Fully-Specified L2 Processing of Negation-Aspect Interactions in Chinese

Zhijun Wen and Bonnie D. Schwartz

1. Introduction

This study examines whether adult L2 learners ("L2ers") can acquire and process morphosyntax absent in the native language (L1), specifically, negation-aspect interactions in L2 Chinese on the part of L1 English speakers. Employing a self-paced reading task, we test whether, as proficiency increases, adult L2ers of Chinese whose L1 (i.e., English) lacks negation-aspect interactions can acquire the knowledge in the target language and use the knowledge in online sentence processing. Our study also assesses whether adult L2ers are able to engage in fully-specified morphosyntactic processing when it involves nonlocal structural (i.e., syntactic) relations.

1.1. Negation in Chinese

In contemporary standard Mandarin Chinese (henceforth "Chinese"), *bu* 'not' and *mei* 'not' are the most commonly used negators for sentential or clausal negation (e.g., Lin, 2003; Zhuang & Liu, 2011).[1] One interesting phenomenon concerning *bu* and *mei*, which has been observed in numerous studies (e.g., Ernst, 1995; M. Li, 1999; Lin, 2003), is that these negators have inherent aspectual

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[1] The negator *mei* can be viewed as a shortened form of *meiyou*, because in contemporary Chinese these two negators are interchangeable almost all the time when they are used for clausal or sentential negation. The negator *mei* can also be used for negating the lexical verb *you* (meaning "to have" or "to exist"). As shown in (i), taken from C. N. Li and Thompson (1981, p. 416), the verb *you* can be negated by *mei* but not by *bu*; and when negated by *mei*, *you* is optional.

(i) a. Wo **mei** (**you**) qian.
I **not** **exist** money
'I don't have any money.'

b. * Wo **bu** **you** qian.
I **not** **exist** money

Without *you* in (ia), *mei* functions not only as a negator but also as a verb. This special use of *mei* will not be discussed further in this study.

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requirements, which reflect an inherent quality of the negators—they possess aspectual features. This is not difficult to see from (1).

(1) a. Lisi **qu** Beijing.
Lisi **go** Beijing
i) 'Lisi goes to Beijing.'
ii) 'Lisi will go to Beijing.'

b. Lisi **bu** **qu** Beijing.
Lisi **not** **go** Beijing
i) 'Lisi doesn't go to Beijing.'
ii) 'Lisi won't go to Beijing.'

c. Lisi **mei** **qu** Beijing.
Lisi **not** **go** Beijing
i) 'Lisi didn't go to Beijing.'
ii) 'Lisi hasn't gone to Beijing.'

Sentences (1b) and (1c) are the negative versions of the affirmative (1a), negated by *bu* and *mei*, respectively. As reflected by the English glosses, (1b) and (1c) have different foci in terms of temporal viewpoints. In (1b) the focus rests on what happens **before** the potential event of Lisi going to Beijing (i.e., negation of the event that Lisi goes or will go to Beijing). In contrast, (1c) focuses on the state **after** the final point of the event (i.e., negation of the state of Lisi being in Beijing now, a state that has to have resulted from going to Beijing). As (1) shows, mere use of negators marks aspect in Chinese. In (1b), *bu* negates an unbounded (i.e., [–bounded]) event, because the event will not happen and thus has no endpoint. In (1c), the event negated by *mei* is bounded (i.e., [+bounded]), because a final point must be imposed in the mind of the speaker as the reference point so that the state beyond the final point can be discussed. In addition to negating a bounded event, *mei* in (1c) focuses the viewpoint on the resultant state (i.e., [+resultant state]). The contrasts between (1a) and (1b)/(1c) indicate that Chinese negators have inherent aspectual features in them, unlike the English negator *not*, which has no aspectual feature. To summarize, the aspectual features of *bu* and *mei* are as follows (based on Ernst, 1995; M. Li, 1999): *bu* [–bounded]; *mei* [+bounded], [+resultant state].

1.2. Aspect markers -le and -guo

Traditionally, *-le* is analyzed as a perfective aspect marker and *-guo* as an experiential aspect marker. According to C. N. Li and Thompson (1981, p. 185), *-le* signifies "that an event is being viewed in its entirety or as a whole" and thus is perfective, while *-guo* emphasizes that an event has taken place or has been experienced with regard to a certain reference time. The major difference between *-le* and *-guo* is illustrated in (2).

(2) a. Lisi qu-**le** Beijing.
Lisi go-**LE** Beijing
i) 'Lisi went to Beijing.'
ii) 'Lisi has gone to Beijing.'

b. Lisi qu-**guo** Beijing.
Lisi go-**GUO** Beijing
'Lisi has been to Beijing.'

The perfective *-le* in (2a) indicates that the whole event of going to Beijing occurred or has occurred. Therefore, *-le* marks bounded events. In contrast, *-guo* makes it clear not only that the event has occurred but also that it has occurred at least once prior to the reference time of the speaker. Some Chinese linguists (e.g., M. Li, 1999; Smith, 1994) argue that the experiential *-guo* focuses on a change of state subsequent to the final point of a situation in addition to presenting a situation as being closed, whereas *-le* only signals that the final state of a situation has been obtained, regardless of whether that

final state lasts or not. For example, *-le* in (2a) signals that the event of going to Beijing is closed, but it provides no further information beyond that and hence it is not known whether Lisi is still in Beijing now. However, *guo* in (2b) indicates not only that the final state (i.e., Lisi's being in Beijing) has been obtained but also that the final state no longer holds, and therefore (2b) would be inappropriate if Lisi is still in Beijing. The examples in (2) show that the experiential *-guo* focuses on a new state that results from the prior situation, while *-le* lacks such a focus. In brief, *-le* has the features of [+bounded] and [–resultant state] while *-guo* has the features of [+bounded] and [+resultant state]. These two aspect markers in Chinese are language-specific. English has no aspect morphemes of the exact equivalence (C. N. Li & Thompson, 1981; M. Li, 1999).

