researchers found that L2-advanced readers were more likely to engage in bridging inferences than L2-intermediate readers.

As noted above, one final limitation in previous work concerns reading proficiency. While reading strategies are known to be important for comprehension, reading strategies and

comprehension processes are also known to interact with one's level of reading proficiency (e.g., Anderson, 2003; McNamara, Louwerse, & Graesser, 2002; Snow, 2002). Consistent with Mohktari & Reichard (2004), a majority of studies have found that more proficient L2 readers utilize more strategies than less proficient readers overall (Ahmadi, Ismail, & Abdullah, 2013; Barnett, 1988; Senay Sen, 2009; Tavakoli, 2014; Upton, 1997; Zhang & Seepho, 2013); however, this result has not always been strong or consistent (Alsamadani, 2008; Mudhumathi & Ghosh, 2012). The relation between reading strategy use and proficiency may be more complex than it seems. On one hand, strategy use, especially in terms of coherence building strategies, should be related to higher reading proficiency (e.g., Magliano et al., 1999; McNamara, 2007; Nokes & Dole, 2004). On the other hand, if L2 strategy use is a compensatory mechanism as some have postulated (Alsheikh & Mohktari, 2011; Anderson, 2005; Carrell et al., 1989; Jimenez et al., 1995, 1996), this would suggest that strategy use may actually *decrease* as proficiency increases. This may be especially true of support strategies and other self-report strategies that are less related to coherence building. If L2 readers, and less proficient readers in general, rely more heavily on the use of support strategies, as previous research suggests, then accounting for a reader's proficiency level in the target language may ameliorate the effect of L2 status on support strategy use.

Another problem regarding reading strategy use and proficiency is that results may differ depending on what measures are used (see Brantmeier, 2002 for review). Despite attempting to address the importance of reading proficiency, some studies have relied on self-report measures of proficiency rather than more objective measures (Alhaqbani & Raizi, 2012; Iwai, 2009; Shoerey & Mokhtari, 2001; Mokhtari & Reichard, 2004). Other studies have measured proficiency in terms of comprehension outcomes, such as oral recall, written recall, or multiple-

choice tests (see Brantmeier, 2002). Additionally, a large portion of research has examined proficiency as a categorical variable rather than a continuous variable, comparing high/low or intermediate/advanced L2 readers (Ghavamnia et al., 2013; Horiba, 1996; Karimi, 2018; Zwaan & Brown, 1996). It has been frequently pointed out that dichotomizing continuous variables is a poor statistical practice that reduces power and obscures individual differences (e.g., Cohen, 1983; MacCallum, Zhang, Preacher, & Rucker, 2002). Thus, to properly account for individual differences between L2 and non-L2 readers, it is imperative that a continuous, objective measure of reading proficiency be used.

Based on the literature discussed above, it is clear that there are several questions that require further investigation. Do L2 readers report using different (or more) strategies than non-L2 readers? Can other measures of strategy use, that directly assess the use of important text processing strategies in a situated context, help reveal differences between native and L2 readers and supplement the use of self-report measures in an L2 context? To what extent is strategy use tied to reading proficiency? The current study explores these questions while addressing some of the limitations mentioned above.

The Current Study

In the current study we explored whether or not differences exist between college-level L2 and non-L2 readers in the strategies they use to comprehend a text. To do this, we examined differences in self-reported strategy use (e.g., MARSI; Mokhtari & Reichard, 2002). We also explored whether the situated use of certain text processing strategies differed between L2 and non-L2 readers. Specifically, we investigated the use of paraphrasing (i.e., rephrasing part or all of a sentence), bridging (i.e., connecting information from the current sentence to prior text information), and elaboration (i.e., bringing in knowledge from outside the text to embellish text

content) as strategies given their importance in reading comprehension (Magliano & Millis, 2003; Magliano, Millis, RSAT Development Team, & Levinstein, 2011; Singer & Halldorson, 1996). In order to understand the relation between reading strategies and reading proficiency, we also used an objective measure of basic reading skills.

Method

Participants

Participants were 76 native English readers (59% female) and 73 L2 readers (58% female). L2 status was based on responses to a demographic survey asking, "What is your first language?" Additionally, participants were asked what their primary language is at home. First and primary home language information is presented in Table 1. Table 2 presents the number of participants who reported different first and primary languages. For example, if a participant reported Spanish for first language, but English as primary home language, they would be classified in Table 2 as Non-English to English. If a participant indicated that their first language is French, but their primary home language was Arabic, they would be classified in Table 2 as Non-English to Non-English. All analyses were run with and without participants who had different first and primary languages. These analyses resulted in similar outcomes; thus, we utilized the full sample for all analyses. All participants were students in a South Central community college district and were compensated with gift cards from "Giftcertificates.com" ($25 for completing session 1 and an additional $35 for completing session 2). Participants ranged in age from 18-50 (M = 21.58, SD = 6.47) and were ethnically diverse, with similar proportions of ethnicities in L2 and native speaking groups (see Table 3 for details). Data was collected as part of a separate ongoing study.

