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The influence of semantic predictability on transposition effects in Chinese and English

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Abstract: Semantic predictability is one of the important factors that influence word processing and recognition. Based on the SPaM paradigm (Self-paced reading + Masked priming), the present study explores the influence of semantic predictability on TL effects in Chinese and English. The findings show that in both languages, internal and final transpositions produce priming effect in low-predictability preceding and following contexts as well as in high-predictability following contexts. From the perspective of priming magnitude, internal transposition produces greater priming effect than final transposition in English, while in Chinese, final transposition produces greater priming effect than internal transposition. In high-predictability preceding contexts, internal and final transpositions reveal significant priming effect and initial transposition produces close-to-significant-level priming effect in English, while in Chinese, no significant priming effect is observed in initial, internal or final transpositions.

Keywords: Chinese and English; semantic predictability; transposition effect

1 Introduction

During reading, most readers would probably not notice anything wrong with the following sentence: “Because of the impressive diligence of the jugde, the trial is now concluded.” If this is the case, it is likely that they have misinterpreted the nonword “jugde” for the real word “judge”. This phenomenon is known as transposition effects (or transposed-letter effect): A transposition stimulus (e.g. *jugde*) is perceptually more similar to its base word (*judge*) than an orthographic control (i.e., a replaced-letter stimulus such as *junper*; Gracia-Orza et al. 2010: 1603).

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The studies on transposed-letter effect can be traced back to the 1950s when Bruner and O'Dowd (1958) investigated the processing of English words with transposed letters (Gomez et al. 2008). In the following 40 years, very little research has been conducted in this field (Chambers 1979; Forster et al. 1987; Rawlinson 1976) until the popularity of the "Cambridge University email" over the Internet in September 2003:

> Fi yuo cna raed tihs, yuo hvae a sgtrane mnid too. Cna yuo raed tihs? Olny 55 plepoe out of 100 can:
>
> I cdnuolt blveiee taht I cluod aulactly uesdnatnrd waht I wsa rdanieg. The phaonmneal pweor of the hmuan mnid, aoccdrnig to rscheearch at Cmabrigde Uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is that the frist and lsat ltteer be at the rghit pclae. The rset can be a taotl mses and you can sitll raed it whotuit a pboerlm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe. Azanmig huh? Yaeh and I awlyas tghuhot slpeling was ipmorantt! If you can raed tihs forwrad it.

This email aroused worldwide interest of readers and frenzy of netizens, and was soon translated into over 20 other languages such as French, Italian, German, Spanish, and Finnish. This phenomenon also aroused researchers' interest in the cognitive process involved in the reading, and was called the "Cambridge University Effect", although Davis (2003), a scholar at the Cognitive and Brain Science Research Center of Cambridge University, clarified that this email has nothing to do with Cambridge University.

Thereafter, much research has been conducted in transposed-letter effect in a wide range of languages in different language families, but most of the research has focused on alphabetic languages, such as French (Peressotti and Grainger 1999; Schoonbaert and Grainger 2004), English (Blythe et al. 2014; Dunabeitia et al. 2009; Perea and Lupker 2003a, 2003b, 2004), Spanish (Acha and Perea 2008a, 2008b) and so on. In the past decade or so, research on transposition effect in the Chinese language has gradually emerged (Cao et al. 2021; Gu and Li 2015; Liu 2016; Wang 2014; Zhang et al. 2021). However, compared with those in alphabetic languages, studies in the Chinese language are scarce and insufficient in research depth and systematicness (Liu and Wang 2016).

