

THE REPRESENTATION AND PROCESSING OF PAST TENSE
IN CHINESE ENGLISH-LANGUAGE LEARNERS

by

Chang-Ching Chen

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As members of the Dissertation Committee, we certify that we have read the dissertation
prepared by Chang-Ching Chen

entitled THE REPRESENTATION AND PROCESSING OF PAST TENSE
IN CHINESE ENGLISH-LANGUAGE LEARNERS

and recommend that it be accepted as fulfilling the dissertation requirement for the

Degree of Doctor of Philosophy

_____ Date: 12/16/08
Dr. Janet Nicol

_____ Date: 12/16/08
Dr. Kenneth Forster

_____ Date: 12/16/08
Dr. Feng-hsi Liu

_____ Date:

_____ Date:

Final approval and acceptance of this dissertation is contingent upon the candidate's
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I hereby certify that I have read this dissertation prepared under my direction and
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_____ Date: 12/16/08
Dissertation Director: Dr. Janet Nicol

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SIGNED: Chang-Ching Chen

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DEDICATION

This dissertation is dedicated to my parents:

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who love me and encourage me through out my study in the U.S.A.

and 孫郁淳

who is supportive and freshens up my life.

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ABSTRACT

In general, L2 learners have great difficulty mastering aspects of grammar in the second language. For example, Chinese-speaking ESL learners often fail to mark past tense in their speaking and writing (Aaronson & Ferres, 1987; Bayley, 1991; Bean & Gergen, 1990; Jia & Fuse, 2007; Krashen & Pon, 1975; Lardiere, 1998; Wei, 2000), and there are some suggestions in the literature that Chinese learners of English never master English tense (Lardiere, 1998). One question that arises is whether the failure to learn to use the past tense is due to a failure of competence or a failure of performance. If the former, then Chinese-speaking ESL learners should show such failures in all tasks including comprehension tasks.

However, little research has investigated L2 comprehension of tense marking in reading. The studies (Gass, 2001; Guillelmon & Grosjean, 2001; Jiang, 2004, 2007) have showed that late L2 learners are not sensitive to certain types of grammatical marking. They have poor inflectional comprehension. It is possible that Chinese English-language learners are insensitive to grammatical violation involving tense during reading. This dissertation tests this idea.

A group of English-proficient college students from Fu-Jen University in Taiwan was tested in a number of tasks. In paper-and-pencil tests, Chinese English-language learners showed knowledge of the past tense forms and the appropriate contexts for their usage. This suggests that past tense marking is learnable. Chinese English-language learners can acquire this knowledge. Does the relative mastery of past tense show up in comprehension in a similar L2 population? A reading comprehension test that measured reading time to sequential segments of a sentence indicated that unlike native speakers of English who were tested, Chinese English-language learners were insensitive to

grammatical violation involving tense. This finding is consistent with the other studies, indicating that L2 learners are insensitive to grammatical marking during reading.

Overall, it appears that high-functioning Chinese English-language learners can learn almost the proper way to use tense, but fail to do so during performance.

CHAPTER 1: LEXICAL PROCESSING IN NATIVE SPEAKERS OF CHINESE

Chinese is different from English in many aspects. The differences between Chinese and English may provide a useful way to investigate lexical processing. For example, unlike English, Chinese does not have a systematic correspondence between orthography and phonology (see Shen & Forster, 1999 for detailed discussion). This feature makes it possible to investigate a pure orthographic effect.

Although a facilitating effect is observed in Chinese orthography (Ding, Peng, & Taft, 2004; Feldman & Siok, 1999; Perfetti & Tan, 1998; Shen & Forster, 1999; Zhou & Marslen-Wilson, 1995; Zhou, Marslen-Wilson, Taft, & Shu, 1999), orthographic studies in Chinese have not so far investigated the prime lexicality effect, found by Forster and Veres (1998), who investigated the different effectiveness of words and non-words as form primes that were orthographically similar to their targets in English.

The prime lexicality effect has been reported from orthographic studies. Forster and Veres (1998) used a masked priming paradigm in which a prime was presented for a very short period (see Forster (1998) and Forster, Mohan, and Hector (2003) for detailed discussion of the masked priming technique). In the lexical decision task (Forster & Veres, 1998), undergraduate subjects made a decision on whether the presented series of letters was an English word. The materials contained three types of prime: a related non-word “convenge,” a related word “converse,” and an unrelated word “acoustic” with the corresponding target “CONVERGE.” The results from Experiment 2 showed that non-word primes were more effective than word primes when non-word targets (e.g. “univorse”) were one-letter different from real words and were therefore harder to reject. A prime lexicality effect was obtained. In Experiment 4, the non-word targets were

manipulated to become easier to reject. When non-word targets (e.g. “anivorse”) were two-letter different from real words, word primes were just as effective as non-word primes. The prime lexicality effect disappeared. The different effectiveness of word primes and non-word primes was due to different degrees of difficulty in the rejection of non-word targets. To summarize the difference between non-word primes and word primes across two experiments, non-word primes were unaffected by the difficulty of the non-word targets, but word primes were strongly affected.

The prime lexicality effect can be interpreted in the entry-opening model (Forster & Veres, 1998). Entry-opening means that preliminary process should carry out before lexical access. This process is called entry-opening. When a close match (i.e. one-letter difference) is detected between stimulus and entry, the entry is opened. When a perfect match is detected between stimulus and entry, the entry is also opened. The system can distinguish close matches from perfect matches. In the case of a word-word combination, the prime will open its entry, and the target will also open its entry. In both cases, a perfect match is involved. If there are two perfect matches, this leads to an error signal. This is a problem only because the visual system treats the prime and target as if they were a single object. The resolution of conflict between two perfect matches and one stimulus object may be to reset the system and to access the target again. Since the prime is no longer active, there is no priming. The entry-opening model also explains how the effect of one-letter-difference non-word targets is relevant. The response to an error signal depends on whether the subject is being cautious or not. Being careful means a system reset and re-access of target. When subjects make few errors (i.e. they are being careful), there is a greater prime lexicality effect. However, in the case of non-word and word combination, only one perfect match is marked as matching exactly with the

physically presented target. Hence, there is no need for a reset, and form priming is obtained from non-word primes.

An alternative account offered by interactive activation model (Davis & Lupker, 2006; McClelland & Rumelhart, 1981; Rumelhart & McClelland, 1982) explains the prime lexicality effect. Given that inhibition mechanism is installed in the interactive activation model, the inhibition mechanism plays a crucial role to explain the prime lexicality effect. A word prime spreads activation to many related units across different levels which in turn compete with each other, the winner being the entry for the target word. This results in the observation of an inhibitory effect from word primes. However, a non-word prime is less likely to activate any strong competitors for the target. A facilitating effect from non-word primes is therefore observed. Although the interactive activation model explains the prime lexicality effect, it fails to explain why the prime lexicality effect depends on difficulty of word-nonword discrimination.

In order to investigate whether a similar prime lexicality effect that interacts with word-nonword discrimination is obtained in Chinese, form similarity between prime and target in Chinese can be analogous to one-letter difference between prime and target in English. Reviewing the following studies regarding form similarity in Chinese will give us some insights to construct form similarity between prime and target.

1.1 Establishing Form Similarity in Chinese

Compared with English, the Chinese language contains more complicated orthographic components: characters are used. One way to illustrate the complicated orthographic components in Chinese is to indicate how many strokes may be involved in a character. For example, a character “鬱” is composed of thirty-two strokes.

When researchers manipulate form similarity in Chinese, they may adopt a stroke-based form similarity as in one-stroke difference “丶” between “今” and “令” (Perfetti & Tan, 1998; Shen & Forster, 1999; Tan, Hoosain, & Peng, 1995), a radical-based form similarity as in one-radical shared “義” between “蟻” and “議” (Cheng, 1992; Ding, Peng, & Taft, 2004; Feldman & Siok, 1999; Perfetti & Zhang, 1991; Shen & Forster, 1999; Tan, Hoosain, & Peng, 1995; Wu & Chen, 2000, 2003), or a character-based form similarity as in one-character shared “華” between “華僑” and “華貴” (Zhou & Marslen-Wilson, 1995; Zhou, Marslen-Wilson, Taft, & Shu, 1999).

Like words, non-words can be created in terms of stroke-based form similarity (Shu & Anderson, 1999), radical-based form similarity (Cheng, 1981, 1992; Cheng & Yang, 1989; Kuo, Yeh, Lee, Chen, Lee, Chen, Ho, Hung, Tzeng, & Hsieh, 2004; Liu, Zhang, Tang, Mai, Chen, Tardif, & Luo, 2008; Peng, Li, & Yang, 1997; Shu & Anderson, 1999; Wu & Chen, 2003), and character-based form similarity (Cheng, 1981; Jiang, 1999; Zhou, Marslen-Wilson, Taft, & Shu, 1999).

In the current study, we prefer character-based form similarity over stroke-based and radical-based similarity for the following reasons. First, character-based form similarity employs two-character words that are often used in contemporary Chinese. Second, two-character words can avoid phonological similarity as a potentially confounding variable because there is no correspondence between the visual form and sound in a two-character word. However, if form similarity is based on the radical, the phonetic radical may play a confounding variable in orthography because some phonetic radicals “里” (/li3/) can predict the sound of a whole character “裡” (/li3/). (See Shen & Forster, 1999 for detailed discussion). Unlike Chinese, English cannot easily separate phonology from orthography. Third, character-based form similarity in non-words allows

for the manipulating of legality of character; for example, different combinations of a valid character and a pseudo-character. Unlike English, Chinese, by using of two-character non-words, can connect the issue of form similarity with legality of character. However, with stroke-based and radical-based form similarity, we cannot manipulate the legality of character because a pseudo-character would always be involved. Overall, form similarity between a prime and its target in the current study will be defined as sharing a whole character. If this study was conducted in English, the example would be like a related non-word prime “blackstock” and a related word prime “blackberry” with the corresponding target “BLACKBOARD.”

1.2 Experiment 1: Lexical Priming

The goal of the experiment is to examine whether a prime lexicality effect can be observed in Chinese. This is of interest not only as an extension of the findings of Forster and Veres (1998) to a language with a morphographic script, but also to determine whether it is a purely orthographic effect because in Chinese, phonology is separable from orthography.

1.2.1 Method

Participants

Thirty native speakers of Chinese were recruited from the University of Arizona. At the time of testing, eleven participants were undergraduates, eight were master’s students, and eleven were doctoral students. Before coming to the United States, participants’ highest education in Taiwan was as follows: six participants had received a

diploma from senior high schools. Eighteen participants had received a bachelor's degree. Six participants had received a master's degree.

Materials

Word targets were traditional Chinese two-character words “快樂” (happy /kuai4le4/).

For each target word, three types of primes were selected: (1) a word that shared one character with the target, (2) a non-word that shared one character with the target, and (3) a completely unrelated word. In the first two conditions, the shared character was either in the first position or in the second position. For example, the pair of 伸縮 and 伸展 were visually similar with a shared first character “伸”. However, the pair of 伸縮 (expand and contract /shen1suo1/) and 伸展 (spread /shen1zhan3/) were different semantically and phonologically. Similarly, in the case of a related non-word prime, the pair of 伸點 and 伸展 were visually similar with sharing the same first character “伸”. However, 伸點 (non-word /shen1dian3/) and 伸展 (spread /shen1zhan3/) were different phonologically. Finally, unrelated word primes and targets were different visually, semantically, and phonetically; for instance, 天空 (the sky /tian1kong1/) and 伸展 (spread /shen1zhan3/).

To test for the presence of a prime lexicality effect, 36 target words were tested under three priming conditions: related word prime, related non-word prime, and unrelated word prime. In addition, in order to establish that the experiment was capable of detecting a priming effect, 36 additional target words were also tested under three priming conditions: identical word prime, related non-word prime, and unrelated word prime. The only difference between the two sets of items was that the word primes in

detecting a priming effect were identical while the word primes in testing for the presence of a prime lexicality effect were orthographically related. Three counterbalanced lists of items were constructed. In order to prevent physical overlap, the size of target (18 points) was slightly larger than that of prime (12 points), and targets (Kaiti) and primes (Minti) were different fonts. Stimulus was presented in random order on the center of screen.

Seventy-two Chinese two-character non-word targets were created, based on Jiang (1999) who selected any two real characters to form a Chinese two-character non-word. No word or non-word appeared more than once. (See Appendix A for these materials.)

The DMDX software (Forster & Forster, 2003) controlled the presentation of the stimuli, recorded response times and errors, and gave feedback (correct or wrong) to participants.

Overall, each list contained 144 test items and 20 practice items.

Procedure

Participants were assigned randomly to one of three counterbalanced lists. Chinese instructions were shown on the computer monitor before the experiment. Participants were instructed to decide whether a presented item was a legitimate word as accurately and as quickly as possible. If the presented item was a legitimate word, then subjects pressed a Yes key. If the presented item was not a legitimate word, subjects pressed a No key. The feedback of each response appeared on computer monitor, showing the accuracy and reaction time of subjects' response. After the presentation of every 16 test items, a break was offered. Each trial involved the following sequence of stimuli: forward mask for 500 ms, prime for 50 ms, and then target for 500 ms. (See Figure 1.1.)

