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The Effects of Top-down and Bottom-up Cognitive Processes in Chinese EFL Learners' Incidental Vocabulary Acquisition

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Abstract

This study analyzed the correlation between the incidental acquisition of vocabulary using different processing strategies during reading by 56 native Chinese-speaking students studying English at a university in China. Based on top-down and bottom-up cognitive processes, the study discussed the lexical processing strategies employed by the participants in analyzing unknown words. Based on introspective data collected during think-aloud and the subsequent vocabulary retention test results, the researcher explored the acquisition effects of different strategies. The results indicated that the bottom-up processing strategy showed better acquisition effects than the top-down strategy. Finally, the researcher discussed the reasons why Chinese college students performed better with the bottom-up cognitive approach in incidental vocabulary acquisition while reading, attempting to provide pedagogical implications for L2 vocabulary teaching in China.

Keywords: incidental vocabulary acquisition, lexical processing strategies, top-down cognitive process, bottom-up cognitive process, acquisition effects, cognitive approach

1. Introduction

Regardless of the stage of learning, one of the main challenges of second language learning is acquiring and expanding vocabulary knowledge. While it has been suggested that by using vocabulary lists directly, students can learn approximately 30 words per hour (Ellis, 1994), this is unlikely to be the most common means of acquiring vocabulary items for advanced learners (Hulstijn, 2013; Fraser, 1999; Paribakht & Wesche, 1999; Wode, 1999). There is evidence from various second language contexts that vocabulary can be learned from reading and other forms of input. Thus, it is often assumed that a large portion, if not all, of one's second language vocabulary is acquired incidentally, as a result of other forms of cognitive activity involving comprehension (Gass, 1999).

In very general terms, incidental vocabulary acquisition is defined as the unintentional picking up of vocabulary knowledge because the learner is not aware of an upcoming retention test (Hulstijn, 2013). However, this purpose-oriented definition does not provide any information about the mechanisms underlying incidental vocabulary acquisition. In light of this, it is worthwhile to examine in more detail the cognitive processes involved in incidental vocabulary acquisition, which is the result of another activity, such as the reading comprehension task discussed in this study.

The purpose of this study was to examine Chinese EFL learners' incidental vocabulary acquisition in a reading comprehension task and to compare the relative importance of different types of cognitive processes in incidental vocabulary acquisition. In this study, the researcher examined the frequency of Chinese EFL learners' use of different vocabulary processing strategies in a reading comprehension task and the effects of these strategies on vocabulary retention. On this basis, this study further explored the bottom-up/top-down cognitive processes involved in the incidental acquisition of vocabulary during reading. In order to fulfill the research objectives, this study attempts to answer the following research questions:

(1) What lexical processing strategies do Chinese college students adopt when they encounter unknown words during reading?

(2) What are the effects of these vocabulary processing strategies on vocabulary retention?

(3) What are the differences between bottom-up and top-down cognitive processes in terms of learning

outcomes?

2. Lexical Processing Strategies

2.1 Classifications of Lexical Processing Strategies

The different strategies that a person employs to acquire, store and use language effectively are known as language learning strategies (O'Malley & Chamot, 1990). Lexical processing strategy is a language learning strategy used by learners when trying to process unfamiliar words. There are many mental activities that learners perform when trying to process unfamiliar words. A lexical processing strategy is usually defined as one of the following strategy options that students can use when confronted with unfamiliar words (Fraser, 1999): (1) ignoring unfamiliar words, (2) consulting a dictionary or consulting others, or (3) inferring their meanings. In addition, strategies for inferring word meanings can be further categorized according to the cues on which the inferences are based. Learners can infer word meanings based on (a) non-linguistic factors provided by context/background knowledge or (b) linguistic factors provided by knowledge of the native or target language (O'Malley & Chamot, 1990). Based on Fraser's categorization of lexical processing strategies, researchers have classified lexical processing strategies according to the cognitive processes involved in them, i.e., top-down processing strategies and bottom-up processing strategies.

In terms of the specific approach to the cognitive process, vocabulary processing strategies can be categorized into two main types: top-down and bottom-up. O'Malley and Chamot (1990) state that in the bottom-up cognitive process of vocabulary processing, the learner starts by digesting the attributes of the individual lexical items, and ultimately progresses to understanding the whole text. In contrast, the top-down approach to lexical processing is characterized by the fact that the learner first tries to determine the meaning of the whole text before determining the meaning of individual words (O'Malley & Chamot, 1990, p. 129). Based on these two approaches to vocabulary processing, Figure 1 illustrates the categorization of vocabulary processing strategies.