Table 1

First Language and Primary Home Language Information for Sample

Language	Number of Speakers Reporting First Language	Number of Speakers Reporting Primary Home Language
English	76	82
Albanian	2	2
Amharic	2	2
Arabic	6	8
Balochi	1	1
Bengali	1	0
Burmese	1	1
Chinese (Mandarin)	4	3
Farsi	1	1
French	7	5
German	1	0
Gujarati	1	1
Harari	1	0
Khasi	1	0
Khmer	1	1
Nepali	3	3
Romanian	1	0
Russian	1	0
Spanish	11	13
Swahili	1	1
Tagalog	1	0
Tigrinya	1	1
Turkish	0	1
Turkmen	1	0
Urdu	5	7
Urhobo	1	0
Vietnamese	17	16

Table 2

Differences in First Language and Primary Home Language

Category	Count
First Language Same as Primary Home Language	117
Non-English to English	16
English to Non-English	11
Non-English to Non-English	4

Note: Non-English to Non-English indicates that a participant's primary language was not English (e.g., French), but their first language was a different Non-English language (e.g., Arabic).

Table 3
Demographic Information for L2 and Native English Speaking Samples

Sex/Ethnicity	L2 Proportion	Native Proportion
Female	.58	.59
White**	.14	.33
Black	.22	.32
Asian***	.51	.12
Hispanic	.12	.21
Native American/ Pacific Islander	.00	.03
Age		
18-21	.35	.40
22-25	.08	.04
26-34	.04	.03
35-50	.04	.03

Note: Significance levels indicate significantly different proportions between the L2 and Native-speaking samples, $^{**}p < .01$, $^{***}p < .001$

Materials

Study Aid Reading Assessment (SARA). Participants completed the SARA (O'Reilly, Sabatini, Bruce, Pillarisetti, & McCormick, 2012; Sabatini, Bruce, & Steinberg, 2013; Sabatini, Bruce, Steinberg, & Weeks, 2015) as a measure of English reading proficiency. SARA is a test of six basic reading proficiencies: decoding and word recognition, morphology, vocabulary abilities, sentence processing, efficiency of comprehension, and reading comprehension. For the

decoding/word recognition measure, participants determined whether a stimulus was a word, non-word, or pseudo-homophone as quickly as possible. The vocabulary measure involved participants selecting the appropriate synonym or topically related word to match a target word. To measure morphological processing, participants read sentences and filled in the blank with the morphologically correct word. The sentence processing measure involved participants reading sentences and filling in the blank with the appropriate word. Lastly, the reading comprehension component consisted of short passages associated with multiple-choice questions. Each of the subscales has been shown to have good reliability (all Cronbach's α's > .76) and the scale has been argued to be valid due to the subscales' high intercorrelations (Sabatini et al., 2013; Sabatini et al., 2015).

Reading Strategy Assessment Tool (RSAT). The RSAT (Magliano, Millis, RSAT Development Team, & Levinstein, 2011) was administered to participants to measure their use of strategies while reading a text. RSAT is a think-aloud tool that presents a text sentence by sentence and periodically presents a prompt asking participants to report their thoughts ("What are you thinking about now?").

Participants read two texts presented in a randomized order: a science text with seven think-aloud prompts (titled "The Power of Erosion", 22 sentences), and a history text with six think-aloud prompts (titled "Louis XVI and the French Revolution", 19 sentences). Sentences were presented one at a time and readers advanced at their own pace. Only the current sentence was visible during reading. None of the prior text was available when participants were asked to report their thoughts. Participants reported their thoughts by typing them in a box below the prompt. While think-aloud protocols are traditionally produced orally, the strategies revealed when thinking aloud are similar when produced orally or by typing (Muñoz, Magliano, Sheridan,

