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Investigating the roles of vocabulary knowledge and word recognition speed in Chinese language listening

Abstract: This study examines the roles of vocabulary knowledge and word recognition speed in Chinese listening proficiency. A standardized listening proficiency test and a self-designed vocabulary knowledge test were used to measure participants' listening proficiency and vocabulary knowledge respectively. The gating method was used to examine participants' word recognition speed. The result shows a high correlation between vocabulary knowledge and listening proficiency and a high medium correlation between word recognition speed and listening proficiency. In terms of the contributions of vocabulary knowledge and word recognition speed to listening proficiency, the result shows that vocabulary knowledge contributes to 77.1% of listening proficiency and is a stronger predictor of listening proficiency. In contrast, word recognition speed does not contribute over or beyond vocabulary knowledge to listening proficiency.

Keywords: vocabulary knowledge, word recognition speed, listening, Chinese, gating

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1 Introduction

Vocabulary is believed to play an important role in second language (L2) acquisition as it affects the acquisition of other linguistic structures and is basic to comprehending the language. According to the Lexical Learning Hypothesis, "Vocabulary knowledge is indispensable to acquire grammar" (Malvern et al. 2008: 270) and acquiring vocabulary is the major task of language learning. The perceived importance of vocabulary has led some researchers to argue that vocabulary is "the heart of language comprehension and use"

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(Hunt and Beglar 2005: 24) and that developing a large vocabulary is a very important priority for L2 learners (Lee and Cai 2010).

One strand of research on vocabulary focuses on the relationship between vocabulary and reading comprehension (such as Hu and Nation 2000, Laufer 1989, Laufer 1992, Laufer and Ravenhorst-Kalovski 2010, Schmitt et al. 2011). This line of research reveals that sufficient vocabulary knowledge is the prerequisite for successful reading comprehension and that there is a threshold of vocabulary knowledge below which adequate comprehension is unlikely to be achieved. Surprisingly, studies examining the association between vocabulary and listening comprehension are rare. Not much is known about the precise contribution of vocabulary to listening and how different dimensions of lexical competence affect listening. In addition, most previous studies examine vocabulary in the EFL (English as a foreign language) context, presumably for the reason that EFL learners constitute the largest population of language learners. With the rapid pace of globalization and fast development of the Chinese economy, the number of learners of Chinese as a foreign language (CFL) has increased dramatically. However, the quantity of studies on vocabulary acquisition in the CFL setting is disproportionately small compared to the quickly growing learner population and the increasingly important role that China plays in the global economy.

The present study was therefore conducted to investigate the contributions of vocabulary to Chinese L2 listening. In particular, this study focuses on vocabulary knowledge and word recognition speed. The working definition of vocabulary knowledge in this study is knowledge of meanings of 3,000 high-frequency words; word recognition speed is operationally defined as speed of accessing word meanings.

2 Literature review

2.1 Dimensions of lexical competence

Researchers generally acknowledge the complexity of lexical competence and have consequently identified its different dimensions. The primary dimension that is most examined in previous studies is breadth of vocabulary knowledge, or vocabulary size, which refers to the quantity of words for which a learner has some knowledge of meaning (Qian 1999, Staerh 2009). Depth of vocabulary knowledge constitutes another important dimension of lexical competence. It refers to "the quality of the learner's vocabulary knowledge" (Read

1993: 357) and includes such components as pronunciation, spelling, meaning, register, frequency, and morphological and syntactic properties (Qian 1999). Although breadth and depth of vocabulary knowledge are frequently identified as two complementary dimensions of vocabulary knowledge, empirical studies show that they are closely related (Akbarian 2010, Milton 2009, Qian 1999, Read 2004), and both account for variance in reading comprehension (Qian 2002).

The complexity of lexical competence is also revealed by various categorizations that capture different aspects of this competence. For instance, Meara (1996a) proposes the dimensions of size and organization (connectivity of words in one's mental lexicon), while Henriksen (1999) distinguishes three dimensions of lexical competence: a "partial-precise knowledge" dimension, a "depth of knowledge" dimension, and a "receptive-productive" dimension (vocabulary for comprehension and production).