Context refers to the parts of something written or spoken that immediately precede and follow a word or passage and clarify its meaning (Pearsall 1998: 396). Words appearing in a sentence context are sometimes predictable. For example, when seeing the partial sentence "The cowboys ride a ____ to move about", readers may more likely predict the missing word to be "horse" than "camel". However, in the partial sentence "People in the desert ride a _____ to move about", it will just be the other way round. Semantic predictability refers to the probability of context in which the target words may appear (Luke and Christianson 2012). The previous related studies in different paradigms have found that semantic predictability can facilitate word recognition during language processing (Luke and Christianson 2012: 628). Results of behavioral research have shown that semantic predictability can affect word recognition and facilitate the reaction times of subjects in lexical decision and naming tasks (Duffy et al. 1989; Fischler and Bloom 1979; Hess et al. 1995; Stanovich and West 1979). The results of eye movement research have also found that semantic predictability can affect reading (Ehrlich and Rayner 1981; Kliegl et al. 2004; Morris 1994; Rayner and Well 1996; Zola 1984). Rayner and Well's (1996) eye movement study results are a case in point. They have observed fewer fixation times for high semantic predictability words than words with low semantic predictability. Electrophysiological evidence provided by event-related potentials (ERPs) has also shown that semantic predictability has an impact on reading (Federmeier and Kutas 1999; Kutas and Hillyard 1984; van Berkum et al. 1999). For example, Kutas and Hillyard (1984) have found that N400 is less likely to appear when semantic predictability is high. As to studies based on the Chinese language, Li (2016) has found in an eye movement study that in the process of sentence reading in the Chinese language, the subjects had a significantly higher frequency of word skipping under the condition of high semantic predictability, compared with low semantic predictability.

The studies mentioned above have proved that semantic predictability has an impact on reaction time, eye movement and electrophysiological response, and is an important factor affecting vocabulary processing and recognition. However, in the field of transposition effect, there is a lack of research involving semantic predictability. Luke and Christianson (2012) studied the effect of semantic predictability on English letter transposition. The results show that compared with the context with low semantic predictability, the context with high predictability can eliminate transposed-letter effect in English. However, Luke and Christianson only examined the influence of semantic predictability on English transposition effect, and they failed to take into account the position of context (i.e. preceding context and following context). Xu and Sui (2018) investigated the influence of semantic predictability on the transposition effect of Chinese two-character words by using eye movement paradigm. The results of their study show that under the condition of high semantic predictability, the reading times of target words are significantly shorter and fixation times are less. However, Xu and Sui's study only involved two-character Chinese words, and hence failed to take into account the influence of transposition position (i.e., initial, internal, and final transpositions) on transposition effects. In addition, most of the subjects on the transposition effect of alphabetic languages are L1 speakers, and there are few studies on L2 speakers. However, relevant studies have shown that L1 background of L2 learners will have an impact on L2 word processing (Yang et al. 2021). The present study intends to answer the following two research questions:

(1) Do semantic predictability and context position influence transposed-letter effect in English? If yes, to what extent?
(2) Do semantic predictability and context position influence transposition effect in Chinese? If yes, to what extent?

Based on these two questions, two experiments have been designed. Experiment 1 focuses on the influences of semantic predictability and context position on transposed-letter effects in English, while Experiment 2 intends to explore their influences on transposition effects in Chinese.

2 Experiment 1

The main purpose of Experiment 1 is to explore the influence of semantic predictability and context position on transposed-letter effect in English, employing Luke and Christianson's (2012) self-paced reading + masked priming paradigm (hereinafter referred to as SPaM paradigm).

2.1 Subjects

Thirty third-year English majors from a university in Jiangsu Province participated in the experiment. They were all native speakers of Chinese, with an average age of 21.67 (SD = 1.35). All subjects were right-handed, with normal or corrected-to-normal vision. They had all passed TEM-4, a nationwide proficiency test for English majors in China, and therefore were regarded as L2 learners of intermediate level.

2.2 Materials

Before Experiment 1, 36 students were asked to rank the familiarity scale of 120 target words used in Luke and Christianson's (2012) experiment ("1" means very unfamiliar and "5" means very familiar). Based on the ranking, we maintained 60 words with a familiarity scale above 4.0 (Mean = 4.33). Since the materials used by Luke and Christianson (2012) only include sentences with high and low semantic predictability, we adjusted the word order of these sentences accordingly so that sentences with preceding and following contexts are also included in the materials. After each trial, a true-or-false tag question was added to the sentence to ensure that the subjects would read the sentences carefully. In addition, their answers to the questions would

Table 1: Examples of 4 types of sentence contexts in Experiment 1.