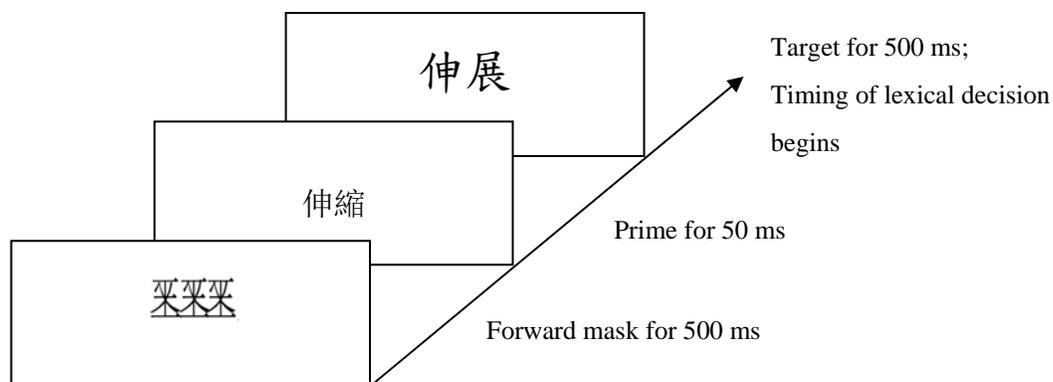


Figure 1.1 Presentation of lexical decision task

A practice session was given before the test session. After the experiment was finished, participants were asked whether they noticed any stimulus that was briefly shown before the target. None of participants reported seeing any primes. It took participants around 25 minutes to finish the experiment.

1.2.2 Results

Trials on which an error occurred were discarded. A 3 x 3 ANOVA was carried out with the factors being list and prime type. Two analyses (F_1 for subject analysis and F_2 for item analysis) were carried out.

Priming

When targets were words, as shown in Table 1.1, identical word primes produced a repetition priming effect (26 ms.), and non-word primes produced a facilitating effect (19 ms.).

Table 1.1 Mean reaction times and error rates for word targets in demonstration of priming

Target	Type of prime (masked)		
	Identical word (Repetition priming)	Non-word (Form priming)	Control
	快樂	快私	離開
Word—快樂	580 ms. (2.8 %)	587 ms. (4.5 %)	606 ms. (5.4 %)
Priming	26 ms.	19 ms.	

Analysis of responses to word targets showed significant effects. There was a significant effect on prime type for subject analysis, $F_1(2, 54) = 3.68, p < .05$ and for item analysis, $F_2(2, 66) = 8.88, p < .001$. Then, pairwise analyses were computed. The difference between the identical word prime condition and the unrelated control condition was significant for subject analysis, $F_1(2, 27) = 4.54, p < .05$, and for item analysis, $F_2(2, 33) = 16.69, p < .001$. The difference between the non-word prime condition and the unrelated control condition was significant for subject analysis, $F_1(2, 27) = 5.41, p < .05$, and for item analysis, $F_2(2, 33) = 8.02, p < .01$. The difference between the identical word prime condition and the non-word prime condition was non-significant for subject analysis, $F_1(2, 27) = 0.71, p > .05$, or for item analysis, $F_2(2, 33) = 0.66, p > .05$.

When targets were non-words, as shown in Table 1.2, identical non-word primes produced a repetition priming effect (9 ms.), and non-word primes produced a facilitating effect (16 ms.).

Table 1.2 Mean reaction times and error rates for non-word targets in demonstration of priming

Target	Type of prime (masked)		
	Identical nonword (Repetition priming)	Non-word (Form priming)	Control
	遲旋	遲纏	估計
Non-word—遲旋	692 ms. (2.9 %)	685 ms. (5.8 %)	701 ms. (6.3 %)
Priming	9 ms.	16 ms.	

However, analysis of responses to non-word targets showed no significant effect. There was no significant effect on prime type for subject analysis, $F_1(2, 54) = 0.85$, $p > .05$, or for item analysis, $F_2(2, 66) = 1.28$, $p > .05$. Error rates were non-significant for subject analysis, $F_1(2, 54) = 2.84$, $p > .05$, but were significant for item analysis, $F_2(2, 66) = 3.40$, $p < .05$.

Prime lexicality effect

As shown in Table 1.3, when targets were words, word primes produced no priming effect (0 ms.), and non-word primes produced a facilitating effect (27 ms.) that was similar to the facilitating effect (19 ms.) from non-word primes in demonstration of priming.

Table 1.3 Mean reaction times and error rates for word targets in testing of prime lexicality effect

Target	Type of prime (masked)		
	Word	Non-word	Control
	伸縮	伸點	天空
Word—伸展	604 ms. (4.5 %)	577 ms. (4.4 %)	604 ms. (5.9 %)
Priming	0 ms.	27 ms.	

Analysis of responses to word targets showed a significant effect of prime type for subject analysis, $F_1(2, 54) = 5.42, p < .01$, and item analysis, $F_2(2, 66) = 7.88, p < .001$. Then, pairwise analyses were computed. The difference between the non-word prime condition and the unrelated control condition was significant for the subject analysis, $F_1(2, 27) = 6.68, p < .05$, and item analysis, $F_2(2, 33) = 11.69, p < .05$. The difference between the word prime condition and the non-word prime condition was significant for subject analysis, $F_1(2, 27) = 9.29, p < .01$, and for item analysis, $F_2(2, 33) = 11.95, p < .05$. There was no significant difference between the word prime condition and the unrelated control condition. None of differences in error rates were significant.

When targets were non-words, word primes produced a very small inhibitory effect (-1 ms), and non-word primes produced a facilitating effect (16 ms), as shown in Table 1.4.

Table 1.4 Mean reaction times and error rates for non-word targets in testing of prime lexicality effect

Target	Type of prime (masked)		
	Word	Non-word	Control
	兇手	兇荒	逮捕
Non-word—兇足	713 ms. (7.9 %)	696 ms. (7.2 %)	712 ms. (5.7 %)
Priming	-1 ms.	16 ms.	

However, analysis of responses to non-word targets showed no significant effect. There was no significant effect on prime type for subject analysis, $F_1(2, 54) = 1.61, p > .05$, or for item analysis, $F_2(2, 66) = 0.58, p > .05$.

1.2.3 Discussion

There are three main findings. First, the different pattern of effectiveness of word primes and non-word primes indicates a prime lexicality effect, which is a real effect without a phonologically confounding variable. Word primes produced no priming effect while non-word primes produced a facilitating effect. Second, the facilitating effect from non-word primes was obtained both in testing of the prime lexicality effect and in demonstration of priming. Third, the masked repetition priming was obtained.

A prime lexicality effect is demonstrated in the current study when priming with a word is less effective than with a non-word. The existence of a prime lexicality effect is readily explained by the entry-opening model (Forster & Veres, 1998). Two perfect matches that are opened by prime and target send an error message to the system. The system is reset to erase the error. The target is accessed again, and then no priming is obtained from word primes. On the other hand, no reset is required when a prime is a non-word. Form priming is obtained because one perfect match is exactly for the target.

As motioned earlier, the interactive activation model (Davis & Lupker, 2006; McClelland & Rumelhart, 1981; Rumelhart & McClelland, 1982) accounts for the fact that priming with a word is less effective than with a non-word from the viewpoint of inhibition mechanism, but no inhibitory effect from word primes is observed in the current study.

Two issues remain unresolved in the current experiment. First, when Forster and Veres (1998) obtained the prime lexicality effect, one-letter-different non-word targets that were hard to reject were used. Second, when Forster and Veres (1998) used two-letter-different non-word targets that were easy to reject, they failed to obtain the prime lexicality effect. This poses an obvious question. Does the same effect occur in

Chinese? What types of Chinese non-word targets are easy to reject (analogous to two-letter-different non-words in English), and what types are hard to reject (analogous to one-letter-different non-words in English)? The current finding suggests that the Chinese non-word targets used in this experiment could be taken as hard non-word targets because the prime lexicality effect is observed and word primes produces no form priming. Perhaps a different result might occur if easier non-word targets were used. In order to answer these questions, we need to construct different types of non-word targets that differ in difficulty. The following experiment was designed to achieve this.

1.3 Experiment 2: Lexical Decision

The current experiment involves a simple lexical decision task with no priming. The purpose of this experiment is twofold. First, the experiment is designed to verify whether the non-word targets used in Experiment 1 were relatively difficult. Second, the same experiment will also examine what type of Chinese non-words are easy targets to reject.

1.3.1 Method

Participants

Twelve Taiwanese participants who were able to read traditional Chinese characters were recruited from the University of Arizona. At the time of testing, five were undergraduates, two were master's students, and five were doctoral students. Before coming to the United States, participants' highest education in Taiwan was as follows: three had received a diploma from senior high schools. Seven had received a bachelor's degree. Two had received a master's degree.

Materials

Sixty Chinese two-character non-word targets were created that were divided into four types. They were transposed non-words, random non-words, real-plus-pseudo characters non-words, and two pseudo-characters non-words. The first type was transposed non-words. A real two-character word “機會” (opportunity /ji1hui4/) was transposed in order to form a transposed non-word “會機” (non-word /hui4ji1/). The second type was random non-words. Any two real characters were combined to form a two real characters non-word (Jiang, 1999) as in “兇足” (non-word /xiong1zu2/). The items were taken from non-word targets in the set of testing for prime lexicality effect from Experiment 1. The third type was real-plus-pseudo characters non-words. A real character “攜” (carry /xi1/) was combined with a pseudo-character “^多” to form a real-plus-pseudo characters non-word “攜^多”. The pseudo-character “^多” contained a left constituent “示” and a right constituent “多” that both occurred in the legal position. The fourth type was two pseudo-characters non-words. Any two compound characters (e.g. “檔” and “如”) with formation of left constituent “木” and “女” and right constituent “當” and “口” were selected. The left constituent of each compound character was transposed (i.e. “木” and “女”) to form a two pseudo-characters non-word “女當” and “木口”. The left transposed constituent still occurred in the legal position, and a valid character became a pseudo-character. (See Appendix B for these materials.)

The stimuli also included 60 Chinese two-character word targets.

Every target was generated in Adobe Photoshop Elements 2.0 and was saved as an individual image file. The font of target was the New Thin Ming, and the size of target was 45 points.

Overall, the list contained 120 targets and 16 practice items.

Procedure

The procedure was the same as in Experiment 1, except that no primes were included. After presentation of every 15 test items, participants could decide whether they wanted to take a break. A target was presented for 500 ms. on the center of screen. Stimuli were presented in random order. No target appeared more than once. The presentation of the stimulus, the recording of response times and errors, and the presentation of feedback to participants' responses were controlled via DMDX (Forster & Forster, 2003). It took participants around 15 minutes to finish the experiment.

1.3.2 Results

Trials on which an error occurred were discarded. A one-way ANOVA was carried out with the factor being non-word type.

As shown in Table 1.5, mean reaction times from fast to slow were two pseudo-characters non-words, real-plus-pseudo characters non-words, random non-words, and transposed non-words. The pattern of mean error rates from low to high was the same with that of mean reaction times from fast to slow.

Table 1.5 Mean reaction times and error rates for non-word targets

Type of non-word target			
Transposed 會機	Random 兇足	Real-plus-pseudo 嬌俾	2 Pseudo-characters 犒侍
753 ms. (19.3%)	665 ms. (6.1%)	609 ms. (3.3%)	599 ms. (1.7%)

Analysis of responses to non-word targets showed a significant effect on subject analysis, $F_1(3, 33) = 28.27$, $p < .001$, and on item analysis, $F_2(3, 56) = 33.02$, $p < .001$. Comparisons between individual conditions showed a significant difference between the transposed condition and the random condition, for subject analysis, $t_1(11) = 6.40$, $p < .05$, and for item analysis, $t_2(28) = 4.29$, $p < .05$. The difference between the random condition and the real-plus-pseudo condition was significant for subject analysis, $t_1(11) = 2.75$, $p < .05$, and for item analysis, $t_2(28) = 3.58$, $p < .05$. The difference between the two pseudo-characters condition and the real-plus-pseudo condition was non-significant on subject analysis, $t_1(11) = 1.22$, $p > .05$, or on item analysis, $t_2(28) = 0.58$, $p > .05$.

For errors, the main effect of non-word type was significant on subject analysis, $F_1(3, 33) = 10.64$, $p < .001$, and item analysis, $F_2(3, 56) = 9.84$, $p < .001$. Comparisons between individual conditions showed a significant difference between the transposed condition and the random condition on subject analysis, $t_1(11) = 3.41$, $p < .05$, and on item analysis, $t_2(28) = 2.97$, $p < .05$. The difference between the two pseudo-characters condition and the real-plus-pseudo condition was non-significant on subject analysis, $t_1(11) = 1$, $p > .05$, or item analysis, $t_2(28) = 0.73$, $p > .05$. The difference between the random condition and the real-plus-pseudo condition was non-significant on subject analysis, $t_1(11) = 1$, $p > .05$, or item analysis, $t_2(28) = 0.82$, $p > .05$.

1.3.3 Discussion

The results show that the Chinese random non-words that were used in Experiment 1 are indeed relatively difficult to reject, both with respect to reaction times and error rates. However, they are not as difficult as Transposed non-words, which were the most difficult, and which probably would be the case in English also.

As for easy non-word targets, Chinese real-plus-pseudo characters non-words were relatively easy targets to reject, as were two pseudo-characters non-words. Two reasons to choose real-plus-pseudo characters non-words over two pseudo-characters non-words are that first, there is no significant difference between two categories of Chinese non-words and that second, neither of the characters in two pseudo-characters non-words are represented in the mental lexicon so they are not required to be accessed in the mental lexicon. That is, they may not trigger any attempt at lexical access.