& McNamara, 2006). The locations of the prompts were selected because they afford a bridging inference that connects ideas in the text and/or support an elaborative inference (Magliano et al., 2011). The instructions given to participants are modeled on those used by Trabasso and Magliano (1996). Specifically, participants were instructed to report their understanding of the sentence they just read in terms of what they had been reading and what they know about the topic and to focus on whatever thoughts immediately come to mind after reading the question prompt (Ericsson & Simon, 1993). They were not provided specific instructions on how to report their thoughts. However, participants were given a computer-guided practice, in which they read a short, 5-sentence text excerpt on the transcontinental railroad and reported their thoughts at two sentences. A computer algorithm evaluated the length of the responses, and if responses had less than five words, participants received the feedback "We are interested in your thoughts about the texts. In your responses to the prompts, please tell us more about your understanding of what you are reading" and were required to write a longer response. This feedback was presented only during the practice text. After responding to the first prompt, participants were shown example responses from other students. These examples reflected a variety of processing strategies (e.g., bridging, elaboration, paraphrasing, questioning). As such, they did not encourage a specific type of strategy. After practice was completed, participants read the two texts.

RSAT incorporates natural language processing algorithms to score each protocol for evidence of paraphrasing, bridging to the prior text content, and elaborating with concepts not explicitly in the text. RSAT computes paraphrasing, bridging, and elaboration scores for each participant response and an average score for each strategy is computed for each participant. RSAT uses the "bag of words" approach for calculating these scores (Magliano & Graesser, 2012). Specifically, each protocol is compared to two semantic benchmarks that include the

content words (nouns, verbs, adjectives, and adverbs) in (1) the current sentence that was just read and (2) prior sentences. The paraphrasing score is based on the content words in the protocol that appeared in the current sentence and the bridging score is based on content words from the prior texts. An elaboration score is based on content words in the protocol that were not in the text, thus the elaboration score reflects using world knowledge to strategically process the text beyond the explicit discourse content. It is important to note that synonyms for words in the texts are not included as part of the elaboration score (see Appendix for an example of RSAT and automated scoring). Despite the simplicity of the scoring algorithms, RSAT shows good construct validity in that there are moderate to high correlations between computer scores and human judgments of the presence of paraphrasing (r = .75), bridging (r = .71), and elaboration (r = .50)[2] (Magliano et al., 2011). Test-retest reliability of the automated scores is high, particularly when the open-ended nature of the assessment is taken into consideration (r's ranging from .59 to .79). Additionally, like human judgments of think-aloud protocols (Magliano & Millis, 2003), RSAT scores are predictive of performance on standardized tests and experimenter generated tests of comprehension (Magliano et al., 2011). RSAT has been used as a research tool in various studies exploring comprehension processes and individual differences in comprehension processes (e.g., Higgs, Magliano, Vidal-Abarca, Martínez, and McNamara, 2017; Kopatich, Magliano, Millis, Parker, Ray, 2019; Magliano, Durik, & Holt, 2011; Ray & Magliano, 2015).

[2] The fact that synonyms are not currently accounted for in elaboration scores may help explain the lower correlation with human judgments. The automatic detection of elaborations has been a challenge for natural language processing tools (e.g., McNamara, Boonthum, Levinstein, & Millis, 2007) and should be explored in future work.

Metacognitive Awareness of Reading Strategies Inventory (MARSI). The MARSI is a 30 item self-report scale that assesses readers' awareness and perceived use of reading strategies (Mokhtari & Reichard, 2002, 2004). The instrument consists of three subscales that reflect three types of strategies (i.e., Global, Problem Solving, and Support Strategies).

The Global strategy subscale consists of 13 items reflecting reading strategies applied globally to support comprehension of a text (e.g., "I have a purpose in mind when I read", "I think about what I know to help me understand what I read", " I preview the text to see what it's about before reading it"). The Support strategy subscale consists of 8 items reflecting strategies related to using support mechanisms or tools to help construct meaning from text (e.g., "I take notes while reading", "I underline or circle information in the text to help me remember it", "When text becomes difficult, I read aloud to help me understand what I read."). The Problem Solving strategy subscale consists of 9 items that reflect strategies that readers use to take action to repair or solve problems they encounter in understanding information in the text (e.g., "I try to get back on track when I lose concentration", "When the text becomes difficult, I reread to increase my understanding", and "I adjust my reading speed according to what I read.")

MARSI was validated with a native English-speaking population (n = 825) with reading abilities ranging from middle school to college (Mohktari & Reichard, 2004). Reliabilities for all subscales were acceptable (Cronbach's α's: Global Strategies = .92, Support Strategies = .87, Problem Solving Strategies = .79; Mokhtari & Reichard, 2002). In the current study, reliability was similarly high (Cronbach's α's: Global Strategies = .89, Support Strategies = .85, Problem Solving Strategies = .84).