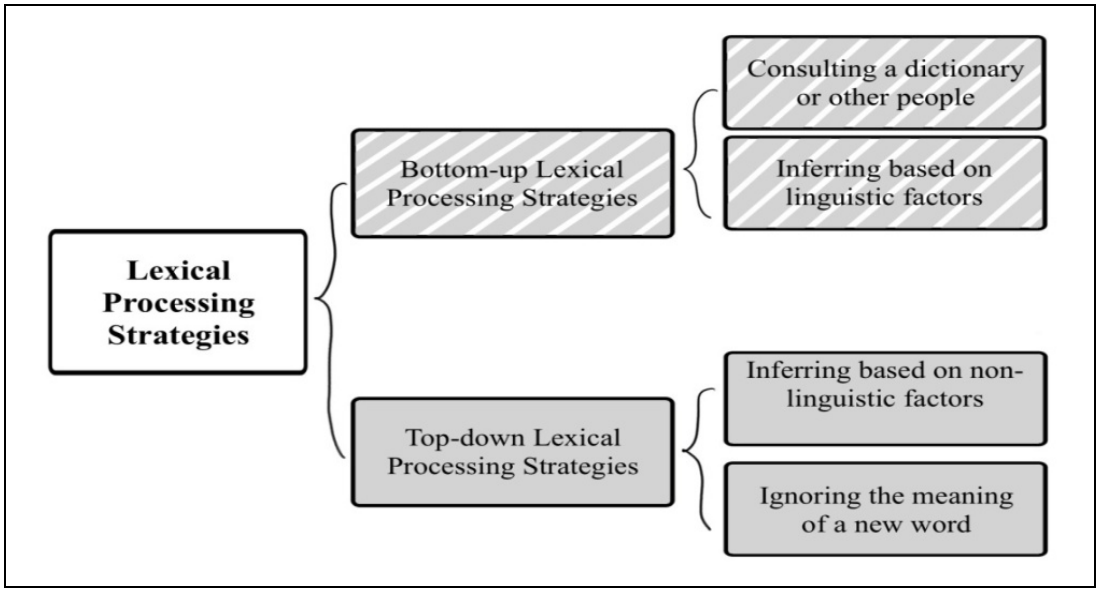

Figure 1. Classification of Lexical Processing Strategies Based on Top-down and Bottom-up Cognitive Processes

Based on Figure 1, the different lexical processing strategies can be categorized into two groups according to the cognitive approach involved. Bottom-up lexical processing strategies consist of two parts: consulting a dictionary or other people, and inferring word meanings based on the linguistic features of the word. Inferring word meanings based on non-linguistic factors and ignoring neologisms belong to the top-down lexical processing strategies.

2.2 Cognitive Factors Influencing Lexical Processing Strategies

The first step in the language acquisition process for second language learners is to transform language input into intake. In this process, the learner's attention is crucial. If the learner does not pay attention to the linguistic features of the input, it is impossible to process and extract the information. Schmidt (2001) argued that "learning is a by-product of the learner's attentional processing" (p. 29). According to him, attention is the conscious noticing of features of existing linguistic input by the learner and is influenced by the following six

factors: frequency of occurrence, perceptual salience, pedagogical approach, task requirements, learner expectations and processing ability (Schmidt, 2001).

When a learner encounters and notices an unfamiliar phrase, the integration of the important features of that phrase into the mental lexicon is greatly affected by the depth of processing. According to Craik and Lockhart (1972), the degree of mental processing determines how much of the target information is retained in the mind. Memory retention is a result of cognitive processing. Memory retention is enhanced to a greater extent when the degree of cognitive processing is deeper (Zhang & Wu, 2001).

The concept of involvement load was developed by Laufer and Hulstijn (2001) as a combination of a motivational dimension (need) with two cognitive dimensions (search and evaluation). The hypothesis (Laufer and Hulstijn, 2001) states that involvement load can be quantified as an index of the sum of its components (demand, search, and evaluation). According to Laufer and Hulstijn (2001), vocabulary acquisition is influenced by the learner's involvement load; the greater the involvement load that the learner puts into the task under the same conditions, the greater the impact of the task in facilitating vocabulary acquisition, the greater the impact of the task on facilitating vocabulary acquisition and the greater the effect of vocabulary retention.

The cognitive factors mentioned above can affect incidental vocabulary acquisition in the following ways:

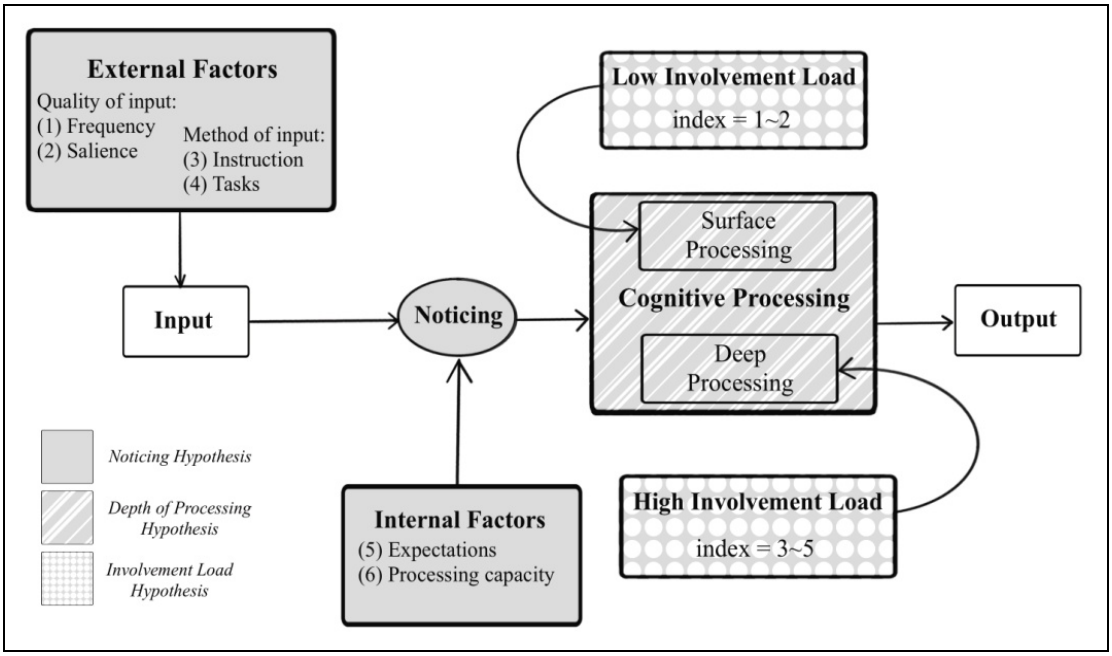

Figure 2. Cognitive Process of Incidental Vocabulary Acquisition

3. Method

3.1 Participants

This study involved 56 college students at a local university in China. The participants were all sophomores and none of them majored in English. 22 of them majored in journalism and 19 in Chinese. There were 22 journalism majors, 19 Chinese majors, and the rest were engineering majors. 29 participants were female and the rest were male. The average age of the participants was 19.7 years old. The participants were enrolled in the researcher's college English course, a general education course open to all undergraduate students who are not English majors. In this course, students develop their overall language skills with a particular focus on reading and writing.

None of the participants had studied or were preparing to study in countries where English is the native language. At the time of this study, all participants had been studying English as a foreign language for at least eight years. They had enrolled in the course based on their placement test scores at the time of admission and had studied at the same level of English for two semesters. In addition, all the participants had just passed the College English Test-4 (CET-4), indicating that they were intermediate English learners. The results of the test showed a minimum score of 504 and a mean score of 512 with a standard deviation of 3.05 points. Therefore, it can be assumed that the participants had similar levels of English proficiency.

According to the Teaching Requirements for College English Courses issued by the Ministry of Education of the People's Republic of China in 2007 and the participants' performance on the CET-4 exam, the participants' English proficiency level reached B1 (independent users at the lower-intermediate level), which suggests that the overall vocabulary size of the participants in this study was about 4,000 to 4,500 words. The following table summarizes the overall information about the participants.

Table 1. Summary of the Participants' Condition

Items	Descriptions
Total number	56
Average age	19.7
Gender	Female: 29, Male: 27
Major	Chinese: 19, Engineering: 15, Journalism: 22
English proficiency	B1 (Independent users at a lower intermediate level)
Vocabulary level	4000~4500 words
Experience of study-abroad	None

In this study, all tasks were completed by the same group of students. The researcher did this in order to maintain consistency in data collection and to ensure, to some extent, the reliability of data analysis.

3.2 Procedure

3.2.1 Unknown Vocabulary Extraction

The researchers examined the reading texts using the lexical description tool VocabProfilers from the Compleat Lexical Tutor corpus (https://www.lextutor.ca) to ensure that the selected reading texts contained new vocabulary that could be used by the participants. The online corpus showed the vocabulary contained in the two reading texts, which were distributed among the top 12,000 commonly used words (K-1 ~ K-12) according to the BNC and COCA corpora.

In the next step, the researcher showed all participants all the words from K-3 to K-12 in the texts (which were distributed between 2,000 and 12,000 commonly used words according to the online corpus) and asked them to mark the words they did not understand in the word list. Participants had to check the box next to each unknown word in the word list. In addition, they were asked to mark new words on first impression without using any learning strategies. All participants had to complete the extraction task within 15 minutes.

3.2.2 Reading for Comprehension

Three days after completing the unfamiliar words extraction task, subjects were asked to complete a reading comprehension task. The reading comprehension task consisted of two passages. The first passage was an excerpt from a literary work (William Faulkner's A Rose for Emily), and the second passage was an illustrative scientific article (The Story of Silk) taken from Test 3 of Cambridge IELTS 11. The task required participants to read the articles at a normal reading speed and to answer 10 multiple-choice questions (5 questions per article) related to the content of the articles. Participants were given dictionaries and it was made clear that they could consult them as needed. None of them were aware that they would be tested on unfamiliar words after reading comprehension in order to maximize the likelihood of incidental vocabulary acquisition. The time limit for this task was 45 minutes.

