Does Deeper Processing Lead to a Better Recall Result?--- A Study on Second Language Vocabulary Learning

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Abstract

This study surveyed Chinese EFL learners about what activities they do after class to enhance the memorization of English vocabulary. Based on the survey responses and the framework of levels of processing (Craik and Lockhart, 1972), three tasks were designed to induce different levels of processing of a word list. Task 1 was a phonological processing task; Task 2 a semantic processing task with oral production of sentences; and Task 3 a semantic processing task with written production of sentences. Participants of three tasks were instructed to process a word list of 15 English words and then conduct an immediate free recall task. The results showed that more elaborative processing leads to a slightly better immediate free recall results. There was no statistically difference between recall results of three tasks. There was a modality difference in the recall results: Oral production task produced slightly higher recall results than written production task. Syllable-based word effect, primacy and recency effects were observed in the results. Grammaticality of sentences produced in both semantic processing tasks is not an indicator for recall results.
Keywords: levels of processing, phonological processing; semantic processing; second language vocabulary learning

INTRODUCTION

Vocabulary learning has been an important task for Chinese EFL learners. This study surveyed 19 Chinese EFL learners about what vocabulary learning activities they do to enhance their memorization of English vocabulary. Based on the survey results and the levels of processing framework (Craik and Lockhart, 1972), three tasks were designed and conducted to induce phonological and semantic processing of a word list. 45 Chinese EFL learners participated in the tasks; the immediate free recall tasks were conducted after each task, and the results were recorded and analyzed.

BACKGROUND

Memory system has been examined from different perspectives. Memory is viewed as storages in which information travels from one store to another (Atkinson and Shiffrin, 1968). The storage view of memory system proposes that information gets registered in sensory memory, then those selected pieces travel into short-term memory and then collaboratively, the information is processed with the knowledge/information extracted from short-term and long-term memories. The distinction between memory storages mainly depends on the duration that information can stay in the specific memory storage and the capacity of those storages. However, researchers are not satisfied with this storage view of memory system.

Tulving (1985:386) proposed that memory is composed of multi-systems (procedural, semantic and episodic systems) with an emphasis on the correlated processes between these systems. In Tulving's view, different memory systems are not distinguished by the duration or capacity to hold information. Instead, Tulving (1985) argued that these memory systems are different in the way how knowledge is acquired and how knowledge is represented (387). This classification is different from Ackinson and Shiffrin's in that this ternary view of memory system looks at the inner organization of the memory system but not at its functional aspects (e.g., duration and capacity).

Craik and Lockhart (1972) put forward the "levels of processing" as a framework of human memory system, proposing that memory system is a dynamic system. The

"levels of processing" view regards memory traces as a byproduct of encoding process. They argued that more in-depth processing leads to stronger memory traces; therefore, a better memory results. Craik and Lockhart (1972) argued that memory does not have to be a store-based system and they emphasized that it is the encoding process that accounts for 'memorization'.

Craik and Lockhart's (1972) proposal of levels of processing has been criticized due to insufficient explanation on the index of "levels" (Baddeley, 1978; Craik, 2002; Laufer and Hulstijn, 2001). Craik (2002:309) discussed the issue of index and argued that elaboration on the information (meaningfulness) should be considered as the index of "depth of level". Though he did not provide a detailed report on how to measure meaningfulness, it has been generally agreed by the researchers that elaboration on the target information does help enhance the memory result (either in the way of integrating new information to the knowledge in the memory or in helping building up the access route for the target information) (Frase, 1975; Eysenck, 1982; Anderson, 1995).

Craik and Tulving (1975) conducted ten experiments to examine retention of verbal information under different levels processing. In their research, subjects were instructed to process the words at different depths: shallower processing engaged subjects in recognizing target words' typescript; intermediate processing asked subjects to process target words' rhyme features; and the deep processing involved processing of semantic and syntactic features of target words by deciding whether the words would fit in sentences. The words they chose were simple nouns, common concrete nouns. Five questions were used to elicit different levels of processing with a focus on typescript, rhyme and semantic/syntactic features. The recognition results confirmed the hypothesis that processing target words at deeper level helps retain the words in the memory system. This point of view was agreed by Tulving (1985) when addressing procedural memory system.