Data Analysis

In order to test whether L2 and native English readers differ in terms of their self-reported strategy use and in their use of text processing strategies, we conducted a series of regression analyses with the RSAT and MARSI subscale scores as outcome variables. In addition to these frequentist analyses, Bayes' factors were also computed using the BayesFactor package in R (Morey, Rouder, & Jamil, 2015). Bayes' factors quantify the support for one hypothesis over another. Specifically, they compare support for the alternative hypothesis to support for the null hypothesis. Using Bayes' factors is thus an appealing means of analyzing the data as it allows one to evaluate the relative support for the null and alternative hypotheses. That is, in contrast to traditional null hypothesis testing, using Bayes' factors allows researchers to support a null finding rather than "failing to reject" it. The Bayes' factors computed here are interpreted as the ratio of evidence for the alternative hypothesis to evidence for the null hypothesis, meaning values greater than 1 indicate support for the alternative hypothesis and values less than 1 indicate support for the null hypothesis (Masson, 2011; Rouder, Morey, Speckman, & Province, 2012).

Procedure

The study consisted of two sessions. All measures were accessed via web-links with instructions for each measure provided on the websites. All participants completed session one in a computer lab with trained study administrators. Some instructors allowed class time for students to participate in the first session and other students completed it outside of class time. The second session was self-administered with students completing the session on their own outside of class. During the first session, participants first completed the SARA, followed by RSAT. This session took between 60-90 minutes to complete. After the measures were completed participants were given information for completing the second session, which took

participants approximately 60 minutes to complete. During the second session, participants completed the MARSI along with other assessments not used in the current analyses and a demographic survey.

Results

Descriptive Statistics and Preliminary Analyses

Missing data was present for three L2 and three native speakers. These cases were thus deleted resulting in a final sample of 73 L2s and 70 native speakers. Correlations between measures are shown in Table 4 and descriptive statistics for RSAT, SARA, and MARSI are listed in Table 5 by L2 reader status. A series of t-tests were conducted on the SARA subscales between L2 and native English readers. All these tests were highly significant when using Bonferroni corrections (all *p*'s < .001) and indicated that, on average, L2 participants had lower proficiency in all of the component skills measured by SARA.

In order to test and control for the effect of proficiency in the main analyses, the SARA subscale scores were entered into a principal components analysis (PCA). The PCA revealed one component, which accounted for 76% of the variance in SARA subscale scores. Separate PCAs were conducted with each subgroup and found similar relationships between the variables. Therefore, regression scores from the initial PCA (both L2 and native English readers) were then saved and were used as a continuous reading proficiency score in the regression models presented here. We refer to the scores derived from the PCA as reading proficiency scores for the remainder of the paper.

Table 4

Correlation Matrix of Input and Outcome Variables

Measure	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. RSAT Bridging	.47***	.74***	.02	-.09	.08	.27**	.22**	.34***	.34***	.30***	.39***	.35***
2. RSAT Elaboration		.37***	.02	-.13	.06	.46***	.40***	.44***	.40***	.40***	.42***	.48***
3. RSAT Paraphrasing			-.01	-.08	.10	.31***	.26**	.31***	.34***	.32***	.43***	.37***
4. MARSI Global Strategy				.84***	.79***	-.05	-.07	-.07	-.14	-.10	-.03	-.09
5. MARSI Support Strategy					.70***	-.17*	-.19*	-.20*	-.25**	-.19*	-.14	-.22
6. MARSI Problem Solving						.02	.03	-.03	-.03	.01	.17*	.03
7. SARA Word Reading/ Decoding							.82***	.75***	.64***	.65***	.70***	.87***
8. SARA Vocabulary								.74***	.63***	.66***	.71***	.86***
9. SARA Morphology									.75***	.73***	.68***	.89***
10. SARA Sentence Processing										.84***	.72***	.87***
11. SARA Efficiency											.73***	.88***
12. SARA Reading Comprehension												.86***
13. Proficiency												

