Canadian Social Science
Vol. 6, No. 6, 2010, pp. 45-60

ISSN 1712-8056 [Print]
ISSN 1923-6697[Online]
www.cscanada.net
www.cscanada.org

A Comparison Study on Word Association Between English Native Speakers and Chinese English Learners[1]

UNE ÉTUDE COMPARATIVE SUR L'ASSOCIATION DE MOTS ENTRE LES LOCUTEURS DE LANGUE MATERNELLE ANGLAISE ET LES APPRENANTS CHINOIS DE L'ANGLAIS

WANG Hui-li[2]

BING Wen-duo[3]

HOU Yan[4]

Abstract: The paper aims to make a comparison study between word association of native speakers and that of Chinese English learners (CELs). Through data analysis of the word association results, the nature of the second language (L2) mental lexicon is explored.

A continuous free word association test (WAT) was conducted to 150 students from Dalian University of Technology (DUT). And the Minnesota word association norms are selected as a native speakers' word association test for the comparison. The results of WATs are classified and analyzed with respect to response type and part of speech.

The major findings in the paper are as follows:

(1) The words in L2 mental lexicon are essentially semantically-related, just like the mental lexicon of L1 speakers. But phonological relation plays a more important role in L2 mental lexicon than in L1 mental lexicon.

(2) Nouns are easy to be activated for both native speakers and L2 learners. And responses of the same part of speech as the stimulus word are easier to be activated.

(3) Difference in culture and limitation of language competence may cause the different word association of natives and L2 learners. And L2 learners' native language is likely to have influence on their L2 mental lexicon.

Keywords: mental lexicon; word association; Chinese English learners

Résumé: Le document vise à faire une étude comparative entre l'association de mots entre les locuteurs de langue maternelle anglaise et les apprenants chinois de l'anglais (ACA). Grâce à l'analyse des données des résultats d'association de mots, la nature de

[1] **Supported by"the Fundamental Research Funds for the Central Universities".**
[2] Institute for Language and Cognition, School of Foreign Languages, Dalian University of Technology, Dalian, China Email: hilarydut@gmail.com.
[3] Institute for Language and Cognition, School of Foreign Languages, Dalian University of Technology, Dalian, China
[4] Institute for Language and Cognition, School of Foreign Languages, Dalian University of Technology, Dalian, China
*Received 30 June 2010; accepted 12 September 2010

lexique mental de la deuxième langue (L2) est explorée. Un test continu de l'association de mots libre (TAM) a été réalisée chez 150 étudiants de l'Université de Technologie de Dalian (UTD). Et les normes d'association de mots de Minnesota sont sélectionnée comme un test d'association de mots chez les locuteurs natifs pour faire la comparaison. Les résultats de TAM sont classés et analysés en fonction du type de réponse et de la partie du discours.

Les conclusions principales de cet article sont les suivantes:

(1) Les mots dans le lexique mental L2 sont sémantiquement liés, tout comme le lexique mental des locuteurs de L1. Mais les relations phonologiques jouent un rôle plus important dans le lexique mental L2 que dans le lexique mental L1 .

(2) Les noms sont faciles à être activés pour les locuteurs natifs et les apprenants de L2. Et les réponses de la même partie du discours en tant que le mot de stimulus sont plus faciles à activer.

(3) La différence de culture et la limitation de la compétence linguistique peuvent causer une association de mots différente des autochtones et des apprenants de L2. Et la langue maternelle des apprenants de L2 est susceptible d'avoir une influence sur leur lexique mental L2.

Mots-clés: lexique mental; association de mots; apprenants chinois de l'anglais

INTRODUCTION

For any language, vocabulary plays a significant role. Without vocabulary, communication cannot happen in a meaningful way. Thus lexical researches have aroused more and more interest among linguists. And the study of mental lexicon has drawn special attention from researchers. In the past thirty years, there has been great development in lexical research. Researchers make great efforts to try revealing the organization of mental lexicon which contains an extremely large amount of information. By now, agreement has been reached on the organization of the first language (L1) mental lexicon. Researchers commonly agree that words in L1 mental lexicon are connected with each other semantically and are stored in mind around a semantic network. However, there is still disagreement among researchers on the organization of the second language (L2) mental lexicon. Three kinds of viewpoints have been advanced, namely phonological view, semantic view and syntactic view. With the application of word association test (WAT) to linguistic study, more and more researchers have started to use this efficient method in the study of L2 mental lexicon to try to find answers to this unsettled issue.

The present paper also tries to apply the WAT method to investigate the mental lexicon of Chinese English learners (CELs). The purpose of this paper is to make a comparison of the word association patterns between English native speakers and CELs by comparing their WAT results. At the same time, the features of the L2 mental lexicon are to be revealed after a careful analysis and comparison of data. The following questions are to be discussed and answered in the paper.

(1) Is L2 mental lexicon organized in a similar way with L1 mental lexicon?
(2) Does the part of speech of the stimulus word influence the part of speech of its response words?
(3) What are the factors that are likely to cause the differences between word association of L1 speakers and that of L2 learners?

1.1 Mental lexicon

The study of mental lexicon is a relatively new branch of psycholinguistic study. It mainly explores how vocabularies are stored in one's mind and how they are retrieved (Gui, 2000).

The term "mental lexicon" is sometimes referred to as internal lexicon also. It is explained by Aitchison (2003) in her book "Words in the Mind: An Introduction to the Mental Lexicon" as the "mental dictionary", or the long-term permanent memory of lexical knowledge in one's mind. And Aitchison used to compare the mental lexicon to a book. A more recent definition is given by Richards & Schmidt (200) in the Dictionary of Language Teaching & Applied Linguistics, considering mental lexicon as "a person's mental store of words, their meanings and associations".