The evidence shows that the legality of the character may play an important role in lexical decision. First, the difference between random non-words and real-plus-pseudo characters non-words was significant, indicating that one invalid character makes two types of non-words different. Second, the legality plays a similar role in English poly-morphemic non-words in the study of Taft and Forster (1976). The reaction times for English poly-morphemic non-words (e.g. footmilge) involving a real word are slower than those involving no real word (e.g. mowdflick). This pattern is also found in the current study: the reaction times for transposed non-words, random non-words, and real-plus-pseudo characters non-words involving one real character are slower than those for two pseudo-characters non-words involving no real character. Third, the legality also plays an important role in Chinese radical in the study of Shu and Anderson (1999). Error

rates of pseudo-characters that involved legal radicals were higher than those of pseudo-characters that contained illegal radicals. This pattern is also found here: error rates for transposed non-words, random non-words, and real-plus-pseudo characters non-words involving one real character were higher than those for two pseudo-characters non-words involving no real character.

Given these data on the relative difficulty of non-words in Chinese, future research can now examine whether the priming effect from word primes will return if easier non-word targets are used, as was found in the Forster and Veres (1998) study.

CHAPTER 2: TENSE ACQUISITION IN A SECOND LANGUAGE

In general, L2 learners have great difficulty mastering aspects of grammar in a second language, in particular, the marking of grammatical features. This difficulty can be observed directly in students' L2 spoken and written productions, both in spontaneous production and in controlled tasks. For example, in my own experience as an English-as-foreign-language (EFL) teacher in Taiwan, I would give a pair of sentences such as "John talked to his mother yesterday" vs. "John talked to his mother" to my students and asked my students to orally translate each sentence into Chinese. My EFL learners often translated "John talked to his mother" as "*John talk to his mother" in Chinese. (Ungrammaticality is indicated by an asterisk "*".) My interpretation of this is that Chinese EFL learners fail to notice the presence of the suffix "-ed" in the English sentence. This problem has been explored in a number of studies, with participants with varying levels of proficiency.

In what follows, studies of the difficulty mastering aspects of past tense forms in the second language showed in Chinese English-as-second-language (ESL) learners will be reviewed.

2.1 Morphological difficulty in Chinese ESL learners

The following second language acquisition studies show that Chinese English-as-second-language learners have difficulty learning to use past tense marking.

One study, conducted by Bean and Gergen (1990), employed more than one task to determine whether a Chinese ESL learner encountered difficulty in her usage of the regular past tense marking. The participant, named Jean, came to the United States at the

age of 33 to attend college. After her arrival, she had many opportunities to be exposed to a variety of English-speaking environments. She was asked to participate in three different tasks. These were an interview, a picture-description task, and a “spoken morpheme test” where subjects fill in the gap orally. Her utterances were audio-recorded. When the speech productions were analyzed, the results revealed that across all three tasks, she had not produced the suffix “-ed” in any of her utterances where regular past tense marking was required.

Similarly, a three-week study by Krashen and Pon (1975) investigated whether the English utterances of a female participant (over age 40, who was a native speaker of Chinese) contained past tense marking. When she came to the United States around the age of 20, she started learning English and later received a bachelor’s degree, with 4.0 GPA. The experimenters tape-recorded the woman’s spoken English. One type of error she frequently made involved the irregular past tense. (No examples were given.)

Later research documents the kinds of mistakes Chinese ESL learners made when they had difficulty producing the correct English past tense forms. In an eight-month longitudinal study by Bayley (1991), twenty native speakers of Chinese, originally from Taiwan or Mainland China, were recruited in the United States. Their general profile was as follows. The age range was from 18 to 40. Their length of stay in the United States varied from 2 months to 4 years 6 months. Most subjects were undergraduate students, graduate students, ESL students, and adult education students. The graduate students had TOEFL scores of at least 550. ESL students had TOEFL scores ranging from 410 to 500. TOEFL scores are not reported for the other two groups. In this study, the researcher played the role of the interviewer for two reasons. The interviewer was a native speaker of English, thereby necessitating participants’ use of English to communicate. In addition,

the interviewer had spent time in China so the interviewer's experience abroad made the participants feel more comfortable during the interview. The content of the interviews with the participants related to their experiences, such as their English learning experience, their family, and the retelling of a movie. During the interview, the researcher tried to elicit the use of the past tense. Analysis of the recorded data revealed that when participants made past tense errors, they substituted an unmarked verb (e.g. happen), they over-generalized the -ed ending (e.g. runned), they produced a past participle (e.g. seen), or used the third person singular (e.g. helps). Overall, this study showed that Chinese ESL learners had difficulty using the correct past tense form in their spoken English.

Jia and Fuse (2007) investigated the types of errors Chinese ESL learners were likely to make in naturalistic speech and considered both regular verbs and irregular verbs. In this more recent study, five female and five male Chinese ESL learners participated. They attended New York public schools where ESL programs were provided. Two types of errors were found. The first type of error was the use of base forms such as "watch" for "watched" and "take" for "took." The rate of errors for regular past tense forms was 95.6%, and that for irregular past tense forms was 92.3 %. The second type of error was erroneously inflected verbs such as "watches" for "watched" and "takes" for "took" (no error rate was reported for these).

In later research, a comparison of several verbal inflectional morphemes was made by Wei (2000) to determine the degree of difficulty of different English tense forms for Chinese ESL learners. In this study, adult Chinese ESL learners were recruited in the United States. They had had TOEFL scores below 350 and at the time of the interview were taking a course to improve their English language skills. The participants were interviewed by the researcher who elicited from the subjects the different usages of

morphemes attached to base verbs such as progressive “-ing,” past participle “-ed,” and past tense “-ed.” The oral English of the participants was recorded for later transcription and coding. The results showed that the percentage of correctness from high to low was 80% for progressive, 42% for past participle, and 12% for past tense. Again, this study demonstrates that the adult Chinese ESL learners have great difficulty using the correct form of past tense in their spoken English.

Another study observed a single subject whose correct usage of past tense marking over a long period of time did not increase at all. Lardiere (1998) conducted this study over approximately 19 years. A Chinese woman named Patty was recruited. She had earned her bachelor’s and master’s degrees in the United States. During this longitudinal study, she was interviewed three times: the first audio-recording was made when she was thirty-two, and the second and third audio-recordings when she was forty-one. After the data from her spontaneous utterances were transcribed, her use of past-tense morphology was tallied so that the correct past tense forms were counted in the context where the usage of past tense was required. The percentages of the correct usage of past tense marking among three recordings from first time to third time were as follows: 34.8%, 34.9%, and 33.8 %. Overall, after almost two decades and an advanced U.S. degree, her percent usage of past tense marking in the context of past events showed no increase whatsoever.

In addition to difficulties with usage of past tense forms in oral English, as noted in the studies cited above, one might ask if Chinese English-language learners are likely to show the same pattern in written English production. Aaronson and Ferres (1987) analyzed writing samples produced by two Chinese-English speakers. Both samples were examples of academic writing for the purpose of research. Both papers received grades of

A-. The GPAs of the two participants were 3.5 and 3.0. The backgrounds of the two were also similar; both were undergraduate students at New York University who had been educated in public schools and who had attended Chinese language schools for at least 8 years. One subject had come to the United States when she was five years old. The other was born in the United States. Analysis of their writing samples indicated a marked overuse of the present tense (i.e. the substitution of “is” for “was”).

Overall, the above various empirical studies demonstrate that Chinese ESL learners have great difficulty producing past-tense marking correctly: they tend to omit it both in speech (Bayley, 1991; Bean & Gergen, 1990; Jia & Fuse, 2007; Krashen & Pon, 1975; Lardiere, 1998; Wei, 2000) and in written language (Aaronson & Ferres, 1987). (See Table 2.1 below for a summary of the studies.)

Table 2.1 Studies of past-tense learning difficulty for Chinese ESL population

Author (Year)	L1 population	L2 Proficiency	Design	Skill	Findings
Krashen & Pon (1975)	Chinese adult	Received bachelor's degree in the USA	Three-week longitudinal case study	Speaking	Error of irregular past tense verbs
Aaronson & Ferres (1987)	Chinese undergraduate students	Attended New York University	Case study	Writing	Wrong past tense forms
Bean & Gergen (1990)	Chinese adult	Admitted to an US university	Interview Picture-description Spoken morpheme test	Speaking	No application of the suffix "-ed"
Bayley (1991)	Chinese adults	550 TOEFL score for graduate students Below 500 TOEFL score for ESL students	Eight-month longitudinal study	Speaking	Errors including a base verb, overgeneralization, past participle, and number morpheme of third person singular
Lardiere (1998)	Chinese adult	Received bachelor's and master's degree in the USA	19 years longitudinal case study	Speaking	Low percent usage (34%) of past tense marking in the required context
Wei (2000)	Chinese adults	Below 350 TOEFL score	Interview	Speaking	12% of correctness for past tense usages
Jia and Fuse (2007)	Chinese elementary and high school students	Attended New York public school	Spontaneous conversations	Speaking	Errors including base forms (95.6% for regular & 92.3 % for irregular) and erroneously inflected verb

Chinese ESL learners' learning difficulty using the past tense may be due to the fact that there is no tense in Chinese. That is, there is no grammatical manifestation of tense, only time adverbials such as "yesterday". Hence, it is possible that Chinese ESL learners transfer Chinese "grammar" to English.

However, Chinese ESL learners are not the only ones who show difficulty mastering tense. Children with Specific Language Impairment (SLI) often show poor performance with grammatical markers (Felbaum, Miller, Curtiss, & Tallal, 1995; Rice & Wexler, 1995, 1996). For example, a study by Rice and Wexler (1995) investigated the rate of omission of tense markers in children whose English (as a first language) was impaired. Subjects consisted of an experimental population of language impaired children at age 5 and the control population of normally developing children that were further divided into a group of age-matched 5 year olds and a group of language-matched 3 year olds. The children's utterances from an elicitation task and a spontaneous speech task were recorded. The results from the elicitation task showed that the percentage of omissions of the regular past tense suffix "-ed" in the language impaired children, 3 year old normal children, and 5 year old normal children was 73 %, 50%, and 8%, respectively. The results from the spontaneous speech task showed that the percentage of omissions of the regular past tense suffix "-ed" in these same groups was 82 %, 44%, and 10%, respectively. The accuracy of past tense production was significantly lower in both tasks for the children with language deficit than for the normal children at ages 3 and 5, even children who were matched with the SLI children on other aspects of language.

A similar study was conducted by Rice and Wexler (1996) who recruited aged-matched children in order to compare language impaired children with unimpaired children. An analysis of the spoken productions indicated that the accuracy rate of

tense-related morphemes for the language impaired children was considerably lower (below 50%) than that of normal children (above 90%).

Language impaired children also show an impairment in comprehension. This was documented in a study by Felbaum, Miller, Curtiss, and Tallal (1995) who recruited six year old children to participate in an auditory comprehension task. In this experiment, an experimenter read a sentence to the children, and they matched a picture to the sentence. The average score for the sentences containing the past tense marker “-ed” for sixty-seven language impaired children was significantly lower than that for fifty-four normal children.

The SLI studies indicate that there may be an inherent difficulty in the acquisition of inflectional morphology that is independent of the difficulty that speakers of a non-tense language may have when they acquire English.

Returning now to Chinese ESL learners, it is unclear what the source of the problems is. It could be that L2 learners do not develop tense *knowledge*, or that they do not master tense *usage*. “Off-line” tests that allow subjects to recall explicitly what they know about a language and allow them to revise their answers test the subjects’ competence, or knowledge. However, “online processing” tests that do not allow subjects to contemplate their knowledge test the subjects’ performance. Subjects may show knowledge of a grammatical rule, yet be unable to make use of such information under time constraints. Or they may not have mastered the grammatical rule, either because they are still acquiring the language or because their L2, with all its ungrammaticalities has “fossilized”, as is likely to be the case with the participants in some of the studies discussed above, who have lived in the US for a long period of time.

CHAPTER 3: CHINESE ENGLISH-LANGUAGE LEARNERS' PERFORMANCE OF ENGLISH PAST TENSE IN OFF-LINE GRAMMAR TEST

The results of past studies have shown that Chinese ESL learners make errors in their production of the past tense, and some studies show that such difficulty may persist indefinitely.

This chapter focuses on testing competence. An off-line test will be used in order to measure L2 learners' grammatical knowledge. In this first experiment, the population that was targeted is English majors in a university setting. These subjects are likely to be proficient, without signs of fossilization. There is good reason to think that these students are proficient in English. First, this group of English majors is immersed in English instruction. Second, the Department of English offers a variety of types of course, including language skills, and content courses in literature and linguistics. Third, submitting term papers and giving oral presentations in English are required. Fourth, reading assignments require the reading of textbooks in English. Thus, the group of Chinese English-language learners should have reasonable proficiency in English; otherwise, they cannot handle such activities in English.

3.1 Experiment 1: Grammar Test

3.1.1 Method

Participants

Thirty-four Taiwanese participants, enrolled in the course "Introduction to Linguistics", were recruited from the Department of English at Fu-Jen University. In return for their participation, the participants received a small gift worth approximately

\$5. The average age of the participants, 27 female and 7 male, was 22.

Based on selected questionnaires commonly used in similar bilingual works (Jiang, 2004; Lehtonen, Niska, Wande, Niemi, & Laine, 2006), additional language background information from this group of nonnative speakers of English was solicited. This included questions about English learning background, self-rated English language proficiency, a variety of proficiency tests, and other-than-English-language background. The types of questions used in the questionnaire included yes-or-no questions, multiple-choice questions, and open-ended questions.

Their self-rated English proficiency on a one-to-six scale (where 1 was poor and 6 was excellent) for listening, speaking, reading, and writing skills was 3.1, 2.7, 2.9, and 2.7 respectively. At an average age of 11, the participants had begun learning English and studied the language for an average of 11 years. For 23 hours per week, they used English mostly in school. For 17 hours per week, they used English primarily with classmates and friends. For 21 hours per week, they used English when listening to radio and watching television. Nine out of 34 participants had spent an average of 30 months in Australia, Canada, or United States for the purposes of travel, studying abroad, or short-term immigration.

