

Informing ICALL Reading System Design by Linking Text Complexity and Learner Proficiency with Textual Feature Vector Distance

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Reading texts of appropriate difficulty levels to L2 learners' proficiency levels provides them with comprehensible input (Krashen, 1985) that helps promote their L2 proficiencies, enables them to practice being competent readers, and motivates them to read more (Milone and Biemiller, 2014). However, whether a reading text is appropriate to an individual reader is a rather subjective issue, because reading comprehension is affected not only by the complexity of the text, but also by a number of reader-related factors such as the purpose of reading, the reader's ability, prior knowledge, and interests (Lexile, 2007). As a result, a challenge that foreign language teachers usually face is how to choose suitable reading materials for learners of different L2 proficiency levels.

One solution to this problem is to assess the readability of a text either qualitatively (Pearson and Hiebert, 2014) or quantitatively (Benjamin, 2012; Collins-Thompson, 2014; Zakaluk and Samuels, 1988) before it is assigned to students. Most research opts for the quantitative approach because it is considered more objective and easier to automatize with Natural Language Processing (NLP) technologies. However, one serious drawback with previous research on text readability is that it overlooks the interaction between the reader and the text (Kintsch and Vipond, 1979).

Cunningham and Mesmer (2014) proposed a Theoretical Model of Text Complexity that distinguished *text complexity* from *text difficulty*. While the former refers to the word-, syntactic- and discoursal-level features of a text, the latter considers the readers' performance on certain tasks based on the text. However, there has been little research on how the two concepts can be linked so as to inform the design of ICALL systems that are capable of choosing texts of appropriate reading levels for individual learners.

The present study proposes using Euclidean distance of textual feature vectors for linking text complexity and learner proficiency. It is hypothesized that the same set of textual features can be used to unify the reading input and the learner production into the same vector space so that it would be possible to decide whether a reading text is at an appropriate level for learners of specific proficiency levels. Following Vajjala and

Meurers’s (2012) feature schemes for text complexity, 102 lexical and syntactic features were extracted from and used as representational vectors of each text from a 5-level authentic reading corpus from Newsela¹ and a 2-level L2 writing corpus (Wang and Wang, 2015). It was found that the Euclidean vector distances are positively correlated with reading level differences with authentic reading texts, i.e., greater level differences result in greater vector distance and vice versa (ANOVA $F(3, 296) = 403.1, p < .001$; Post hoc TukeyHSD test $p < .001$). Similarly, the vector distance between the higher-level writings and an authentic reading input to solicit the writings is shorter than that between the lower-level writings and the input (Paired sample T-test: $t = 3.35, df = 47, p \leq .001$).

These results validated the proposed method which forms the basis for designing ICALL systems for reading text selection based on individual learner’s L2 proficiency.

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