In another study, Chapelle (1994: 164–167) presents a more comprehensive picture of vocabulary ability that incorporates three components: the context of language use, vocabulary knowledge and processes, and the metacognitive strategies required for vocabulary use in context. Chapelle's categorization includes not only declarative knowledge about discrete vocabulary items but also procedural knowledge involving the context and processes of the use of the knowledge. In her categorization, vocabulary knowledge encompasses vocabulary size, knowledge of word characteristics (which is equivalent to depth of vocabulary knowledge), and lexicon organization (the way that morphemes and words are represented and connected in the mental lexicon). Vocabulary processes refer to lexical access, which encompasses a series of sub-processes, including attending to word features, encoding phonological or orthographic information, accessing structural and semantic features, integrating the word meaning with the mental representation of the text, and parsing and composing words.

One important component of Chapelle's categorization, vocabulary processes (lexical access), is also found in other taxonomies of vocabulary knowledge under different terms. In his review of the studies on vocabulary training and reading comprehension, Mezynski (1983) proposes the "access hypothesis," which emphasizes the importance of fast access to word meanings and efficient use of word meanings in text processing. Meara (1996b, in Henriksen 1999: 313) calls attention to the dimension of automaticity – a "hidden dimension of lexical competence." In another instance, Laufer and Nation (2001: 9) use "fluency dimension" to refer to the speed of accessing knowledge of various aspects of a word. The literature shows that researchers have recognized the speed of accessing word meanings as an important dimension of lexical competence.

However, very few empirical studies have attempted to examine its role in reading or listening comprehension. One purpose of this study is to include the speed factor in the investigation of the relationship between vocabulary and listening comprehension.

2.2 Vocabulary knowledge and reading comprehension

Given the paucity of this line of research in listening comprehension, relevant studies in reading comprehension must also be considered. It should be noted that given the distinct differences between reading and listening, findings on the role of vocabulary across the two modalities may not be comparable.

A large number of studies have examined the relationship between vocabulary knowledge and L2 reading comprehension, with emphasis being placed on breadth of vocabulary knowledge. This group of studies reveals that vocabulary knowledge is correlated with reading comprehension and that knowing a large number of words is important for adequate comprehension of written texts. For instance, Laufer (1992) examined the relationship between vocabulary size and reading comprehension and found significant correlations between scores of vocabulary (less than 2,000, 3,000, 4,000, and 5,000) and scores of reading comprehension. Shiotsu and Weir (2007) investigated the contributions of breadth of vocabulary knowledge and syntactic knowledge to reading comprehension. Their study shows that both vocabulary knowledge and syntax are important predictors of reading comprehension.

The importance of breadth of vocabulary knowledge is also revealed in studies investigating the coverage of vocabulary (percentage of known words) necessary for adequate reading comprehension. For instance, Laufer (1989) found a significant difference in comprehension between learners who knew 95% or more of lexical tokens and those who knew less and argued that 95% coverage is required for adequate comprehension. In a recent study, Schmitt et al. (2011) investigated the relationship between the percentage of known vocabulary in a text and the degree of comprehension of the same text. They found a relatively linear relationship between the percentage of known vocabulary and the level of reading comprehension. These studies reveal that a prerequisite for successful comprehension is knowing a high percentage of words in a text. Larger vocabulary size results in higher lexical coverage and consequently enhances reading comprehension.

Another noticeable finding in the literature is the high interconnection between breadth and depth of vocabulary knowledge. Qian (1999) investigated the relationship between breadth and depth of vocabulary knowledge and

reading comprehension. His study reveals that breadth of vocabulary knowledge, depth of vocabulary knowledge, and reading comprehension are highly correlated. Qian argues that the results might be due to the high association between the two dimensions or the construct overlap of their measures used in the study. The results of these studies reveal the difficulty of designing instruments that can clearly differentiate breadth and depth of vocabulary knowledge. Vermeer's (2001) study shows that no conceptual distinction exists between these two dimensions and they are affected by the same factors. Zhang (2012) found that breadth and depth of vocabulary knowledge are significantly related and both correlate with reading comprehension.

