1 **Can L2 sentence processing strategies be native-like? Evidence from**
2 **English speakers' L2 processing of Chinese base-generated-topic**
3 **sentences**

4
5
6 **Abstract**

7 This article reports on an empirical study examining English speakers' L2 processing of

8 Chinese base-generated-topic (BGT) sentences. Forty-four highly proficient English-

9 speaking L2 learners of Chinese and 23 native Chinese speakers were involved in the

10 study. Results of a self-paced reading task reveal that both native Chinese speakers' and

11 L2 Chinese learners' processing of Chinese BGT sentences is syntactically induced in a

12 top-down manner. English speakers are sensitive to and are able to make use of syntactic

13 cues as well as semantic information in their processing of Chinese BGT sentences. The

14 study provides disconfirming evidence against the Shallow Structure Hypothesis

15 (Clahsen and Felser, 2006a, b), which predicts that unlike native speakers, L2 learners do

16 not rely on structure-based processing strategies when solving ambiguities in L2 sentence

17 processing.

18

19 **Kay words**

20 second language, sentence processing, Chinese base-generated topics, native-like

21 strategies

22

1. Introduction

24 It is widely observed that children generally learn their mother tongues rapidly and

25 successfully, but few adults can have native-like mastery of the target language in their

26   acquisition of a second language (L2). One of the accounts for this contrast is the Shallow

27   Structure Hypothesis (SSH) by Clahsen and Felser (2006a, b), which states that during

28   real-time language comprehension, L2 learners can only construct shallow structure

29   representations that contain basic argument-predicate relations but lack detailed syntactic

30   information, and therefore their comprehension relies almost exclusively on lexical-

31   semantic and pragmatic information. The SSH has brought many researchers' attention to

32   the mechanism that native (L1) speakers and L2 speakers utilize in sentence processing.

33   However, most studies that Clahsen and Felser (2006a) refer to in support of their SSH

34   focus on filler-gap dependencies in processing L2 wh-questions or relative clauses, and it

35   is not clear from studies in the L2 processing literature whether the SSH can be

36   confirmed in any "gapless" structure in L2 sentence processing. In this article, we will

37   report an empirical study investigating L2 processing of the Chinese base-generated-topic

38   sentence, which we hope can provide useful evidence about how "gapless" structures are

39   processed in L2 as well as L1 sentence processing.

40   In Mandarin Chinese (henceforth Chinese), it is common to have sentences like (1),

41   where the topic *Shuiguo* "fruits" is a base-generated topic and is not a constituent derived

42   from inside the sentence. There is no gap in the sentence and all positions in the argument

43   structure are phonetically and lexically filled. Since the Chinese base-generated-topic

44   sentence has a "gapless" structure, it would be interesting to see whether L1 and L2

45   parsers would initially process the first two NPs, i.e. *Shuiguo* "fruits" and *wo* "I", as the

46   topic and the subject of the sentence respectively, whether any restructuring of the initial

47   analysis would have to take place, and how the subcategorization need of the verb *chi*

48 "eat" is satisfied in the sentence processing. Semantic constraints of the Chinese base-

49 generated-topic sentence will be examined as well.

50

51   (1) *Shuiguo wo zui   ai   chi xiangjiao.*

52   fruit   I most love eat banana

53   As for fruits, I like to eat bananas the most.

54

2. Base-generated-topic Sentences in Chinese

56 Chinese has been considered a topic-prominent language in the literature, in contrast to

57 English, which is claimed to be a subject-prominent language (cf. Li and Thompson,

58 1976, 1981; Huang, 1984a,b; Xu, 2006; Xu and Langendoen,1985; Huang, Li, and Li,

59 2009; among many others). In Chinese, it is common to have a topic at the sentence-

60 initial position, followed by a sentence, which serves as a comment about the topic. This

61 can be exemplified in (1), in which the topic S*huiguo* "Fruits" has no syntactic relation

62 with any constituent in the comment and there is no gap in the comment either. This

63 "gapless" topic structure suggests that the sentence-initial topic is base-generated in the

64 left periphery and is not a result of movement. Sentences like the one in (1) are what

65 Gundel (1988) calls the topic-comment construction and are also known in the literature

66 as a "Chinese-style" topic structure, a term which originated in Chafe (1976). English

67 does not allow sentences with a base-generated topic, and for the topic in the "Chinese-

68 style" topic structure to be acceptable in English, it is usually encoded into a prepositional

69 phrase like *as for…, of…*, or *speaking of…*, as can be seen in the English translation of

70 the topic in (1).