1.3. Negation-aspect interactions

As discussed in Section 1.1, *bu* and *mei* each possess inherent aspectual features. These inherent aspectual features constrain the negators' ability to co-occur with the aspect markers *-guo* and *-le* in a [negator + V + aspect marker] construction. Consider the data in (3).

(3) a. Ta gang kan-**guo** zhe-ben shu.
3sg just look-**GUO** this-CL book
'He/She has just read this book.'

b. Ta **mei** kan-**guo** zhe-ben shu.
3sg **not** look-**GUO** this-CL book
'He/She hasn't read this book.'

c. * Ta **bu** kan-**guo** zhe-ben shu.
3sg **not** look-**GUO** this-CL book

d. Ta gang kan-**le** zhe-ben shu.
3sg just look-**LE** this-CL book
i) 'He/She just read this book.'
ii) 'He/She has just read this book.'

e. * Ta **mei** kan-**le** zhe-ben shu.
3sg **not** look-**LE** this-CL book

f. * Ta **bu** kan-**le** zhe-ben shu.
3sg **not** look-**LE** this-CL book

Sentences (3a)–(3c) are marked with the experiential aspect marker *-guo*, and sentences (3d)–(3f) are marked with the perfective aspect marker *-le*. As can be seen, *mei* can co-occur with *-guo* (3b), but not with *-le* (3e), while *bu* cannot co-occur with either *-guo* (3c) or *-le* (3f). These negation-aspect co-occurrence restrictions can be accounted for by appealing to the (in)compatibility of their aspectual features (e.g., Ernst, 1995; M. Li, 1999; Smith, 1994).[2] The negator *mei*, with the aspectual features of

[2] To account for the negation-aspect interactions in Chinese, some researchers (e.g., Huang, 1988; Zhuang & Liu, 2011) adopt Wang's (1965) *-le*/*you* alternation analysis, which treats *mei* as a variant form of *bu* before *you* (in *meiyou*). Wang proposed that *you* is a perfective morpheme that appears only in a negative context, in which case *bu* is changed to *mei* by a special morphological rule, whereas in an affirmative context *you* is transposed to post-verbal position and changed to *-le*. As Ernst (1995) and M. Li (1999) pointed out, the *-le*/*you* alternation approach is a stipulative solution, and there is no independent evidence to corroborate the claim that *mei* and *bu* originate from one common negator. Moreover, the *-le*/*you* alternation entails that any sentence that can be negated by *mei* should in principle allow the perfective *-le* in its affirmative counterpart, which is clearly not true (e.g., *wo* ***mei*** *juede hen lei* [I not feel very tired] 'I didn't feel very tired' vs. * *wo juede-****le*** *hen lei* [I feel-LE very tired]). The problems with the *-le*/*you* alternation analysis led researchers such as Ernst and Li to propose that *mei* and *bu* have inherent aspectual requirements, which better explain why the negators can or cannot co-occur with aspect markers such as *-guo* and *-le*. The present study follows the spirit of these latter proposals, especially that of M. Li (1999), taking a morphosyntactic feature-based approach to deal with the negation-aspect interactions.

[+bounded] and [+resultant state], is compatible with *-guo*, which has the same features, but not with *-le*, because the [+resultant state] feature in *mei* clashes with the [–resultant state] feature in *-le*. The negator *bu* is not compatible with either *-le* or *-guo*, because the [–bounded] feature in *bu* clashes with the [+bounded] feature in *-le* and *-guo*. As mentioned earlier, the English negator *not* has no aspectual feature, and hence negation-aspect interactions do not occur in English.

1.4. L2 theoretical background

Negation-aspect interactions in Chinese, so far, have received little or no attention in research on L2 acquisition and L2 processing (for a recent review of research on the L2 acquisition of Chinese, see Zhao, 2011). It is not known whether L1-English L2ers (or L2ers of any other language background) can acquire these negation-aspect interactions and process them in real-time sentence comprehension. The current study addresses this issue through an online study, using experimental sentences like (3).

L2 researchers generally agree that functional morphology in the target language (TL) poses severe (if not in fact the most severe) problems, and often persistent problems, for adult L2ers (e.g., Hopp, 2007; Slabakova, 2008). L2 representational-deficit theories (e.g., Franceschina, 2005; Hawkins & Chan, 1997; Hawkins & Liszka, 2003), in variants of the Failed Functional Features (FFF) hypothesis, state that the features of TL functional categories (or of the elements that fill those categories) are not accessible/acquirable to post-critical-period L2ers unless the features have been instantiated in the L1. Because negation-aspect interactions in Chinese are regulated by grammatical features not instantiated in English counterparts (e.g., *not* has no inherent aspectual feature, and thus there are no negation-aspect interactions in English), L2 acquisition theories like the FFF hypothesis predict that L1-English L2ers cannot acquire these functional features and hence the negation-aspect interactions that depend on them.

L2 processing-deficit theories like the Shallow Structure Hypothesis (SSH; Clahsen & Felser, 2006a, 2006b) claim that adult L2ers are unable to process complex syntax such as nonadjacent morphosyntactic relations, even when their proficiency reaches very advanced levels. The SSH states that the mental representation that L2ers build in online sentence processing lacks structural details and that L2 comprehension is primarily based on lexical semantics, world knowledge, and simple heuristics. Such views of L2 processing predict that L1-English adult L2ers of Chinese cannot use the knowledge of Chinese negation-aspect interactions (on the assumption that the pertinent linguistic properties are acquirable) in online processing of sentences such as (3), because those sentences involve a nonlocal morphosyntactic dependency relation: The negators and the aspect markers in (3) are separated by the verb *kan* ‘read’ (e.g., … *mei* ***kan****-guo* …; * … *bu* ***kan****-guo* …).