In a subsequent study, Qian (2002) proposes four dimensions of vocabulary knowledge, including breadth of vocabulary knowledge, depth of vocabulary knowledge, lexical organization, and automaticity of vocabulary knowledge. Although Qian examined only breadth and depth of vocabulary knowledge in this study, he argues that the four dimensions of vocabulary knowledge are "intrinsically connected and interact closely with one another in all fundamental processes of vocabulary use and development" (Qian 2002: 516). This view is partially supported by his finding that breadth of vocabulary knowledge, depth of vocabulary knowledge, and reading comprehension are highly correlated.

Empirical studies examining the significance of speed of accessing word meaning to reading comprehension are still limited. Such negligence is surprising, as rapid and automatic word recognition is believed to be crucial to successful reading comprehension (such as Nassaji 2003). Within the limited body of research, Laufer and Nation (2001) conducted a study and examined the relationship between vocabulary size and speed of meaning recognition. Their study shows that meaning recognition speed is moderately related to vocabulary size and that increases in automaticity fall behind increases in vocabulary size. In another study, Harrington and Carey (2009) examined the use of a vocabulary test as a placement tool that includes both accuracy (vocabulary size) and response time in recognizing words. The result reveals a substantial correlation between vocabulary accuracy test and another existing placement test measuring participants' abilities in listening, writing, speaking and grammar, whereas the vocabulary response time test has a weaker association with the placement test. In another study, Harrington and Roche (2014) found that vocabulary accuracy (vocabulary size) and vocabulary response time correlated with participants' grade-point average and that the accuracy test is a more sensitive and consistent measure than the response time test. More research is clearly needed to help us better understand the relationship between speed of accessing word meanings and vocabulary size.

2.3 Vocabulary knowledge and listening comprehension

Existing research reveals various factors affecting listening comprehension, such as vocabulary knowledge (Kelly 1991), syntax (Call 1985), linguistic knowledge combined with background knowledge (Park 2004), metacognitive knowledge (Vandergrift 2006), and so on. Few empirical studies have specifically investigated the precise contribution of vocabulary to listening. Nonetheless, researchers generally acknowledge that insufficient vocabulary knowledge constitutes a key problem in L2 listening (Flowerdew and Miller 1992, Kelly 1991, Rost 1994, Vandergrift 1999, Vogley 1995). The limited body of research on vocabulary and listening also sheds some light on this issue.

Kelly (1991) collected data of auditory misperceptions from an English teacher and 38 English learners. He found that the lexical error rate was high for both the language teacher and the learners. He also observed that lexical errors caused severely distorted comprehension problems in 65.5% instances and concluded that lexical ignorance was the major cause of comprehension failure. Kelly's study shows that vocabulary knowledge is crucial to successful listening, but it does not examine the precise contribution of vocabulary knowledge to listening.

In another study, Mecartty (2000) investigated the role of lexical and grammatical knowledge in reading and listening comprehension. With respect to listening comprehension, he found that both lexical and grammatical knowledge significantly correlate with listening comprehension, but only lexical knowledge accounts for variance in listening comprehension (14%). Bonk (2000) investigated the relationship between lexical familiarity of words in four texts and comprehension of the texts. He found that learners need high lexical familiarity to achieve reasonable comprehension and that lower word familiarity is unlikely to be linked to high comprehension scores.

Staehr (2008) examined the relationship between vocabulary size and listening, reading, and writing. His study reveals a higher correlation between vocabulary size and reading than between vocabulary size and listening. Vocabulary size accounts for 72% of variance in reading compared to 39% of variance in listening. He also proposes 2,000 words as the threshold level for both reading and listening. As Staehr points out, the lower contribution of vocabulary to listening might relate to the fact that the vocabulary test measures learners' knowledge of written forms, which might underestimate the impact of vocabulary on listening. In a subsequent study, Staerh (2009) investigated the contribution of breadth and depth of vocabulary knowledge to listening comprehension. He found that both breadth and depth of vocabulary knowledge are significantly correlated with listening comprehension. Taken together, they

account for 51% of variance of listening proficiency. This study shows that vocabulary size plays a much more significant role in listening comprehension than depth of vocabulary knowledge: breadth of vocabulary knowledge alone accounts for 49% of the variance of listening proficiency, whereas depth of vocabulary knowledge only adds 2% to the variance explained by breadth of vocabulary knowledge. Staehr's study provides empirical evidence of the contribution of different dimensions of vocabulary knowledge to listening. One flaw in the experiment design of Staehr's two studies is the use of a test eliciting learners' knowledge of written forms of words instead of their spoken forms. Empirical evidence shows that learners' knowledge of written forms is not equal to their knowledge of spoken forms (Milton, Wade and Hopkins 2010, Milton and Hopkins 2006).