71 Li and Thompson (1976) suggest that the notion of topic in Chinese is as basic as that of

72 subject in general grammar descriptions and that the topic in Chinese cannot be viewed as

73 derived by movement from some argument position in the sentence. They point out that

74 an important characteristic of the topic in Chinese is that it is independent of the verb and

75 need not be an argument of a predicative constituent in the sentence. From the sentence in

76 (1), we can see that the topic *Shuiguo* "Fruits" is not determined by the verb, and

77 sentences of this type provide clear evidence that the topic leaves no "gap" in the

78 sentence and that no process of movement is involved.[1, 2]

79 Huang (1984a) argues that topic-comment sentences in Chinese "must count as basic

80 forms in that they cannot be plausibly derived from other 'more basic' forms" (p. 550),

81 and this view is also shared by Xu (1986) and Cole (1987). In this article, we assume that

82 the topic in the "Chinese-style" topic structure is base-generated in the Specifier of the

83 Topic Projection (TopP) in the left periphery of the sentence, in the sense of Rizzi (1997).

84 It should be pointed out that although base-generated-topic (henceforth BGT)

85 sentences are common in Chinese, Chinese also allows topic structures in which the topic

86 is a result of movement, as indicated in the sentence in (2), where the topic *Zhe ben shu*

87 "this book" is originally based-generated as the object of the verb *xihuan* "like" before it

---

[1] The topic in (1) should not be treated as being the same as the left dislocated NP, *John*, in the following example, because the left dislocated NP in English, although also base-generated, has to be co-indexed with a constituent in the sentence, as shown by the co-indexation between *John* and the pronoun *him* in the following example.

      (i) $John_i$ I don't trust him_i.

[2] Shi (2000) argues that every topic must be syntactically licensed and that it cannot be merely semantically related to the comment as a whole. However, his argument has been challenged by many linguists, including Pan and Hu (2001, 2002), who provide counter-evidence to Shi's analysis. As pointed out by Xu (2006), if Shi were correct, there would be no significant structural difference between topic-prominent languages and other languages.

88 is topicalized to the Specifier of TopP. While this kind of Chinese topic sentences are not

89 the focus of the study, their existence in Chinese is likely to affect both native Chinese

90 speakers' and L2 Chinese learners' processing of Chinese BGT sentences, as will be

91 shown in our empirical study.

92

93 (2)   *Zhe ben shu$_i$ wo bu xihuan t$_i$.*

94   this CL book I   not like

95   This book, I don't like.

96

3. Semantic Constraint on Base-generated Topics in Chinese

98 The base-generation of the topic is subject to various pragmatic and semantic constraints.

99 In (1), the topic *Shuiguo* "Fruits" on the one hand, and the NP *xiangjiao* "banana" in the

100 comment on the other, form a hyponymy relationship, with the topic being the

101 superordinate and the NP in the comment being its hyponym. The Chinese-style topic

102 structure would not be felicitous if the hyponymy relationship is violated even if the topic

103 is base-generated in Spec TopP. As can be seen in (3a), the topic *Xiangjiao* "bananas" is

104 a hyponym while the NP *shuiguo* "fruit" in the comment is the superordinate. This

105 reversed hyponymy relationship leads to the infelicity of the sentence. Similarly, the

106 sentence would be unacceptable if the base-generated topic forms a sisterhood

107 relationship with the NP in the comment, as shown between *xiangjiao* "bananas" and

108 *pingguo* "apples" in (3b), or has no hyponymy relationship with the NP in the comment,

109 as shown between *Shuiguo* "Fruits" and *binggan* "biscuits" in (3c).