2. Our study

To assess whether L1-English L2ers of Chinese can use and hence acquire knowledge of negation-aspect interactions in Chinese and whether they can come to engage in fully-specified morphosyntactic processing, our study used a noncumulative moving-window, self-paced reading task (Just, Carpenter, & Woolley, 1982). The experimental sentences are like (3). If L1 English-speaking L2ers can acquire and subsequently use the requisite knowledge, they should spend longer time reading the regions at and/or following, first, *-guo* in ungrammatical (3c) than *-guo* in grammatical (3b) and the affirmative control in (3a), and, second, *-le* in ungrammatical (3e) and (3f) than the affirmative control in (3d).

2.1. Participants

Participants of this study included 30 adult native speakers of Chinese and 54 L1-English adult L2ers of Chinese. Participants were naive as to the purposes of the experiment, and were compensated a small fee for taking part. The L2 participants were divided into two proficiency groups (Advanced; Intermediate) based on their scores from a Chinese proficiency test, the format of which is similar to a C-test in alphabetic languages. The proficiency test contains two short, approximately equal-length texts, in which the Chinese character in the second half of some words was left out (k = 25 per text). Participants need to complete the words so that the sentences and texts make sense, filling in each

blank with just one character. (If they did not know how to write a character, they could use *pinyin* instead.[3]) The L2ers' scores were initially used to create two groups of 27; this was subsequently adjusted slightly so as to have one L2 group with the same number of participants as in the Native group as well to even out the number of participants for each of the 6 presentation lists (see 2.2. Materials) in both L2 proficiency groups. This resulted in a cut-off point of 19.5: Those who scored 19.5 and above out of 50 were grouped as Advanced (n = 30); those who scored less than 19.5 were grouped as Intermediate (n = 24). Background information on the three groups is given in Table 1.

Table 1. *Participants' Chinese Background Information*

Group	Years of learning Chinese		Years of residence in China and Taiwan		Chinese proficiency test scores	
	M	*SD*	*M*	*SD*	*M*	*SD*
Natives (n = 30)	N/A	N/A	N/A	N/A	45.6	2.3
Advanced L2ers (n = 30)	6.1	6.5	4.1	7.0	28.3	8.1
Intermediate L2ers (n = 24)	3.4	3.3	0.8	0.9	10.8	5.1

The three groups' Chinese proficiency levels differed from each other significantly, $F(2, 81) = 249.66$, $p < .001$.

2.2. Materials

For the experiment, 24 sets of experimental stimuli like (3) were constructed, using simplified Chinese characters. Each experimental sentence was split into 7 regions for the purpose of the self-paced reading task. Table 2 illustrates the regions as well as the conditions of the sentences in (3).

Table 2. *Sample Set of Experimental Stimuli*

Conditions	Regions						
	1	2	3	4	5	6	7
gang–guo	他	**刚**	看	**过**	这	本	书。
	Ta	**gang**	kan	**-guo**	zhe	ben	shu.
	3sg	**just**	look	**-GUO**	this	CL	book
mei–guo	他	**没**	看	**过**	这	本	书。
	Ta	**mei**	kan	**-guo**	zhe	ben	shu.
	3sg	**not**	look	**-GUO**	this	CL	book
**bu–guo*	他	**不**	看	**过**	这	本	书。
	Ta	**bu**	kan	**-guo**	zhe	ben	shu.
	3sg	**not**	look	**-GUO**	this	CL	book
gang–le	他	**刚**	看	**了**	这	本	书。
	Ta	**gang**	kan	**-le**	zhe	ben	shu.
	3sg	**just**	look	**-LE**	this	CL	book
**mei–le*	他	**没**	看	**了**	这	本	书。
	Ta	**mei**	kan	**-le**	zhe	ben	shu.
	3sg	**not**	look	**-LE**	this	CL	book
**bu–le*	他	**不**	看	**了**	这	本	书。
	Ta	**bu**	kan	**-le**	zhe	ben	shu.
	3sg	**not**	look	**-LE**	this	CL	book

The regions of primary interest were 4, 5, and 6. Participants are likely to slow down in those regions if they detect an ungrammatical use of the (post-verbal) aspect marker in relation to the (pre-verbal) negator. As shown in Table 2, each set of experimental stimuli contained six conditions. The *gang–guo* and *gang–le* conditions are affirmative control conditions, and both are grammatical. The *mei–guo* condition is a grammatical negation condition. The other three negation conditions (i.e., **bu–guo*, **mei–le*, **bu–le*) are ungrammatical. As is standard convention in the self-paced reading paradigm, comprehension questions followed the test sentences; these were simple *yes*/*no* questions, like *Ta kan-guo zhe ben shu, duima?* 'He/She has read this book, right?' for the *-guo* sentences

[3] *Pinyin* is the official romanization system for written Chinese, based on the pronunciation of the Beijing dialect.

(10a)–(10c) or *Ta kan-le zhe ben shu, duima?* 'He/She (has) read this book, right?' for the *-le* sentences (10d)–(10f). The 24 sets of experimental sentences were distributed across 6 presentation lists in a counterbalanced (i.e., Latin square) design. Each participant randomly received one list and thus saw only one condition from each set of experimental stimuli.

The experiment used 64 fillers (52 grammatical and 12 ungrammatical) to conceal what is being tested. They had different constructions but were similar in length to the experimental sentences. Importantly, these fillers included 8 grammatical uses of *bu* in other sentence types, such as (4).

(4) Ta **bu** qu nali xuexi wai yu.
3sg **not** go there study foreign languages
'He/She does/will not go there to study foreign languages.'

The purpose of these 8 grammatical *bu* items is to prevent participants from making any association between the appearance of *bu* and ungrammaticality because the experimental sentences with *bu* were all ungrammatical. In addition, another type of filler (k = 8) was specifically devoted to a screening procedure, so as to ascertain which participants were not attentive enough in performing the self-paced reading task (resulting in the exclusion of 2 participants in the advanced L2 group), and it was also devoted to assessing participants' comprehension accuracy. These fillers are simple factual statements such as *Mei zhou you qi tian* 'There are seven days in a week' and hence easy to answer. They are all grammatical sentences and should better measure comprehension accuracy; they were designed in this way because the experimental stimuli contained ungrammatical sentences and the ungrammaticalities may reduce comprehension accuracy. Altogether, each participant read 88 sentences plus 8 practice sentences. The sentences were pseudo-randomized when presented to participants.