3.2.3 Think-aloud Protocol

Reading comprehension is followed by a think-aloud task. In general, the think-aloud protocol can be divided into the following three stages.

First, the researcher explained the reasons for participating in the think-aloud protocol to ensure that participants understood the purpose of the procedure. After that, the researcher introduced the participants to different vocabulary processing strategies based on the categorization model used in this study as well as specific information gathered during the pilot study interviews. Specific examples were provided to the participants to ensure that they understood the concepts. Finally, the researcher asked each subject to report the specific lexical processing strategies they used to deal with each unknown word and the reasons for doing so, based on the unknown words in the word list. Each subject's verbal report was conducted through online or face-to-face interviews with the researcher and research assistants. The interviews were conducted in the subjects' native language (Mandarin) in order to reduce their anxiety. If necessary, the researcher might ask participants to

explain or summarize certain passages, including new vocabulary. Throughout the interviews, notes were taken on specific strategies. During note-taking, the researcher asked questions when the participant appeared confused or paused, such as "What do you think about these passages?", "Why did you pause?", "Do you have a problem here?", etc. The interview process was audio-recorded for each participant for later transcription and data analysis.

3.2.4 Vocabulary Retention Test

One week after the think-aloud protocol, subjects were asked to take a vocabulary retention test to assess the effect of incidental vocabulary acquisition. The test took the form of a five-level vocabulary knowledge test based on the Vocabulary Knowledge Scale (VKS) developed by Wesche and Paribakht (1996). Subjects were asked to self-assess their vocabulary knowledge according to the following five categories:

I: I haven't seen this word before.

II: I've seen this word, but I don't know what it means.

III: I have seen this word, maybe it means _____ (synonym/translation).

IV: I know this word. It means _____ (synonym/translation).

V: I can use this word in a sentence, e.g., _____ (if you answer this question, please also answer Question IV).

3.3 Analyses

After collecting data from the unknown vocabulary extraction task, the researcher identified the unknown vocabulary words labeled by each subject to determine how they differed in the number of neologisms. In addition, the researcher developed a list of specific new words for each subject for further analysis.

Based on the data collected through the reading comprehension task, the researcher scored each subject's reading comprehension skills based on the number of correct answers they provided in response to questions testing their comprehension of the reading text. The total score was 10 points, with 1 point awarded for each reasoned solution.

During the think-aloud task, the researcher and research assistants recorded the participants' use of vocabulary processing strategies. After each subject completed the think-aloud task, the researcher transcribed all significant recordings into text. Using the transcribed text and notes, the researchers counted and categorized the vocabulary processing strategies used by the participants during the reading.

The new word retention test was administered through a self-test report. The self-test reports are based on Wesche and Paribakht's (1996) Vocabulary Knowledge Scale (VKS) and the score scale outlined in the same paper. A word retention test was customized for each participant since the corresponding new words were different for each student.

Based on Wesche and Paribakht's (1996) VKS and their score scale outlined in the same paper, the former was categorized into five categories based on subjects' familiarity with the new vocabulary, and the latter into five levels. Thus, the Vocabulary Knowledge Scale can be categorized into Levels I, II, III, IV, or V depending on the participants' familiarity with new words. If a participant gives a correct answer to Levels III to V, he or she will be awarded points accordingly; if the answer is incorrect, he or she will be downgraded to Levels II to IV and will only be awarded 2 to 4 points. The table below explains what the scores mean.

Table 2. Meaning of Scores Based on Wesche and Paribakht's (1996) VKS

Categories	Scores	Meaning
I	1	The word is not familiar at all.
II	2	The form is familiar, but the meaning is unknown.
III	3	A probable or related meaning is given.
IV	4	The meaning is known in terms of semantic appropriateness.
V	5	The meaning is known in terms of semantic appropriateness and grammatical accuracy in a sentence.

The researcher categorized the retention effects of the new words into two groups to differentiate between the subjects' mastery of the new words. Words scoring 1 and 2 were categorized as [-acquired], while words scoring 3, 4, and 5 were categorized as [+acquired]. Based on the binary acquisition status, the final retention rate of

each word can be determined. Therefore, this study was able to investigate the relationship between processing strategies and vocabulary retention effects.

Obviously, each subject provided a different set of data according to his/her own situation, and each subject learned each unknown word differently. Given the interdependent structure of the data collected in this study, traditional statistical modeling was not appropriate. Therefore, a generalized linear mixed-effect model was used to analyze the collected data. The use of this model allows for correlations between vocabulary, study participants, and vocabulary processing strategies, as well as non-normally distributed variables.