However, the mental lexicon and a book dictionary differ in content, organization and retrieval. First, with regard to content, there is far more detailed information of a word in one's mind than the explanation of an entry in a dictionary. And new information is added to one's mental lexicon at any time of his life while words in a dictionary are almost fixed. Second, in the respect of organization, words in a book dictionary are organized alphabetically, from A to Z, while the mental lexicon is not. Third, as for retrieval, words in one's long-term memory are retrieved far more quickly. And the process of retrieval of the mental lexicon is more complicated as context is concerned in communication.

1.2 Organization of mental lexicon

As mentioned above, words in a book dictionary are organized from A to Z. Then, how is the mental lexicon organized in mind? This question has aroused the interest of many linguistic researchers. Unlike a book dictionary, the mental lexicon is invisible in mind. Thus the organization of mental lexicon can only be observed through the representation of the retrieval process.

There are mainly two points of view with regard to the organization of mental lexicon: phonological organization and semantic organization. Some researchers believe that the organization of mental lexicon is phonology dominating, as it is found that words with similar beginnings, similar endings and similar rhythms are likely to be tightly bonded (Aitchison, 2003). Besides, some researchers find evidence from the phenomenon of slip of tongue. Here are a few examples.

Example 1 Because I've got an apartment.
(Because I've got an appointment.)
Example 2 Sea shore
(She sore.)
Example 3 In my day life
(In my daily life)

Note: In each example, the sentence or phrase in parentheses is the correct one, while what is above it is the error one

The existence of these slips of tongue indicates the existence of a phonological network in the mental lexicon.

However, the other semantic view of organization of mental lexicon is accepted by more and more researchers. They suggest that words in the mental lexicon are stored in a semantic network. Words in the same semantic field tend to be stored together, while words in different semantic fields are loosely related (Aitchison, 2003). This view has been widely proved through word association experiments by researchers. It is found that most of the responses in word association test have semantic relations with the stimulus word.

1.3 Organization of L2 mental lexicon WAT and response types

As L2 acquisition is different from L1 acquisition, the issue that whether L2 mental lexicon is organized in the same way as L1 mental lexicon has been noted among linguistics researchers. Many researchers have tried to investigate the organization of L2 mental lexicon, and they have not reached agreement yet on this issue. There are three major viewpoints concerning the organization of L2 mental lexicon, namely phonological view, semantic view and syntactic view (Hou, 2008).

1.3.1 Phonological views

In the study of L2 mental lexicon, there has been a view that words in L2 mental lexicon are essentially phonologically connected, as it has been found through WATs that L2 learners tend to produce a large number of clang responses. The most important evidence supporting this view is provided by Paul Meara (1984) who directed the Birkbeck Vocabulary Project in the 1980s. He drew a conclusion after a few researches based on WAT that the mental lexicon of English learners is different from that of native speakers. And he found that "Phonology appears to play a much more prominent organizing role in the L2 mental lexicon than it does in the LI mental lexicon".

Although several researchers support Meara's view and try to find evidence, the phonological view is still challenged by researches who indicate L2 mental lexicon is similar to L1 mental lexicon and is semantically based.

1.3.2 Semantic view

Semantic view claims that semantics play a predominating role in L2 mental lexicon. The evidence to this view is that L2 learners produce a high proportion of paradigmatic responses in WATs, just like native speakers.

This view is supported by many researchers such as O'Gorman(1996), Singleton (1999), and is becoming widely accepted by other researchers.

1.3.3 Syntactic view

A syntactic view holds the idea that words in mental lexicon have mainly syntagmatic relations with each other. That is to say, links between words are mainly sequential or collocational in nature (Xu, 2008). It was first advanced by Wolter (2001) in a WAT conducted to 13 Japanese English learners and 9 native speakers. The results show that Japanese English learners produce more syntagmatic responses and clang-other responses than paradigmatic responses. Wolter (2001) came up with the conclusion that L1 and L2 mental lexicon are fundamentally different for words that are well known. Syntagmatic relations play a more important role in organizing the words that comprise the non-native speaker mental lexicon.

1.4 WAT and response types

1.4.1 Word association test

Word association indicates the interrelation of words in one's mind, which refers to "the link or links that connect different words in some manner in a person's mental lexicon" (Schmitt & Meara, 1997).

In early studies, researchers found that there is a great deal of consistency in the response words in word association tests produced by subjects, which suggests that speakers of a language have a similar kind of mental connection between words (Zhang, 2009). Thus word association pattern is considered by linguistics researchers as a reflection of the way the words are stored and linked in one's mental lexicon, and word association test is regarded as an important approach in studying mental lexicon.

Word association test (WAT) has a long history in psychological research. It is a common method within psychology which has been used to reveal the private world of an individual, including his verbal memories, thought processes, emotional states and personalities etc. In a word association test, stimulus words are projected orally or in written form to the subjects who must respond with the first word which comes to their minds, and this word is referred to as a response word. Psychologists examine the feature of the response words, and sometimes the amount of time it takes to respond.

Invented by F. Galton, WAT was widely used by psychologists such as Jung, Kent and Rosanoff in their researches. And it was Kent and Rosanoff who firstly applied WAT in the study of English language in 1910 (He, 2009). Kent & Rosanoff's study was the first large scale study based on WAT which was carried out in English among 1,000 subjects. They used 100 stimulus words and read one word at a time to the subject who was asked to give the first word that came into his/her mind (lknur, 2010). After analyzing the data, they claimed that there was uniformity in the organization of associations and people shared stable networks of connections among words. The use of WAT in research flourished in the 1950s and 1960s, but mainly in psychological fields. More influential work with WAT in linguistic study was done by Meara who was in charge of psycholinguistic research of the Birkbeck Vocabulary Project in 1980 and 1982. Since then, investigation into L2 mental lexicon using WAT has never ceased.