Context type	Examples (target word: *monkey*)
HP	The banana that was grabbed by the *monkey* ended up on the floor.
Question (answer)	The monkey grabbed the banana. (True)
HF	The *monkey* grabbed the banana but he finally dropped it on the floor.
Question (answer)	The monkey ate the banana. (False)
LP	After drinking a big glass of beer, the monkey ended up on the floor.
Question (answer)	The monkey didn't drink any beer. (False)
LF	The *monkey* ended up on the floor after drinking a big glass of beer.
Question (answer)	The monkey drank a glass of beer. (True)

HP, high-predictability preceding context; HF, high-predictability following context; LP, low-predictability preceding context; LF, low-predictability following context.

Table 2: 8 prime conditions in Experiment 1 (target word: *monkey*).

The banana that was grabbed by the *monkey* ended up on the floor.	
Identity	monkey
TL Initial	omnkey
SUB Initial	nankey
TL Internal	moneky
SUB Internal	monahy
TL Final	monkye
SUB Final	monkga
URL	thirsty

be used as a criterion in data selection: Only correct response times would be included in final data analysis. Examples of sentences and tag questions with 4 types of context are shown in Table 1.

Each target word has 8 prime conditions: Identity (the prime is the same as the target word); TL Initial (initial letters transposed); SUB Initial (initial letters substituted); TL Internal (internal letters transposed); SUB Internal (internal letters substituted); TL Final (Final letters transposed); SUB Final (final letters substituted); and URL (unrelated word prime). See Table 2 for details.

2.3 Procedures

A within-subject design of 2 (semantic predictability: high vs. low) × 2 (context position: preceding context vs. following context) × 8 (prime conditions) was adopted in Experiment 1. The experiment was run using E-Prime Professional software (2.0 version). The subjects were about 75 cm in front of a 19-in. monitor with the refresh rate set to 1000 Hz.

All materials were presented in the middle of the screen, with black words on a white background. The steps of the SPaM paradigm ran as follows. First, a red fixation cross ("+") appeared on the left side of the screen, indicating the beginning of the experiment. When the subjects pressed the space bar, the "+" sign disappeared and the first word of the sentence would appear on the screen. When the participants finished reading it and pressed the space bar, the second word of the sentence would appear on the screen (If there was no press of the space bar in 3,000 ms, the first word would disappear automatically and the second word would appear on the screen). If the word was the target word, then there would be a prime word (any one of the 8 prime conditions) before it, and the prime would be displayed for 57 ms. After the subjects read the sentence in this way, they would see a true-or-false question based on the sentence they had just read, and they had to make a judgment whether the statement was correct or false. The time limit for the judgment was 3,000 ms. If the subject did not respond within 3,000 ms, the software would automatically determine that the answer was wrong. The purpose of these tag questions was to make sure the subjects read the sentences carefully.

Before the experiment, there were 12 practice trials. If the accuracy rate of practice was 90 % or above, the subjects would go directly into the formal experiment. If their accuracy rate was below 90 %, they would have to repeat the practice trials until their accuracy reached the desired rate.

2.4 Results and discussion

Reaction times were measured from the onset of the target word. The accuracy rate of answers to the tag question was 95.3 %, showing that the subjects carefully read the sentence and the subsequent tag questions. Reaction times with incorrect response were excluded from data analysis. In addition, reaction times below 150 ms, above 1500 ms or 3 times above the standard deviations were excluded, accounting for 1.7 % of the total data. Therefore, a total of 6.4 % of the data was excluded. The mean reaction times under the four contextual conditions are displayed in Table 3.

As shown in Table 3, the mean response times of L2 subjects under the four contextual conditions were 625, 628, 542 and 629 ms, respectively, while the mean response times of L1 subjects in Luke and Christianson's (2012) experiment were 239 and 321 ms, respectively. Obviously, the processing speed of L2 learners was far slower than that of their L1 counterparts. The reason for this difference lies in the language proficiency level of the subjects: The subjects in Experiment 1 of the present

Table 3: Reaction times of target words in Experiment 1 (ms).