***$p < .001$, **$p < .01$, *$p < .05$

Table 5
Descriptive Statistics for Measures Used in the Current Study

	Potential Score Range	L2 Mean	L2 SD	Native Mean	Native SD
RSAT Bridging	0-	1.71	1.08	1.92	1.40
RSAT Elaboration	0-	2.74	1.83	3.35	2.28
RSAT Paraphrasing	0-	1.22	0.69	1.23	0.73
SARA Word Reading/Decoding	0-50	28.87	9.83	39.29	9.23
SARA Vocabulary	0-38	22.84	7.29	27.93	6.26
SARA Morphology	0-32	22.03	8.89	30.29	6.96
SARA Sentence Processing	0-26	16.74	4.54	20.04	4.82
SARA Efficiency	0-36	33.69	8.02	37.75	7.54
SARA Reading Comprehension	0-22	10.57	3.84	13.36	4.39
MARSI Global Strategies	1-5	3.47	0.65	3.47	0.71
MARSI Support Strategies	1-5	3.37	0.76	3.32	0.79
MARSI Problem Solving	1-5	3.74	0.62	3.76	0.78

Primary Analysis

Regression analysis and Bayes' factor results for the main effects are presented in Table 6. Collinearity assumptions were met for all analyses. The interaction terms for the models were excluded as none of these approached significance in any of the analyses (p's > .35). With regard to MARSI, both the standardized beta-weights and Bayes' factors suggest that L2 reader status is not a significant predictor of self-reported strategy use[3]. This is surprising given that in Shoerey and Mokhtari's (2001) study it was found that L2 readers reported more support strategy use

[3] In the analyses presented here, L2 status refers to reported first language. We also examined these analyses using primary home language as our measure of L2 status and found the same results. We therefore only discuss L2 status in terms of first language.

than their native English counterparts. Furthermore, reading proficiency predicted the use of support strategies as measured by MARSI but not global or problem-solving strategies. This effect suggests that those with less proficiency report using more support strategies and vice versa.

Table 6
Results of Regression and Bayes' Factor Analyses

Outcome Variable	Main Effect	β	*t*-value	*p*-value	ΔR^2	Bayes' Factor	Hypothesis Supported
RSAT Elaboration	L2 Status	0.07	0.83	.41	.00	.77	Null
	Proficiency	0.54	4.60	< .01	.15	$6.8x10^6$	Alternative
RSAT Paraphrasing	L2 Status	0.18	2.12	.04	.02	.18	Mixed
	Proficiency	0.44	3.60	< .01	.17	5980	Alternative
RSAT Bridging	L2 Status	0.09	0.99	.32	.01	.28	Null
	Proficiency	0.47	3.78	< .01	.11	1237	Alternative
MARSI Global Strategy	L2 Status	-0.05	-0.50	.62	.00	.18	Null
	Proficiency	-0.14	-1.02	.31	.00	.29	Null
MARSI Support Strategy	L2 Status	-0.07	-0.76	.45	.00	.19	Null
	Proficiency	-0.24	-1.83	.07	.02	4.14	Alternative
MARSI Problem Solving	L2 Status	-0.00	-0.02	.98	.00	.18	Null
	Proficiency	0.00	0.01	.99	.02	.19	Null

With regard to situated text-processing strategy use, a slightly different picture emerges. The standardized beta-weights for RSAT paraphrasing scores suggests that L2 readers use more paraphrasing than their native English-speaking counterparts. However, the Bayes' factor actually supports the null hypothesis, albeit weakly, that there is no difference between groups. For RSAT bridging and elaboration, both traditional frequentist and Bayesian statistics supported the null hypotheses for L2 reader status. This indicates that both groups engage in similar amounts of bridging and elaboration while reading. Proficiency, however, showed a different

pattern, with both frequentist and Bayesian statistics indicating that higher proficiency results in more use of all three RSAT strategies, regardless of L2 reader status.

Discussion

The current study explored the role of L2 status and reading proficiency in self-reported strategy use and situated text processing strategy use, as measured through MARSI and RSAT, respectively. Our findings suggest that after controlling for proficiency there appears to be no differences in strategy use between native English readers and L2 English readers. Specifically, results indicated that L2 status was not a significant predictor of situated text processing strategy use (i.e., bridging, elaboration, paraphrasing). Moreover, L2 status did not predict the self-reported use of different levels of reading strategies measured using MARSI. Reading proficiency, on the other hand, was a significant predictor of situated text processing strategy use and also negatively predicted the self-reported use of support strategies (but not global or problem-solving strategies).