WAT has several types. It can be a single free association test, a controlled association test, a continual association test or a continuous multiple free association test. In a single free WAT, the subject is required to give only one response to each stimulus word; in a controlled WAT, the subject is asked to choose one response from a few given choices; in a continual WAT, one single response is required for one stimulus word, but the stimulus is presented several times; in a continuous WAT, the subject should give as many responses as possible for one stimulus within a given period of time, or the number of responses is demanded by the test designer.

In terms of the method of data collection, WAT can be divided into four types: aural-oral, aural-written, written-oral, and written-written (Zhang & Chen, 2009). Aural-oral method means the stimulus words are given out orally and the subject hears the stimulus word then speak out a response word/ response words

while in an aural-written test the subject hears the stimulus word and write down the response word. Written-oral test gives the stimulus word in written form and requests the subject to speak out the response word after seeing the stimulus word. Written-written test makes the subject write down his/her answers on the test paper.

1.4.2 Response types of WAT

The responses of a WAT are traditionally divided into three types by researchers, namely phonological response, syntagmatic response and paradigmatic response (Gu, 2006). Phonological responses are responses that resemble the stimulus word only phonologically and have no semantic connection to the stimulus word. E.g. *needle*-noodle, *white*-light (Note: the italic words are the stimulus words, and it applies to all the examples in the paper.). Syntagmatic responses are words that have a sequential or collocational relationship to the stimulus word and are usually (but not always) from a word class different from that of the stimulus word. E.g. *eagle*-fly, *earth*-move. Paradigmatic responses are usually words from the same word class with the stimulus word, and perform the same grammatical function within a given sentence. There are several types of paradigmatic response with regard to the semantic relation between the stimulus word and the response, namely coordinates (*fruit*-vegetable), superordinates (*eagle*-bird), subordinates (*dog*-terrier), synonymy (*table*-desk), and antonymy (*black*-white) etc.

The above-mentioned way of dividing WAT responses into three types is commonly adopted by researchers. But later, Weinreich proposes a theory that the organization of a bilingual lexicon is a combination of a lexical form and lexical meaning (Zhang, 2009). On the basis of this idea, word association pattern is described in terms of phonological relation and semantic relation.

In the practices of WAT, researchers find that some responses can't be grouped into any of the three types, and have no phonological relation or obvious semantic relation with the stimulus. Therefore, some researchers divide response words into paradigmatic, syntagmatic and clang-other responses. Here the clang-other responses include phonological responses and all the unclassifiable responses.

As for the data analysis in the paper, response words are classified generally into three categories: semantically-related responses, non-semantically-related responses and null responses. In a more detailed classification, semantically-related responses include paradigmatic responses and syntagmatic responses; non-semantically-related responses include clang/phonological responses and unclassifiable responses; null-responses include meaningless response word or no-response and responses produced by repeating the stimulus words.

As the classification of the responses was a far more complicated process and the subjects' responses don't always fall into the pre-designed categories perfectly, a clear and detailed definition of each category is needed. So the actual execution in the paper of classifying the three major categories, namely paradigmatic response, syntagmatic response and phonological response, are defined in detail.

(1) Paradigmatic responses: responses that show a clear semantic connection to the stimulus word. The paradigmatic responses are most of the time from the same word class with the stimulus word. E.g. *beautiful*-handsome, *high*-low, *trouble*-problem etc.. But sometimes words that are not from the same word class with the stimulus word also have clear semantic relation with the stimulus, so they are also classified into paradigmatic responses. E.g. *anger*-annoy, *comfort*-convenient, *sickness*-ill etc. (Zhao, 2007).

(2) Syntagmatic responses: responses that form a clear sequential or collocational relation with the stimulus word and usually come from a different word class with the stimulus word. There are mainly three types of responses falling into this category: a) words that can form a sequential relation with the stimulus word, such as modification between adjective and noun. E.g. *beautiful*-girl, *wish*-to, *house*-build etc. b) words that form a collocational relation with the stimulus word and are usually used together with the stimulus word as an idiom. E.g. *short*-sweet ("short and sweet" means to the point), *butterfly*-stomach ("have butterflies in one's stomach" means feel very nervous) etc. c) syntagmatic relation exists between a compound word and the words with which the compound word is formed (Saussure, 2001). E.g. *house*-household, *house*-hold, *house*-housework, *house*-work etc.

(3) Phonological responses: a) words that are only similar to the stimulus word in pronunciation and bear no semantic relation with the stimulus word. E.g. *smooth*-smith, *house*-mouse etc.. b) words that are similar to the stimulus word in form but have no semantic connection with the stimulus word (Zhang, 2009).

E.g. *whistle*-wish, *man*-many etc.. c) words that are the derivative forms of the stimulus word. E.g. *man*-manly, *music*-musical etc.

1.5 Related studies on mental lexicon of CELs based on WAT

In China, researches on mental lexicon began much later than those in the western world. Not until the 1990s did some researchers start the study on CELs' mental lexicon. However, in recent years, more and more researchers begin to study L2 mental lexicon.

It was Gui (1992) who first claimed that the mental lexicon of CELs was organized around a semantic network. He also agrees on the idea that there is only one semantic network in the mind of a multilingual person.

Dong and Gui (2002) advanced a shared distributed asymmetrical model after taking the translation between English and Chinese into consideration. They notice that translation equivalents of the two languages do not always share the same concept. Instead, they are partially same with some points particular to one language. Conclusion is made that the shared concept of the translation equivalents shares the same conceptual representation in mind.

Zhang (2005) made a WAT test by following Wolter's study, comparing the response types of 40 advanced CELs and those of 19 native speakers. From the test, she found that the majority of CELs' responses were phonological responses which take even more a percentage than the total number of paradigmatic responses and syntagmatic responses. The conclusion is that L2 learners haven't built meaningful semantic connection between most of the words in mental lexicon, and that L2 mental lexicon is essentially phonological-related while L1 mental lexicon is essentially semantic-related. The conclusion, to some extent, confirms the idea of Meara.