Milton, Wade and Hopkins (2010) investigated the relationship between vocabulary knowledge, in both orthographic and phonological forms, and overall language skill along with the four subskills of listening, speaking, reading, and writing. They found that learners' orthographic vocabulary size exceeds their phonological vocabulary size; both types of vocabulary knowledge are significantly correlated with listening and contribute to variance in listening. Phonological vocabulary accounts for 44% of the variance in listening and reaches 51% when orthographic knowledge is included in the model. In terms of the results related to reading, this study shows that orthographic knowledge explains 48% variance in reading. Milton, Wade and Hopkins (2010) distinguished between orthographic and phonological vocabulary knowledge and provided empirical evidence of their different contributions to listening. Their study shows that vocabulary knowledge in the aural form contributes more to listening than that in the written form. The contribution of phonological vocabulary knowledge to listening can be as high as the contribution of orthographic vocabulary knowledge to reading. In this study, participants' listening ability was measured by IELTS, which required participants to read questions and listen to a text for answers. The test format unavoidably confounds reading with listening, as reading skill is needed to understand the questions. Consequently, the contribution of orthographic vocabulary knowledge to listening might be overestimated and the opposite might be true for the impact of phonological vocabulary knowledge on listening.

There are some studies examining the relationship between lexical coverage and listening comprehension. Schonell et al. (1956, in Adolphs and Schmitt 2003) found that 2,000 word families provide 99% coverage of spoken discourse. In a more recent study, Adolphs and Schmitt (2003) revisited the issue and reported that 2,000 and 3,000 word families cover 95% and 96% of spoken discourse respectively. These studies suggest that vocabulary at 2,000-word and 3,000-word levels is vital for comprehending spoken texts. Expanding

vocabulary at these levels is perhaps the most important factor for listening, whereas word knowledge beyond these levels may contribute decreasingly to listening comprehension.

Studies examining the contribution of word recognition speed to L2 listening are rare. An oral text exists at a particular point in time and easily fades away, which makes listening a cognitive-resource-intensive activity. Efficient and economic use of precious cognitive resources, such as fluent access to vocabulary knowledge, is crucial to successful listening. Theories of working memory capacity (e.g. Just and Carpenter 1992) also provide a basis for examining the speed aspect to explain variance in listening ability.

To sum up, existing studies show that vocabulary is crucial to successful listening. However, the precise contribution of vocabulary knowledge to listening is inconclusive as research in this area is insufficient and flaws of the limited number of studies restrict the generalizability of their findings. Not much is known about the relationship between word recognition speed and listening. The current study was therefore conducted to examine the significance of vocabulary knowledge and word recognition speed to listening.

3 Research design

3.1 Research questions

The present study addresses the following research questions:

1) Are there correlations among vocabulary knowledge, word recognition speed, and L2 listening proficiency?
2) What are the contributions of vocabulary knowledge and word recognition speed to L2 listening proficiency?

3.2 Participants

Twenty-two students enrolled in Chinese courses at high-intermediate or advanced levels at a university in Canada participated in the study. Students taking these two levels of courses have completed 234 or 312 hours of classroom study respectively or have reached the same levels determined by a placement test. High-intermediate and advanced level courses presuppose a mastery of 800-word or 1,300-word bases respectively, which are included in

the lower-level curriculum implemented at the university where this study was conducted.

One student worked through the experimental procedure on a pilot basis as a check on the feasibility of the design. These data were not included in the analysis. As one student did not complete the word recognition speed task, data provided by him were discarded. Therefore 20 (four male and 16 female) participants provided valid data for statistical analysis.

3.3 Materials

Three tests were used to examine participants' listening proficiency, vocabulary knowledge, and word recognition speed.