A variety of test results provided further indication of language proficiency. Eleven of the 34 participants had an average English score of 65 out of 100 (87th percentile) on the College Entrance Exam. Two of the 34 participants took the TOEIC (Test of English for International Communication) and TOEFL. The average TOEIC score was 795 out of 990 (i.e. high intermediate level). The average TOEFL score was 570 out of 677 (i.e. intermediate level). Their average score for English related courses in the Department of English for 21 of 34 participants was 66.7 out of 100 (i.e. intermediate level).

Overall, this group of subjects would be considered “intermediate.”

Materials

As mentioned before, the grammar test can measure what subjects know about proper past tense usage. The grammar test included written story-retelling and two-choice questions. For story-retelling, a short story was created and was narrated in the present tense as in “Mary is a few minutes late for her date.” At the end of the passage, in the space provided, the participants had to re-write the just-read story in the past tense. (See Appendix C for these materials.) For the two-choice questions, eight sentences containing a blank were constructed, e.g. “Larry _____ the dishes last night.” Participants selected the correct answer from one of the following: washed washing. Half of the questions required an irregular past tense form as the correct answer, and half required a regular past tense form as the correct answer. Four filler questions were included, which required as a correct response, a verb that was not in the past tense. (See Appendix D for these materials.)

Procedures

The grammar test was administered to the participants in class. In the first part of the test, the participants rewrote a story in the past tense. The participants’ writing responses were collected before the second part of the test was distributed. Then, the participants were asked to answer multiple choice questions. The rationale for separate distribution of the two tests was to prevent the participants from copying the past tense verbs from the multiple choice questions into their story-retelling. They finished the grammar test in 25 minutes.

3.1.2 Results

Written story-retelling

The errors from story-retelling in written language were categorized. For regular past-tense verb forms, errors included dropped regular past-tense morphemes (e.g. “appear”), the use of present tense morpheme (e.g. “walks”), and others (e.g. “pretended”). For irregular past-tense verb forms, errors included bare verbs (e.g. “hold”), the overgeneralization of regular past tense rule (e.g. “holded”), and the present tense (e.g. “is”). The overall error rate was 14.1 %, 52 out of the 370 counted past tense verbs.

Table 3.1 Error types and error rates for regular past-tense verb form in story retelling

Type of errors	Token	Percentage
Dropped regular past-tense morpheme “appear”	8/132	6%
The present tense “walks”	9/132	6.8%
Others	2/132	1.5%
Overall error rate		14%

Table 3.2 Error types and error rates for irregular past-tense verb form in story retelling

Type of errors	Token	Percentage
Bare verb “hold”	6/238	2.5%
Overgeneralization of regular past tense rule “holded”	3/238	1.3%
The present tense “is”	24/238	10.1%
Overall error rate		14%

The individual error rates were 6% for dropped regular past tense morpheme, 6.8% for the present tense, and 1.5% for others. The error rates for the regular past tense verbs were 14 %. (See Table 3.1.) The individual error rates were 2.5% for the bare verb, 1.3% for the overgeneralization of regular past tense rule, and 10.1 % for the present tense. The

error rates for irregular past tense verbs were 14 %. (See Table 3.2.)

Two-choice questions

For the two-choice questions, 21 of 34 participants answered all questions correctly. Ten of 34 participants answered one question wrong. The average accuracy for regular past tense forms was 91.4% and that for irregular past tense forms was 96.4%. (See Table 3.3.) There was not a significant difference between regular and irregular past tense forms.

Table 3.3 Average accuracy scores for two-choice questions

	Regular past tense	Irregular past tense
Mean accuracy	91.4%	96.4%

3.1.3 Discussion

The Chinese English-language learners in the current study, though “intermediate” based in their scores and self-evaluation, are actually much better at producing the past tense than subjects in the past studies. In the paper-and-pencil grammar test used here, Chinese English-language learners show knowledge of past tense forms and the appropriate contexts for the usage of past tense forms. This finding is at odds with the studies described above that have indicated that Chinese ESL learners make a substantial numbers of errors in their production of past-tense morphology (Aaronson & Ferres, 1987; Bayley, 1991; Bean & Gergen, 1990; Jia & Fuse, 2007; Krashen & Pon, 1975; Lardiere, 1998; Wei, 2000).

The fact that the Chinese English-language learners in the current study have relatively good mastery of past tense forms may be due to the fact that they have time to

think: they are able to consider in their story-retelling rules of grammar that they may have learned explicitly. The spoken tests in many of the past studies (Bayley, 1991; Bean & Gergen, 1990; Jia & Fuse, 2007; Krashen & Pon, 1975; Lardiere, 1998; Wei, 2000) cannot offer the same advantage as written tests. This may be one of reasons that ESL subjects have low accuracy of past tense in Lardiere (1998) and in Jia and Fuse (2007).

The kinds of errors observed here are consistent with those reported in the literature. The dropped regular past tense morpheme (e.g. “appear” for “appeared”) is viewed as omission in Jia and Fuse (2007) and in Bayley (1991), both from speaking output of Chinese ESL learners. The present tense error (e.g. “walks” for “walked”) is viewed as the substitution of another morpheme in Jia and Fuse (2007) and in Bayley (1991). The bare verb of irregular past tense form (e.g. “hold” for “held”) is viewed as omission in Jia and Fuse (2007). The overgeneralization of regular past tense rule (e.g. “holded” for “held”) has found in the studies of ESL learners (Bayley, 1991; Dulay & Burt, 1974) and in the studies of native speaking of English children (Cazden, 1968; Ervin, 1964; Kuczaj, 1977).

CHAPTER 4: TENSE COMPREHENSION IN NATIVE SPEAKERS OF ENGLISH

Does the relative mastery of past tense show up in comprehension in a similar L2 population? As mentioned earlier, most past research employed tasks that investigated the difficulty of acquisition of past tense by Chinese ESL learners involved a production task. There is a need to use an on-line comprehension task to empirically test a population of Chinese English-language learners because the on-line comprehension task provides a better approximation of what they are understanding under time constraints. Chinese English-language learners do not have time to reflect and are engaging in reading to understand meaning. In an effort to identify a suitable task for the current study, tasks such as the syntactic priming task and the self-paced reading task are considered. Both have been shown to be sensitive to ungrammaticality involving grammatical marking.

4.1 Comprehension in L2 Learners

Although the processing of the past tense has been examined at a lexical level in morphological priming studies (Marslen-Wilson, 1999; Marslen-Wilson & Tyler, 1997, 1998; Stanners, Neiser, Herson, & Hall, 1979), the processing of the past tense has not been examined at the level of the sentence with on-line methods. (However, other grammatical features have been tested.)

The syntactic priming task has been used effectively to investigate inflectional processing. The syntactic priming task may require lexical decision, naming, or shadowing (see Nicol, 1997, for review) of a word that is preceded by sentence context. Faster responses to the word are observed when it is syntactically compatible with the preceding context. The following studies employed the syntactic priming task to

investigate the processing of inflectional markers in native speakers in languages such as Serbo-Croatian (Gurjanov, Lukatela, Lukatela, Savic, & Turvey, 1985; Katz, Boyce, Goldstein, & Lukatela, 1987; Lukatela, Kostic, Feldman, & Turvey, 1983; Lukatela, Moraca, Stojnov, Savic, Katz, & Turvey, 1982), French (Cole & Segui, 1994; Grosjean, Dommergues, Cornu, Guillelmon, & Besson, 1994; Jakubowicz & Faussart, 1998), Italian (Bates, Devescovi, Pizzamiglio, D'amico, & Hernandez, 1995), and Dutch (van Berkum, 1996). Overall, these studies demonstrate a syntactic congruency effect.

A bilingual study, conducted by Guillelmon and Grosjean (2001), employed the syntactic priming task to investigate whether an English-French bilingual population was sensitive to gender marking in French. Participants were grouped into early and late learners of French. The early bilingual speakers began to use English as their L1 at an average age of around two and began to use French as their L2 at an average age of four. The late bilingual speakers began to use English as their L1 at an average age of one and began to use French as their L2 at an average age of about 16. Native French speakers were also tested. In the experiment, participants were told to listen to a spoken sentence fragment (e.g. *le joli bateau*, meaning “the pretty boat”) and then to repeat the last word (e.g. *bateau*) of the sentence fragment as quickly as they could. Their naming times were recorded. The materials were divided into three conditions: a congruent condition with gender agreement between determiner and noun (e.g. *le joli bateau*), an incongruent condition with incorrect gender marking (e.g. **la joli(e) bateau*, meaning “the (feminine) pretty boat”), and a control condition in which a gender-neutral possessive pronoun was used (e.g. *leur joli bateau*, meaning “their pretty boat”). All materials were audio-recorded by a native speaker of French. The results revealed a congruency effect (significant facilitation of 44 ms.) and an incongruency effect (significant inhibition of 55

ms.) for early bilingual speakers. Late bilinguals showed no effect whatsoever.

The next task we consider is the self-paced reading task. In this task, participants read phrases one at a time. The phrases are visually presented on a computer screen. Participants advance throughout the sentence by pressing a computer key. The reading times of each phrase is recorded.

A second-language study by Jiang (2004) sought to examine whether or not native Chinese speakers who learned English as a second language were sensitive to the number morpheme in their reading of English. Two different groups of subjects whose TOEFL scores were higher than 550 and who started learning English at the age of 12 took part in the two self-paced reading tasks.

In one experiment, the critical comparison was between singular verb “was” in sentences like (2a) and (2b).

(2a) The key to the cabinets was rusty from many years of disuse. (Test condition)

1 2 3

(2b) The key to the cabinet was rusty from many years of disuse. (Control condition)

1 2 3

Jiang reasoned that if Chinese ESL learners were sensitive to the number marking on the local noun “cabinets” and the number specification on the verb “was,” then they would take a longer time to process the sentence at either Region 2 (*was*) or Region 3 (*rusty*), or both. This prediction was based on results from Nicol, Forster, and Veres (1997) who showed slower reading times for sentences like 2a for native English speakers. The results showed that the average reading time differences at Region 2 was non-significant

at 29 ms. and that the average reading time difference at Region 3 was non-significant at -1 ms. Chinese ESL learners showed no difference between the conditions. Unlike native speakers of English, Chinese ESL learners appeared to be insensitive to English number.

His second experiment sought to investigate the question more directly by testing Chinese ESL learners on ungrammatical sentences like (3a) below.

(3a) *The bridge to the island were about ten miles away. (Ungrammatical condition)

1 2 3

(3b) The bridges to the island were about ten miles away. (Grammatical condition)

1 2 3

If Chinese ESL learners were aware of the number disagreement between the subject (e.g. *bridge*) and its verb (e.g. *were*) as in (3a), they would take a longer time to process the sentence at either Region 2 (e.g. *were*) or Region 3 (e.g. *about*), or both, compared with the grammatical condition. The results showed no difference in reading times for the grammatical vs. ungrammatical conditions. In other words, unlike native speakers of English, Chinese ESL learners appeared to be insensitive to violations of subject-verb agreement.

A more recent study by Jiang (2007) examined number-sensitivity in a different kind of construction: “*The visitor took several of the rare coin in the cabinet.” He found that again, Chinese ESL learners showed no sensitivity to the grammatical violation of number, unlike native speakers of English.

So far, the methods under consideration for testing comprehension include the syntactic priming task and the self-paced reading task. Below, results of baseline

experiments with native English speakers are reported. (It is necessary to examine the performance of native speakers of English on these on-line comprehension tasks because if they do not show a grammaticality effect, we obviously cannot expect the L2 learners to do so.)

4.2 Experiment 1: Syntactic Priming

The aim of this experiment is to determine whether the syntactic priming task is suitable for examining whether there is a “tense congruency effect” for native speakers of English. In this task, sentence fragments are presented auditorily and in critical cases, a tensed verb appears for lexical decision. Native speakers of English are expected to show this tense congruency effect: their average reaction time for the grammatical tense condition should be faster than their average reaction times for the two ungrammatical conditions.

4.2.1 Method

Participants

Thirty (23 female and 7 male) undergraduates, native speakers of English enrolled in Psychology or similar courses at the University of Arizona, voluntarily participated in the experiment for course credit. Their average age was 19 years old. Their self-reported English language skills on a one-to-six scale where 1 was poor and 6 was excellent were 5.4 for listening and speaking abilities and 5.2 for reading and writing abilities.

Materials

Forty-eight sentence triplets were created (see 4a, 4b, and 4c below for an example).

Each triplet included three conditions: a grammatical condition, an ungrammatical tense condition, and an ungrammatical phrase structure condition. In the grammatical condition (4a), a time adverbial is congruent with the past tense verb; in the ungrammatical tense condition (4b), a time adverbial is not congruent with the past tense verb; and finally, in the ungrammatical phrase-structure condition (4c), the verb as a grammatical category is congruent with the preceding fragment. Within the ungrammatical phrase-structure condition, half of the sentences started with past time adverbs and half of the sentences started with future time adverbs. Each trial contained an auditory fragment containing a time adverbial (i.e. bracketing indicates auditory presentation.), followed by a visual target containing a past tense verb (i.e. underlining indicates visual presentation).

(4a) { Yesterday Pat } walked (Grammatical condition)

(4b) *{ Tomorrow Pat will } walked (Ungrammatical tense condition)

(4c) *{ Yesterday Pat and } walked (Ungrammatical phrase-structure condition)

The auditory fragments were recorded by a native speaker of English. The recording included the verb. Later, the verb was removed with the use of a sound editor, *Audacity*.