2.3. Procedure

Participants were tested individually. They were given specific instructions on the experimental procedure before the self-paced reading experiment started. They were told that they would read some Chinese sentences on a computer monitor in a word-by-word or character-by-character fashion at their own pace and at the end of each sentence answer a *yes*/*no* comprehension question by pressing the designated *Yes* or *No* key on the computer keyboard. The instructions also gave a specific example. The experimental materials were presented in simplified Chinese characters (font: STSong; font size: 14), and each test sentence appeared in a single line on the computer screen. The session started with 8 practice items. The DMDX software (Forster & Forster, 2003) was used to present materials and to collect response data. After the self-paced reading experiment, participants were asked to fill out a language background questionnaire first and then take the Chinese proficiency test.

2.4. Results

Data analysis covered both reading time (RT) and comprehension accuracy. For the raw RTs, a two-step data-trimming procedure was performed. First, participants' RTs of a region (i.e., word or character) longer than 2,000 msec—the cut-off point—were replaced with that cut-off point. Second, each participant's RTs that were two *SD*s away from the participant's own mean RT were replaced with the corresponding cut-off point. Overall, data-trimming affected 4.8% of the Natives' data and 8.7% of the L2ers' data. Most adjustments pertained only to the RTs of the last region.

As mentioned earlier, the experiment used a special type of filler (simple factual statements) to check participants' attentiveness in performing the self-paced reading task as well as to assess participants' comprehension accuracy. The mean accuracy rates and the standard deviations for this type of filler (k = 8) are as follows: (a) Natives, M = 0.96, SD = 0.1; (b) Advanced L2ers, M = 0.97, SD = 0.1; and (c) Intermediate L2ers, M = 0.92, SD = 0.1. The results thus show high attentiveness and high comprehension accuracy for all three groups.

As for the three participant groups' comprehension-accuracy rates for the experimental sentences, they are shown in Figure 1. Overall, the mean comprehension-accuracy rate of each group was at least 91%, suggesting that the participants did pay attention in performing the task and comprehended the sentences accurately 91% of the time (for each condition, accuracy was at least 86%). A 3 (*group*) × 6 (*condition*) repeated measures ANOVA carried out on the arcsine-transformed accuracy data showed a

main effect of condition, $F(5, 405) = 4.44$, $p = .001$, and a main effect of group, $F(2, 81) = 6.99$, $p = .002$. These main effects mean that the participants performed differently in the different task conditions, and that the three groups differed from each other in their comprehension accuracy.

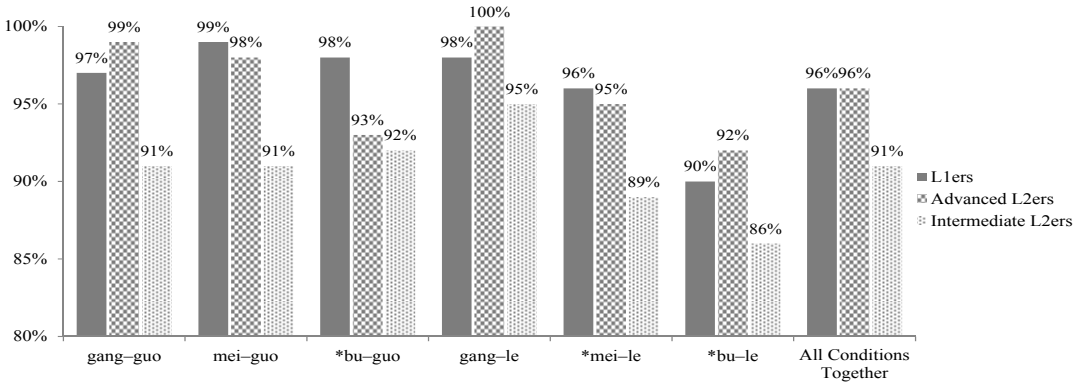

Figure 1. Participants' Mean Accuracy Rates for Experimental Stimuli.

We can also see, from Figure 1, that the three groups showed higher comprehension accuracy for grammatical *-le* sentences than for ungrammatical *-le* sentences. This is not difficult to understand; ungrammaticality may derail a participant's comprehension process and disrupt retention of the sentence meaning. This also means that an incorrect response to the comprehension question does not necessarily represent a failure to process the sentence. For this reason, the data analysis of this study did not exclude participants' RTs for incorrect question trials.

For the RT data analysis, the *-guo* sentences and *-le* sentences were analyzed separately. Figures 2–7 show the three groups' mean RTs by region for *-guo* and *-le* sentences. Overall, the Natives and Advanced L2ers, but not the Intermediate L2ers, clearly slowed down at the post-critical *zhe* and *ben* regions (i.e., Regions 5 and 6) when reading the ungrammatical *-guo* and *-le* sentences. These RT patterns indicate that the Natives and the Advanced L2ers were sensitive to the ungrammaticalities in those types of sentences.

To test the statistical significance of these patterns, repeated-measures ANOVAs were conducted separately for the *-guo* and *-le* sentences. The analyses focused on the RTs at Regions 5 and 6. Post-hoc pairwise comparisons used paired-samples *t* tests (two-tailed). The ANOVAs and *t* tests were performed on both participants (F_1 and t_1) and items (F_2 and t_2). Following standard self-paced reading convention, the significance level was set at $\alpha = 0.05$ for all statistical tests.

Figure 2 depicts the Natives' mean RTs by region for the three types of *-guo* sentences.