4. Results

4.1 Types and Frequencies of the Strategies

The researcher conducted descriptive statistics on the specific types and frequencies of lexical processing strategies used by the participants. From the participants' verbal reports, it was clear that they generally used four types of lexical processing strategies during reading comprehension. Figure 3 shows a comparison of the frequency of processing strategies used by the participants during the reading comprehension task.

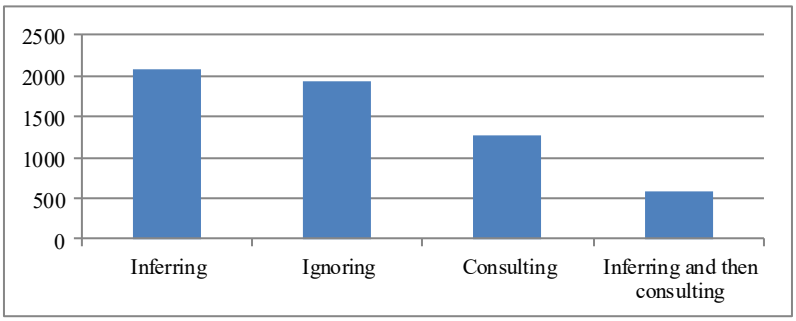

Figure 3. Types and Frequencies of Lexical Processing Strategies Used by the Subjects

As we can see in Figure 3, the most frequently used lexical processing strategy in this study was "inferring word meaning", which accounted for 35.3% of all lexical processing strategies, i.e., 2,068 times. The second most frequently used lexical processing strategy was "ignoring word meaning" (1,933 times). This strategy accounted for 33% of the total number of lexical processing strategies in this study. The frequency of "consulting the dictionary or seeking others' help" was 1,279 times, which accounted for 21.8% of the total number of lexical processing strategies. It was found that "inferring the meaning of the word and then checking the dictionary" was the least frequently used vocabulary processing method, with subjects using it a total of 577 times. Combining the two strategies of "inferring" and "consulting", this strategy accounted for 9.9% of the total number of vocabulary processing strategies used by the participants.

Regarding the cognitive process approach, the researcher categorized the vocabulary processing strategies used by the subjects into top-down and bottom-up strategies. Since the strategy of "inferring before consulting" was also initiated by the strategy of "inferring", the researcher examined the strategy of "inferring before looking up in the dictionary" together with the strategy of "inferring". Table 3 summarizes the frequency and proportion of top-down and bottom-up vocabulary processing strategies.

Table 3. Frequencies of Top-down and Bottom-up Lexical Processing Strategies

		Top-down		Bottom-up	
	Total number	Ignoring	Inferring based on non-linguistic factors	Inferring based on linguistic factors	Consulting
Frequency	5,857	1,933	1,284	1,361	1,279
Percentage	100%	33.0%	21.9%	23.3%	21.8%
Percentage (total)	100%	54.9%		45.1%	

Table 3 shows that the frequency and percentage of top-down lexical processing strategies are slightly higher than bottom-up lexical processing strategies. This shows that learners process more words when reading for comprehension, from the overall meaning of the context to the specific meaning of each new word.

4.2 Acquisition Effects of the Strategies

In order to analyze the effects of subjects' vocabulary processing strategies, data collected from the think-aloud task and the vocabulary retention test were statistically analyzed. A total of 5,857 pairs of vocabulary processing strategies and unknown words were identified. The ignoring strategy was used 1,933 times; the inferring strategy was used 2,068 times; the consulting strategy was used 1,279 times; and the inferring and then consulting strategy was used 577 times. For more specific information on the acquisition rates for each strategy, see Table 4 below.

Table 4. Frequencies and Retention Effects of Four Major Lexical Processing Strategies

		Ignoring N (%)	Inferring N (%)	Consulting N (%)	Inferring and then consulting N (%)
	Frequency	1,933 (100)	2,068 (100)	1,279 (100)	577 (100)
[- acquired]	Score = 1	717 (37.1)	64 (3.1)	189 (14.8)	8 (1.4)
	Score = 2	801 (41.4)	412 (19.9)	567 (44.3)	67 (11.6)
[+ acquired]	Score = 3	212 (11.0)	421 (20.4)	215 (16.8)	95 (16.5)
	Score = 4	145 (7.5)	809 (39.1)	91 (7.1)	135 (23.4)
	Score = 5	58 (3.0)	362 (17.5)	217 (17.0)	272 (47.1)

The subcategories of inferring strategies were analyzed in terms of both linguistic and non-linguistic factors. Linguistic factors included intralinguistic and interlinguistic cues, and nonlinguistic factors included contextual and background information. The inferring strategies were used a total of 2,645 times, including 2,068 times for merely inferring the meaning of a new word and 577 times for looking up the dictionary after inferring the meaning. Below are the specific frequency of use and mastery rates for each sub-strategy at different score levels.