Zhang (2009) from the School of Foreign languages in Southeast University do a research project "Word Association Patterns in Chinese EFL Learners' Mental Lexicon", making a very detailed research on CELs word association. She concluded from her research that the L2 mental lexicon is a mixture of relatively semantically-related associations and a considerable proportion of non-semantically-related associations. And different types of stimulus words have effects on the patterns of word association in the L2 mental lexicon. Besides, the word association patterns vary with the increase of L2 learners' vocabulary proficiency.

2. METHODOLOGY

2.1 Research objective

The purpose of the paper is to make a comparison study on the word association between native speakers and Chinese English learners (CELs). By analyzing the results of a native speakers' WAT and a CELs' WAT, the features of the two word association results are explored and compared. Then the similarity and difference of the patterns of word association in L1 mental lexicon and L2 mental lexicon can be seen from the results.

2.2 The WATs for study

To compare the word association pattern of native speakers and CELs, two sets of WAT are needed for data analysis. The WAT of CELs is conducted to the students from Dalian University of Technology (DUT) and the Minnesota word association norms are chosen for the analysis of the word association of native speakers.

2.2.1 The Minnesota WAT

The Minnesota word association norms were obtained by Russell (1952) in University of Minnesota. About 1008 samples were collected and classified. All the subjects are students, mostly sophomores, in introductory psychology classes.

The Minnesota WAT adopts the single free association test, i.e., the subjects are required to write the first word which makes him/her think of. And the data of the WAT is collected by a written-written method, i.e., the stimulus words are in written form and the subjects are asked to write down their response words.

As for the selection of the stimulus words, there are the 100 stimulus words in the Kent-Rosanoff word association test and are presented in classic Kent-Rosanoff order. The test is attached in **Appendix 1.**

2.2.2 The DUT WAT

150 tests were conducted to sophomores from English enhanced classes with engineering study background in DUT. All of them are native speakers of Chinese and have learnt English as their second language for about eight years. After taking out a few invalid samples which the subjects failed to provide responses to all stimulus words, all together 129 valid samples are obtained.

The DUT WAT is a continuous free association test, i.e., the students are asked to produce as many responses as possible to one particular stimulus word in a limited time of thirty seconds. The stimulus words are given in form of PPT slides. The students will look at the slide and write down their responses within thirty seconds until next slide of the stimulus word is played on, so the DUT WAT is also a written-written word association test.

50 stimulus words are selected out of the 100 stimulus words of the Kent-Rosanoff word association test. They were: table, dark, music, sickness, man, deep, soft, eating, mountain, house, black, mutton, comfort, hand, short, fruit, butterfly, smooth, command, chair, sweet, whistle, woman, cold, slow, wish, river, white, beautiful, window, rough, citizen, foot, spider, needle, red, sleep, anger, carpet, girl, high, working, sour, earth, trouble, soldier, cabbage, hard, eagle and stomach. Most of the 50 stimulus words are noun or have a noun part of speech and all of them are words with high frequency and are emotionally neutral.

2.3 Data analysis

The results of the Minnesota WAT and the DUT WAT are carefully classified and analyzed. As the Minnesota WAT is a single free association test yet the DUT WAT is a continuous one, only the primary responses, i.e. response in the first place, of the DUT test is studied and compared with the Minnesota test. And for the Minnesota test covers 100 stimulus words, only half of them which are selected in the DUT test are analyzed in this paper. There are a few major steps of data processing are made.

Table 2.1 Responses of *table*

Frequency	Responses	Response Type	Part of Speech
53	desk	P	Noun
37	chair	P	Noun
4	able	C	Adjective
3	cup	P	Noun
3	table		
2	bed	P	Noun
2	dinner	S	Noun
2	leg	P	Noun
2	take	S	Verb
1	apple	C	Noun
1	book	S	Verb
1	booth	P	Noun
1	cable	C	Noun
1	chart	P	Verb
1	cloth	S	Noun
1	dog	OT	Noun
1	family	OT	Noun
1	floor	P	Noun
1	glass	S	Noun
1	Meals	S	Noun
1	pen	P	Noun
1	room	P	Noun
1	seat	P	Noun
1	table tennis	S	N.P.
1	task	OT	Noun

Notes:
1. P represents Paradigmatic Response
2. S represents Syntagmatic Response
3. C represents Clang Response
4. OT represents Other Response
5. N.P. represents Noun Phrase
6. This is a clipped part of the whole Excel sheet for the stimulus word *table*

First, all the primary responses in the 129 valid samples of the DUT test are put into Excel document and into 129 different sheets. As for the Minnesota WAT, the results have already been arranged according to the frequency of the responses to each stimulus word. What is left to be done is to put the data into 50 different sheets in Excel document.

Second, the 129 subjects' responses to one particular stimulus word are rearranged into one Excel sheet, so altogether 50 sheets are obtained. Then, the frequency of each response is counted and the responses are rearranged according to their frequency, from the high to the low.

Third, the response type and part of speech of each response word in the two WATs are classified for later comparison on the percentage of each response type and of part of speech. Table 2.1 is part of the Excel document of the stimulus word *table* in DUT test.

3. FINDINGS AND DISCUSSION

As mentioned in Part 2, the WAT results of Minnesota and DUT are put into 50 Excel sheets each, with the frequency, type and part of speech of each response listed. In this part, further data analysis will be made and the results be discussed. First, features of the two WATs are studied and comparison is made. Second, factors influencing the differences between L1 and L2 word association are summarized. Third, a discussion on the results is made to conclude this part.

3.1 Features of L1 and L2 WAT responses and their comparison

3.1.1 On response type

According to the relation of the response and the stimulus word, three types of responses in word association are classified, namely semantically-related type, non-semantically-related type and null response type, with each type classified into smaller groups. The detailed classification of different response types and the proportion of each type will be shown in the following Table 3.1, and a comparison between native speakers and CELs will be made in terms of response type.