Standard counterbalancing procedures were used. No sentence fragments from the same triplet were presented in the same list. Within each list, half of the sentence fragments contained a regular past tense verb and half contained an irregular past tense verb. (See Appendix E for the stimulus set.)

For the fillers, 24 additional grammatical sentences were included so that the proportion of grammatical and ungrammatical sentences was nearly balanced. Half of the sentence fragments started with past time adverbials such as “Around yesterday morning,

Holly and these”, and half with future time adverbials such as “Tomorrow morning, Sally will ship.” The items were not arranged in counterbalanced lists but were the same across the three lists.

Forty-two non-word targets were constructed and were divided into two types: inflected and uninflected. One type of non-word target was inflected by using the suffix “-ed”, e.g. “whorced.” The other type was not inflected, e.g. “foor.” The non-word targets were paired with auditory fragments that resembled those in the three test conditions. Each condition contained 14 sentence fragments, half with inflected non-word targets and half with not inflected non-word targets.

Overall, each presentation list contained 114 items. Of these, there were 72 word targets and 42 non-word targets. The reason for not using equal numbers of word and non-word targets was to reduce the length of the experiment (bearing in mind that the goal was to test L2 learners who would also be asked to complete questionnaires about their language background). Each presentation list included 54 grammatical sentences and 60 ungrammatical sentences. The items were presented in random order. The strings of letters appeared in the center of a computer monitor. One sixth of the visual word targets were followed by a paraphrase task in which subjects were asked “Write down what was just presented”. The presentation of materials and recording of response data were controlled via DMDX (Forster & Forster, 2003.)

Procedures

Participants were randomly assigned to one of three presentation lists. Prior to the start of the experiment, participants were given instructions about what they would be doing during the experiment. Participants were then asked to listen to each fragment

presented over speakers and to make a lexical decision to a visually presented item, as rapidly and as accurately as possible. They were to then press a *Yes* button or a *No* button to indicate if the visual stimulus was a word or not. See below for an illustration of the sequence of events in a syntactic priming task.

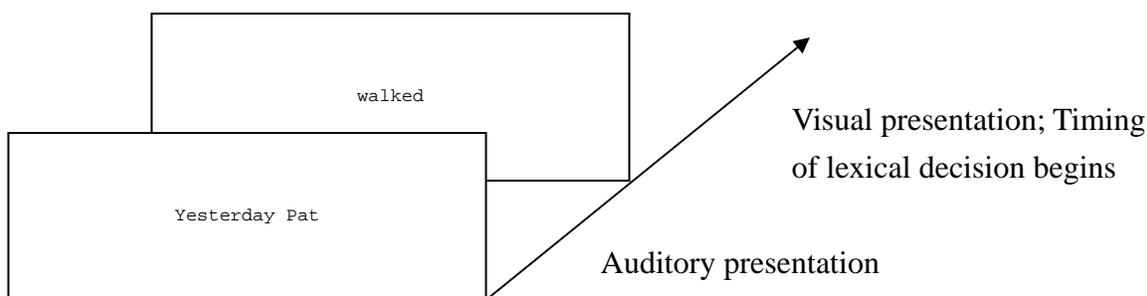


Figure 4.1 Presentation of syntactic priming task

Six practice items were given prior to the actual test items so participants were able to familiarize themselves with the task. It took participants around 15 minutes to finish the experiment.

4.2.2 Results and discussion

After data collection, reaction times and error rates were calculated individually. A 3 X 3 ANOVA was carried out with the factors being list and grammaticality. Trials where an error occurred were discarded. As shown in Table 4.1, the grammatical condition was no faster than the ungrammatical tense condition and only slightly faster than the ungrammatical phrase-structure condition.

Table 4.1 NS' average reaction times and error rates in syntactic priming task

	<u>Grammatical</u>	<u>Ungrammatical tense</u>	<u>Ungrammatical phrase-structure</u>
	Yesterday Adam	Tomorrow Adam will	Yesterday Adam and
Past tense verb (walked)	589 ms. (1.38%)	585 ms. (6.96%)	597 ms. (4.89%)

Analysis of the reaction times to targets showed that there was no significant effect of grammaticality.

Analysis of the error rates on the lexical decision task revealed that there was the significant effect of grammaticality on both the subject analysis, $F_1(2, 54) = 9.7, p < .01$, and the item analysis, $F_2(2, 84) = 9.36, p < .01$. Pairwise analyses indicated that the difference between the grammatical condition and the ungrammatical tense condition was significant on both the subject analysis, $F_1(1, 27) = 21.37, p < .01$, and the item analysis, $F_2(1, 42) = 14.60, p < .01$. The difference between the grammatical condition and the ungrammatical phrase-structure condition was also significant, for subjects, $F_1(1, 27) = 7.26, p < .05$, and items, $F_2(1, 42) = 9.72, p < .05$.

The results of the paraphrase task suggest that some participants were possibly not integrating the auditory and visual sentence fragments. When they were asked “What was just presented?” only five out of 30 participants wrote down the whole sentence. Seven participants wrote the auditory portion, and 18 participants wrote the visually presented word. The low number of participants to show the sign of integrating the auditory input with its visual input may result from the imprecise instructions: “What was just presented?” which can be interpreted as relating to the auditory presentation, the visual presentation, or both. These three interpretations account for the variety of answers,

obtained from the participants. A failure to integrate the target words into the preceding sentence fragment does not, however, account for the fact that a grammaticality effect showed up in the errors. This effect was unexpected and is difficult to explain. Ultimately, it was decided that a different task might be more suitable for our purposes.

4.3 Experiment 2: Self-paced Reading

The goal of this experiment was to examine whether a grammaticality effect could be obtained from native speakers of English in another kind of task. Again, grammatical and ungrammatical sentences are presented. It is expected that native English speakers will show reading slowdown in the ungrammatical sentences.

4.3.1 Method

Participants

Forty native speakers of English (29 female and 11 male) were tested. The participants were enrolled in Psychology or other introductory courses at the University of Arizona and took part in the experiment voluntarily for course credit. Their average age was 19 years old. On a scale of one-to-six, the participants self-reported their English proficiency as 5.4 for listening ability, 5.5 for speaking ability, 5.3 for reading ability, and 5.1 for writing ability.

Materials

Two sets of items were created. The first set consisted of thirty-two sentence quartets as in (5) below. Two members of each quartet were grammatical; the other two members were ungrammatical. In the grammatical condition, the sentences contained the

present perfect tense such as “has moved” (5a), or a base verb “move” preceded by an auxiliary verb “can” (5c). In the ungrammatical counterparts, one contained the auxiliary verb “can” followed by a past tense verb such as “moved” thus violating the grammatical rule that a verb following an auxiliary verb must be an uninflected verb (5b), and the other contained an un-tensed verb paired with “has” (5d). There were two regions of interest: (1) the main verb (such as “moved”) and (2) the following phrase. Forward slashes indicate separate regions.

(5a) Alan has / moved / a number of / times. (Grammatical condition)

1 2

(5b) * Alan can / moved / a number of / times. (Ungrammatical condition)

1 2

(5c) Alan can / move / a number of / times. (Grammatical condition)

1 2

(5d) *Alan has / move / a number of / times. (Ungrammatical condition)

1 2

The second set pairs tensed or un-tensed verbs with an adverb that conveys a past event. This set consisted of 32 pairs of sentences. Each pair included two conditions: the grammatical tense condition and the ungrammatical tense condition.

(6a) Yesterday Pat / walked / to school / on her own. (Grammatical tense condition)

1 2

(6b) *Yesterday Pat / walk / to school / on her own. (Ungrammatical tense condition)

1 2

Two sentence regions were examined as shown in (6a & 6b): the first region at the point where the sentence pairs diverged (numbered 1) such as “walked” or “walk” and the

subsequent region, (numbered 2), such as “to school.”

In addition, twenty filler sentence pairs for the first set were created as below:

Walter can / examine / the leaky faucet.

*Pete has / help / me with / the boxes.

Pete has / helped / me with / the boxes.

*Walter can / examined / the leaky faucet.

The first pair was the filler sentences for the comparison between “has moved” and “can moved.” The second pair was the filler sentences for the comparison between “has move” and “can move.”

Other 20 filler sentences for the second set were created which contained the future tense.

Next Friday, Irene will / refuse / to accept / the new contract.

*Sometime tomorrow morning, Holly / will / delivered / a package / to my home.

Four lists (e.g. List A, List B, List C, & List D) were created. Sentences like (5a) and (5b) were counterbalanced across List A and List B and sentences like (5c) and (5d) were counterbalanced across List C and List D. Sentences like (6a) and (6b) were balanced across Lists A and B and again across Lists C and D. Each of Lists A and B included 16 sentences in each condition. Counterbalancing meant that if a sentence in the grammatical condition was presented in List A, its ungrammatical counterpart was presented in List B; likewise for Lists C and D. The filler sentences were the same across the two lists.

Each presentation list contained 104 sentences: 64 test sentences and 40 filler sentences. The sentences were presented in random order. Sixteen test sentences were

followed by a yes-or-no comprehension question; these were presented in complete sentences, not phrase-by-phrase. In order to prevent subjects from focusing on tense, comprehension questions were worded as follows: “This sentence was about Pat walking to school on her own.” Half of the answers for the comprehension questions were YES; half were NO. The presentation of materials and the data collection were controlled via the DMDX software program (Forster & Forster, 2003). Overall, each presentation list contained 52 grammatical sentences and 52 ungrammatical sentences. (See Appendix F for the stimulus set.)

Procedures

The participants were randomly assigned to one of four presentation lists. Before the start of the experiment, the participants were given directions about what they would be doing during the experiment. They were instructed to read, as quickly as possible, the sentences that appeared phrase-by-phrase on a computer screen and to answer comprehension questions as accurately as possible. Six practice items were included at the beginning of the experiment in order to familiarize participants with the reading task.

During each trial, the first region appeared on a computer screen. The participant then pressed a designated keyboard to view a subsequent region until they read the final region in a sentence. For example, if the test sentence was “Yesterday I walked to school on my own.”, the first region shown was “Yesterday I XXXXXX XXXXXXXXXXXX XXXXXXXXXXXX.” By pressing a designated key, the first phrase was replaced by X’s, and the second word appeared, as in “XXXXXXXXXXXXX walked XXXXXXXXXXXX XXXXXXXXXXXX.”, and so on. Each sentence was presented centrally on the computer monitor. (See below for an illustration of self-paced reading task.) After a sentence was

finished, the next item was either a comprehension question that was related to the sentence they had just read or a new sentence. If a yes-or-no comprehension question was presented, the participants pressed a *Yes* key or a *No* key to indicate their answer. It took approximately 10 minutes for participants to finish the experiment.

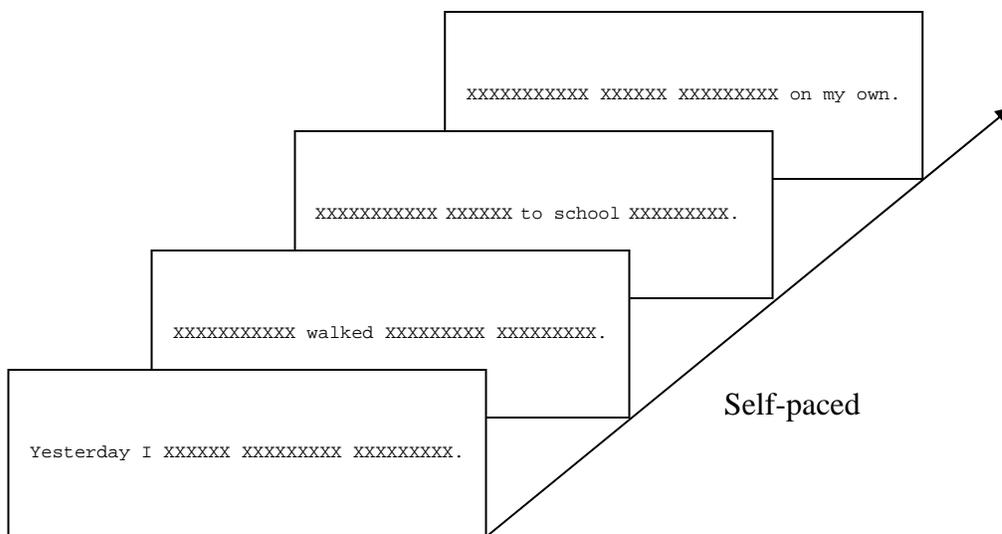


Figure 4.2 Depiction of the moving window self-paced reading task

4.3.2 Results and discussion

Set 1 comparison

After the data were gathered, for each region of interest, a 2 X 2 ANOVA was carried out; the factors were list and grammaticality. The first table below displays the results from the Set 1 comparison (e.g. has moved vs. can moved). Recall the comparison between “has / move(d) / a number of” and “can / move(d) / a number of”. There was a 24 ms. difference at Region 1, and a 13 ms. difference at Region 2.

Table 4.2 NS' average reading times from Set 1 in self-paced reading task

	<u>Region 1</u>	<u>Region 2</u>
Grammatical	515	588
Ungrammatical	539	601
Difference	24* ms.	13 ms.

*Significant at $p < .05$

For Region 1, there was a significant effect of grammaticality on both the subject analysis, $F_1(1, 38) = 5.39, p < .05$, and the item analysis, $F_2(1, 60) = 8.95, p < .05$. For Region 2, the effect of grammaticality was non-significant.

The mean accuracy for comprehension questions for these sentences was 90% when the questions such as “This sentence was about Pat walking to school on her own.” were asked.