Craik and Tulving's (1975) experiments were designed to investigate word retention in episodic memory. The words they used in the study were nouns. This is rarely the case for EFL learners who face a dictionary of words covering different parts of speech. In their study, subjects were asked questions and by answering questions they

were supposed to engage in different levels of processing. For EFL learners, they are mostly independent learners after class and therefore, they are not in the similar situations.

He (2012) conducted two tasks designed with target levels of processing: Task 1 (a phonological processing task) instructed students to read out the words aloud and then perform an immediate free recall task; Task 2 (a semantic processing task) instructed students to read out the words aloud and then to speak out a sentence with the words; immediate free recall task was conducted. The results showed that semantic processing task produced slightly higher recall results. However, because the same group of students participated in the two tasks (though there was a two-week interval between the two tasks), students might have been influenced from the first task and then they might expect an immediate free recall task in Task 2. What's more, the words used in He (2012) covered from 1 to 4 syllables and they are not evenly distributed. There might be a word length effect. This might explain why students recalled the 1-syllable words highest and 4-syllable words lowest.

The current research was informed by the levels of processing and the idea that elaborative processing of target words will lead to a better learning result. This research improved He (2012) in the following aspects: 1) Chinese EFL learners were surveyed about the activities they do after class to enhance their memorization of English words. The survey is to justify and inform the tasks designed in the study; 2) Three tasks were designed and three groups of students participated the tasks; 3) A word list of 15 words was used for this study; there were five 1-syllable words, five 2-syllable words and five 3-syllable words.

THE STUDY

I. The survey

The survey was conducted at an online course taken by Chinese EFL learners. The question "What do you do to remember English words?" was posted as a forum in the Discussion Board of the course. Students were encouraged to respond to the survey in their free time. The forum was open for a two-week period. The participation in the survey will not affect students' final result of the course. Altogether, 19 students

responded to the survey. The following is the summary of students' responses to the question.

Table 1: Summary of responses to the survey.

Activities	Number of students
Read the text with the target words	6
Reading words out (follow pronunciation)	13
Use the words to make a phrase or a sentence or in the writing assignment	6
English songs	1
Flash cards	2
Associate words in the word families/other learned words/objects	1
Translate English words into Chinese or vice versa	2
Write words down	7
Identify suffixes or prefixes	1
Review words	7

Table 1 above summarized the responses by indexing the activities mentioned by students. We can see that the mostly adopted activities are reading words out, using the words to make a phrase, a sentence or in the writing assignments, and writing words down. Among these, reading words out is considered important for remembering words as well as for retrieving them. For most students, they would firstly get familiarized with the pronunciation and then move on to semantic or syntactic features of vocabulary (to make a phrase or sentence, or associate the word with other words or objects etc.) For example, students mentioned in the responses:

"*When I remember a single word, I prefer to follow the pronunciation of it in mind, rather than by spelling each letter.*"

"Usually, I remember English words through writing them down on the paper. I seldom reading them out because it will make me forget [them] more quickly. "

These responses showed that pronunciation is considered as an effective clue for remembering words. Associating words within their word families or other words (e.g., synonyms), or using the words to make a phrase or a sentence are considered helpful for vocabulary learning as well.

II. Task design

The procedure of this study basically replicated He (2012), which used two tasks (a phonological processing task and a semantic processing task) and compared the immediate free recall results of the tasks. As it has been mentioned above that He (2012) used the same group of participants for both processing tasks and this might influence the result, and the word list consisted of words from 1 to 4 syllables (see Table 2 below).