Table 5. Frequencies and Retention Effects of the Sub-categories of Inference Strategy

		Linguistic Factors		Non-linguistic Factors	
		Intra-lingual cues	Inter-lingual cues	Contextual information	Background information
		N (%)	N (%)	N (%)	N (%)
	Frequency	1,122 (100)	239 (100)	1,207 (100)	77 (100)
[- acquired]	Score = 1	18 (1.6)	16 (6.7)	26 (2.2)	12 (15.6)
	Score = 2	84 (7.5)	19 (7.9)	352 (29.2)	24 (31.1)
[+ acquired]	Score = 3	203 (18.1)	52 (21.8)	247 (20.5)	14 (18.2)
	Score = 4	483 (43.0)	101 (42.3)	341 (28.2)	19 (24.7)
	Score = 5	334 (29.8)	51 (21.3)	241 (19.9)	8 (10.4)

From the descriptive statistics listed in the previous section, it is clear that different word processing strategies lead to different levels of vocabulary retention. Considering the effects of different unknown lexical items on data processing, this study utilized RStudio for Windows to build a generalized linear mixed-effects model to test the relationship between different lexical processing strategies and vocabulary acquisition effects.

In the modeling process, the researcher used "vocabulary retention effect" as a binary variable, i.e., acquired (=1) and non-acquired (=0); "strategy" as a fixed effect; and "participant" and "vocabulary" as random effects. According to the likelihood ratio chi-square test, there was a significant effect of vocabulary processing strategy on vocabulary retention ($\chi^2(3) = 1683.9$, $p < 0.001$). The following figure shows the modeled effects of different vocabulary processing strategies.

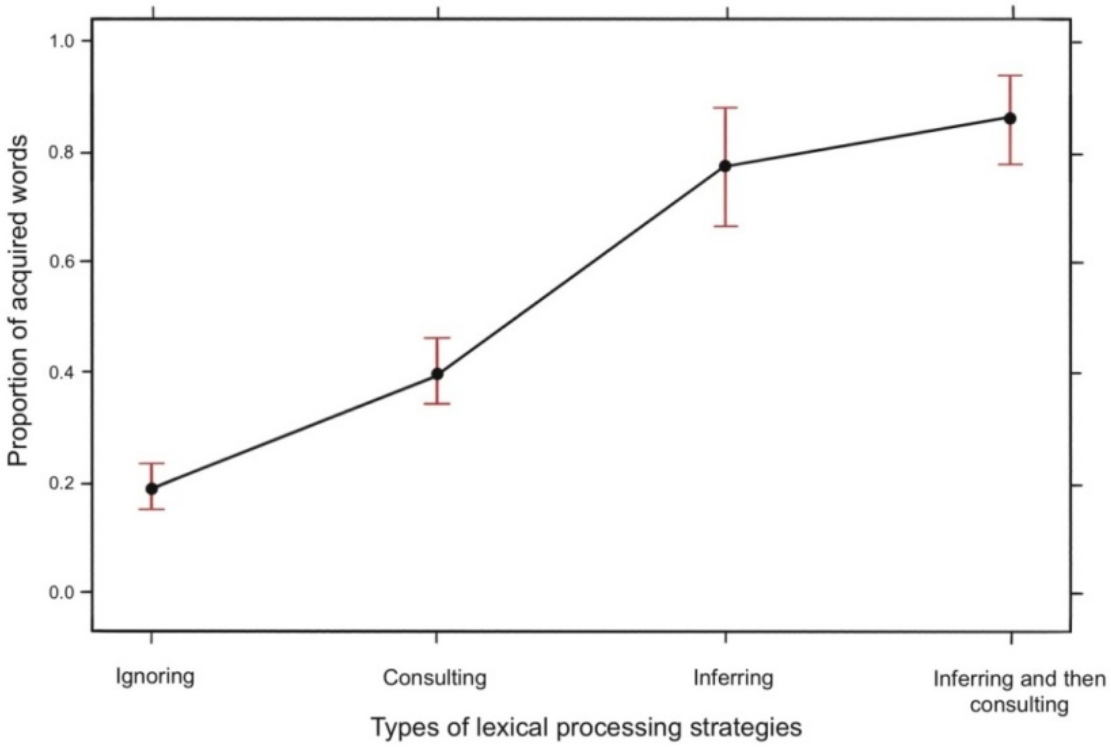

Figure 4. Modeled Effect of Four Types of Lexical Processing Strategies

The figure above shows the proportional values after the reverse transformation and their respective confidence intervals for direct comparison of the acquisition effects. The model shows that 19.3% of vocabulary acquisition is accomplished by ignoring the meaning of the new word. The percentage of vocabulary acquisition was higher for the consulting strategy compared to the ignoring strategy at 39.1%. The inferring strategy succeeded in acquiring 77.8% of the unknown vocabulary, which was significantly higher than the above two strategies. Among the four vocabulary processing strategies, the inferring and then consulting strategy acquired the highest percentage of vocabulary at 86.1%.