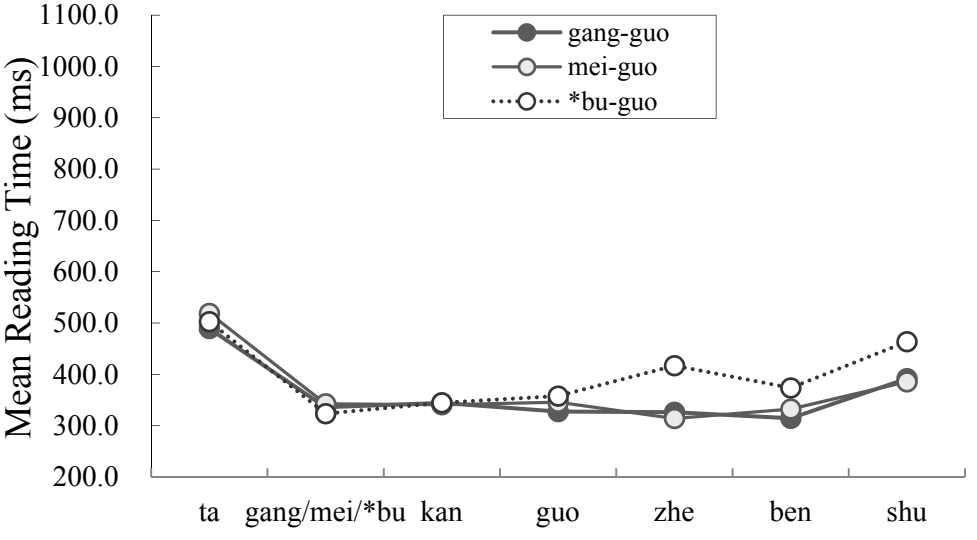

Figure 2. Natives' Mean RT (msec) Profile for *-guo* Sentences.

At Region 5 there was a significant main effect of ungrammaticality, $F_1(2, 58) = 16.71$, $p < .001$, $\eta_p^2 = .37$; $F_2(2, 46) = 19$, $p < .001$, $\eta_p^2 = .45$. The effect spilled over to Region 6, $F_1(2, 58) = 6.37$, $p = .003$, $\eta_p^2 = .18$; $F_2(2, 46) = 8.04$, $p = .001$, $\eta_p^2 = .26$. Subsequent pairwise comparisons indicated significant differences at Region 5 between the **bu–guo* and *gang–guo* conditions, $t_1(29) = 4.93$, $p < .001$; $t_2(23) = 4.66$, $p < .001$, and between the **bu–guo* and *mei–guo* conditions, $t_1(29) = 4.49$, $p < .001$; $t_2(23) = 5.45$, $p < .001$, and at Region 6 between the **bu–guo* and *gang–guo* conditions, $t_1(29) = 3.24$, $p = .003$; $t_2(23) = 3.41$, $p = .002$, and between the **bu–guo* and *mei–guo* conditions, $t_1(29) = 2.15$, $p = .04$; $t_2(23) = 2.70$, $p = .013$. The Natives were, in sum, significantly slower reading the ungrammatical *bu* sentences than the other two types of sentences at these two regions.

The Natives' mean RT patterns for the three types of *-le* sentences are presented in Figure 3.

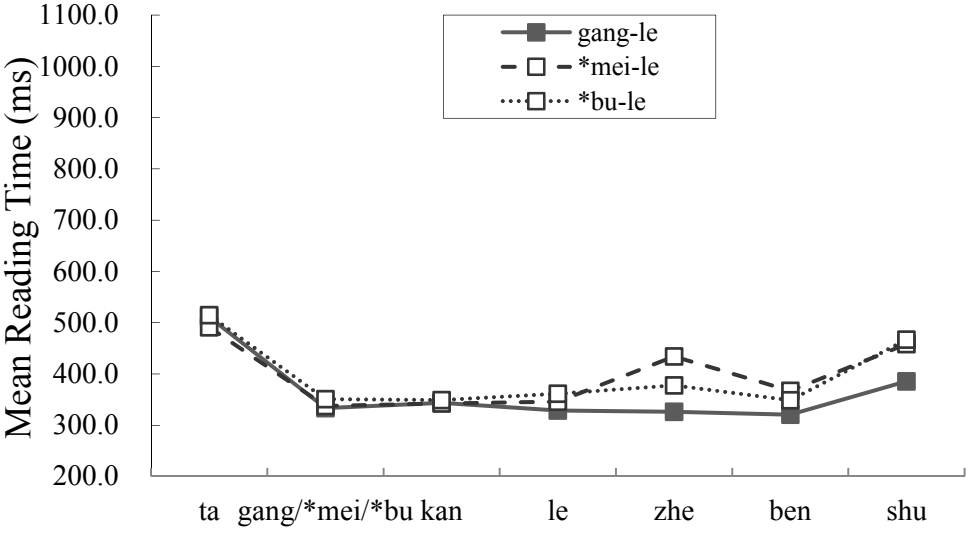

Figure 3. Natives' Mean RT (msec) Profile for *-le* Sentences.

Again, a main effect of ungrammaticality was found at Region 5, $F_1(2, 58) = 17.95$, $p < .001$, $\eta_p^2 = .38$; $F_2(2, 46) = 16.43$, $p < .001$, $\eta_p^2 = .42$, as well as at Region 6, $F_1(2, 58) = 6.25$, $p = .003$, $\eta_p^2 = .18$; $F_2(2, 46) = 6.1$, $p = .004$, $\eta_p^2 = .21$. Subsequent pairwise comparisons revealed significant differences at Region 5 between the *gang–le* and **mei–le* conditions, $t_1(29) = 5.9$, $p < .001$; $t_2(23) = 5.07$, $p < .001$, and between the *gang–le* and **bu–le* conditions, $t_1(29) = 3.25$, $p = .003$; $t_2(23) = 4.15$, $p < .001$, and at Region 6 between the *gang–le* and **mei–le* conditions, $t_1(29) = 3.35$, $p = .002$; $t_2(23) = 3.2$, $p = .004$, and between the *gang–le* and **bu–le* conditions, $t_1(29) = 2.35$, $p = .026$; $t_2(23) = 2.6$, $p = .016$. The Natives spent significantly longer time reading the (ungrammatical) *bu* and *mei* sentences than the affirmative control sentences at these two regions.