The listening proficiency test. Given the proficiency level of the participants, the listening section of a sample Chinese Proficiency Test (HSK) at the basic level was used to measure participants' listening proficiency.[1] HSK, which is often nicknamed the "Chinese TOEFL," is China's only standardized Chinese proficiency test for CFL learners.

The listening section of the HSK test at the basic level consists of three parts. The first part includes individual sentences for which test-takers need to choose a picture that matches the meaning of the sentence they hear. The second part includes one-sentence questions and requires test-takers to choose an appropriate answer to the question from four options. The third part includes conversations. After listening to a conversation, test-takers are required to choose an answer to the question based on the contents of the conversations. The listening test comprises 50 multiple-choice items, with each item worth two points.[2]

Vocabulary knowledge test. The vocabulary knowledge test was specifically developed for the current study by the author. Words included in the test were

1 An older version of the HSK test was used in this study as its current version was not available at the time of data collection. Before the older version of HSK was officially launched, test designers had examined its reliability in 1985, 1986 and 1987. The result showed high reliability of the three tests (0.949, 0.964 and 0.97) (Sun 2007). Similar findings have been obtained in more recent research (Xie 1998, Nie 2006). Studies have also been conducted to examine its validity. For instance, Wang (2006) examined the criterion validity of the test and found that it had relatively reliable criterion validity.

2 It should be noted that the listening test used in this study cannot rule out the reading component as it requires participants to read answers and make a selection accordingly. Ideally, the test items for the purpose of the current study only involves the use of the listening ability. Given the lack of such a standardized Chinese proficiency test, the use of such a test is not possible.

selected from the *Syllabus of Graded Words and Characters for Chinese Proficiency* (2001). The syllabus includes 8,822 words and samples 1,000-, 3,000-, 5,000-, and 8,000- word frequency ranges. Corresponding to the four ranges, words are divided into four levels, with Level 1 representing the highest-frequency words and Level 4 the lowest-frequency words. The four levels include 1,033, 2,018, 2,202, and 3,569 words respectively.

Given the proficiency levels of the participants, words from the first two levels were used in the vocabulary knowledge test. In designing the test, the first step taken was to select every tenth word from these two levels of words. As Chinese contains a large number of homophones (monosyllabic words in particular), a pilot study was conducted to tease out these words. In the pilot test, homophones were selected and read to five native speakers of Mandarin. After listening to a word, they were asked to report its meaning in English or Chinese. Words which were given a homophone meaning by any of the five Mandarin native speakers were removed from the vocabulary list. This resulted in a list of 103 words at Level 1 and 201 words at Level 2.

A native speaker of Mandarin recorded the words. After the first participant completed all the tasks used in this study, it was found that the three tests taken together were too long and caused a fatigue problem. To reduce the length of the experiment, the vocabulary knowledge test was further revised by selecting every other word on the list. The final version of the vocabulary knowledge test included 51 words at Level 1 and 99 words at Level 2. In the experiment, the participants listened to the words in isolation. After they heard a word, they were asked to write its meaning in English.

Participants' answers were scored based on a 0–3 scale (Nagy et al. 1985, in Read 2000): an incorrect meaning was given a score of 0; a distant partial meaning was credited with 1; a very close partial meaning was awarded 2; and the correct meaning was given a score of 3. The use of this marking scheme meant that the vocabulary knowledge test measured not only the number of words participants knew but also the degree of their knowledge of the words. Qian (1999: 284) recognizes "meaning" as one component of depth of vocabulary knowledge, which includes denotative meaning, connotative meaning, polysemy, antonymy, synonymy, and so on. In light of Qian's framework of depth of vocabulary knowledge, the vocabulary knowledge test used in this study measured participants' breadth of vocabulary knowledge and some aspects of depth of vocabulary knowledge.

The rationales for the design of the vocabulary knowledge test are as follows. Firstly, there is a lack of existing well-validated and widely acknowledged vocabulary breadth and depth tests in Chinese. Secondly, previous research reveals the difficulty in designing tests that differentiate breadth and

depth of vocabulary knowledge. A preliminary step in examining the role of vocabulary knowledge in Chinese L2 listening is perhaps to include both dimensions in the test. Thirdly, the vocabulary knowledge test reflects the notion that vocabulary is not an "all-or-nothing phenomenon" (Laufer 1998: 256) and recognizes Henriksen's (1999) "partial-precise" dimension of vocabulary knowledge.