Table 2: Wordlists used in He (2012)

Task 1	Task 2
Fever	Never
Skill	Spill
Bed	Net
Temper	Fossil
Narrator	Essential
Foreign	Perceive
Perception	Rejection
Cap	Top
Phenomenon	Fundamental
Condition	Tradition
Assume	Pressure
Discuss	Debate
Interaction	Reservation
Hit	Pit
Add	Odd

In the survey, students mentioned that they pay a lot of attention to the pronunciation feature of words and they also think that using the words to make a phrase or a sentence is very important for remembering the words. Therefore, we add one written task for semantic processing task to examine whether writing down a sentence would influence the recall results. To reduce the word-length effect, and to examine if there would be a modality effect, the current study designed three tasks: 1) a phonological processing task asking students to read out the words aloud only; 2) a semantic processing task with oral production instructing students to read out the words first and then speak out a sentence with the words; 3) a semantic processing task with written production instructing students to read out the words first then write down a sentence with the words.

III. Research questions

1. Does deeper processing lead to better recall results? Is there a difference in recall results between oral production and written production groups?
2. Is there a syllable-based word-length effect?
3. Is there a primacy and recency effect?
4. Is grammaticality of sentences produced in oral and written groups a factor influencing the recall results?

IV. Material

One word list of 15 words was used in this study. The words were taken from textbook glossary that participants have learned and were selected based on the number of syllables (5 words of one syllable, 5 words of two syllables and 5 words of three syllables). The words were then randomly arranged and were put on slides of a PowerPoint file and presented on a laptop.

V. Participants

Altogether 45 Chinese EFL learners participated in the study. They were from the second grade of a tertiary institution in China. Participants were randomly divided into three groups. Participation was voluntary and not related to participants' course work.

VI. Procedure

The tasks were conducted in a two-week schedule. Participants took interviews individually in a study room with the researchers. They were told that the tasks aimed to examine how Chinese EFL learners process English words and they were not told that there would be a recall task at the end. The words were presented to the participants on the slides of a PPT file. Words were placed at the center of each slide. When participants were ready, they could press the space key to start the task. The procedure was self-paced and recorded.

The phonological processing task instructed participants to process each word on the phonological level. Each participant was asked to read out the word loudly only. After viewing each word and pronouncing each word out, the participants were asked to conduct an immediate free recall task.

The semantic processing task with oral-production instructed participants to process each word on the semantic level. Participants were asked to read out the word loudly first and then speak out a sentence with the word. When participants finished the word list, they were asked to perform an immediate free recall task. It was not a requirement to make a sentence with every word. But participants were encouraged to try to speak out whatever they can come up with. If they found it was too difficult to make a sentence, they can proceed without making one. Each participant was given enough time to make the decision.

The semantic processing task with written-production instructed participants to process words on the semantic level. The difference between this group and oral-production group is that participants in this task were instructed to write down a sentence with the words instead of speaking sentences out. After viewing and pronouncing each word, the participants were given a piece of paper to write down a sentence with the target word. After writing the sentence, the researchers would take the paper away and a blank sheet was prepared for the next word. To give a blank paper for each word was to prevent participants from reading previously produced sentences. This might interfere with the processing of the following words.

RESUTLS AND DISCUSSION

I. Does deeper processing lead to a better recall results?

Table 3 shows the recall results of three processing tasks. It shows that semantic processing with oral production of sentences produced the highest recall results (Sum=100, M=6.66). Both semantic processing tasks received higher recall results than phonological processing task. The recall results were then analyzed by one-way ANOVA; there is no statistically difference between three processing tasks as shown in Table 4. We don't think the results of these three processing tasks can provide an answer to RQ1 "Does deeper processing lead to a better recall result?" According to the design of the processing tasks, both semantic processing tasks engaged participants into "deeper" processing. Both semantic processing tasks asked participants to read out the words aloud and then to process the word for its semantic and morpho-syntactic features. Craik's (2002) mentioned that, "deeper processing" means "processing for more meaningfulness", the results from this study might offer supportive evidence to this view. However, as semantic processing tasks actually asked participants to do "two activities" (reading words out aloud, and making a sentence), this actually instructed participants to do "more things" with the target words comparing to phonological processing task, which only instructed participants to do one thing, "reading words out aloud". This difference of time contributing to the processing of target words might be the factor influencing the recall results.