How do these findings help answer our primary research questions? First, do L2 readers consistently report using different (or more) strategies than non-L2 readers? Unlike Shoerey and Mokhtari (2001) who found that L2 readers reported using more support strategies than non-L2 readers, we found no difference in self-reported strategy use between L2 and non-L2 participants. We find this result somewhat curious given we used similar measurement tools in similar populations to the previous study. One important difference between the present study and that of Shoerey and Mokhtari (2001) is the use of different measures of reading proficiency. While they used a self-report measure of reading ability, the current study relied on a more objective measure of reading proficiency (SARA). Using a self-report measure of proficiency

can be problematic as self-report measures often lack validity due to participants inaccurately representing and reporting what's being measured (Cromley & Azevedo, 2006, 2011; Tourangeau & Yan, 2007; Veenman, 2011). The current results suggest that Shoerey and Mokhtari's finding that L2 readers reported using more support strategies than non-L2 readers may have more closely matched our finding that these differences were driven by proficiency, had proficiency been accounted for using a more objective measure. However, more research is needed to confirm this proposition.

Next, what can situated measures of text processing strategy use tell us about native and L2 readers? The current study contributes to the understanding of the relation between L2 reader status and strategy use by examining the use of a situated measure of text-processing strategies which are known to be important for comprehension. While the MARSI accounts for an array of reading strategies, it is a self-report measure focused on certain categories of strategy use (e.g., support). Cromley and Azevedo (2006, 2011) argue that using self-report measures requires people to infer what they generally do across all reading situations, which can be difficult to do and can lead to inaccuracies. Additionally, self-report measures may be susceptible to desirability bias (Tourangeau & Yan, 2007), wherein readers may report using any strategies that they think are "good" or important to teachers, etc. (Veenman, 2011). However, when a person is able to directly reflect on a specific reading task, it allows them to situate their responses in a given context. Here, our situated measure of reading strategy use (RSAT) did not involve self-assessment, but instead captured reader's thoughts in a specific reading context, at a specific moment, providing evidence of strategy use. Results from RSAT revealed differences between proficient and less proficient readers. Proficient readers, engaged in more paraphrasing, bridging,

and elaborating than less proficient readers, regardless of L2 status (Horiba, 1996; Karimi & Shabani, 2013; Zwaan & Brown, 1996).

Lastly, to what extent is strategy use tied to reading proficiency? The findings of the current study corroborate previous findings suggesting that awareness of strategies and proficiency tend to go hand in hand in both native and L2 populations (Ahmadi et al., 2013; Auerbach & Paxton, 1997; Alexander & Jetton, 2000; Kletzien, 1991; Pressley, 2000; Zhang & Seepho, 2013). This makes some intuitive sense in that reading strategies should enable more proficient reading and would likely be present in a proficient reader's skillset. While some have proposed that reading in a second language is distinct from reading in a native language (Bernhardt, 1991; 2003), results from the present study suggest that differences between L2 and non-L2 readers may be based primarily on proficiency, at least at the college level. That the association between reading proficiency and reading strategy use might be similar across L2 and non-L2 readers is supported by the absence of an interaction between L2 status and proficiency. Skilled readers, regardless of L2 status, seem to use more situated text processing strategies and are less reliant on support strategies. Future research should replicate the findings of the current study in other populations (e.g., 4-year institutions, K-12 populations). Additionally, the current research highlights the need for assessments of reading strategy use that are aligned with strategy use in a particular context, as mentioned above.

Previous research has, at times, explored the role of strategy use as a compensatory mechanism in L2 readers (Alsheikh & Mohktari, 2011; Anderson, 2005; Carrell et al., 1989; Chang, 2006; Jimenez et al., 1995, 1996). Results from the present study suggest that low proficiency readers, regardless of L2 status, reported using more support strategies than high proficiency readers. On one hand, this may be seen as support for the claim that less proficient

readers (but not L2 readers per se) rely on support strategies to compensate for lower-level deficiencies (e.g., decoding, vocabulary, etc.; Chang, 2006). For example, it is plausible that the use of external aids (e.g., looking up words, circling/underlining content, taking notes), as measured by MARSI, could allow less proficient readers to decrease their WM load and achieve higher levels of comprehension (Huang, Chern, & Lin, 2009; Maasum & Maarof, 2012). In line with this claim, Huang, Chern, and Li (2009) found that L2 readers often relied most on support strategies, and that such strategies contributed to better comprehension outcomes. On the other hand, there is evidence that suggests that using support strategies alone/in isolation may negatively impact comprehension. For example, rehearsal strategies such as underlining and highlighting are thought to keep readers focused on surface-level features and individual concepts, thus preventing readers from connecting discourse concepts and creating a deeper understanding of the text (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013; Upton, 1997). Thus, it is plausible that the readers in this study were less proficient, in part, because of their reliance on certain support strategies. The specific role of support strategies and whether or not they serve as compensatory mechanisms in low proficiency readers should be further explored in future research.