Depending on the type of factors involved in the inferring process, differences in the acquisition percentages were observed in the previous section. This could be the reason for the large confidence intervals for the two reasoning strategies. In order to test whether different reasoning cues lead to different lexical retention effects, the lexical retention effects of the reasoning strategies were further categorized according to the nature of the factors involved. Therefore, the researcher conducted another generalized linear mixed-effects analysis.

In the modeling process, reasoning strategies were classified into two categories, including inferring from nonverbal factors and inferring from verbal factors. The researcher modeled the vocabulary retention effect as a dichotomous variable in the same way as in the previous analyses; “sub-strategy” as a fixed effect and “participant” and “vocabulary” as random effects. Another likelihood ratio chi-square test indicated a significant effect of sub-strategy use on retention ($\chi^2(1) = 213.7$, $p < 0.001$). Figure 5 depicts the modeled effects of the various factors involved in inference.

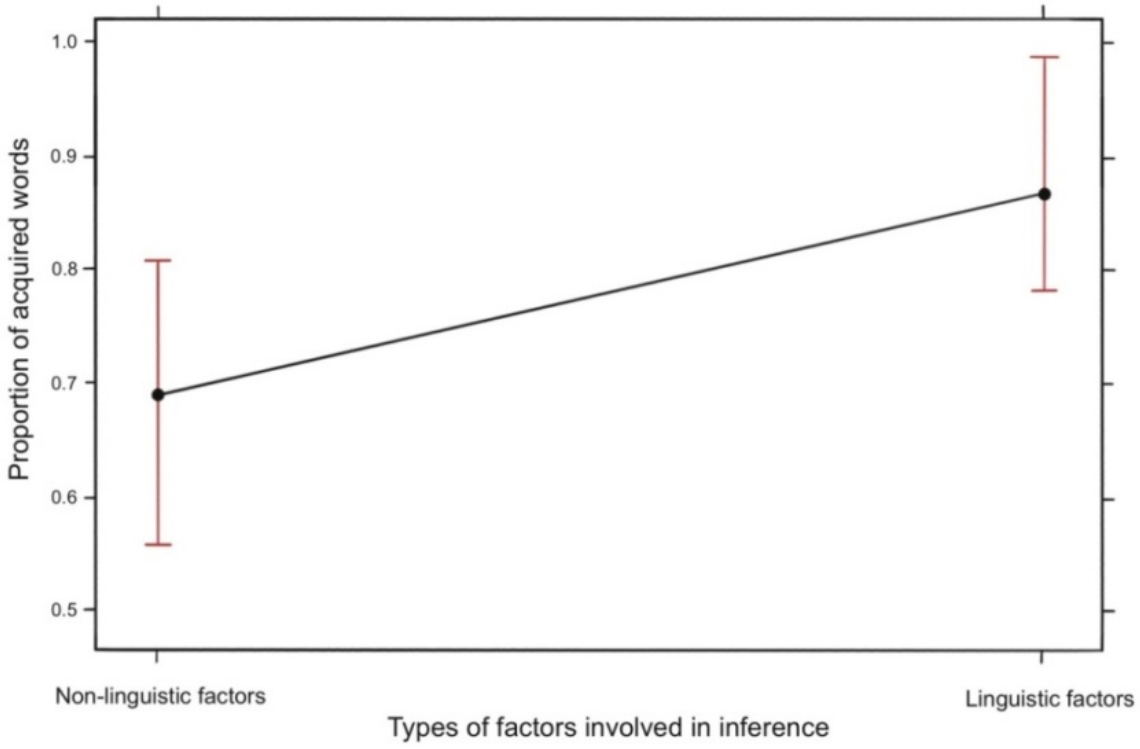

Figure 5. Modeled Effect of Two Types of Factors Involved in Inference Processing Strategy

As shown in Figure 5, the acquisition effect of the inferring strategies involving linguistic factors (87.3%) was significantly higher than that of the strategies not involving linguistic factors (68.7%). According to the model, although the confidence intervals for both types of factors were wide, the confidence intervals for the non-verbal factors were wider. This may be due to the small sample size of this study, individual differences in subjects, and differences in the unknown words recognized by each subject. In the present experiment, language-based inference was a less frequent but more efficient strategy for vocabulary memorization than inference based on contextual information or prior knowledge.

According to the definition and classification of top-down and bottom-up lexical processing strategies discussed above, in the current study, the bottom-up lexical processing strategies performed better than the top-down ones in terms of learning outcomes. Related details are discussed in the following part.

5. Discussion

5.1 Top-down Processing of Unknown Vocabulary

As discussed earlier, top-down processing of lexical items begins with the overall meaning of the text and then moves on to specific words. According to the current study, the top-down lexical processing strategy consists of two strategies: the ignoring strategy and the inference strategy based on non-linguistic factors. In terms of frequency of use, both strategies were used frequently, and there were more top-down processing strategies than bottom-up strategies in the present study. However, the incidental acquisition rate of these two strategies was much lower than that of the bottom-up processing strategy.