Set 2 comparison

The second table displays the results from Set 2 comparison. A 2 ms. difference at Region 1 and a 9 ms. difference at Region 2 were obtained.

Table 4.3 NS' average reading times for Set 2 in self-paced reading task

	<u>Region 1</u>	<u>Region 2</u>
Yesterday Pat	walked/walk	to school
Grammatical (walked)	524	589
Ungrammatical (walk)	526	598
Difference	2 ms.	9 ms.

Analysis of the reading times for each of two regions revealed that for Region 1, the effect of grammaticality was not significant. For Region 2, there was no significant effect of grammaticality.

The mean accuracy rate for comprehension questions for these sentences was 93%.

This experiment showed that the effect of a mismatch between verb form and auxiliary verb was significant. Thus, for native speakers, the self-paced reading task is sensitive to the tense manipulation.

Surprisingly, there was no effect of a mismatch between verb form and time adverbial. This may be due to differences in word length and morphological structure of the verbs. Consider examples (7a) and (7b):

(7a) Yesterday Pat / walked / to school / on her own. (Grammatical tense condition)

1 2

(7b) *Yesterday Pat / walk / to school / on her own. (Ungrammatical tense condition)

1 2

In Region 1, “walked” appears in the grammatical tense condition and “walk” in the ungrammatical tense condition. Obviously, “walk” is shorter than “walked” and morphologically simpler. The effect of ungrammaticality may be reduced significantly by the fact that “walk” is easier to process. It was expected that the effect of grammaticality would outweigh the lexical level effects, but this was not the case.

However, if word length in number of characters is controlled, there is a numerical difference in the expected. Take Region 1 for example. The mean reading times for the grammatical condition is 95 ms. per character. The mean reading times for ungrammatical condition is 117 ms. per character. This is a difference of 22 ms. per character, which could well be significant. However, having to perform this adjustment complicates the data analysis and therefore Chinese English-language learners are not tested on this condition.

CHAPTER 5: TENSE COMPREHENSION IN CHINESE ENGLISH-LANGUAGE LEARNERS IN ON-LINE READING TASK

Native speakers of English discern a mismatch between verb form and a preceding auxiliary verb, and this slows their reading: they show a grammaticality effect. Do Chinese English-language learners demonstrate this effect? The following experiment will test this.

5.1 Experiment 1: Self-paced Reading

By means of the self-paced reading paradigm, the current experiment will examine whether Chinese English-language learners show the grammaticality effect, shown by native speakers.

5.1.1 Method

Participants

Forty college students (33 female and 7 male) from Fu-Jen University in Taiwan were recruited from the Department of English where instruction is in English; 19 were enrolled in the course of Business English and 21 in the course of Introduction to Linguistics. Participants received \$5 for their participation. The average age of participants was 24. The participants self-rated their English proficiency on a one-to-six scale where 1 was poor and 6 was excellent with the following results: 3.2 for listening skills, 2.9 for speaking skills, 3.3 for reading skills, and 2.9 for writing skills. These are comparable to the self-ratings for the group tested in the grammar test.

The profile of participants' English learning background indicated that on average,

they had begun studying English at the age of 12 and had studied English for an average of 12 years. For 16 hours per week, they used English, mostly in school. For 11 hours per week, they used English mostly with classmates and friends. For 14 hours per week, they used English when listening to radio or watching television. Ten out of 40 participants had lived in United States, Australia, or Canada--with an average stay of 11 months--for the purpose of traveling, studying aboard, working, or short-term immigration.

Twenty-three out of 40 participants provided their English scores on the College Entrance Exam, the average score of which was 65 out of 100 (87% below) . Eleven out of 40 participants had taken the TOEIC with an average score of 717 out of 990 (i.e. intermediate level). None of the participants had taken TOEFL. The average score for English related courses for 34 out of 40 participants was 74.4 out of 100 (i.e. intermediate level).

Materials

The same thirty-two sentence quartets, used in Experiment 2 of Chapter 4, were used here. An example appears below.

(1a) Alan has / moved / a number of / times. (Grammatical condition)

1 2

(1b) * Alan can / moved / a number of / times. (Ungrammatical condition)

1 2

(1c) Alan can / move / a number of / times. (Grammatical condition)

1 2

(1d) *Alan has / move / a number of / times. (Ungrammatical condition)

1 2

Overall, there were 52 sentences and 8 comprehension questions. Each presentation list

contained 26 grammatical sentences and 26 ungrammatical sentences. (See Appendix B for the stimulus set.) The same counterbalancing procedures and design as in Experiment 2 of Chapter 4 were used here.

Procedures

The procedures were identical to those in Experiment 2 of Chapter 4. The participants took approximately 10 minutes to finish the task.

5.1.2 Results

Data were analyzed in a 2 X 2 ANOVA, where the factors were list and grammaticality. The table below displays the results from the two regions of interest. Recall the comparison between “has / move(d) / a number of” and “can / move(d) / a number of”.

Table 5.1 NNS’ average reading times from Set 1 in self-paced reading task

	<u>Region 1</u>	<u>Region 2</u>
Grammatical	738	887
Ungrammatical	720	879
Difference	-18 ms.	-8 ms.

For Region 1, there was no significant effect of grammaticality, $P > 0.05$. For Region 2, the effect of grammaticality was non-significant, $P > 0.05$. For the comprehension questions, the mean accuracy was 74%.

5.1.3 Discussion

Unlike native speakers of English, Chinese English-language learners did not show

a grammaticality effect. In fact, they show a reverse grammaticality effect, though this difference in reading times is non-significant. This trend for Chinese English-language learners to read the grammatical sentences more slowly than ungrammatical ones is puzzling. This trend could be interpreted in two ways: (1) it reflects a real effect that would become significant with more subjects or more items or both and (2) it is simply a spurious trend. Each possibility will be considered in turn.

A real reverse grammaticality effect would indicate that subjects are sensitive to the ungrammaticality. But why would they read the critical regions of the ungrammatical sentences more quickly than they would read the grammatical sentences? Consider Gass' (2001) study which found that L2 learners showed a reverse grammaticality effect in an acceptability judgment task. The subjects in her study judged whether French sentences contained subject-verb agreement or disagreement. A group of second-year L2 learners of French who had received 3.9 years of French instruction took part. Sentences were either grammatical (such as 1a) or ungrammatical (such as 1b). In 1b, the verb "parle" (speak) has an -s ending, which marks 2nd person, not 1st person.

(1a) Je parle de cette histoire de mon frère. (Grammatical condition)

"I speak (1st person) about this story of my brother."

(1b) *Je parles de cette histoire de mon frère. (Ungrammatical condition)

"I speak (2nd person) about this story of my brother."

The results showed that the average reaction time to judge grammatical sentences (2187 ms.) was significantly different from that of ungrammatical sentences (2142 ms.).

This might suggest that the NNS subjects in the current study were doing a sort of

implicit acceptability judgment task, meaning that the NNS subjects implicitly made a decision about whether the sentences were grammatically acceptable and once a decision was made, they started reading more rapidly. Since the ungrammatical sentences contain an ungrammaticality mid-sentence, the decision point is therefore earlier in the sentence than for the grammatical sentences (for which a decision is made only at the end of sentence). If they were looking for ungrammaticality, they would notice it in Region 1 only for the ungrammatical sentences.

The other interpretation of the results is that the non-significant reversal is spurious, and that further testing will show that NNS at this level of proficiency show no difference between the grammatical and ungrammatical variants of the sentences. This would mean that during sentence processing tasks in which they read sentences for comprehension, they are not processing tense information. This result would be in line with Jiang's (2004) findings for number and is the interpretation that we tentatively adopt here.

If the results from the current on-line reading task are compared with those from the previous paper-and-pencil tests, Chinese English-language learners show different results for two tasks. Chinese English-language learners do not demonstrate sensitivity to grammatical violations during on-line reading, while they show that they have the knowledge of the grammatical rules in the paper-and-pencil tests. The same pattern is observed in the number morpheme study by Jiang (2004). Jiang (2004) claimed that his finding of insensitivity was due to a failure of performance, not a failure of competence. These experiments suggest that the same holds of tense marking.

APPENDIX A: Stimuli for Lexical Priming

I. Testing of the prime lexicality effect

A. Word target

伸展 生活 愛情 臉盆 城市 再見 流淚 仲夏 課稅
 市場 女孩 先生 熱情 葉子 畢業 路徑 權力 過量
 凝神 改變 遠足 變故 勇猛 健康 出色 列車 命題
 演習 真誠 體會 約束 交流 別人 利誘 刻苦 功課

B. Related word prime

伸縮 生意 愛心 臉龐 城牆 再婚 流氓 仲裁 節稅
 職場 男孩 學生 事情 孩子 商業 田徑 權衡 食量
 凝結 改天 遠望 變化 勇士 健談 出局 列席 命運
 演講 真偽 體育 約會 交通 別致 利息 刻板 功能

C. Related non-word prime

伸點 生節 愛剛 臉來 城猜 再賦 流虛 仲惟 芳稅
 酸場 瑕孩 容生 塗情 庇子 陸業 懷徑 權萎 坊量
 凝許 改親 遠絕 變蓉 勇反 健午 出擺 列凸 命佛
 演榮 真隕 體挫 約熱 交希 別蔬 利窩 刻助 功滴

D. Unrelated word prime

天空 系列 懷念 永遠 春天 下雨 掉落 音樂 味道
 放鬆 允許 呼吸 聲音 愛心 風箏 作樂 單曲 意願
 思維 警告 申請 排班 獲利 成員 雖然 恐嚇 使用
 瞭解 檢驗 效果 合格 發現 消除 呼吸 正確 亂象

E. Non-word target

兇足 逃安 活所 懈能 鑽答 互龍 煞頭 喝說 辯喃
 撮淳 審兆 弱薩 受惚 系尊 投識 賭呼 時小 烘服

危信 應遷 明翔 掛從 遮律 時雜 饒步 憤爛 抑福
 麻零 慶求 嘆麗 芭象 情妝 懶盛 醒冒 階想 繩氣

F. Related word prime

兇手 逃跑 活動 懈怠 鑽孔 互補 煞車 喝茶 辯論
 撮合 審慎 弱點 受傷 系統 投射 賭注 時尚 烘烤
 危險 應對 明顯 掛彩 遮擋 時間 進步 燦爛 幸福
 凋零 追求 美麗 形象 化妝 茂盛 假冒 夢想 客氣

G. Related non-word prime

兇荒 逃為 活特 懈貼 鑽奸 互跡 煞獵 喝輔 辯裁
 撮性 審天 弱閉 受紛 系將 投偵 賭戳 時訴 烘蒐
 危蘭 應浩 明澳 掛政 遮歷 時香 陸步 巡爛 爆福
 腳零 殖求 密麗 緣象 畜妝 基盛 窮冒 囊想 飽氣

H. Unrelated word prime

逮捕 資訊 否則 行為 衝擊 基因 技術 蛋白 基礎
 結構 中心 方面 新鮮 困境 曾經 作品 記住 倔強
 失常 遺跡 感慨 孤獨 嚴肅 陽光 分析 微笑 保護
 待遇 歉意 反省 賞賜 忘記 誣賴 煩惱 憑證 沉淪

II. Demonstration of priming

A. Word target and identical word prime

快樂 思想 等待 渴望 沙漠 瘋狂 阻擋 改革 規則
 旅遊 消費 教育 成長 喜歡 感覺 盡責 謊言 餐券
 名冊 恰當 歡呼 讓位 同事 恭喜 運銷 羞愧 彎腰
 編排 贖金 率先 對質 器材 靠近 計畫 付款 協助

B. Related non-word prime

快私 思埔 等豔 渴勢 沙懾 瘋與 阻堪 改崛 規光

旅發 消敦 教攜 成勤 喜滢 感伊 盡格 謊沛 餐氣
 名由 恰型 歡恥 讓漫 同動 恭鼓 運月 羞詹 彎業
 編貌 贖信 率留 對司 器離 靠安 計源 付鼎 協足

C. Unrelated word prime

離開 老實 放棄 和睦 失落 引起 冷熱 鼓吹 理由
 感覺 擔任 豐碩 友愛 清涼 恭敬 夢想 歡迎 罰寫
 遭遇 媒體 藥品 賠償 分辨 個體 表示 採收 簡單
 立即 影響 恐懼 功能 創傷 優勢 進入 重要 競爭

D. Non-word target and identical non-word prime

遲旋 牽懸 峭壟 霧膺 費連 罰榮 續飄 車惋 奏襪
 勵繫 晴早 脆緊 首逸 遣貫 奎鳴 烈略 犯和 力溫
 數振 覺鎮 虎酬 娜藥 已盾 麗藉 曼版 邊參 河科
 淇籌 筏專 袖副 捷當 凝難 愁懲 槽週 蒞曉 表孤

E. Related non-word prime

遲纏 牽刁 峭難 霧財 費熟 罰洲 續稔 車妄 奏菲
 勵薄 晴舶 脆概 首諳 遣禮 奎請 烈聘 犯牌 力賢
 數韜 覺養 虎惜 娜霞 已屹 麗蹲 躡版 徹參 盡科
 詠籌 環專 挽副 填當 雲難 萍懲 柔週 駱曉 覆孤

F. Unrelated word prime

估計 記憶 發表 地位 研究 世界 領先 利用 國際
 科技 單位 超過 訝異 個案 業者 國外 考慮 進口
 走私 範疇 利益 沒有 討論 購買 流逝 爭取 銷毀
 反對 另外 倉庫 查獲 立法 爭議 規範 身分 繼承

APPENDIX B: Stimuli for Lexical Decision

I. Word target

天空 作樂 合格 結構 系列 微笑 發現 中心
 懷念 意願 消除 分析 永遠 保護 交友 新鮮
 春天 警告 正確 困境 下雨 申請 亂象 曾經
 掉落 排班 逮捕 作品 音樂 獲利 資訊 記住
 味道 成員 否則 倔強 放鬆 雖然 行為 失常
 允許 恐嚇 衝擊 遺跡 呼吸 使用 基因 感慨
 聲音 瞭解 技術 孤獨 愛心 檢驗 蛋白 嚴肅
 風箏 效果 基礎 陽光

II. Non-word target

A. Transposed non-word

會機 面方 致導 踐實 策政 場劇 行執 顧回
 標目 重嚴 須必 態型 怨抱 續持 意注

B. Random non-word

兇足 懈能 煞頭 撮淳 受惚 投識 系尊 審兆
 弱薩 喝說 辯喃 鑽答 互龍 逃安 活所

C. Real-plus-(pseudo) character non-word

矯(仁賻) 服(肚住) 容(柱伐) 響(飯枚) 民(錢佑)
 攜(衫移) 庫(作牲) 配(博侍) 質(地仟) 網(打行)
 藍(神抽) 感(流佑) 湄(鑛諫) 廢(塊洗) 麻(駐紋)

D. Two pseudo-characters non-word

陶特 解謀 計即 認洩 裕院 如檔 鈴強 報肆
網拉 館猛 塊體 徑瑞 卻秋 後紛 能對

APPENDIX C: Story Comprehension

Part I. Reading

Directions: Please read the short story.