Word recognition speed test. The target words included nine nouns and eleven adjectives. These are high-frequency words and are taught in the beginning-level Chinese courses at the participants' university. All the target words occurred at the end of semantically neutral sentences (which do not suggest the meaning of the target words).[3]

The gating paradigm (Grosjean 1980 and Grosjean 1985) was used to measure word recognition speed. In the traditional gating paradigm, participants listen to portions of a word, one portion each time in increasing length, until the whole word is heard. After participants hear each portion, they are required to identify the word on the basis of the information received thus far.[4]

In this study, the first gate contained the preceding sentence context and the first 80 millisecond (msec) of the target word. The second gate contained the first gate plus the following 40 msec of the target word, and so on until the last gate when the whole word was unfolded. The sentences were read by a native speaker of Mandarin and gated by a technical specialist. After listening to the recording at each gate, the participants were asked to write down the last word of the sentence in Chinese characters or pinyin and in English. The point at which the participants correctly identified the target word, without any change in their responses thereafter, was taken as the time when they recognized the word.

3.4 Procedure

The author trained an assistant to collect the data. Each time the assistant met with a group of participants that varied in size from one to four people. The assistant first outlined the tasks the participants were expected to complete.

3 Nouns and adjectives are used in the test as they are "full words" which carry actual meanings. In addition, they can occur at the end of a sentence, which is required by the gating paradigm used in this study.

4 Grosjean (1980: 268) used "isolation point" to refer to "the amount of acoustic-phonetic Information needed from the onset of the word to the point at which it is isolated from other words". The time measured in this study is the time needed to get to the isolation point. It should be noted that at this point the identification of both form and meaning may take place. The task requirement used in this study that participants write down the word in both Chinese characters or pinyin and in English means that word meaning should be identified as well.

Each session started with the listening test. Given the length of the vocabulary knowledge test and word recognition speed test, each test was split into two halves. After the participants finished the listening test, they completed the first half of the vocabulary knowledge test and then proceeded with the first half of the word recognition speed test. This was followed by the second half of the vocabulary knowledge test and the word recognition test. As human subjects were involved in the study, ethics approval was obtained from the university where the study was conducted. Participants were asked to sign a consent form informing them of the purpose of the study, the tasks they were expected to perform, the type of personal information to be collected, risks and benefits for participation, how the collected information was dealt with, and their right to withdraw from the study. Precautions were taken to avoid unintended release of the raw data.

4 Results

4.1 Are there correlations among vocabulary knowledge, word recognition speed, and L2 listening proficiency?

Pearson product moment correlation was used to start examining the relationship among vocabulary knowledge, word recognition speed, and listening proficiency. The result is reported in Table 1.

Table 1 shows a high positive correlation between vocabulary knowledge and listening proficiency ($r = 0.878$, $n = 20$, $p < 0.001$). The data also show a negative high medium correlation between word recognition speed and listening proficiency ($r = -0.514$, $n = 20$, $p = 0.020$). The negative correlation between word recognition speed and listening proficiency means that participants who spent more time recognizing words performed less well in the listening proficiency test. The result also reveals that word recognition speed is more correlated with vocabulary size than with listening proficiency ($r = -0.611$, $n = 20$, $p = 0.004$). Vocabulary size and word recognition speed overlap by 37%.

4.2 What are the contributions of vocabulary knowledge and word recognition speed to L2 listening proficiency?

We ran a stepwise regression analysis using listening proficiency as the criterion and vocabulary knowledge and word recognition speed as predictors. The stepwise

Table 1: Pearson correlation among vocabulary knowledge, word recognition speed and listening proficiency.

		Proficiency	Vocabulary size	Word recognition speed
Proficiency	Correlation	1	**0.878**	**−0.514**
	Sig. (2-tailed)		<0.001**	0.020*
	N	20	20	20
Vocabulary size	Correlation	0.878	1	**−0.611**
	Sig. (2-tailed)	<0.001**		0.004**
	N	20	20	20
Word Recognition speed	Correlation	−0.514	−0.611	1
	Sig. (2-tailed)	0.020*	0.004**	
	N	20	20	20

*significant at alpha = 0.05 level; **significant at alpha = 0.01 level.