The Advanced L2ers' mean RT profiles for the *-guo* and *-le* sentences are presented below in, respectively, Figures 4 and 5. Similar to the Natives, the Advanced L2ers showed a main effect of ungrammaticality for the *-guo* sentences at Region 5, $F_1(2, 58) = 4.77$, $p = .012$, $\eta_p^2 = .14$; $F_2(2, 46) = 7.09$, $p = .002$, $\eta_p^2 = .24$, and at Region 6, in the participant analysis, $F_1(2, 58) = 3.34$, $p = .042$, $\eta_p^2 = .10$, but (unlike the Natives) not in the item analysis, $F_2(2, 46) = 1.92$, $p = .158$, $\eta_p^2 = .08$. Subsequent pairwise comparisons revealed significant (or marginally significant) differences at Region 5 between the **bu–guo* and *gang–guo* conditions, $t_1(29) = 1.83$, $p = .077$; $t_2(23) = 2.2$, $p = .038$, and between the **bu–guo* and *mei–guo* conditions, $t_1(29) = 2.63$, $p = .013$; $t_2(23) = 3.79$, $p = .001$; and at Region 6 the difference between the **bu–guo* and *gang–guo* conditions, although numerically quite large, did not reach statistical significance, $t_1(29) = 1.48$, $p = .149$; $t_2(23) = 1.18$, $p = .25$, but the difference between the **bu–guo* and *mei–guo* conditions did reach significance in the participant analysis, $t_1(29) = 2.83$, $p = .008$, and marginal significance in the item analysis, $t_2(23) = 1.95$, $p = .064$.

As seen in Figure 5, the Advanced L2ers also showed a main effect of ungrammaticality for the *-le* sentences at Region 5, $F_1(2, 58) = 4.83$, $p = .011$, $\eta_p^2 = .14$; $F_2(2, 46) = 5.05$, $p = .01$, $\eta_p^2 = .18$, and at Region 6, it was significant in the participant analysis, $F_1(2, 58) = 3.31$, $p = .044$, $\eta_p^2 = .10$, but marginal in the item analysis, $F_2(2, 46) = 2.48$, $p = .095$, $\eta_p^2 = .10$. Subsequent pairwise comparisons

showed significant differences at Region 5 between the *gang–le* and **mei–le* conditions, $t_1(29) = 2.39$, $p = .024$; $t_2(23) = 3{,}71$, $p = .001$, and between the *gang–le* and **bu–le* conditions, $t_1(29) = 2.63$, $p = .014$; $t_2(23) = 2.15$, $p = .042$; and at Region 6 a marginal difference was found between the *gang–le* and **mei–le* conditions, $t_1(29) = 1.97$, $p = .058$; $t_2(23) = 1.84$, $p = .079$, and a significant difference was found between the *gang–le* and **bu–le* conditions, $t_1(29) = 2.42$, $p = .022$; $t_2(23) = 2.07$, $p = .05$. In brief, the Advanced L2ers, like the Natives, spent significantly more time, at Regions 5 and 6, reading the ungrammatical *-guo* and *-le* sentences than they did for the corresponding grammatical sentences. (See also Section 2.5 below.)

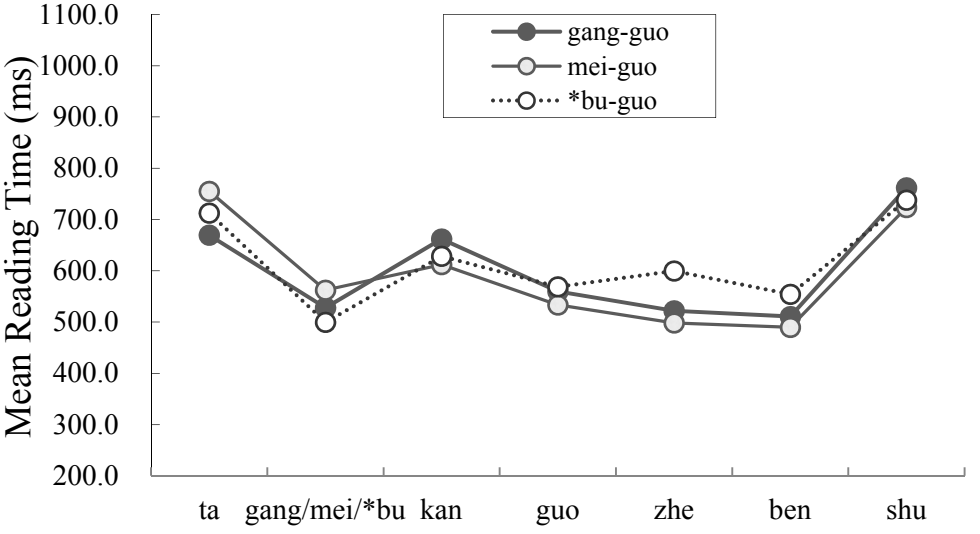

Figure 4. Advanced L2ers' Mean RT (msec) Profile for *-guo* Sentences.

