Article

Measuring Knowledge of Words with Multiple Meanings

Yuko Hoshino
Tokyo Fuji University
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Abstract

When reading or listening to English, we encounter many words, most of which are high-frequency, polysemous words. Due to their polysemous nature, not knowing one particular meaning of a high-frequency word may prevent learners from understanding the wider contexts. Therefore, it is necessary to know whether learners have knowledge of multiple meanings of one word; however, there is no universally accepted way to measure knowledge of words with multiple meanings. With this in mind, the current paper looks at the difficulties of measuring learners' knowledge of polysemous words and describes ongoing research on this topic.

1 Introduction

When reading or listening to English we encounter many words, most of which are high-frequency words. For example, Adolphs and Schmitt (2003) found that 209 word families cover more than 80% of spoken vocabulary and 1000 individual word forms cover 89.25% of the spoken British National Corpus. In addition, when we turn our attention to written texts, which generally include more low-frequency words than spoken texts, Nation (2006) summarized that the most frequent 1000 word families cover 78–81% of the total word count. Hence, high-frequency words are important for understanding English.

It is also generally understood that vocabulary knowledge correlates with comprehension of texts, as shown by Jeon and Yamashita's (2014) meta-analysis of 31 studies which yielded a correlation coefficient of $r = .79$ [.69–86]. This relationship has also been presented by investigations looking at the connection between reading comprehension and vocabulary breadth (e.g., Iso & Aizawa, 2010; Laufer & Ravenhorst-Kalovski, 2010), which refers to how many words learners know (i.e., knowing many low-frequency words means they are better learners). However, the lexical coverage of low-frequency words is much lower than that of high-frequency words. Thus, it is possible that knowing high-frequency words is equally as important as knowing low-frequency words when it comes to comprehension of texts. High-frequency words often have more than one meaning, so not knowing one particular meaning of a high-frequency word possibly prevents learners from understanding the text. In order to investigate this issue, it is necessary to know whether learners have knowledge of multiple meanings of one word, however, there is no universal way to measure knowledge of words with

multiple meanings. With this in mind, the current paper describes ongoing research into measuring learners' knowledge of multiple meanings of one word.

2 Difficulty in Measuring Knowledge of Words with Multiple Meanings

The importance of knowing high-frequency words, which often have more than one meaning, is widely understood, but much of the existing research has focused on how effectively learners acquire low-frequent new words. Learning new words is different from learning new senses of old words. When learners first try to acquire a new word, both the word form and its meaning are new, but when they learn a new meaning of a known word, "people add to their already extensive repertoires of words for which they know multiple different senses" (Rodd, Gaskell, & Marslen-Wilson, 2002, p. 1096). Thus, learning a new meaning of a previously known word requires restructuring of one's existing mental lexicon that contains the word. This presents a number of difficulties when attempting to determine whether learners have succeeded in acquiring new meanings or not.

First is ambiguity resolution. When a word has more than one meaning, and there is a target meaning the researcher wants to measure, it is necessary to distinguish the target meaning from other meanings. One solution is to provide context. For example, Khanna and Cortese (2011), who investigated the Age of Acquisition (AoA) of ambiguous and polysemous words, presented the target word *duck* as follows:

duck

To bend down

By presenting the definition "to bend down," the researchers distinguished the target meaning from the meaning of *duck* as a bird. Degani and Tokowicz (2013) also provided minimum contexts for target words (e.g., *rose*: *red rose* and *rose above*). However, the problem remains as to whether these minimum contexts provide sufficient cues for the learners to use when their knowledge is being assessed. Also, when longer texts are presented in order to better resolve the ambiguity, the amount of information the text contains differs by context, which produces another problem.

The second difficulty pertains to grammatical knowledge. When a word's meaning changes, often its grammatical usage changes as well. For example: *time* can be used as a noun or as a verb, both relating "what is measured in minutes, hours, days." Should we differentiate *time* as a noun from *time* as a verb when we want to measure knowledge of multiple meanings of this word? A word like *present* makes this problem more complicated. *Present* has two meanings: *existing or happening now* and *gift*. *Present* meaning "now" often takes the adjectival form; however, it can also be used as a noun. On the other hand, *present* meaning "gift" is often used as a noun but can also be used as a verb. This change of word class makes it difficult to separate grammatical knowledge and knowledge about multiple meanings. Moreover, with verbs tending to be more abstract and ambiguous than nouns (Crossley, Subtirelu, & Salsbury, 2013), it is especially

important to consider this difference between word classes. There are also cases where usage differs between two or more meanings within the same word class. For example, *admit* has two meanings (*enter* and *confess*), but *admit* meaning "enter" takes a direct object after the main verb whereas *admit* meaning "confess" takes a full clause (Uçkun, 2012). Therefore it seems contextual meaning and grammatical structure help determine the intended meaning of words with multiple meanings.