Context type	Identity	URL	TL Initial	SUB Initial	TL Internal	SUB Internal	TL Final	SUB Final	Mean
LP	598	642	639	641	604	638	612	635	625
LF	602	643	635	649	606	641	610	643	628
HP	532	558	544	546	533	546	538	543	542
HF	610	635	631	654	602	639	607	631	629

study were third-grade English majors, who were mostly L2 learners with an intermediate proficiency level in English, while the subjects of Luke and Christianson (2012) were L1 college students with an advanced proficiency level. This shows that the subjects' language proficiency level had an impact on transposition effect.

It can also be seen from Table 3 that the reaction times under the high-predictability preceding context was significantly shorter than those under the other three contextual conditions.

In order to learn about the influence of context type and priming type on reaction times, SPSS (Version 26.0) was applied to analyze these data. The results showed that the main effect of semantic predictability was significant, $F(1, 238) = 24.2381$, $p < 0.001$. The main effect of contextual position was not significant, $F(1, 238) = 0.7635$, $p > 0.05$. The main effect of priming type was significant, $F(7, 554) = 19.1987$; $p < 0.001$. The interaction effect between the three factors was significant, $F(14, 1108) = 12.6371$, $p < 0.01$. The results of post hoc analysis showed that there was no significant difference in response times under the three contextual conditions of low-predictability preceding context, low-predictability following context, and high-predictability following context, $ps > 0.05$. However, there were significant differences between the above three contexts and the high-predictability preceding context, $ps < 0.001$.

To explore the influence of different transposition positions on transposition effects, we analyzed relevant data by paired-sample *T*-test. Results are shown in Table 4.

It can be seen from Table 4 that under the three conditions of low-predictability preceding, low-predictability following, and high-predictability following contexts, there was a significant priming effect in internal and final transpositions, but no significant priming effect was observed in final transposition. In high-predictability preceding context, there was also a significant priming effect in internal and final transpositions. Although there was no significant priming effect in initial transposition, the *p* value was 0.06, close to the significant level.

Table 4: Paired-sample *T*-test results under four contextual conditions.

	T-value	Sig.
LP context		
TL versus SUB Initial	0.975	>0.05
TL versus SUB Internal	16.734	<0.001***
TL versus SUB Final	11.628	<0.01**
LF context		
TL versus SUB Initial	1.286	>0.05
TL versus SUB Internal	18.539	<0.001***
TL versus SUB Final	13.822	<0.01**
HP context		
TL versus SUB Initial	1.867	0.06 >0 .05
TL versus SUB Internal	21.716	<0.001***
TL versus SUB Final	18.235	<0.001***
HF context		
TL versus SUB Initial	0.653	>0.05
TL versus SUB Internal	16.743	<0.001**
TL versus SUB Final	12.956	<0.01**

In order to know the difference of priming magnitude in three different positions, we used the reaction times of unrelated priming as the baseline, and the difference between this baseline and the reaction time of a certain transposed-letter prime was the priming magnitude. The results are shown in Figure 1.

As shown in Figure 1, under the four contextual conditions, internal transposition produced the greatest priming magnitude, followed by final and initial transpositions. This means initial transposition is the most disruptive in word processing and recognition in English, followed by final and internal transpositions. In other words, initial letters play the most important role in word processing and recognition.

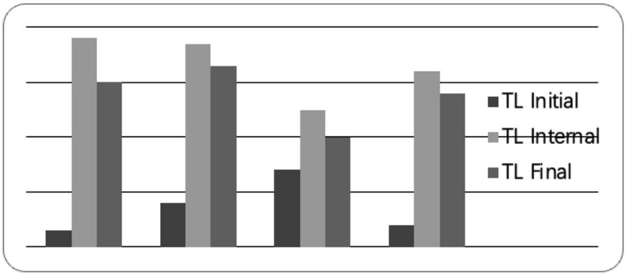

Figure 1: Magnitude differences of three transposition types.