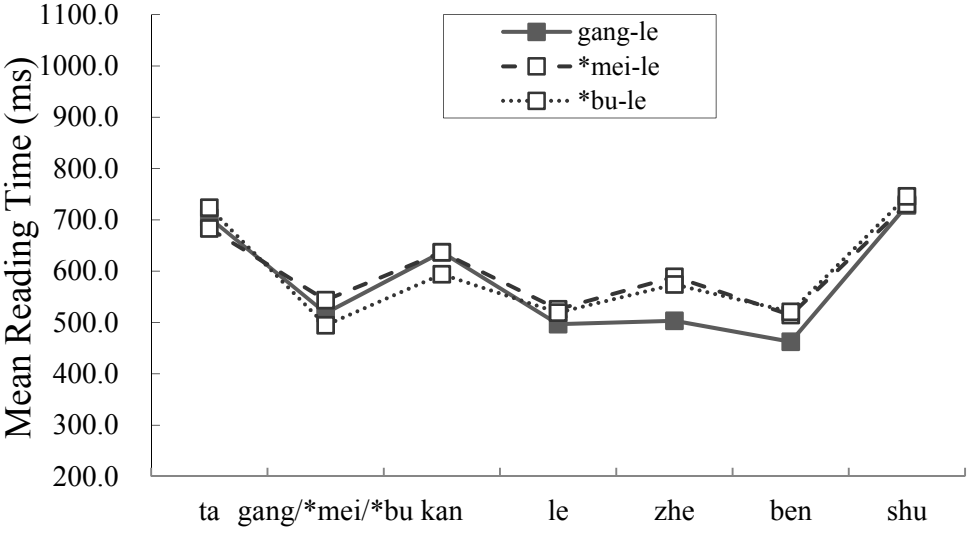

Figure 5. Advanced L2ers' Mean RT (msec) Profile for *-le* Sentences.

The Intermediate L2ers' mean RT profiles for the *-guo* and *-le* sentences are shown below in Figures 6 and 7, respectively. No significant main effect of ungrammaticality was found for the *-guo* sentences (at Region 5, Fs < .85, ps > .43; at Region 6, Fs < .65, ps > .52) or the *-le* sentences (at Region 5, Fs < .29, ps > .75; at Region 6, Fs < 1.02, ps > .37). The Intermediate L2ers showed no reliable sensitivity to the ungrammaticalities in the *-guo* and *-le* sentences.

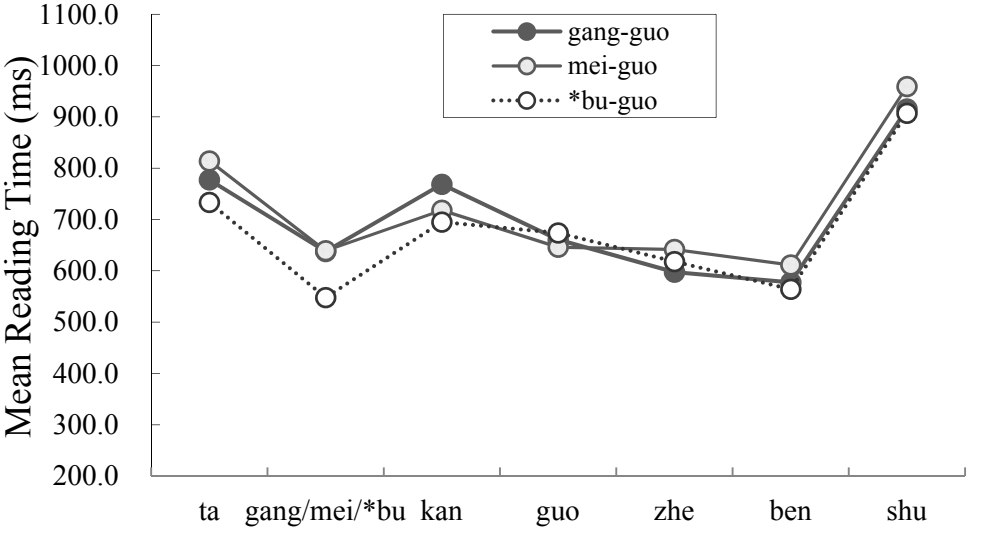

Figure 6. Intermediate L2ers' Mean RT (msec) Profile for *-guo* Sentences.

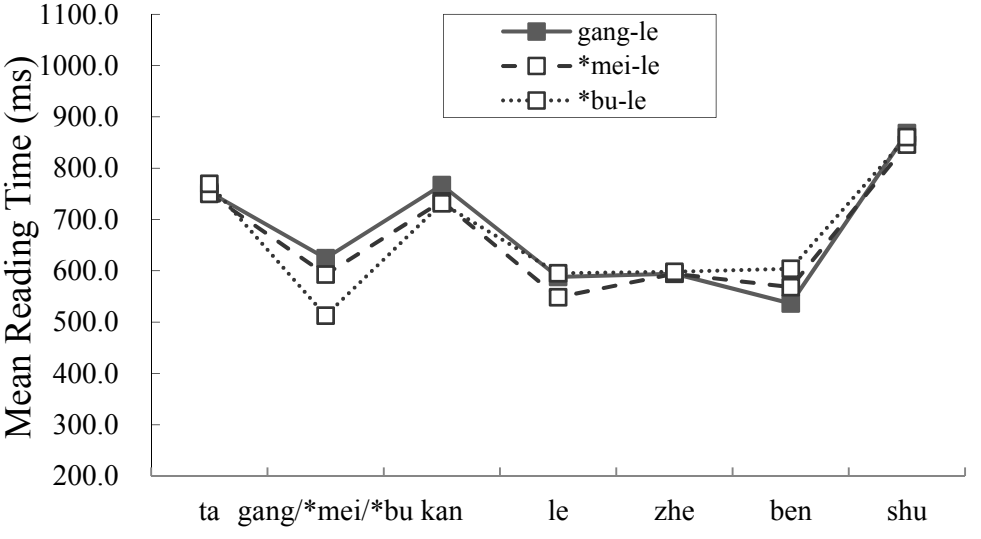

Figure 7. Intermediate L2ers' Mean RT (msec) Profile for *-le* Sentences.

2.5. Discussion

The present study has examined how adult L2ers (and adult natives) process interactions of negation and aspect in Chinese in real-time sentence comprehension in an attempt to find out whether adult L2ers of Chinese whose L1 (i.e., English) lacks negation-aspect interactions can ultimately acquire such morphosyntactic knowledge and use the knowledge in online sentence processing. By employing experimental sentences targeting nonlocal structural relations in the TL, the study has also investigated whether adult L2ers can come to engage in fully-specified morphosyntactic processing.