110

111   (3)a.   *Xiangjiao wo zui ai chi shuiguo.

112   banana   I   most love eat fruit

113   *Bananas, I like to eat fruits the most.

114   b.   *Xiangjiao wo zui ai chi pingguo.

115   banana   I   most love eat apples

116   *Bananas, I like to eat apples the most.

117   c.   *Shuiguo wo zui ai chi binggan.

118   fruit   I   most love eat biscuit

119   *Fruits, I like to eat biscuits the most.

120

121 The relation between the topic and the comment is commonly characterized as

122 "aboutness" in the literature, and according to Gundel's (1985) formulation of

123 "aboutness", "an entity, E, is the pragmatic topic of a sentence, S, iff S is intended to

124 increase the addressee's knowledge about, request information about or otherwise get the

125 addressee to act with respect to E" (p. 86). Takami and Kamio (1994) also point out that

126 the topic must be characterized by the rest of the sentence. Based on the formulations of

127 "aboutness", we can argue that the infelicity of the sentences in (3) is due to the violation

128 of the aboutness condition.

129

130   **4. Studies of L2 Topic Structures**

131 Since the stimulating paper by Li and Thompson (1976), topic-prominence as a linguistic

132 phenomenon has attracted much attention, not only from scholars working on language

133 typology and linguistic theory, but also from researchers in L2 acquisition, particularly

134 those working with special reference to target languages such as Chinese. An interesting

135 question that people ask is whether native speakers of a subject-prominent language such

136 as English are able to acquire features of a topic-prominent language like Chinese.

137 Jin (1994) conducted a L2 study examining the behaviours of adult native English

138 speakers acquiring Chinese as a topic-prominent language. She used three production

139 tasks, oral interviews, story retelling and free compositions, to elicit data from English

140 speakers' L2 Chinese. The results indicate that English speakers go through a process of

141 systematically transferring subject-prominence features to their L2 Chinese at early

142 stages. When their Chinese proficiency is limited, they tend to rely on the subject-

143 prominent structure of English in their L2 Chinese, which Jin argues is evidence of

144 typological transfer from a L1 subject-prominent language to a L2 topic-prominent

145 language. When learners have reached what Jin calls a requisite proficiency, they become

146 sensitive to syntactic features of topic-prominence in Chinese and start to use base-

147 generated topics. Similar results are also reported in Jung's (2004) study of L2

148 acquisition of Korean, a topic-prominent language, by English speaker. In Jung's study,

149 English speakers are found to be able to use base-generated topics in their L2 Korean

150 writing at an advanced level and there is evidence of L1 transfer of subject-prominence to

151 English speakers' L2 Korean at earlier stages. Both Jin's and Jung's studies demonstrate

152 that base-generated topics are acquirable by speakers of a subject-prominent language.

153 However, it is not clear from these studies in what way Chinese or Korean BGT

154 sentences are processed in real time by L2 learners and whether the L2 syntax of base-

155 generated topics is governed by the semantic constraint discussed in the previous section.

156   AUTHOR (1995) carried out a study specifically investigating the acquisition of

157   base-generated topics in Chinese by English-speaking learners. Over 100 English-

158   speakers were involved in the study and the results of an acceptability judgement test

159   indicate that although English-speaking learners of Chinese at earlier or intermediate

160   stages had difficulty accepting sentences with a base-generated topic like (4), there is

161   clear evidence that the base-generated topic in Chinese can be eventually acquired by

162   English-speaking learners. However, AUTHOR's study, like Jin's and Jung's, only

163   indicates that the base-generated topic can be established in English speakers' L2 Chinese

164   syntax, and it does not provide us with any information about how Chinese BGT

165   sentences are processed in real time and whether these sentences are regulated by the

166   semantic constraint in L2 Chinese.