Table 3.1 Proportion of response types

Response Type		Native Speakers	Chinese English Learners
Semantically-Related	Paradigmatic	71.53%	50.97%
	Syntagmatic	23.67%	24.94%
	Total	95.20%	75.91%
Non-Semantically-Related	Clang	0.39%	9.81%
	Unclassified	4.38%	12.23%
	Total	4.77%	22.04%
Null Response	None/Meaningless		0.82%
	Repetition of SW	0.03%	1.23%
	Total	0.03%	2.05%

Note: SW represents Stimulus Word

As can be seen from Table 3.1, the semantically-related response type takes an overwhelming proportion of native speakers' responses. And for CELs, the semantically-related type is also the majority, though clang-other response type makes up a large proportion. This result confirms the semantic organization of mental lexicon mentioned in chapter 2. It can also be seen from Table 4.1 that for both native speakers and CELs, paradigmatic response type takes the largest proportion of all the responses, being 71.53% and 50.97% respectively, followed by syntagmatic response type. This result provides evidence for the semantic view of L2 Mental lexicon that the mental lexicon of L2 learners is

predominantly meaning-based and organized around a semantic network instead of a phonological or syntactic network. Moreover, CELs produce more clang-other responses than natives, especially clang responses. Shown in Table 3.1, CELs produce 9.81% clang responses while native speakers produce only 0.39%. It indicates that phonological relation plays a more important role in L2 mental lexicon than in L1 mental lexicon.

The clang/phonological relation always draws attention and interest of L2 mental lexicon researchers. Here in this paper, a relatively high proportion of clang responses for CELs is shown. As is discussed in the methodology part, clang responses can be grouped further into three types of responses, namely phonological responses, orthographical responses and derivational responses. In the following Table 3.2, the proportions of the three types of clang responses in CELs' WATs are presented.

Table 3.2 Three types of clang response

Response Type	Percentage
Phonological	34.19%
Orthographical	22.15%
Derivational	43.66%

CELs, as shown in Table 3.2, produces most derivational responses, followed by phonological responses and orthographical responses. Some examples of the three types of clang responses produced by CELs are presented here.

Phonological responses:
dark-duck, table-able, mutton-button, smooth-smith, chair-hair, cold-hold
Orthographical responses:
smooth-moon, rough-through, man-many, stomach-storm, sickness-nest
Derivational responses:
music-musician, deep-deepen, comfort-comfortable, soft-softy, hand-handful
Note: word to the left of the dash "-" is the stimulus word, to the right is the response word.

These clang responses have no semantic relation to the stimulus words, in others words the meaning of the stimulus word is not taken into consideration by the subjects. Thus clang responses indicate a lower degree of lexical knowledge for a word. The large proportion of clang responses produced by CELs may be mainly attributed to two reasons. First, low degree of knowledge for the stimulus words or unfamiliarity with the stimulus words is one of the reasons. For the limited knowledge, some CELs haven't built an effective semantic network for some of the stimulus words, or even can't recognize the word. For example, for the word "mutton" , there are response words "puzzle, wonder" and for the word "whistle", one subject provides "unfamiliar". Without a semantic network, they failed to produce any semantically-related responses. As shown in Table 3.1, there are 0.82% no-responses or meaningless responses for CELs (e.g. *carpet*- manitkin, *anger*- gama). Second, the subjects did not concentrate on the test and did not want to make efforts in giving responses. This may be seen from the 2.05% no-response, especially with 1.23% responses being the repetition of the stimulus words (e.g. "man" as the response to "man").

In summary, words in the mental lexicon of CELs are fundamentally semantically-related and stored around a semantic network which is similar to that of native speakers. At the same time, phonological relations play an active role in the organization of CELs' mental lexicon.

3.1.2 On part of speech

The part of speech of the responses reflects largely the word association pattern of the subjects. Words of what part of speech are easier to be activated by native speakers and by CELs； whether there is any difference between the two groups； is there any relation between the part of speech of the responses and that of the stimulus words. With the results of data analysis of WATs shown as follows, these questions are to be discussed in this part.

As shown in Table 3.3, noun, adjective and verb responses take almost the whole part of all the responses for both the native speakers and CELs, being 99.36% and 98.58% respectively whereas words of other parts of speech such as adverbs, prepositions, pronouns, interjections etc. total only 0.64% and 1.42% of all the responses. That is to say, content words like noun, adjective and verb are easier to be activated than functional words in association tests for both native speakers and CELs. As for the slight difference in the percentage of each part of speech between native speakers and CELs, the reason may be attributed to the

language difference between English and Chinese. For example, there are 25.93% adjective responses and 6.92% verb responses for natives but 22.59% and 9.75% for CELs. As we all know, more nouns and adjectives are used in English language, while more verbs and verbal phrases are used in Chinese (Tong, 2009). Besides, Chinese students can be influenced by their native language while speaking English, the result might be the excuse for CELs producing more verb responses than the natives.

Table 3.3: Proportion of different parts of speech of responses

Part of Speech	Natives	Chinese English Learners
Noun	66.51%	66.25%
Adjective	25.93%	22.59%
Verb	6.92%	9.75%
Total	99.36%	98.58%
Others	0.64%	1.42%

Moreover, noun responses take a large proportion of all the responses, and the situation is equally the same in native speakers and CELs. As is shown in Table 3.3, noun responses account for 66.51% of natives' responses and 66.25% of CELs' responses. One assumption to explain this case may be that nouns can be activated by all the stimulus words no matter what part of speech the stimulus word is. Noun can form sequential relation with an adjective stimulus word and with a verb stimulus word easily. On the contrary, adjective stimulus word can hardly activate a verb response word.

For a deeper study of the relation between the part of speech of the responses and that of the stimuli, twelve words of different parts of speech are selected from the fifty stimuli, four from each part of speech. The part of speech of their responses are counted and shown in the following Table 3.4.