Table 2: Coefficient statistics of vocabulary knowledge and listening proficiency

Model		Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.
		B	Std. Error	Beta		
1	(Constant)	25.879	5.801		4.461	<0.001**
	Word	0.189	0.024	0.878	7.791	<0.001**

**significant at alpha = 0.01 level.

regression shows that the best predictor of listening proficiency is vocabulary knowledge. The *R* square is 0.771, meaning that vocabulary knowledge contributes to 77.1% of listening proficiency. The regression model is significant (F (1,18) = 60.706, $p < 0.001$). Regression coefficients are reported in Table 2.

Data in Table 2 show that vocabulary knowledge (Beta = 0.878, $p < 0.001$) contributes to listening proficiency significantly, but word recognition speed does not contribute over or beyond vocabulary knowledge to listening proficiency, although the correlation between word recognition speed and listening proficiency is in the higher medium area, as shown in Table 1.

We ran another separate forced entry regression model to see how word recognition speed predicts listening proficiency. The *R* square is 0.264, meaning that word recognition speed contributes to 26.4% of listening proficiency (F (1,18) = 6.468, $p = 0.02$).

5 Discussion

The result of this study shows that both vocabulary knowledge and word recognition speed are correlated with listening proficiency. A high positive correlation is found between vocabulary knowledge and listening proficiency, indicating that more vocabulary knowledge relates to better listening performance. The negative high medium correlation found between word recognition speed and listening proficiency reveals that faster access to word meanings correlates with higher listening proficiency. The observation that vocabulary knowledge and word recognition speed are not equally correlated with listening provides an empirical rationale for identifying and examining the different dimensions of lexical competence. The finding that word recognition speed correlates with listening proficiency lends support to Mezynski's (1983) "access hypothesis," which highlights the importance of fast access to word meanings. It validates the inclusion of "vocabulary processes" (Chapelle 1994), "fluency dimension" (Laufer and Nation 2001), or automaticity of vocabulary knowledge (Qian 2002) in the categorization of lexical competence.

The result that vocabulary knowledge is highly correlated with listening proficiency confirms that of previous studies on vocabulary and listening comprehension (such as Mecartty 2000, Milton, Wade and Hopkins 2010, Staerh 2009). It is also consistent with findings with regards to the relationship between vocabulary and reading comprehension (such as Laufer 1992, Zhang 2012, Zhang and Annual 2008). The studies conducted thus far consistently show that knowing sufficient words is necessary to achieve adequate comprehension of both written and spoken texts.

In terms of the significance of vocabulary knowledge and word recognition speed to listening proficiency, this study shows that their contributions are not equivalent. Vocabulary knowledge contributes more to listening proficiency than word recognition speed does (77.1% versus 26.4%). Vocabulary knowledge and listening proficiency are so highly correlated that they almost measure the same construct. These findings suggest that deficiency in vocabulary knowledge may cause comprehension breakdown (Kelly 1991) and lend support to the Lexical Learning Hypothesis, which emphasizes the central role that vocabulary plays in L2 comprehension.

A comparison between this study and those conducted by Staehr (2008) and Milton, Wade and Hopkins (2010) shows that the contribution of vocabulary knowledge to listening can be as high as or even higher than that for reading. However, the contribution of vocabulary knowledge to listening observed in this

study (77.1%) seems to be higher than that found by Staehr (39%) and Milton et al. (44%). In Staehr's study, the vocabulary knowledge test measured learners' knowledge of words in written forms that could potentially underestimate the contribution of vocabulary knowledge to listening. A plausible reason for the discrepancy between this study and Milton, Wade and Hopkins (2010) might relate to the frequency levels of the vocabulary examined in the studies: vocabulary knowledge test used in Milton, Wade and Hopkins (2010) examined learners' knowledge of 5,000 words, whereas this study evaluated learners' knowledge of 3,000 words. Perhaps vocabulary knowledge within the 3,000-word level or lower makes more contribution to listening than vocabulary knowledge beyond the 3,000-word level does. This finding seems to substantiate the results of Schonell et al. (1956, in Adolphs and Schmitt 2003), and Staehr (2008), which show that higher-frequency words (the first 2,000 or 3,000) are crucial for listening comprehension.