Table 5 shows the recall results from He (2012). The current study supports He's (2012) finding in that both semantic tasks produced higher recall results. We think this is because participants were engaged in more elaborative processing of target words. As for why oral-production processing task yielded slightly higher recall results than written-production, this might be attributed to the way participants conducted recall task. The immediate recall results were conducted orally, and this echoes the way they were asked to process the words (speaking the words out aloud and then speaking out a sentence with the words). This might be the reason why oral-production of sentence task received the highest recall results.

Table3: Recall results of three tasks.

Tasks		No. of Participants	1syllable	2syllables	3syllables	Sum	Mean
Phonological processing		15	37	15	30	82	5.46
Semantic processing	Oral production	15	42	19	39	100	6.66
	Written production	15	37	15	37	89	5.93

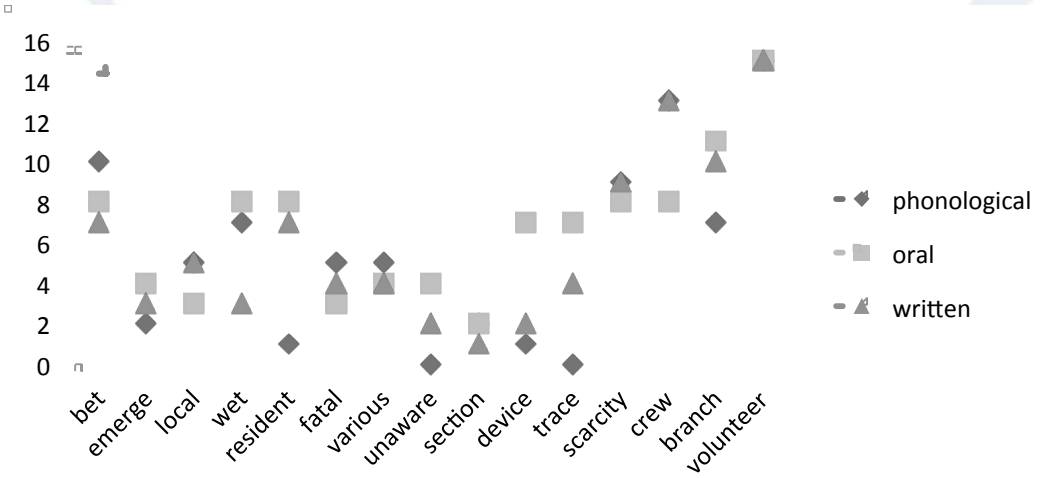
Table 4: ANOVA analysis of the recall results.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10.978	2	5.489	.319	.728
Within Groups	722.000	42	17.190		
Total	732.978	44			

Table 5: Recall results from He (2012).

He (2012) Tasks	1 syllable	2syllable	3 syllable	4 syllable	Sum	Mean
Phonological processing	48	36	20	17	121	7.11
Semantic processing	61	46	21	22	150	8.82

Figure 1: The number of each word recalled in three tasks.



II. Syllable-based word length effect

It has been reported that short words are recalled better than long words (Campoy, 2008; Jalbert et al, 2011). There are two types of word length effect. A time-based word length effect has not been confirmed due to inclusive results from different types of stimuli, and the syllable-based word length effect has been reported consistently with different types of stimuli (Jalbert et al, 2011). One explanation offered for syllable-based word length effect was based on the frame work of phonological loop (Baddeley et al, 1975; Baddeley, 1986). It hypothesized that words will be rehearsed in the phonological loop once they enter in the working memory system. It makes sense that shorter words will be rehearsed more times than longer words within the same duration. Therefore, in the immediate recall, shorter words (words with lesser syllables) are to be recalled more than longer words (words with more syllables).

Figure 2: Syllable-based word recall results.

Figure 3: Syllable-based word recall results from He (2012).