One potential limitation to the current study is that we had limited information about our L2 readers beyond self-reported L2 status and primary home language. Information about participants' L1/L2 reading habits, L1 reading ability, and age of acquisition were not collected in the present study but should be considered in future research as they may allow for a more in depth investigation of the issues raised here (see Guo, 2018). Given this paucity of background information, we are cautious in drawing strong conclusions about our population in comparison to those in prior studies. However, as mentioned previously, some research has used self-report

measures of proficiency (Alhaqbani & Raizi, 2012; Iwai, 2009; Shoerey & Mokhtari, 2001) or ignored proficiency all together (Ghahari & Basanjideh, 2017). Thus, although the current study is not definitive, it does suggest that an objective measure of reading proficiency may be critical in understanding the relationship between strategy use and L2 reader status.

Despite this limitation, these results may have important implications for L2 research. First, as mentioned above, this study emphasizes the need for well-developed, objective measures of proficiency when studying reading strategy use. Second, this study is the first that we know of to use automated measures of reading strategy use. While think-aloud measures are widely used, they can be time and labor intensive to code and are subject to interpretation and bias (e.g., McNamara et al., 2007). With the development of natural language processing tools like RSAT, researchers may more easily apply and analyze think-aloud measures in reading strategy research. We view this research as a first step toward demonstrating the value of such tools. Moreover, this research suggests that there is an added value to measuring situated text processing strategy use, as delineated by theories of discourse comprehension (McNamara & Magliano, 2009). Here, specific theory-driven, coherence building processes were examined while readers engaged with the text. This allowed for measures of reading strategies that were grounded both in theory and within a given reading context (Cromley & Azevedo, 2006; McNamara & Magliano, 2009).

An additional implication of this research arises when considering academic policies surrounding admission and placement criteria. There has historically been a widespread belief that L2 learners need be treated as a special, “at risk” population of students (Applebee, Langer, Mullis, 1987; Mokhtari & Reichard, 2004; Mullis, Campbell & Farstrup, 1993). This has at times lead researchers to look for deficits in L2s, rather than similarities between L2 and native

populations (Jimenez et al., 1995; Mokhtari & Reichard, 2004). In the current study, L2 status was not a good predictor of either self-reported strategy use or situated text processing strategy use measured. What does this mean in terms of L2 practices and instruction? Placement processes that determine whether or not L2 readers are required to take developmental courses vary across colleges (Bunch & Endris, 2012; Maloy, 2016). While many colleges rely strictly on placement test scores, other programs require that L2 learners take remedial courses, irrespective of their proficiency levels (Bostian, 2017; Maloy, 2016; Mokhtari & Reichard, 2004). For example, students may be placed in remedial courses based on questions about their language background, or the country in which they attended high school (Maloy, 2016). Thus, native and L2 learners are often divided into separate reading and writing courses at the college level (Di Gennaro, 2008; Maloy, 2016). While the implications of this are understudied, some researchers argue that required remedial courses place already disadvantaged students in a more precarious position, in terms of college success (Attewell, Lavin, Domina, & Levey, 2006; Bostian, 2017; Harklau, 2000). Here, we present findings suggesting that reading proficiency is more predictive of readers' use of reading strategies that support comprehension than L2 status. As such, these results suggest that proficiency assessments may be a better indicator of L2 students' need for remedial reading courses in order to succeed in college.

While the importance of fostering an awareness and use of reading strategies should not be discounted (Plonsky, 2011), the current study suggests that a continued emphasis on foundational skills (e.g., word recognition, vocabulary, morphology) may benefit L2 college readers with low proficiency. Allowing these readers to improve aspects of their L2 proficiency will free up mental resources and enable readers to use both local and global strategies (Chang, 2006; Karimi, 2018). Until a reader becomes more proficient, the strategies and skills taught in

many reading courses may lay idle (e.g., Chang, 2006; Cummins, 1979; Guo, 2018; Tsai, Ernst, & Talley, 2010).

Previous research suggests that a certain level of proficiency is required for L1 reading skill to transfer to L2 reading contexts (i.e., the "linguistic threshold hypothesis"; Clarke, 1979; Cummins, 1979; Yamashita, 2002). In the present study we did not have information on L1 proficiency for our L2 readers and we are, therefore, unable to comment on the transfer of L1 skills to L2 contexts. Our results do, however, emphasize the importance of L2 reading proficiency, inferencing, and metacognitive awareness in L2 reading comprehension. Similarly, while researchers have explored the idea of linguistic transfer based on linguistic similarity (i.e., linguistic distance; Chiswick & Miller, 2005), the current sample was too diverse to achieve sufficient power for examining linguistic distance (see Table 1). Future research may consider measures of L1 proficiency and linguistic distance in addition to the measures used here.