Mary is a few minutes late for her date. When she arrives at the restaurant, the restaurant is closed. She wonders where John, her boyfriend, is. When she is about to leave, John shows up. He apologizes to her for his lateness again and again, but she does not accept his apology and tells him that he should be on time. Just when Mary is about to walk away, the door opens. A waiter comes out and says “Happy Birthday!” to Mary. A bunch of waiters holding a cake appear by the door and wait for Mary and John to come in.

Part II. Writing

Directions: Please write eight sentences describing the events in the above story that took place yesterday.

Thank you for your participation.

APPENDIX D: Multiple Choice

Multiple Choice (single answer)

Directions: Please check (X) the correct answer in the circle.

- 1 Mozart _____ music when he was a child.
 wrote writing

- 2 Larry _____ the dishes last night.
 washed washing

- 3 Peter _____ his letter yesterday.
 mailed mailing

- 4 Tina _____ a book for her mom last week.
 buying bought

- 5 Henry _____ hamburgers for breakfast this morning.
 ate eating

- 6 Helen _____ an interesting English book last night.
 studied studying

- 7 Susan _____ next to him in the classroom last month.
 sat sitting

- 8 Jack _____ a building recently.
 designing designed

- 9 Your lawyer is _____ you a question.
 asking asked

- 10 The tour guide is _____ our itinerary.
 arranging arranged
- 11 The teacher is _____ the rules to students.
 explaining explained
- 12 My uncle is _____ Chinese chess with his niece.
 playing played

Thank you for your participation.

APPENDIX E: Stimuli for Syntactic Priming

I. Visual word target with auditory fragment

A. Grammatical condition

Yesterday Adam walked
Yesterday evening Albert asked
Last weekend Henry started
Last February Robert visited
A moment ago Raymond arrived
Yesterday afternoon Vincent suggested
Three days ago Brian called
Many years ago Tony traveled
In the old days John carried
Recently Troy joined
The day before yesterday Mike planned
About two hours ago Eric worked
Around five weeks ago Alice showed
One month ago today Karen decided
Last month Judith prepared
Last Monday Amy answered
Last summer Brenda played
Last Wednesday night Carol looked
Late yesterday Catherine arrived
Early yesterday Doris applied
At midnight yesterday Elaine helped
Late yesterday afternoon Grace continued
Early yesterday morning Helen danced
A long time ago Jamie traveled
Two months ago William ran
Last Thursday Alan forgave
Last January Alex bought
Last March George brought
Last April Tom made
Yesterday evening at 9 Charles stood

Around two hours ago Jerry slept
Last semester Daniel taught
Last May David spoke
Last summer Frank drove
Last Christmas Edward became
Last Tuesday Gary came
Yesterday morning Angela saw
Yesterday at 5 p.m. Betty went
Last year Christine kept
Last week Elsa knew
Last semester Emily took
Decades ago Jennifer gave
Last time Jessica's voice rose
Last November Judy told
The other day Kelly wrote
Seven months ago Linda met
Two years ago Lisa left
Ten minutes ago Maggie ate

B. Ungrammatical tense condition

Tomorrow Adam will walked
Tomorrow evening Albert will asked
Next weekend Henry will started
Next February Robert will visited
In the future Raymond will arrived
Tomorrow afternoon Vincent will suggested
In the future Brian will called
In the future Tony will traveled
One of these days John will carried
Sooner or later Troy will joined
The day after tomorrow Mike will planned
Two hours from now Eric will worked
Five hours from now Alice will showed
In one month from today Karen will decided
Next month Judith will prepared

Next Monday Amy will answered
Next summer Brenda will played
Next Wednesday night Carol will looked
Late tomorrow Catherine will arrived
Early tomorrow Doris will applied
At midnight tomorrow Elaine will helped
Late tomorrow afternoon Grace will continued
Early tomorrow morning Helen will danced
In the near future Jamie will traveled
Two months from now William will ran
Next Thursday Alan will forgave
Next January Alex will bought
Next March George will brought
Next April Tom will made
Tomorrow evening at 9 Charles will stood
Two hours from now Jerry will slept
Next semester Daniel will taught
Next May David will spoke
Next summer Frank will drove
Next Christmas Edward will became
Next Tuesday Gary will came
Tomorrow morning Angela will saw
Tomorrow at 5 p.m. Betty will went
Next year Christine will kept
Next week Elsa will knew
Next semester Emily will took
Decades from now Jennifer will gave
Next time Jessica's voice will rose
Next November Judy will told
Some day soon Kelly will wrote
In the future Linda will met
In the future Lisa will left
In the future Maggie will ate

C. Ungrammatical phrase structure condition

Yesterday Adam and walked
Yesterday evening Albert and asked
Last weekend Henry and started
Last February Robert and visited
A moment ago Raymond and arrived
Yesterday afternoon Vincent and suggested
In the future Brian and called
In the future Tony and traveled
One of these days John and carried
Sooner or later Troy and joined
The day after tomorrow Mike and planned
Two hours from now Eric and worked
Five hours from now Alice and showed
In one month from today Karen and decided
Next month Judith and prepared
Next Monday Amy and answered
Next summer Brenda and played
Next Wednesday night Carol and looked
Late yesterday Catherine and arrived
Early yesterday Doris and applied
At midnight yesterday Elaine and helped
Late yesterday afternoon Grace and continued
Early yesterday morning Helen and danced
A long time ago Jamie and traveled
Two months ago William and ran
Last Thursday Alan and forgave
Last January Alex and bought
Last March George and brought
Last April Tom and made
Yesterday evening at 9 Charles and stood
Two hours from now Jerry and slept
Next semester Daniel and taught
Next May David and spoke
Next summer Frank and drove
Next Christmas Edward and became
Next Tuesday Gary and came

Tomorrow morning Angela and saw
 Tomorrow at 5 p.m. Betty and went
 Next year Christine and kept
 Next week Elsa and knew
 Next semester Emily and took
 Decades from now Jennifer and gave
 Last time Jessica's voice and rose
 Last November Judy and told
 The other day Kelly and wrote
 Seven months ago Linda and met
 Two years ago Lisa and left
 Ten minutes ago Maggie and ate

II. Visual Non-word target with auditory fragment

A. Grammatical condition

Late yesterday evening Daisy fint
 Early yesterday afternoon Dana talbed
 Last Wednesday Ellen jowon
 Last July Erica greels
 Six weeks ago Flora clired
 Seven years ago Gina thecked
 Nine hours ago Helen andle
 Many months ago Kent soored
 A couple days ago Jack trasted
 Around last weekend Jason mughted
 Last winter Justin estrag
 About five minutes ago Keith unched
 Last fall Larry boove
 Three years ago today Marcus sintled

B. Ungrammatical tense condition

Around tomorrow night Lance will knepped
 Early tomorrow evening Leo will vion

Next Sunday Randolph will pembow
 Next October Russ will imbotted
 In one week from today Victor will roided
 Tomorrow at 10 o'clock Walter will stawn
 In the future William will pralled
 In the near future Felix will chawaus
 One of these days Ford will yistled
 Sooner or later Geoffrey will louched
 The day after tomorrow Lillian will zeart
 Two weeks from now Yvonne will ambined
 Twenty minutes from now Zoe will foor
 In one decade from today Sabrina will whorced

C. Ungrammatical phrase structure condition

Tomorrow at noon Dave and orsile
 Around tomorrow evening Don and hailked
 Next Sunday afternoon Taylor and marlewed
 Next Saturday Thomas and duited
 A couple of hours from now Ian and equen
 Tomorrow at five o'clock Isaac and ist
 Three months from now Jacob and deliped
 Many hours ago James and inixed
 Twenty minutes ago Otto and opurl
 Recently Parker and satchined
 The day before yesterday Owen and ase
 About three hours ago Paul and drieded
 Around eleven weeks ago Kara and canioed
 Eight months ago today Kay and istened

III. Filler

A. Grammatical condition

Tomorrow morning at 9 Sally will ship
 Around tomorrow afternoon Samantha will throw

Next mid-November Stacey will want
Next Friday Irene will clean
Next academic year Olive will engage
Five years from now Pamela will drop
Next anniversary Wayne will discover
Next December Webster will return
Some day soon Earl will add
In the future Elliot will separate
Three weeks from now Pete will examine
In five weeks from today Philip will connect

B. Grammatical condition

Around yesterday morning Holly and these
Yesterday at eight o'clock Hilary and this
Last mid-March Wendy and those
Next Friday afternoon Vicky and her
Next spring semester Joyce and you
Ten weeks from now Rex and some
Next fall semester Robin and many
Next mid-December Oliver and his
Six hours from now Carter and several
Six months ago Jeremy and friends
Four months ago Gavin and lots
Thirty minutes ago Douglas and that

APPENDIX F: Stimuli for Self-paced Reading

I. Set I comparison

A. Grammatical condition

Alan has moved a number of times.

Alex has viewed the river from his window.

Grace has jogged across the state.

Tom has changed his schedule daily.

Jenny has mastered English in just a few months.

Daniel has mentioned the rule several times.

David has looked over the documents.

Frank has experienced many disappointments in his life.

Edward has knocked on my door whenever he wants.

Andrew has cared for my friend's dog.

Andy has reduced the amount of television he watches.

Arthur has guessed the right answer.

Tim has followed a healthy diet for years.

Scott has cried for many hours in his room.

Elaine has covered various topics in her articles.

Elsie has checked the schedule again.

George has made some long-distance phone calls.

Charles has found an apartment near school.

Simon has bought a gift for his friend.

Taylor has built a house near the river.

Flora has caught many fish in the sea.

Helen has sat on the new bench in the park.

Julia has brought the pictures to show you.

Laura has felt disappointed in her performance.

Hilary has held the baby in her arms.

Jamie has thought very carefully about her problem.

Samuel has fed his fish on crackers.

Sampson has said the wrong thing on many occasions.

Joyce has sought answers to her problems.

Thomas has fought for his rights.

Stanley has heard the vague rumors.
Janice has stuck the notice on the wall.

B. Ungrammatical condition

Alan can moved a number of times.
Alex can viewed the river from his window.
Grace can jogged across the state.
Tom can changed his schedule daily.
Jenny can mastered English in just a few months.
Daniel can mentioned the rule several times.
David can looked over the documents.
Frank can experienced many disappointments in his life.
Edward can knocked on my door whenever he wants.
Andrew can cared for my friend's dog.
Andy can reduced the amount of television he watches.
Arthur can guessed the right answer.
Tim can followed a healthy diet for years.
Scott can cried for many hours in his room.
Elaine can covered various topics in her articles.
Elsie can checked the schedule again.
George can made some long-distance phone calls.
Charles can found an apartment near school.
Simon can bought a gift for his friend.
Taylor can built a house near the river.
Flora can caught many fish in the sea.
Helen can sat on the new bench in the park.
Julia can brought the pictures to show you.
Laura can felt disappointed in her performance.
Hilary can held the baby in her arms.
Jamie can thought very carefully about her problem.
Samuel can fed his fish on crackers.
Sampson can said the wrong thing on many occasions.
Joyce can sought answers to her problems.
Thomas can fought for his rights.
Stanley can heard the vague rumors.

Janice can stuck the notice on the wall.

C. Filler item

Pete has help me with the boxes.

Philip has deserve the large reward.

Carol has dance the waltz with John.

Catherine has reject the opportunity to travel.

Doris has play lead guitar in the band.

Walter can examine the leaky faucet.

Justin can push the door open.

Kent can judge the case fairly.

Keith can turn the key in the lock.

Brenda can believe whatever she wants.

Regan has speak many hours on the phone.

Victor has drive after drinking.

Felix has think that the super model is pretty.

Ford has begin his degree at the university.

Geoffrey has get lots of criticism.

Marcus can blow out all the candles.

Larry can stand still for a long time.

Erica can understand Spanish quite well.

Daisy can spend a lot of time fixing that bike.

Dana can strike the first blow in the match.