Figure 2 illustrates

the syllable-based word recall results from the three processing tasks. It can be seen that both 1-syllable and 3-syllable words recalled higher than 2-syllable words. This supports the hypothesis that shorter words might have been rehearsed more times, and this may result in a better recall results. But this does not explain in our study that 3-syllalbe words were recalled higher than 2-syllable words. As Figure 3 shows, He (2012) results in both tasks (phonological and semantic processing with oral production) display a decline from 1-syllable to 3-syllable words. He (2012) used words ranging from 1- to 4-syllable words, therefore the results from the current study cannot be compared to He's results. Still, it is interesting to notice the difference between Figure 2 and 3. One explanation for the high recall results for 3-syllable words in this study might be that 'volunteer' is the last word in the list. And as it is explained later, the recall results of this study might show a recency effect.

III. Primacy and recency effect

Figure 1 demonstrates a primacy and recency effects. That is the first several words were recalled comparatively higher in number, the middle part declined, and the final part of word list were recalled more again (recency effect) (Craik et al, 1970; Craik, 1970). Other explanation was that the words at the very end of the word list were not transferred from the short-term memory to long-term memory (Akinson and Shiffrin, 1968; Waugh and Norman, 1965). That's why it was easier for subjects to recall these words. This might also be attributed to the task design. The current study did not include an interference task after processing of the word list. This might explain why the results show very a strong recency effect.

IV. Grammaticality and depth of processing

Whether grammaticality of sentences produced by participants in semantic processing tasks is a factor influencing the recall results? From the result, grammaticality did not seem to be an influencing factor on the recall results. Table 6 shows sentences of the word "*emerge*" made by participants in oral and written production tasks. We can see that sentences are not all grammatically correct. For example, in written-production, there is a "*She emerges something for me to do*." "*Emerge*" is an intransitive verb. In this sentence, the participant used it as a transitive one. Though, grammatically the sentence was incorrect, the participant recalled the word after processing the word.

Table 6: Sentences of the word 'emerge'.

Oral production task	Written production task
The accident was emerged the other day.	*A shadow emerged at the end of the building.*
As soon as the emerge the case.	*A strong feeling emerged from the bottom of my heart.*
A lot of students emerge in the classroom.	*She emerges something for me to do.*
It is emerge.	*N/A*
The new world emerge everyone to try best to create a new world.	*This kind of phenomenon emerges in 1990.*
I emerge that I can do better.	*I emerged to that desk.*
He emerged to go out.	*N/A*
How will you handle this emerge?	*They suddenly noticed that there was a strange fish emerged from the wather [weather].*
A stranger emerged in my eye.	*It couldn't emerge that the house [was] burned out.*
The whole thing emerged in my mind.	*Bad things emerge at night.*
N/A	*N/A*
The accident emerged in that busy street.	*The fish emerges on the surface of the water with its head.*
Something new will emerge in the future.	*This matter emerged us a lot.*
N/A	*Suddenly, something horrible emerges from my mind.*
N/A	*What you were saying emerged that you were neverous [nervous].*

We think that grammaticality cannot be considered as an indicator of the recall results. Instead, it is the engagement to produce a sentence that makes the processing more elaborative. Even though, participants may fail to produce a grammatical correct, semantic sensible sentence, or even participants may fail to produce a sentence, it does not mean that they cannot recall the word. Instead, if they engage in "thinking of the meaning and grammatical roles" of the target word, it might be highly possible for them to recall the word in the end.

CONCLUSION

The study surveyed Chinese EFL learners about what activities they do after class to enhance their memorization of English vocabulary. The summary of responses

reported that most participants focus on pronunciation of the words and they find using the words to form phrases or sentences helpful. Three tasks were designed to induce different levels of processing, and three groups of participants conducted the processing tasks and immediate free recall tasks. Results from immediate free recall task showed that semantic processing tasks led to a better immediate free recall results. This result agrees what He (2012) has found out. And we contribute this higher recall results to the more elaborative thinking that semantic processing tasks engaged participants into.

Syllable-based word length effect, primacy and recency effects were observed in the result. Grammaticality is not a factor that influences the recall results, instead the elaborative thinking on the target words is considered to be an important factor.

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