Table 3.4 Proportion of different parts of speech of the responses of native speakers

Stimulus Word		Part of Speech		
		Noun	Adjective	Verb
Noun	fruit	92.83%	2.59%	4.58%
	man	97.32%	2.18%	0.30%
	music	89.78%	5.56%	4.56%
	table	97.72%	0.89%	1.29%
Adjective	*beautiful*	*44.76%*	*54.73%*	*0.40%*
	dark	*11.13%*	*87.57%*	*0.30%*
	deep	*34.82%*	*61.31%*	*1.88%*
	soft	39.53%	60.02%	0.45%
Verb	command	65.48%	5.16%	28.57%
	sleep	56.87%	17.43%	24.40%
	whistle	59.03%	8.23%	32.44%
	wish	27.04%	3.28%	59.74%

Table 3.5 Proportion of different parts of speech of the responses of CELs

Stimulus Word		Part of Speech		
		Noun	Adjective	Verb
Noun	fruit	88.28%	8.59%	3.13%
	man	92.13%	5.51%	1.57%
	music	85.83%	7.87%	6.30%
	table	93.65%	3.17%	3.17%
Adjective	*beautiful*	*74.80%*	*24.41%*	*0.79%*
	dark	*47.66%*	*50.78%*	*0.78%*
	deep	*57.81%*	*28.13%*	*11.72%*
	soft	44.09%	51.98%	2.36%
Verb	command	65.08%	3.97%	30.16%
	sleep	45.67%	21.26%	20.47%
	whistle	55.12%	18.11%	22.05%
	wish	27.78%	10.32%	60.32%

After analysis and comparison of the data in Table 3.4 and Table 3.5, there are three major findings in terms of part of speech.

First, noun responses take a relatively large percentage of all the responses no matter what part of speech the stimulus words are. For noun stimulus words, noun responses take an overwhelming proportion of about 90% or more and bear mostly a paradigmatic relation with the stimulus words such as synonyms, coordinates, superordinates, subordinates etc. , while adjective responses modifying the stimulus word and verb responses describing the action of the noun are harder to be activated when noun stimulus words are presented. For adjective stimulus words, noun responses which they are modifying are almost as easily activated as adjective responses which are synonyms or antonyms of the stimulus words. For verb stimulus words, all of which also have a noun part of speech (e.g. command means "to order someone to do something" and also means "an order"), usually more noun responses and adjective responses are activated.

Second, words are easier to be activated by stimulus words of the same part of speech. In Table 3.4, adjective responses take the largest proportion of all the responses to adjective stimulus words, yet take a very small proportion of the responses to noun and verb stimulus words. The case is the same with verb responses which take a much larger proportion of the responses to verb stimulus words than to noun and adjective stimulus words.

Third, there is much difference between the responses to adjective stimulus words of CELs and those of native speakers. It is found in Table 3.4 and Table 3.5 that all noun and verb stimulus words share a similar proportion in responses' part of speech between native speakers and CELs, i.e., the two groups' association patterns of noun and verb stimulus words are quite similar, yet as for adjective stimulus words, the case is not the same. (Stimulus words beautiful, dark and deep which are in italic have great difference in the proportions of different parts of speech of the responses.) In the following Table 3.6 and 3.7, the responses to adjective stimulus words will be discussed with more details.

As shown in Table 3.6, adjective responses rank the first for native speakers, while the case is not the same with CELs. In Table 3.7, words like rough, short obtain more adjective responses than noun responses, words like beautiful, sweet and smooth obtain more noun responses, and words like cold, dark and soft obtain as many noun responses as adjective responses.

After the comparison in Table 3.6 and 3.7, a general conclusion can be made that adjective stimulus words activate more adjective responses than noun responses for native speakers, i.e. , more paradigmatic responses are activated. However, for CELs, paradigmatic relation and syntagmatic relation play an equally important role in word association for adjective stimulus words.

In summary, for all the stimuli, no matter what kind of part of speech it belonged to, noun responses would take up an overwhelming proportion. It means that nouns are the easiest words to be activated for both native speakers and CELs. Besides, the words of the same part of speech with the stimuli are much easier to be activated. The last but not the least, not like native speakers, both paradigmatic and syntagmatic relations play an important role in word association of adjective stimulus words for CELs.

Table 3.6 Adjective stimulus words for native speakers

Word	Part of Speech		
	Noun	Adjective	Verb
beautiful	44.76%	54.73%	0.40%
cold	40.08%	57.24%	1.49%
dark	11.13%	87.57%	0.30%
Word	**Part of Speech**		
	Noun	**Adjective**	**Verb**
deep	34.82%	61.31%	1.88%
hard	22.12%	75.30%	2.58%
high	23.59%	71.85%	1.68%
rough	30.05%	68.86%	1.00%
short	10.35%	89.25%	0.20%
slow	14.34%	78.78%	5.08%
smooth	22.34%	86.59%	0.99%
soft	39.53%	60.02%	0.45%
sour	35.58%	64.02%	0.40%
sweet	39.40%	60.20%	0.30%

Table 3.7 Adjective stimulus words for CELs

Word	Part of Speech		
	Noun	Adjective	Verb
beautiful	74.80%	24.41%	0.79%
cold	42.86%	52.38%	4.76%
dark	47.66%	50.78%	0.78%
deep	57.81%	28.13%	11.72%
hard	33.86%	51.18%	14.17%
high	54.76%	35.71%	3.97%
rough	30.16%	60.32%	6.35%
short	17.19%	82.81%	0
slow	29.60%	52.80%	12.00%
smooth	67.20%	38.40%	5.60%
soft	44.09%	51.97%	2.36%
sour	54.76%	34.92%	6.35%
sweet	80.00%	16.80%	2.40%

3.1.3 Some features of L1 and L2 WAT responses

Responses of low quality. Responses of low quality here refer to no-response or responses produced by repeating the stimulus words, showing personal attitude, naming the objects in the room or continually using one response word for different stimulus words etc. In this study, it is found that for both native speakers and CELs responses of low quality exist. In this section, some examples of those low quality responses will be given.