The third difficulty is the relationship between meanings. Words with multiple meanings can be divided into two types: polysemous and homonymous. The meanings of polysemous words are somewhat related to each other, whereas those of homonymous words are distinct (e.g., Rodd et al., 2002). Homonymy is more prominent because the meanings are usually completely different from each other. On the other hand, polysemy does not usually stand out. For example, some English textbooks for junior high schools in Japan have separate listings for new meanings of previously learned homonymous words. Also, they include notes about these words and try to draw learners' attention to them. However, as written above, textbook writers tend not to turn their attention to polysemy probably because of the semantic relatedness between meanings. Rodd et al.'s (2012) L1 study showed that when the novel meaning and the existing meaning are closely related, the recall of novel meanings is significantly better. Yet it is not yet known whether polysemy is more effectively acquired than homonymy for L2 learners. Even within polysemy, the distance between the meanings differs. One meaning within polysemy is the prototypical meaning, and the others are extended meanings, the degree of which differs. In other words, some meanings are rather strongly related, and learners can easily infer the extended meaning from the prototypical one. However, when their relationship is too strong, we might wonder whether these meanings are two distinct meanings or not. For example, Degani and Tokowicz (2013) asked participants to rate the similarity between the meanings of one word. They used a 7-point scale, and some meanings were rated as not similar (e.g., 1.15 for *red rose* and *rose above*), but others were similar (e.g., 5.30 for *cotton dress* and *cotton thread*). The dictionary entries for *cotton* treat these two meanings as separate, but
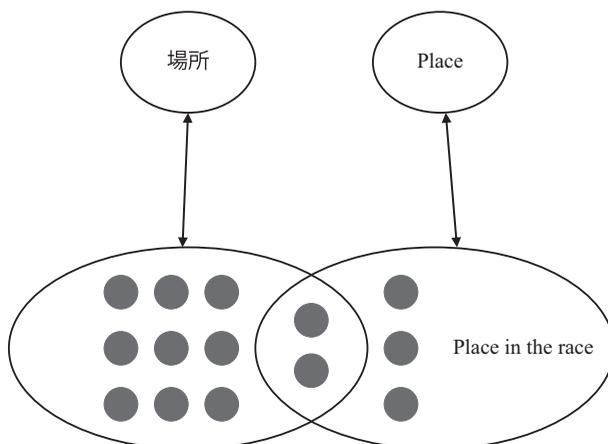

Figure 1. Sense Model (modified from Finkbeiner et al., 2004).

it is not yet known whether teachers should teach these meanings one by one or whether learners will automatically learn the extended meaning (*cotton thread*) when they learn the prototypical one (*cotton dress*).

Another problem related to meaning is cross-language differences. According to the Sense Model by Finkbeiner, Forster, Nicol, and Nakamura (2004), shown in Figure 1, several senses (small black circles in the figure) belong to one word each in the mental lexicon. Some of the senses are shared by two languages, and other senses are language-unique. For example, both *basho* in Japanese and *place* in English refer to "place as a space." Hence, *basho* and *place* are often paired and memorized in the beginning stage of learning, according to the equivalence hypothesis (Ringbom, 1987). However, pairing only one L1 word and one L2 word is insufficient because L1 and L2 concepts are not equal and some senses are peculiar to one language (Finkbeiner et al., 2004). For example, *place* has the concept of "place in the race," which has a different Japanese translation, *jun'i*. Therefore, when developing a test to measure knowledge of words with multiple meanings, it is desirable to measure the developmental change in learners' mental lexicon.

3 Summary of Hoshino (in Press)

Considering some of the abovementioned difficulties, Hoshino (in press) compared six types of test for multiple meanings of basic words to identify the best test from the viewpoints of difficulty, reliability, discriminability, and correlation coefficients. About half of the participants took tests that presented the target words in sentences, and the remaining participants took tests that presented the target words in collocations. Seven basic verbs (*break, get, have, leave, make, see,* and *take*) were the target words, and there were six types of measurement, as Table 1 shows.

In the selection test, participants chose the correct expressions of the target verbs out of eight possible answers. Table 2 shows the selection test in sentential context. The participants read the sentences, decided whether the underlined expressions were correct English expressions or not, and marked their judgment as correct ($\bigcirc$) or incorrect ($\times$) in the right column. The number of correct expressions was six for all the target verbs, but the participants were not notified how many correct answers there would be. The learners who were tested in collocation were presented only the underlined contexts.