D. Comprehension question and (answer)

This sentence was about Alan moving. (Yes)

This sentence was about Alex jumping from the window. (No)

This sentence was about Grace jogging across the state. (Yes)

This sentence was about Tom forgetting his timetable. (No)

This sentence was about George making some long-distance phone calls. (Yes)

This sentence was about Charles losing his job. (No)

This sentence was about Simon giving a gift for his friend. (Yes)

This sentence was about Taylor swimming in the water. (No)

E. Grammatical condition

Alan can move a number of times.
Alex can view the river from his window.
Grace can jog across the state.
Tom can change his schedule daily.
Jenny can master English in just a few months.
Daniel can mention the rule several times.
David can look over the documents.
Frank can experience many disappointments in his life.
Edward can knock on my door whenever he wants.
Andrew can care for my friend's dog.
Andy can reduce the amount of television he watches.
Arthur can guess the right answer.
Tim can follow a healthy diet for years.
Scott can cry for many hours in his room.
Elaine can cover various topics in her articles.
Elsie can check the schedule again.
George can make some long-distance phone calls.
Charles can find an apartment near school.
Simon can buy a gift for his friend.
Taylor can build a house near the river.
Flora can catch many fish in the sea.
Helen can sit on the new bench in the park.
Julia can bring the pictures to show you.
Laura can feel disappointed in her performance.
Hilary can hold the baby in her arms.
Jamie can think very carefully about her problem.
Samuel can feed his fish on crackers.
Sampson can say the wrong thing on many occasions.
Joyce can seek answers to her problems.
Thomas can fight for his rights.
Stanley can hear the vague rumors.
Janice can stick the notice on the wall.

F. Ungrammatical condition

Alan has move a number of times.
Alex has view the river from his window.
Grace has jog across the state.
Tom has change his schedule daily.
Jenny has master English in just a few months.
Daniel has mention the rule several times.
David has look over the documents.
Frank has experience many disappointments in his life.
Edward has knock on my door whenever he wants.
Andrew has care for my friend's dog.
Andy has reduce the amount of television he watches.
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Scott has cry for many hours in his room.
Elaine has cover various topics in her articles.
Elsie has check the schedule again.
George has make some long-distance phone calls.
Charles has find an apartment near school.
Simon has buy a gift for his friend.
Taylor has build a house near the river.
Flora has catch many fish in the sea.
Helen has sit on the new bench in the park.
Julia has bring the pictures to show you.
Laura has feel disappointed in her performance.
Hilary has hold the baby in her arms.
Jamie has think very carefully about her problem.
Samuel has feed his fish on crackers.
Sampson has say the wrong thing on many occasions.
Joyce has seek answers to her problems.
Thomas has fight for his rights.
Stanley has hear the vague rumors.
Janice has stick the notice on the wall.

G. Filler items

Pete has helped me with the boxes.
 Philip has deserved the large reward.
 Carol has danced the waltz with John.
 Catherine has rejected the opportunity to travel.
 Doris has played lead guitar in the band.
 Walter can examined the leaky faucet.
 Justin can pushed the door open.
 Kent can judged the case fairly.
 Keith can turned the key in the lock.
 Brenda can believed whatever she wants.
 Regan has spoken many hours on the phone.
 Victor has driven after drinking.
 Felix has thought that the super model is pretty.
 Ford has begun his degree at the university.
 Geoffrey has got lots of criticism.
 Marcus can blew out all the candles.
 Larry can stood still for a long time.
 Erica can understood Spanish quite well.
 Daisy can spent a lot of time fixing that bike.
 Dana can struck the first blow in the match.

H. Comprehension question and (answer)

This sentence was about Alan moving. (Yes)
 This sentence was about Alex jumping from the window. (No)
 This sentence was about Grace jogging across the state. (Yes)
 This sentence was about Tom forgetting his timetable. (No)
 This sentence was about George making some long-distance phone calls. (Yes)
 This sentence was about Charles losing his job. (No)
 This sentence was about Simon giving a gift for his friend. (Yes)
 This sentence was about Taylor swimming in the water. (No)

II. Set II comparison

A. Grammatical condition

Yesterday Adam walked to school in the rain.
Yesterday evening, Albert asked me a question about myself.
Last weekend, Henry started to take Chinese lessons.
Last February, Robert visited a friend in the hospital.
A moment ago, Raymond arrived at the station with his brother.
Yesterday afternoon, Vincent suggested a tour of the museum.
Three days ago, Brian called a taxi for me.
Many years ago, Tony traveled the whole world to meet interesting people.
Last night, John carried the chairs back into the kitchen.
Recently, Troy joined his family in Canada.
The day before yesterday, Mike planned his trip to ensure the shortest route.
About two hours ago, Eric worked on his science homework.
Last month, Alice showed some interest in drama.
One month ago today, Karen decided to stay in Paris.
Around five weeks ago, Judith prepared a wonderful dinner for us.
Last Monday, Amy answered the invitation to come to the party.
Yesterday morning, Angela saw the necklace on the table.
Yesterday at 5 p.m. Betty went to grocery store for supplies.
Last week, Christine kept the watch in her safe for me.
Last year, Elsa knew about her surprise birthday party in advance.
Last semester, Emily took an introductory course in linguistics.
Decades ago, Jennifer gave a stranger some money for food.
Last time, Jessica forgot that I was coming over.
Last November, Judy told the reporter what her boss had done.
The other day, Kelly wrote in her journal about some of her patients.
Seven months ago, Linda met my mother on the downtown street.
Two years ago, Lisa left her country to marry a man from Italy.
Ten minutes ago, Maggie ate a muffin for breakfast.
Last night, Jerry slept like a baby in his room.
Last Tuesday, Gary came over to talk to me.
Two months ago, William ran into his friend at a bar.
Several years ago, Daniel taught English at a local high school.

B. Ungrammatical condition

Yesterday Adam walk to school in the rain.

Yesterday evening, Albert ask me a question about myself.
Last weekend, Henry start to take Chinese lessons.
Last February, Robert visit a friend in the hospital.
A moment ago, Raymond arrive at the station with his brother.
Yesterday afternoon, Vincent suggest a tour of the museum.
Three days ago, Brian call a taxi for me.
Many years ago, Tony travel the whole world to meet interesting people.
Last night, John carry the chairs back into the kitchen.
Recently, Troy join his family in Canada.
The day before yesterday, Mike plan his trip to ensure the shortest route.
About two hours ago, Eric work on his science homework.
Last month, Alice show some interest in drama.
One month ago today, Karen decide to stay in Paris.
Around five weeks ago, Judith prepare a wonderful dinner for us.
Last Monday, Amy answer the invitation to come to the party.
Yesterday morning, Angela see the necklace on the table.
Yesterday at 5 p.m. Betty go to grocery store for supplies.
Last year, Christine keep the watch in her safe for me.
Last week, Elsa know about her surprise birthday party in advance.
Last semester, Emily take an introductory course in linguistics.
Decades ago, Jennifer give a stranger some money for food.
Last time, Jessica forget that I was coming over.
Last November, Judy tell the reporter what her boss had done.
The other day, Kelly write in her journal about some of her patients.
Seven months ago, Linda meet my mother on the downtown street.
Two years ago, Lisa leave her country to marry a man from Italy.
Ten minutes ago, Maggie eat a muffin for breakfast.
Last night, Jerry sleep like a baby in his room.
Last Tuesday, Gary come over to talk to me.
Two months ago, William run into his friend at a bar.
Several years ago, Daniel teach English at a local high school.

C. Filler item

Sometime tomorrow morning, Holly will delivered a package to my home.
Tomorrow at eight o'clock, Lance will phoned the students' parents from his office.

Next March Wendy will paid the balance on her new car.
Next Friday afternoon, Vicky will avoided going past the construction site.
Next summer, Leo will argued his case in court.
Tomorrow morning at 9:00, Sally will work in the office to schedule meetings.
Tomorrow afternoon, Samantha will prevent the enemy from attacking us.
This coming November, Stacey will invite her close friends to visit.
Next Friday, Irene will refuse to accept the new contract.
Next academic year, Olive will fulfill a promise to teach the course.
Ten weeks from now, Rex will fought in the war overseas.
Next fall semester, Robin will spoke only French to his friends.
Next December, Oliver will made a decision about what to do.
Very soon, Carter will did his essay assignment.
In six months, Jeremy will fed the stray dogs in the park.
Very soon, Pamela will fall into the trap set by the enemy.
Next anniversary, Wayne will present a gift to you.
Next December, Webster will read the textbook for the course.
Some day soon, Earl will cut his hair very short.
In the future, Ellie will begin working at home.

D. Comprehension question and (answer)

This sentence was about Adam walking to school in the rain. (Yes)

This sentence was about Albert telling a story. (No)

This sentence was about Henry starting to take Chinese. (Yes)

This sentence was about Robert renting a car. (No)

This sentence was about Angela seeing the necklace on the table. (Yes)

This sentence was about Betty leaving for hospital. (No)

This sentence was about Christine keeping the watch in her safe for me. (Yes)

This sentence was about Elsa getting a birthday gift. (No)

APPENDIX G: Language Background Questionnaire for NNS

Directions: Please read each question carefully. Check (X) your response in the circle or write down your response in the provided space.

Personal Information

- 1 What is your gender?
 Female Male
- 2 How old are you?

- 3 Which year are you in?
 Freshman Sophomore Junior Senior

English Learning Background

- 4 At what age did you start learning English?

- 5 How many years have you been studying English?

- 6 Have you ever stayed in an English-speaking country?
 Yes No
 If your answer is No, skip 7 ~ 9 questions.
- 7 Please indicate in which English-speaking country/countries you have stayed.

- 8 Please indicate the total length of time you have stayed in English-speaking countries.
 _____year(s) _____month(s)
- 9 Please indicate the purpose of your stay in an English-speaking country.
 Travel Study Immigration Others: (Please specify)
 aboard _____

English Test

- 15 | Your English score on the College Entrance Exam is

- 16 | What is your TOEFL score (if you have taken it)?

- 17 | What is your TOEIC score (if you have taken it)?

- 18 | In the English Department, your average score for English related courses is

Other than English Language Background

- 19 | What language(s) do you speak?
 Chinese Japanese Others: (Please specify)

- 20 | What dialect(s) do you speak?
 Taiwanese Cantonese Hakka Others: (Please specify)

Physical Condition (Please self-report)

- 21 | If you have one of the following, please check (X) your response in the circle.
- Hearing loss
 - Uncorrected hearing loss
 - Uncorrected visual impairment
 - History of concussion or brain trauma
 - Reading difficulty
 - Learning disability

Thank you for your participation.

APPENDIX H: Language Background Questionnaire for NS

Directions: Please read each question carefully. Check (X) your response in the circle or write down your response in the provided space.

Personal Information

1 What is your gender?

Female Male

2 How old are you?

3 Which year are you in?

Freshman Sophomore Junior Senior

English Language Proficiency (Please self-rate)

	Poor	Below average	Average	Good	Very good	Excellent
4 Listening	<input type="checkbox"/>					
5 Speaking	<input type="checkbox"/>					
6 Reading	<input type="checkbox"/>					
7 Writing	<input type="checkbox"/>					

Physical Condition (Please self-report)

8 | If you have one of the following, please check (X) your response in the circle.

- Hearing loss
- Uncorrected hearing loss
- Uncorrected visual impairment
- History of concussion or brain trauma
- Reading difficulty
- Learning disability

Thank you for your participation.

APPENDIX I: List of Free Software

1. Audacity software can be downloaded at <http://audacity.sourceforge.net/download/>.
2. DMDX software can be downloaded at <http://www.u.arizona.edu/~kforster/dmdx/dmdx.htm>.
3. Questionnaire can be formatted at <http://www.my3q.com/>.

APPENDIX J: Human Subjects Approval


 Human Subjects
Protection Program

 1235 N. Mountain Ave.
P.O. Box 245137
Tucson, AZ 85724-5137
Tel: (520) 626-6721
<http://irb.arizona.edu>

November 15, 2007

 Chang-Ching Chen
Advisor: Janet Nicol
Dept of SLAT
P.O. Box 210025

 BSC: B07.391 THE REPRESENTATION AND PROCESSING OF PAST TENSE IN CHINESE-ENGLISH-
LANGUAGE LEARNERS AND NATIVE ENGLISH SPEAKERS

Dear Mr. Chen:

We received your research proposal as cited above. The procedures to be followed in this study pose no more than minimal risk to participating subjects and have been reviewed by the Institutional Review Board (IRB) through an Expedited Review procedure as cited in the regulations issued by the U.S. Department of Health and Human Services [45 CFR Part 46.110(b)(1)] based on their inclusion under *research category 7*. As this is not a treatment intervention study, the IRB has waived the statement of Alternative Treatments in the consent form as allowed by 45 CFR 46.116(d)(2). Although full Committee review is not required, notification of the study is submitted to the Committee for their endorsement and/or comment, if any, after administrative approval is granted. This project is approved with an **expiration date of 15 November 2008**. Please make copies of the attached IRB stamped consent documents to consent your subjects.

The Institutional Review Board (IRB) of the University of Arizona has a current *Federalwide Assurance* of compliance, **FWA00004218**, which is on file with the Department of Health and Human Services and covers this activity.

Approval is granted with the understanding that no further changes or additions will be made to the procedures followed without the knowledge and approval of the Human Subjects Committee (IRB) and your College or Departmental Review Committee. Any research related physical or psychological harm to any subject must also be reported to each committee.

A university policy requires that all signed subject consent forms be kept in a permanent file in an area designated for that purpose by the Department Head or comparable authority. This will assure their accessibility in the event that university officials require the information and the principal investigator is unavailable for some reason.

Sincerely yours,

 Elaine G. Jones, PhD, RN, FNAP
Chair, Social and Behavioral Sciences Human Subjects Committee

EGJ/rf

cc: Departmental/College Review Committee

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