(1) Expressing personal attitude towards stimulus words. Response words that express attitude, such as like, hate, good, bad, terrible etc., are produced by some subjects. E.g.:

cold-hate
command-disgusting
whistle-bad
sour-disinterested
cabbage-distaste
mutton-lousy

Note: word to the left of the dash "-" is the stimulus word, to the right is the response word

(2) Repeating the stimulus words. As discussed in part 4.1.2, 1.23% responses of CELs are produced by repeating the stimulus words. And the case also exists in native speakers, with a percentage of 0.03%. And this type of low quality response is produced to both familiar and unfamiliar stimulus words, which is likely to indicate the unserious attitude of some subjects towards the test.

Linear-forward association. It is found in CELs' responses that some of the responses have no direct relation with the stimulus word but are related through one or more medium words. This kind of situation can also be found in native speakers, but is quite seldom. This difference may be explained by the fact that the words in mental lexicon of L2 learners is not as closely-related as in mental lexicon of native speakers or may be caused by the relatively long time be given to the subjects for careful consideration. Below are some examples.

Example 4 chair—resident

The stimulus word "chair" can't activate the response "resident" directly, but with a process "chair-chairman-president-resident". Here "chairman" and "president" act as the medium words which activate the response word "resident".

Example 5 needle—dumpling
The activating process is "needle-noodle-dumpling"
Example 6 sour—sweetheart
The activating process is "sour-sweet-sweetheart"

Example 7 river—scream

The activating process is "river-stream-scream"

Example 8 spider—superman/X-man

The activating process is "spider—Spiderman—superman/X-man"

Note: word to the left of the long dash "—" is the stimulus word, to the right is the response word

3.2 Factors influencing the differences between L1 and L2 word association responses

3.2.1 Cultural factor

Chinese culture is quite different from that of English speaking countries. When learning a foreign language from different cultures, learners would certainly feel hard for not being capable of understanding the foreign culture which the language is delivering. And for the lack of knowledge of foreign culture, CELs can't activate the same response words as the native speakers do. An example is shown here.

Example 9 *man*-hat

For the stimulus word "man", native speaker produces the response word "hat" which is harder for a Chinese to activate. In western culture, hat is closely related to gentleman, while Chinese will not have the concept that the two words are inseparable.

3.2.2 Language competence

The limitation of language knowledge or even the poor vocabulary knowledge is certainly the reason why CELs feel hard in word association and can't activate some of the responses produced by native speakers.

An obvious example can be found in the response of music. Some of the natives' responses like note, orchestra, clarinet and scale are not activated by CELs as these words are not familiar to most of them.

3.2.3 Influence of native language

When one learns a foreign language, his mother tongue must play an important role in being a medium between the concept in the mind and the foreign language. The influence of the mother tongue causes CELs to produce responses that are harder for native speakers to activate.

Example 10 high-climax

The stimulus word "high" activate "climax" for CELs is very likely made through a process of translating high into Chinese "高", then the Chinese word "高潮" is activated, which is again translated back into English letter "climax" .

3.3 Summary of results and limitation of the research

3.3.1 Summary of results

The following conclusions can be reached according to the data analysis results in the paper.

(1) The words in L2 mental lexicon are essentially semantically-related, just like the mental lexicon of L1 speakers.

(2) Semantics play a more important role than syntactics and phonology for L2 learners.

(3) Clang/phonological relation plays a more important role in L2 mental lexicon than in L1 mental lexicon.

(4) Nouns are the easiest to be activated for both native speakers and CELs. And words of the same part of speech with the stimulus word are easier to be activated.

(5) Paradigmatic relation and syntagmatic relation play an equally important role in word association of adjective stimulus words for CELs.

(6) Difference in culture and limitation of language competence may cause the different word association of natives and L2 learners.

(7) The word association of L2 learners may be influenced by their native language.

3.3.2 Limitation of the present research and suggestion on further improvement

There are limitations on the two WATs which may impact the results of the research. First, there are only 129 valid samples of CELs collected while the Minnesota test has about 1008 samples. This gap between their sample capacity may influence the result. Second, there are a few meaningless responses or unrecognizable words produced by CELs. This may be due to the limited language competence of the subjects or their unseriousness to the test. As it may impact the credibility of the test results, measures should be taken to avoid it as much as possible.

As for the research methodology, the familiarity degree of the stimulus words to the subjects may be taken into consideration when further research to be done.

4. CONCLUSION

In the paper, the WAT results of native speakers (Minnesota WAT) and Chinese English learners (DUT WAT) are analyzed and compared, with the aim to research into the organization of L2 mental lexicon. The main questions discussed are whether the organization of L2 mental lexicon resembles that of L1 mental lexicon, the relation between the part of speech of the stimulus words and that of their responses, and factors that may cause the differences between word association results of native speakers and that of Chinese English learners. Besides, a few other features shown through data of the two WATs are summed up, which may probably be researched further.

The questions are answered in the paper as follows:

(1) The words in L2 mental lexicon are essentially semantically-related, just like the mental lexicon of L1 speakers. But phonological relation plays a more important role in L2 mental lexicon than in L1 mental lexicon.

(2) Nouns are easy to be activated for both native speakers and L2 learners. And responses of the same part of speech with the stimulus word are easier to be conducted.

(3) Difference in culture and limitation of language competence may cause the different word association of L1 and L2 learners. And L2 learners' native language is likely to have influence on their mental lexicon.

REFERENCES

Aitchison, J. (2003). *Words in the mind: An introduction to the mental lexicon.* MA: Blackwell Pub.

De Saussure, F. (2001). *Course in General Linguistics.* Beijing: Foreign Language Teaching and Research Press.