Due to its implicit and unconscious nature, the ignoring strategy clearly has the worst vocabulary retention, as shown in the previous figure. Why, then, is linguistic factor inference superior to non-linguistic factor inference in terms of vocabulary retention? The answer may have to do with the approach to cognitive processes. Inferring strategies based on non-linguistic factors belong to the top-down cognitive process, i.e., students first understand the context and then use contextual clues to infer word meanings. In this process, the subject needs to exert considerable cognitive effort. Word meanings generated through factors other than linguistic knowledge are not automatically preserved, but are embedded in the context. Thus, word meanings inferred from non-linguistic factors can be easily recalled in similar situations. However, meanings inferred from nonverbal cues may also be

lost in the absence of context. It is important to note that the primary focus of nonverbal inference is on meaning, and most of the words inferred through nonverbal inference strategies are not related to the particular form of the word. As a result, subjects are unable to achieve optimal retention despite the considerable cognitive effort invested in making nonverbal inferences. Mondria and Boer (1991) also noted that rich contexts can facilitate learners' reasoning skills while reducing their memorization of vocabulary.

5.2 Bottom-up Processing of Unknown Vocabulary

In contrast to top-down processing, bottom-up lexical item processing begins with the specific form and meaning of the target word and proceeds to the overall context of the word. From the perspective of English language pedagogy, this cognitive process approach is closely related to the traditional approach to language teaching, which has been heavily criticized by scholars and educators. In terms of vocabulary processing in this study, the bottom-up vocabulary processing strategy has performed well in vocabulary acquisition. The bottom-up vocabulary processing strategies in this study included the consulting strategy and the inference strategy based on linguistic factors. The total number of bottom-up strategies was lower than the total number of top-down strategies due to the high frequency of use of the ignoring strategy. However, inferences based on linguistic factors were more common than inferences based on non-linguistic factors. Both bottom-up processing strategies had higher incidental acquisition rates compared to the top-down processing strategies.

The bottom-up cognitive process allows students to become aware of the form of the target word from the outset, which in turn builds a mental lexicon of form-meaning combinations. As a result, the resulting form-meaning combinations are more stable and more likely to allow the subject to recall the specific meaning of the new word. Thus, when the meaning of a word is inferred through linguistic factors, the student is able to use his or her linguistic knowledge to infer the meaning of the word again when the word is taken out of its original context. In contrast, it is not possible for non-linguistic factors to make the same inferences outside of the original context. Therefore, the linguistic factors inference strategy used in this study was the most effective in terms of vocabulary retention, although it was not the most frequently used strategy.

Another reason is related to the dominant language teaching method in China. Although the traditional teaching method may have a negative impact on second language learning, it is still widely used in China as an effective method of language teaching and students are accustomed to this method. Li (2006) argued that the gradual evolution from smaller basic elements to complex structures characterizes the internalization of Chinese philosophy and thought. It is true that most Chinese education (including first language literacy) follows a bottom-up approach (Jin, 2010; Peng, 1997). Some Chinese educators even advocate that the most effective way to teach Chinese literacy is a distinct bottom-up sequence: character, word, sentence, paragraph, and passage (字, 詞, 句, 段, 篇). In fact, most Chinese literacy textbooks follow this sequence. Therefore, it is not surprising that Chinese learners prefer the bottom-up cognitive approach and perform better with this cognitive approach.

6. Conclusion

The current study investigated two approaches of cognitive processes involved in EFL incidental vocabulary acquisition. In this research, lexical items acquired incidentally through reading for comprehension were investigated. Based on the dichotomy of top-down and bottom-up cognitive processes, the bottom-up strategy exhibited significantly better acquisition effects than the top-down strategy. A top-down cognitive approach does not automatically preserve the meaning of a word; it is largely dependent on the context in which it is used. Consequently, the meaning of a word derived from a top-down cognitive process is likely to fade together with its immediate context. However, bottom-up processing seems to provide a strong anchor for newly acquired lexical items, because it is based on direct associations involving form and meaning. Besides, the gradual evolution from smaller linguistic units to complex structures is the internalization of Chinese philosophy and thought. Both of the reasons could explain Chinese college students' better performance with the bottom-up cognitive approach in incidental vocabulary acquisition while reading.

As mentioned earlier, the present study was specifically designed to address issues of Chinese EFL learners' incidental English vocabulary acquisition while reading. The number of participants were relatively limited and the language skill (i.e. reading) involved is too simple to the generalized to other aspects of second language acquisition. An obvious extension of the current research would involve examining the effectiveness of bottom-up and top-down lexical processing strategies on incidental vocabulary acquisition in terms of other language skills (i.e. listening, writing, and speaking), especially the productive language skills.

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Notes

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Note 2. In this research paper, second language, foreign language, and L2 are used interchangeably.

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