Given the influx of L2 readers in post-secondary institutions (Witherell & Clayton, 2014), the current study offers information to researchers and educators alike by providing a better understanding of where and under what circumstances L2 readers struggle. Our findings suggest that after controlling for proficiency there appears to be no differences in strategy use between native English readers and L2 English readers. Future research should carefully measure reading proficiency when examining strategy use and should seek to consider motivational and cultural factors that may influence reading in post-secondary settings.

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Appendix

Example RSAT Text with Responses and Scores. Bolded words in example responses are counted toward a bridging score, italicized words are counted toward an elaboration score, and underlined words are counted toward a paraphrasing score.

Sentence Number	Text	Example Responses	Bridging Score	Elaboration Score	Paraphrasing Score
1.	NEW PARAGRAPH				
2.	Louis XVI, the King of France at the time of the French Revolution, is considered by many historians to be a victim of circumstance.				
3.	On Louis's accession, France was impoverished and burdened with debts, and heavy taxation had resulted in widespread misery among the French people.				
4.	Immediately after he was crowned, Louis repealed some of the most oppressive taxes and instituted financial and judicial reforms.				
Prompt 1	**What are you thinking now?**	**France** was *left* all of these **debts** and *expenses*, and Louis **XVI** had to *take care* of most of them. (L2)	3	4	1
		He *sounds* like he was off to a *good start*. He *probably made Parliament angry*. (Non-L2)	0	7	0
5.	Greater reforms were prevented, however, by the opposition of the upper classes and the court.				
6.	Eventually, Louis had to replace a minister, who was the central architect of the reforms that the majority of the French people needed so badly.				

		Louis had to *make multiple* reforms and replace people. (L2)	0	2	4
Prompt 2	**What are you thinking now?**	Louis *probably* did not *enjoy* doing that. (Non-L2)	0	2	1
7.	NEW PARAGRAPH.				
8.	Louis granted financial aid to the American colonies that were revolting against Great Britain in the New World.				
9.	Consequently, Louis had to increase taxes of both the French nobility and the general population. At the same time, the public became angered by the lavish spending of the French nobility and the royal court.				
10.	NEW PARAGRAPH.				
11.	Louis was unsuccessful in generating the badly needed funds.				
		King Louis *wasn't* a very *successful* man. (L2)	1	2	1
Prompt 3	**What are you thinking now?**	Why would he *give money* to the **American colonies**, *understanding* that his **people** and his **court** were *unhappy*? What a *careless decision*. (Non-L2)	4	6	0
12.	The French finance minister had to continue borrowing money until the limit was reached in 1786.				
13.	NEW PARAGRAPH.				
14.	The French government was in danger of going bankrupt.				

		The French had to *keep* **borrowing money**, and were on the *rink* [*sic*] of bankruptcy. (L2)	2	2	2
Prompt 4	**What are you thinking now?**	It is their *own fault*. They should have **spent** their **money** more *wisely*. (Non-L2)	2	3	0
15.	In 1788, Louis was forced to call for a meeting of the representative governmental body, called the Estates-General; it was the first gathering of that assembly in 175 years.				
16.	Once in session, the Estates-General assumed the powers of government.				
17.	On July 14, 1789, the Parisian populace razed the Bastille, and a short time later imprisoned the King and royal family in the palace of the Tuileries.				
		Unfair punishment was *handed* out. (L2)	0	3	0
Prompt 5	**What are you thinking now?**	It is *sad* for them, but I have no *real sympathy* for the *wealthy*. *Anarchy* and **revolution** is *necessary* sometimes. (Non-L2)	1	6	0
18.	Louis swore obedience to the new French Constitution in 1791, but secretly continued to work against the revolution and plot intrigues with France's enemies.				
19.	In 1792, when the National Convention (the assembly of elected French deputies) declared France a republic, the King was tried as a traitor and condemned to death.				

20.	NEW PARAGRAPH.				
21.	Historians consider Louis XVI a victim of circumstance rather than a despot resembling the former French Kings Louis XIV and Louis XV.				
		Louis XVI was a victim of circumstance. (L2)	0	0	4
Prompt 6	**What are you thinking now?**	I do not *think* that he *deserved* to *die,* but then again it is hard to *say*. (Non-L2)	0	4	0
22.	He was a weak and incompetent king, and was not known for his intelligence.				
23.	He preferred to spend his time at hobbies, such as hunting and making locks, rather than at his duties of state.				