Dong, Y.P. (2005). *Psycholinguistics and foreign language teaching*. Beijing: Foreign Language Teaching and Research Press.

Dong, Y.P. & Gui S.C. (2002). On the Representational Structure of the Bilingual Mental Lexicon. *Journal of Foreign Languages, 140,* 23-29.

Gu, S.Y. (2006). *A Comparison of Word Association between Native Speakers and L2 Learners* (unpublished master's thesis).

Gui, S.C. (2000). *Psycholinguistics* (new edition). Shanghai: Shanghai Foreign Language Education Press

Gui, S.C. (1992). Cognitive View of Foreign Language Learning. *Foreign Language Teaching and Research, 92,* 1-9.

He, L.P. (2009). *Exploring the Network of Bilingual Mental Lexicon through the Word Association Tests* (unpublished master's thesis).

Hou, Y. (2009). *Research into the Mental Lexicon Representation of Chinese English Learners Based on Spreading Activation Model* (unpublished master's thesis).

Ilknur İ. 2010. Playing with words: a study on word association responses. *The Journal of International Social Research, 3(10),* 360-368.

Meara, P. (1984). The study of lexis in Interlanguage. In A. Davies, A. Howart & C. Criper (Eds.), *Interlanguage.* Edinburgh: Edinburgh University Press.

Nunn, R. (2005). Competence and teaching English as an International Language. *Asian EFL Journal, 7(3),* 61-74.

O'Gorman, E. (1996). An investigation of the mental lexicon of second language learners. *Teanga: The Irish Yearbook of Applied Linguistics, 16,* 15-31.

Richards, J. C., & Schmidt, R. (2002). *Longman dictionary of language teaching and applied linguistics* (3rd ed.). London: Longman (Pearson Education).

Russell, J. (1952). *Discussional procedures in communication, Journal of Communication, 2(2),* 26–30

Schmitt, N. & Meara, P. (1997). Researching vocabulary through a word knowledge framework: Word associations and verbal suffixes. *Studies in Second Language Acquisition, 19*,17-36

Singleton, D. (2006). *Exploring the second language mental lexicon.* Beijing :World Books Press

Tong, Y.M. (2009). *Construction of Sentences in English and Chinese.* Dalian: Dalian University of Technology Press

Wolter B. (2001). Comparing the L1 and L2 Mental Lexicon: A depth of individual word knowledge model. *Studies in Second Language Acquisition, 23*, 41-69.

Xiong, K. (2007). Mental Lexicon Representation and Cross-linguistic Transfer in L2 Vocabulary Acquisition. *Foreign Language Research, 138*, 133-136.

Xu, G. (2008). *A Study of Chinese Learners' L2 Mental Lexicon* (unpublished master's thesis).

Zhang, P. (2009). *Word Association Patterns in Chinese EFL Learners' Mental Lexicon.* Nanjing: Southeast University Press.

Zhang, S.J. (2005). Investigating Connection in L2 Mental Lexicon with Word Association Tests. *Journal of PLA University of Foreign Languages, 28(2),* 52-57.

Zhang, S.J. & Chen, X.K. (2009). The Stability of Word Association Test. *Journal of PLA University of Foreign Languages, 32(3),* 42-45.

Zhao, L. (2007). *The Nature of CLE Mental Lexicon* (unpublished master's thesis).

APPENDIX 1

Instructions

This is one of the studies in verbal behavior being done at Minnesota. This particular experiment is on free association. Please write down your name on the outside of the paper passed to you. (You can ignore the place for your name on the other side.) when you open these sheets, you will see a list of 100 stimulus words. After each word write the first word that it makes you think of. Start with the first word; look at it; writer the word it makes you think of; then go on to the next word.

Use only a single word for each response.
Do not skip any words.
Work rapidly until you have finished all 100 words.
When you are through, turn your paper over and write on the back the letter that appears on the board at that time.

Name _____ Class Date

No.	Stimulus	Response	No.	Stimulus	Response
1.	Table		26.	Wish	
2.	Dark		27.	River	
3.	Music		28.	White	
4.	Sickness		29.	Beautiful	
5.	Man		30.	Window	
6.	Deep		31.	Rough	
7.	Soft		32.	Citizen	
8.	Eating		33.	Foot	
9.	Mountain		34.	Spider	
10.	House		35.	Needle	
11.	Black		36.	Red	
12.	Mutton		37.	Sleep	
13.	Comfort		38.	Anger	
14.	Hand		39.	Carpet	
15.	Short		40.	Girl	
16.	Fruit		41.	High	
17.	Butterfly		42.	Working	
18.	Smooth		43.	Sour	
19.	Command		44.	Earth	
20.	Chair		45.	Trouble	
21.	Sweet		46.	Soldier	
22.	Whistle		47.	Cabbage	
23.	Woman		48.	Hard	
24.	Cold		49	Eagle	
25.	Slow		50.	stomach	

Name _____ Class Date

No.	Stimulus	Response	No.	Stimulus	Response
51.	Stem		76.	Bitter	
52.	Lamp		77.	Hammer	
53.	Dream		78.	Thirsty	
54.	Yellow		79.	City	
55.	Bread		80.	Square	
56.	Justice		81.	Butter	
57.	Boy		82.	Doctor	
58.	Light		83.	Loud	
59.	Health		84.	Thief	
60.	Bible		85.	Lion	
61.	Memory		86.	Joy	
62.	Sheep		87.	Bed	
63.	Bath		88.	Heavy	
64.	Cottage		89.	Tobacco	
65.	Swift		90.	Baby	
66.	Blue		91.	Moon	
67.	Hungry		92.	Scissors	
68.	Priest		93.	Quiet	
69.	Ocean		94.	Green	
70.	Head		95.	Salt	
71.	Stove		96.	Street	
72.	Long		97.	King	
73.	Religion		98.	Cheese	
74.	Whiskey		99.	Blossom	
75.	Child		100.	Afraid	