Table 1. Six Types of Measurements in Hoshino (in press)

	Form (within-subject factor)	Context (between-subject factor)
1	Selection	Sentence
2	Translation	Sentence
3	Pairing	Sentence
4	Selection	Collocation
5	Translation	Collocation
6	Pairing	Collocation

Table 2. The Selection Test in Sentential Context in Hoshino (in press)

	○/ ×
1	He <u>broke the secret</u> to the public.
2	They <u>broke the law</u> by not stopping at a red light.
3	They <u>broke the scene</u> in their movies.
4	He <u>broke the end</u> of the story.
5	He <u>broke the skin</u> on his legs.
6	She <u>broke the news</u> to me.
7	The stone <u>broke the surface</u> of the water.
8	I'm not going to <u>break my promise</u> to her.

Table 3. The Translation Test in Sentential Context in Hoshino (in press)

	Write translation
1	He <u>broke the secret</u> to the public.
2	They <u>broke the law</u> by not stopping at a red light.
3	He <u>broke the skin</u> on his legs.
4	She <u>broke the news</u> to me.
5	The stone <u>broke the surface</u> of the water.
6	I'm not going to <u>break my promise</u> to her.

The translation test is presented in Table 3. The material was the same as the selection test except for the distractors (i.e., Nos. 3 and 4 in Table 2). Only the correct expressions were presented, and the participants were asked to write the translations of the underlined expressions. Similar to the selection test, only the underlined contexts were shown to the participants who were tested in the collocation condition.

The pairing test was conducted with the same target materials as the translation test. The participants were required to find three pairs of the target expressions with the same meaning. Each target verb had three pairs (i.e., Nos. 1 and 4, Nos. 2 and 6, and Nos. 3 and 5 have the same meaning in Table 3).

Results showed that of the six measurements, the translation test in sentential context had the highest reliability and discriminability. The translation test had significant correlation coefficients with the vocabulary size test and the reading test, but the selection test and the pairing test did not, also their correlation coefficients were weak or even negative. Between the two translation tests with different length of contexts (collocation or sentence), the test in sentential context had a higher correlation than the one in collocation. Considering that the construct measured by the vocabulary size test and the reading tests was at least somewhat related with the construct that the test for words with multiple meanings was designed to measure, the translation test in sentential context was the better test among the six tests in Hoshino (in press). However, questions remain. How long should the sentence be? What information should be included in it? Are there any other, better tests?

4 Other Possible Measurement Methods

Hoshino (in press) did not use the isolation test, an isolation test is one of the possible methods of measuring multiple meanings. An example is as shown below.

Write as many meanings of each word as possible.

1. present ( ) ( ) ( )
2. take ( ) ( ) ( )

This method is used especially when researchers want to make a list of polysemy meanings (e.g., Durkin & Manning, 1989; Tagashira, Sakata, Hoshino, & Mochizuki, 2014). Rodd et al. (2012) used a similar method. They presented the target words in isolation and asked the participants to write the properties of the novel meanings they had learned. When at least one of the properties they wrote was correct, the response was regarded as correct. However, producing as many meanings as possible without any cues is difficult even for advanced L2 users. For example, in Tagashira et al.'s study above, two English teachers produced answers to the 68 words with multiple meanings, but they answered at most five meanings per word. The average number of answers per word was only two or three, so it is difficult to grasp the development of the mental lexicon by this measure only. Furthermore, there is the problem of loan words. Japanese has a lot of loan words, and this becomes a problem when using this measure. For example, *program* has several meanings in English, and these meanings are often used in Japanese as プログラム [puroguramu]. However, プログラム has different meanings, as in a computer *program* or concert *program*. Hence, if the participants write only プログラム, we do not know which meaning of *program* they intend.

Another measure, which presents the target words in isolation, is the translation recognition test. In this test, researchers present the target word first and then its target meaning to the participants, and participants judge whether the second word is the first word's correct meaning or not as quickly and accurately as possible. The translation recognition test does not require participants to produce the translation, so it is more suitable for investigating the developmental stage of acquisition or beginning learners (Sunderman, 2014).

5 Conclusion

So far, several measurements have been introduced, but we still do not know which measurement is better than others and which should be used in which circumstances. Making a valid test for knowledge of multiple meanings will deepen our understanding of learners' mental lexicon, so the further research is necessary for this topic.

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