Title of Project:
The Role of Content Word Overlap in Second Language Reading

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Final Report

Motivation for the Research

This research aims to define the role that cohesion plays in the readability of a text for second language (L2) learners. Reading is a critical skill for L2 language development, and yet it is one of the most difficult skills to assess. Unlike writing or speaking, where learner errors can be observed, coded, and corrected, reading proficiency must be measured through indirect means.

To assess L2 reading proficiency accurately, the practitioner must first determine the difficulty of the reading passage. However, to date, there is little consensus in how best to measure the difficulty, or readability, of a text. Popular readability tools, such as Flesch-Kincaid Grade Level Index (FKGL; Kincaid, Fishburne, Rogers, & Chissom, 1975), often only measure surface features of the text, such as the number of letters per word and words per sentence. While such formulas have been found to be sufficient in identifying readability for native speakers, they may not capture all of the features of a text that L2 readers rely on for comprehension. A more comprehensive formula, such as Coh-Metrix (Graesser, McNamara, Louwerse, & Cai, 2004), which includes cohesion, may be more reliable in predicting readability for L2 learners

This dissertation utilizes novel methodology to evaluate the interplay of lexical, syntactic, and discourse features of texts used in reading assessments in order to more accurately and effectively assess reading comprehension. Specifically, the role of cohesion is measured in this dissertation as content word overlap, or the number of times a key word is repeated throughout the text following Crossley, Dufty, McCarthy, and McNamara (2007).

Research Questions
- RQ 1: Do readability tools analyzing cohesion predict L2 learner comprehension across proficiency levels better than traditional readability formulas, as assessed by non-cloze tests?
- RQ 2: Does cohesion affect discourse-level text processing by L2 readers?
- RQ 3: Do the effects of cohesion vary based on proficiency of the reader?

Research Methodology

To get a complete picture of the reading processes involved, this study used two experiments to assess reading comprehension: (1) an off-line assessment measuring overall reading comprehension and (2) an on-line assessment tracking eye movement to evaluate processing time in reading.

Experiment 1 broadly explores the role of cohesion in L2 reading by comparing student comprehension scores on a university reading exam with the readability scores of the texts used in the exam. An intensive English program offers a series of three reading comprehension exams for each proficiency level to determine if students are ready to progress to the next level. For each of the five proficiency levels, three exams were used in this study, and results were analyzed within levels. The comprehension scores of students (N=589) from a period of several years were averaged to see if any of the three exams at a particular level (e.g. exam 3A, 3B, or 3C) resulted in abnormal average comprehension scores, indicating the relative difficulty or ease of a given exam. The reading passages for these exams were then analyzed by two readability tools: (1) Coh-Metrix, which measures cohesion, lexical, and syntactic difficulties and (2) FKGL, which measures only lexical and syntactic difficulties. This experiment is among the first to utilize these two reading tools in a non-cloze test assessment with participants of varying proficiencies and first languages (L1s).

Experiment 2 examined cohesion directly with carefully controlled passages written by the investigator and eye-tracking measurements to provide a real-time processing picture of the L2 reader and text difficulty. Participants (N=98), including both L1 as well as beginning and advanced L2 learners, read 48 paragraphs that varied in the amount of cohesion: no cohesion, moderate cohesion, and significant cohesion. Passages were controlled for syntactic difficulty and included the three experimental cohesion conditions interacting with two levels of lexical difficulty. Cohesion was presented as content word overlap, following Crossley et al. (2007). The position of the target word was kept constant across all experimental conditions, and gaze duration of the target word was collected (Rayner & Morris, 1990). This study contributes to the literature as most L2 eye-tracking studies only analyze single sentences, thus eliminating the possibility to study the effects of cohesion and other discourse-level processes.

Summary of Findings

The results of Experiment 1 found that five (out of 15) reading comprehension exams had statistically different averages of comprehension score when compared with other exams at the same level, indicating that these tests were relatively easier or more difficult. All exam questions had been tested for validity and reliability, meaning that the score discrepancies could not be explained by faulty test items. Thus, the readability of the passages was evaluated.

Coh-Metrix readability scores successfully predicted the abnormal exam performance, whereas FKGL readability scores did not. For example, test 3C had an average comprehension score of 56% as compared with test 3B's average score of 72%, a statistically significant difference. In line with these comprehension results, Coh-Metrix's readability score indicated that text 3C was more difficult than text 3B; FKGL indicated no significant difference in readability. These findings were repeated for all of the exams that had significantly higher/lower average comprehension, and overall, the Coh-Metrix readability formula was found to be consistently reliable, whereas FKGL was not. For additional confirmation, exams that were not found to have different comprehension scores found no readability differences according to Coh-Metrix; however, FKGL predicted several exams of these to be more difficult, but this was not confirmed by student performance. These findings were consistent at all levels of proficiency and were not dependent on students' L1. Thus, the results indicate that Coh-Metrix, which includes cohesion alongside word frequency and syntactic difficulty in its measurement, is more reliable than FKGL, which does not consider cohesion.

Experiment 2 measured real-time reading processing and found that presence of cohesion in a short passage facilitated L2 processing but not L1 processing. For both the advanced and the beginner L2 groups, significantly longer gaze duration times on the target word were found when no cohesion was present in the passage as compared to when there was significant cohesion throughout the passage, indicating more difficulty processing the target word without cohesion. Thus, the presence of cohesion facilitated the early processing of the target word for L2 readers and highlighted a difference in processing between L1 and L2 readers.

These findings are important to understanding L2 reading as the main effect for overlap was found in passages regardless of the lexical difficulty in the passage. Thus, passages with beginner level vocabulary were as affected as those with advanced vocabulary by the absence of cohesion. The target words were always high-frequency words and would be recognizable by beginning L2 learners and did not affect the findings. The main effect of overlap demonstrates that the early processing of the target word was sensitive to the amount of overlap in the surrounding context. The presence of overlap therefore facilitates processing, regardless of how difficult the surrounding text is, and speeds the early processing of the target word.

This finding supports the early conclusion of Coady (1979) that low-level readers may rely on contextual information to scaffold their limited lexical and syntactic processing. Since reading requires multiple steps, all demanding resources from a central processor, if certain steps of the reading process can be accomplished with fewer resources, this frees additional processing capacity for other aspects of reading. The presence of cohesion facilitates the processing of text such that the reader is able to use more resources for word recognition. Another possible explanation is that the presence of overlap also increases the activation for the target words; if the reader has seen these words multiple times in the text already, it is more easily accessed (Plummer, Perea, & Rayner, 2014).

Implications

The results of both experiments indicate that cohesion plays a role in the immediate processing of words by L2 readers as well as in overall reading comprehension. Therefore, when designing assessments intended to measure L2 reading comprehension, it is essential that the amount of cohesion present in the text be considered when determining text readability. It is important to note that these results do not diminish the effects that lexical and syntactic complexity have on readability but instead argue that a formula which factors content word overlap in addition to lexical and syntactic complexity is more effective than one which ignores cohesive factors. These three measures are significant as they pertain to the psycholinguistic model of reading through word recognition, sentence parsing, and integrating information into the discourse model, and therefore, all three should be considered when determining text difficulty.

Classroom materials' developers should also give careful consideration to cohesion. Because there are a number of other factors that affect reading comprehension, such as background knowledge, motivation, setting, it is imperative that the text of a reading itself be as free from unintended difficulty as possible so that L2 students are receiving material that is designed for their current level of English.

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