Another interesting finding of this study is that word recognition speed does not contribute over or beyond vocabulary knowledge to listening proficiency. It echoes Mezynski's (1983: 276) view that "automaticity without breadth of knowledge may fail to aid comprehension." The observation that word recognition speed does not make a separate contribution to listening proficiency means that variance in listening explained by word recognition speed is already accounted for by vocabulary knowledge. This result is surprising, as word processing speed is expected to make a unique contribution to listening given the transient nature of sound signals and the limitation of working memory capacity. It should be noted that the observation that vocabulary knowledge overshadows word recognition speed does not mean that word recognition speed is not important. As the result shows, word recognition speed correlates significantly with listening proficiency. Taken individually, word recognition speed is also a significant predictor of listening proficiency and explains 26.4% of the variance in listening proficiency.

In this study, we have found that word recognition speed is more correlated to vocabulary knowledge than to listening proficiency. The high interconnection of the two dimensions corroborates Qian's (2002) view on the close interaction of different dimensions of lexical competence in the use and development of vocabulary knowledge. The result confirms Laufer and Nation's (2001) finding that meaning recognition speed is correlated with vocabulary size. Results of this study seem to suggest that expansion of vocabulary knowledge might also mean acceleration of word recognition speed. The likelihood that an L2 learner possesses superior ability in recognizing words (in terms of speed) but has very limited vocabulary knowledge is low.

6 Pedagogical implications and conclusions

The present study investigates the significance of vocabulary knowledge and word recognition speed to Chinese listening. Some pedagogical implications can be drawn from this study. The results show that vocabulary knowledge and listening proficiency are highly correlated and that vocabulary knowledge is a stronger predictor of listening proficiency than is word recognition speed. Teachers should therefore make students fully aware of the benefit of expanding their vocabulary knowledge in order to improve their listening performance. For beginning learners, specific attention should be paid to learning high-frequency words. Instructors can teach students deliberate word retention techniques and vocabulary learning strategies, such as conducting morphological analysis, using cognates, creating mental images, building connections between new words and known words. To gain familiarity with the spoken form of a word, learners can listen to its sound and learn to pronounce the word correctly. One exercise that helps reinforce the learning of the spoken form of a word is dictation. Learners can also record their own pronunciation, playback and compare their delivery with native pronunciation. It is important to provide learners opportunities to listen to the words in connected speech. Instructors can develop audio texts containing target words, play recordings of the texts in class, and then ask learners to speak the target words.

The results of this study show that both vocabulary knowledge and word recognition speed are correlated with listening proficiency and that vocabulary knowledge and word recognition speed are highly correlated. These results suggest that fluency training should not be neglected in language classrooms either. Instructors can provide repeated exposures to words in different contexts to reinforce learning. Teaching students different phonetic variations of a known word is also important to recognize a word fast in connected speech.

This study examines learners' knowledge of meanings of 3,000 high-frequency Chinese words. Claims made in this paper regarding the contribution of vocabulary knowledge to listening comprehension should therefore be understood in the context of this frequency range and with this methodology. Care should be taken not to overgeneralize the claims to breadth and depth of vocabulary knowledge differentiated in the "traditional" way. One research direction in L2 Chinese acquisition is to design powerful measures that can distinguish breadth and depth of vocabulary knowledge. Further research is also needed to investigate more dimensions of lexical competence (such as connections of words in the mental lexicon) in a cluster and examine whether

the relationship among the different dimensions of vocabulary ability is affected by learners' language proficiency levels.

There are some limitations to the study. Firstly, the study involves a relatively small sample: 20 subjects provided the data for statistical analysis. Ideally, we would use a larger sample size, but the current sample size meets the research requirement. Secondly, the ratio of female and male participants is unbalanced: the data were collected from 16 female and four male learners. Having an equal number of participants from each gender group was not possible for practical reasons. Thirdly, the instrument used to measure participants' listening ability cannot rule out the reading component, an issue which was also acknowledged in the study by Milton, Wade and Hopkins (2010). A task facing CFL researchers is to develop a standardized listening test that measures learners' listening ability exclusively.

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