Luke and Christianson's (2012) experiment observed a significant priming effect in internal transposition, but not in final transposition under the low-predictability context. Under the high-predictability context, no transposition effect was observed in internal or final transpositions. Their experiment did not involve two priming conditions: initial transposition and initial substitution. Experiment 1 of the present study added those two priming conditions. The results of Experiment 1 show that there is no priming effect in initial transposition, but there is a priming effect in internal and final transpositions. Why are there differences between the two studies? Since the two studies used similar materials and research paradigms, it is reasonable to contribute the differences in experiment results to the different subjects. Castles et al. (2007) explored the influence of individual differences on transposed-letter effects in English, and their subjects included adults, third-graders and fifth-graders. The results show that the three kinds of subjects display different patterns in transposition effect: the adults do not show any form of transposition effect, fifth-graders show significant transposition effect, while third-graders show priming effect in both transposition and substitution effects. Castles et al. (2007) maintain that the adults are familiar with vocabulary, so they are highly accurate in word recognition, while the word recognition system of 3rd- and 5th-graders is highly tolerant to the mismatch between letter position and identity and base word. Therefore, the differences in language proficiency of the subjects may be one of the reasons for the differences between the results of this study and those of Luke and Christianson's (2012). In addition, the research results of Yang et al.'s (2021) study show that the L1 word processing habits of L2 learners have an impact on L2 word processing. Their study investigated the effects of different language backgrounds on the backward transposition effect of English words (such as naelc-CLEAR). They found that Chinese–English bilinguals showed a clear backward priming effect in the lexical decision task, but no such effect was observed in English monolinguals, Spanish–English or Arabic–English bilinguals.

3 Experiment 2

Experiment 2 aims to explore the influences of semantic predictability and context position on transposition effect in the Chinese language, using the SPaM paradigm. The overall design of the experiment is as follows.

3.1 Subjects

Forty third-year English majors from a university in Jiangsu participated in the experiment. They were native speakers of Chinese, with an average age of 21.5

(SD = 1.65). All subjects were right-handed, with normal or corrected-to-normal vision. None of them participated in Experiment 1.

3.2 Materials

Xu and Sui's (2018) study employed two-character Chinese words as materials. However, their experiments failed to take into account the positions of character transposition (i.e., initial, internal, and final transpositions). To make up for this limitation, Experiment 2 of the present study chose four-character Chinese words as materials. One hundred high-frequency four-character Chinese words were selected from *The Dictionary of Word Frequency of Common Words in Modern Chinese (in Phonological Order)* (Liu et al. 1990). Based on these 100 words, we selected some sentences with target words close to the end of sentences (an average of 4 sentences per word) from the BCC Corpus of Beijing Language and Culture University (Xun et al. 2016) and the CCL Corpus of Peking University (Zhan et al. 2019). Next, the target words were removed from these sentences. Thirty-six non-English majors (these students did not participate in any part of Experiment 1 or Experiment 2) were asked to fill in the blanks with four-character words. Based on the results of blank filling, the sentences with a frequency of above 70 % are high-predictability context and those below 25 % are low-predictability context. Altogether, a total of 120 sentences with 60 high-predictability context and 60 low-predictability context were selected. Then, we rewrote the sentences and adjusted the target word to the front of the sentences, trying not to change the meaning of the original sentences. Finally, we slightly adapted the sentences of the four context types to ensure that they are roughly the same length (± one or two words). After that, we designed a tag question based on the content of each sentence to ensure the subjects would read the sentences carefully. Only correct response times would be included in the final data analysis. Examples of sentence materials and supporting questions in four contexts are shown in Table 5.

Each target has 8 prime conditions: Identity (the prime is the same as the target); TL Initial (initial characters transposed); SUB Initial (initial characters substituted); TL Internal (internal characters transposed); SUB Internal (internal characters substituted); TL Final (Final characters transposed); SUB Final (final characters substituted); and URL (unrelated prime). See Table 6 for details.

3.3 Procedures

The procedure of Experiment 2 is exactly the same as that of Experiment 1.

Table 5: Samples of target sentences in Experiment 2.