The results show that L2ers whose L1 does not instantiate negation-aspect interactions are indeed able to acquire such knowledge and use it in online sentence processing as their proficiency rises. In reading the *-guo* and *-le* sentences, which were designed to test the participants' abilities to process negation-aspect interactions in Chinese, the Advanced L2ers, but not yet the Intermediate L2ers, patterned like the Natives in their processing profile. They showed clear online sensitivity to violations of the negation-aspect co-occurrence restrictions at issue. These results are incompatible with L2 representational-deficit theories such as the FFF hypothesis (e.g., Franceschina, 2005; Hawkins & Chan, 1997; Hawkins & Liszka, 2003), which hold that L2ers' nontarget-like behavior results from

their deficient L2 representations. The FFF hypothesis claims that functional (i.e., grammatical) features that are not activated in early life become unavailable to adult acquirers. This claim cannot be justified by the data of this study. Despite the fact that the English negator *not* has no aspectual feature and that no negation-aspect interactions occur in English, adult L1-English L2ers are nevertheless able to acquire such morphosyntactic knowledge and use that knowledge in parsing TL sentences.

The results of this study also demonstrate that L2ers can come to engage in fully-specified morphosyntactic processing, contrary to what the SSH (Clahsen & Felser, 2006a, 2006b) claims. According to the SSH, adult L2ers' processing differs fundamentally from that of (mature) native speakers in that it is restricted to shallow parsing, which depends largely on lexical-semantic, contextual, and pragmatic information rather than morphosyntactic information. The SSH argues that L2ers, even at high levels of L2 proficiency, cannot process complex syntactic relations such as nonlocal structural dependencies. Despite the fact that this study involved processing nonlocal structural dependencies between negators and aspect markers in Chinese, the Advanced L2ers displayed clear online sensitivity to such nonlocal syntactic relations. L2 processing, as evidenced by the Advanced L2ers' results in this study, is by no means necessarily shallow in the sense of the SSH.

Proponents of L2 representational- or processing-deficit theories might be tempted to argue that the results of this study can instead be interpreted as indicating that L2ers rely merely on a simple, linear morpheme co-occurrence association/restriction rather than on underlying morphosyntactic knowledge of negation-aspect interactions. However, such an interpretation becomes untenable if we consider the data in (5).

(5) a. * Joe **bu** qu-**le** Paris.
Joe **not** go-**LE** Paris

b. * Joe **bu** qu-**guo** Paris.
Joe **not** go-**GUO** Paris

c. Joe **bu** **keneng** qu-**le** Paris.
Joe **not** **likely** go-**LE** Paris
i) 'It's not likely that Joe went to Paris.'
ii) 'It's not likely that Joe has gone to Paris.'

d. Joe **bu** **keneng** qu-**guo** Paris.
Joe **not** **likely** go-**GUO** Paris
'It's not likely that Joe has been to Paris.'

The ungrammatical (5a) and (5b) become grammatical once *keneng* 'likely' is inserted between *bu* and V-*le*/-*guo*, as in (5c) and (5d). In these cases, *bu* negates *keneng*, which is not bounded in nature and thus has no feature clash with *bu*. There is thus ample evidence suggesting that the co-occurrence restrictions can be eliminated if something such as an auxiliary or adverb intervenes between a negator and V-*le*/-*guo* in sentences like (5). If L2ers adopt a linear strategy in processing such sentences, they will attend only to the co-occurrence associations or restrictions linearly (i.e., not structurally), regardless of what occurs **in between** the associated elements (i.e., a negator and an aspect marker). A linear association account would predict that L2ers treat (5a)/(5c) and (5b)/(5d) in the same way, although (5a) and (5b) are grammatical while (5c) and (5d) are ungrammatical. Sentences like (5c) and (5d), with an intervening element between negator and aspect marker, are not at all infrequent in Chinese. Supposing that L2ers process such sentences merely by linear associations and have learned, through sentences such as (5c) and (5d), that the co-occurrence of *bu* with -*guo*/-*le* and the co-occurrence of *mei* with -*le* are grammatical, this would lead them to treat those experimental sentences violating the negation-aspect co-occurrence restrictions (**bu* V-*guo*/-*le* and **mei* V-*le*) as grammatical. On the other hand, if L2ers have learned, by linear association, that *bu* cannot co-occur with -*guo*/-*le* and *mei* cannot co-occur with -*le*, then upon encountering sentences such as (5c) and (5d) they would inevitably treat them as ungrammatical. However, the results of the present study demonstrate that advanced L2ers do not treat the negation-aspect co-occurrence restrictions indiscriminately or randomly. On the contrary, they know very well which negator can and cannot co-occur with which aspect markers in a [negator + V + aspect marker] construction (i.e., *mei* can

co-occur with *-guo* but not *-le*, and *bu* cannot co-occur with either *-guo* or *-le*). The Advanced L2ers' differentiated treatments of these co-occurrence patterns can hardly be reconciled to a linear association interpretation.

3. Conclusion

This study compared native and nonnative processing of negation-aspect interactions in Chinese and found that adult L2ers whose L1 lacks such morphosyntax can ultimately both acquire it and process it in online sentence comprehension. The finding challenges deficit theories of L2 acquisition/processing but is easily accommodated by L2 proposals that reject the idea that post-puberty L2ers are confined to the grammatical features of their L1 in the acquisition of a nonnative language. These proposals, such as the Full Transfer/Full Access/Full Parse model (Dekydtspotter, Schwartz, & Sprouse, 2006; Schwartz & Sprouse, 1996) and the Fundamental Identity Hypothesis (Hopp, 2007), hold that adult L2 knowledge/representation is not of an epistemologically different type from native-speaker knowledge and that adult L2 processing is, or at least can become, fundamentally the same as native-speaker processing. In addition, the current study demonstrates that adult L2ers are able to engage in fully specified morphosyntactic processing, even when it involves nonlocal structural relations (in the sense of Clahsen & Felser, 2006b, p. 564: "local dependencies, typically involving adjacent words or constituents").

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