Context type	Sample sentence (target word:不可思议)
HP context	她是个接受过高等教育的人, 居然这么容易上当受骗, 这真有点不可思议。
Question (answer)	她受过高等教育, 所以没有轻易上当。(否)
HF context	这真有点不可思议, 她是个接受过高等教育的人, 居然这么容易上当受骗。
Question (answer)	尽管受过高等教育, 她还是上当了。 (是)
LP context	但是我们之间做了约定: 下次一定要一起登上北侧, 观看森林的不可思议。
Question (answer)	我们相约一起登上北侧。 (是)
LF context	为了观看森林的不可思议, 我们之间做了约定: 下次一定要一起登上北坡。
Question (answer)	我们相约一起登上南侧。 (否)

Table 6: Examples of 8 prime conditions in Experiment 2.

她是个接受过高等教育的人, 居然这么容易上当受骗, 这真有点不可思议。	
Identity	不可思议
TL Initial	可不思议
SUB Initial	奇木思议
TL Internal	不思可议
SUB Internal	木恩可议
TL Final	不可议思
SUB Final	不可怪恩
URL	教斝系乂

3.4 Results and discussion

Reaction times were measured from the onset of the target word. The accuracy rate of the answers to the tag question was 96.5 %, showing that the subjects had carefully read the sentence and the subsequent tag questions. Reaction times with incorrect response were excluded from data analysis. In addition, reaction times below 150 ms and above 1500 ms or 3 times above the standard deviations were excluded, accounting for 1.2 % of the total data. Therefore, a total of 4.7 % of the data was excluded. The mean reaction times under the four contextual conditions are displayed in Table 7.

As shown in Table 7, under the high-predictability preceding context, the mean reaction time of the target (751 ms) was significantly shorter than those under the other three contextual conditions (897, 899, and 894 ms, respectively). This shows that compared with the other three contextual types, high-predictability preceding context could better facilitate the processing and recognition of Chinese words, which is consistent with the results of Experiment 1.

Table 7: Reaction times of target words under different contextual conditions (ms).

Context Type	Identity	URL	TL Initial	SUB Initial	TL Internal	SUB Internal	TL Final	SUB Final	Mean
LP	872	915	902	910	877	908	873	915	897
LF	873	918	899	912	888	913	875	919	899
HP	731	775	743	747	739	746	733	745	743
HF	875	913	898	901	885	899	873	912	894

In order to explore the influence of contextual and prime types on reaction time, we used SPSS software to analyze the data. The results showed that the main effect of semantic predictability was significant, $F(1, 238) = 21.362$, $p < 0.001$. The main effect of contextual position was not significant, $F(1, 238) = 0.981$, $p > 0.05$. The main effect of prime type was significant, $F(7, 552) = 20.157$; $p < 0.001$. The interaction effect between the three factors was significant, $F(14, 1104) = 13.578$, $p < 0.01$. The results of post hoc analysis failed to reveal any significant difference among low-predictability preceding context, low-predictability following context, and high-predictability following context, *ps* > 0.05. However, there were significant differences between the above three contextual types and high-predictability preceding context, *ps* < 0.001.

In order to understand the effect of different positions in four contexts, we analyzed the relevant data by paired-sample *T*-test. Results are shown in Table 8.

Table 8: Paired-sample *T*-test results under four contextual conditions.

	T-value	Sig.
LP context		
TL versus SUB Initial	0.863	>0.05
TL versus SUB Internal	12.758	<0.01**
TL versus SUB Final	21.629	<0.001***
LF context		
TL versus SUB Initial	1.287	>0.05
TL versus SUB Internal	13.426	<0.01**
TL versus SUB Final	23.961	<0.001***
HP context		
TL versus SUB Initial	0.932	>0.05
TL versus SUB Internal	1.738	>0.05
TL versus SUB Final	1.693	>0.05
HF context		
TL versus SUB Initial	0.934	>0.05
TL versus SUB Internal	11.912	<0.01**
TL versus SUB Final	19.763	<0.001***

As shown in Table 8, under the low-predictability preceding, low-predictability following, and high-predictability following contexts, there was a significant priming effect in internal and final transpositions, but no significant transposition effect was observed in initial transposition. Under high-predictability preceding context, there was no significant difference between the reaction times of internal, final, and initial transpositions and their corresponding control conditions. This means no significant transposition effect was observed.

In order to explore the reasons for the disappearance of transposition effect in the high-predictability preceding context, we further analyzed the data. When paired-sample *T*-test analysis was conducted between these reaction times and those of the identity priming conditions, no significant difference was observed between these six priming conditions and the identity prime condition ($ps > 0.05$). This indicates that these six priming conditions can facilitate the processing and recognition of target words as much as the identity priming condition.

In order to reveal the influence of different transposition positions on transposition effect in Chinese, we further analyzed the priming magnitude of the three transpositions under four different contextual types. The results are shown in Figure 2.

As displayed in Figure 2, under the four contextual conditions, the priming magnitude of final transposition was the largest, followed by internal and initial transpositions. This shows that in the process of Chinese word processing and recognition, the transposition of initial characters was the most disruptive, followed by the internal and final transpositions.

On the one hand, the results of the present study are different from those of Xu and Sui (2018), which investigated the influence of semantic predictability on the transposition effect of two-character Chinese words by using eye movement paradigm. Each sentence in their experiment included one of the four conditions: the original word (OR), the transposed non-word (TN), the initial substituted non-word

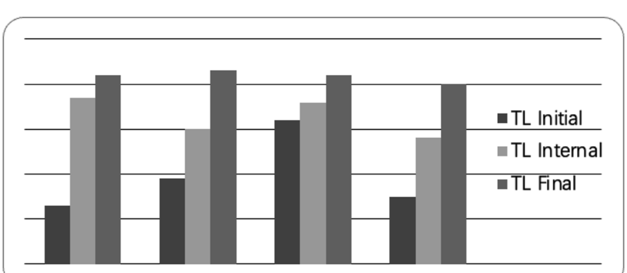

Figure 2: Magnitude differences of three transposition types.

(FS), and the final substituted non-word (ES). Results show that the TN condition is not significant with FS and ES condition under the high-predictability context, but it is the opposite under the low-predictability context. Therefore, they concluded that high-predictability contexts may facilitate the encoding of the Chinese two-character words. However, in the present study, under the low-predictability preceding, low-predictability following, and high-predictability following contexts, there was a significant priming effect in internal and final transpositions, but no significant transposition effect was observed in initial transposition. Under high-predictability preceding context, there was no significant difference between the reaction times of internal, final, and initial transpositions and their corresponding control conditions. This means no significant transposition effect was observed. The difference in the results of the two studies may be attributed to the different experiment paradigms (Blythe et al. 2014).

On the other hand, the results of both studies have shown that contextual type (high- and low-predictability contexts) may have an impact on the encoding and processing of words in the Chinese language. This is consistent with results of previous studies on the processing of Chinese words. Rayner et al. (2005) adopted the eye movement paradigm to study the phenomenon of word skipping in the Chinese language by using two-character Chinese words with different predictability levels. The results showed that words with low predictability had the longest fixation time and were less likely to be skipped, while high-predictability words had the shortest fixation time and higher probability of skipping. Li (2000) used the same paradigm to study sentence reading in the Chinese language, and found that under the condition of preceding context, the lexical decision time was shorter than that in the following context condition, and the difference was significant. All the studies above have shown the impact of context predictability on Chinese word recognition and processing.

4 Conclusions

By employing the SPaM paradigm, the present study explored the effects of semantic predictability on transposition effect in Chinese and English. The results of Experiment 1 showed that the processing speed of L2 English learners was far slower than that of native speakers. Results also revealed that in both languages, internal and final transpositions produced priming effect in low-predictability preceding and following contexts as well as in high-predictability following context. From the perspective of priming magnitude, internal transposition produced greater priming effect than final and initial transpositions in English, while in Chinese, final transposition produced greater priming effect than internal and initial transpositions. In high-predictability preceding contexts, internal and final transpositions produced significant priming effect and initial transposition produced close-to-significant-level priming effect in English, while in Chinese no significant priming effect was found in initial, internal, or final transpositions.

The present study has some limitations. For example, the differences in the subjects' language proficiency levels were not taken into consideration. If possible, future research can take into account different levels of subjects in order to know whether the differences in transposition effects between English and Chinese are caused by individual differences or by intrinsic characteristics of the two languages.

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