167

168   (4)   *Ta jia   li de   ren wo zhi jian-guo ta mama*

169   his family in DE people I only meet EXP his mother

170   *People in his family, I have only met his mother.

171   (=(6) in AUTHOR (1995))

172

173   Another L2 study of Chinese as a topic-prominent language was conducted by Cao, Yang,

174   Huang, Gao and Cui (2006), in which native speakers of Japanese, Korean and English

175   were included in order to examine whether speakers of topic-prominent languages like

176   Japanese and Korean have advantages over speakers of English in their L2 acquisition of

177   Chinese topic structures. Their results suggest that the topic-prominence in learners' L1

178   can facilitate the acquisition of topic-prominence in their L2 because evidence was found

179 in an acceptability judgment task that base-generated topics were accepted by Japanese-

180 and Korean-speaking learners but not by English-speaking learners. However, learners in

181 this study were all at "intermediate and high-intermediate levels" and no learner at an

182 advanced level was included. As shown in Jin's (1994) and AUTHOR's (1995) studies

183 above, English-speaking learners at advanced levels are able to acquire base-generated

184 topics, like *Na ke shu* "that tree" in (5), in their L2 Chinese.

185

186 (5)   *Na   ke   shu, yezi hen da.*

187   that CL tree leaf very big

188   That tree has big leaves.

189

190 Studies reviewed above show that the syntax of base-generated topics is acquirable by

191 English speakers. However, no evidence is provided in the literature as to whether L2

192 learners can process Chinese BGT sentences in the same way as native Chinese speakers

193 and whether the BGT structure in L2 Chinese is governed by the relevant semantic

194 constraint.

195

196 **5. L2 Sentence Processing and the Shallow Structure Hypothesis**

197 In recent years, an increasing number of researchers have paid attention to the mechanism

198 that native speakers and L2 speakers utilize in sentence processing. Some have argued

199 that the lack of native-like ultimate attainment in adult L2 acquisition can at least

200 partially be attributable to adult L2 sentence processing problems, which include

201 problems that adult L2 learners may have in integrating different information sources in

202   real-time L2 sentence processing. For example, Marinis, Roberts, Felser and Clashen

203   (2005) carried out a self-paced reading task with four groups of L2 learners of English

204   whose L1s were Chinese, Japanese, German and Greek, as well as a group of native

205   English speakers. Their study focuses on sentences involving long distance wh-

206   dependencies in sentences like (6a) and (6b).

207

208   (6)a. The manager *who* the consultant claimed _____ that the new proposal had

209   pleased _____ will hire five workers tomorrow. (intermediate gap)

210   b. The manager who the consultant's claim about the new proposal had pleased

211   _____ will hire five workers tomorrow. (no intermediate gap)

212

213   As sentences like (6a) involve wh-extraction from a complement clause, an intermediate

214   gap is assumed to be present at the intervening clause boundary, which breaks the long

215   dependency up into two shorter ones. However, no such intermediate gap is present in

216   sentences like (6b) which involve extraction across a complex NP. In the study, it is

217   assumed that although the linear distance between the filler, i.e. *who*, and its

218   subcategorizer, i.e. *pleased*, is the same in both (6a) and (6b), integrating the filler with

219   its subcategorizing verb should be facilitated by the availability of an intermediate gap at

220   the clause boundary if the parser consults a mental representation of the filler at this point

221   during processing. In the study, longer reading times were observed in the native English

222   speaker group, but not in L2 groups, at the intervening clause boundary in the extraction-

223   VP condition, as in (6a), compared to the corresponding nonextraction condition, as in

224   (6b). The results also show that only native English speakers', but not L2 groups',

225 reading times at the segment containing the subcategorizing verb are significantly shorter

226 for sentences that contain an intermediate gap, as in (6a), than for those that do not, as in

227 (6b). The interpretation by the authors is that native English speakers associate the filler

228 with an intermediate gap when processing sentences involving wh-extraction from an

229 embedded clause, which facilitates filler integration later on. In contrast, there is no such

230 interaction or intermediate gap effect in L2 processing although L2 learners, like native

231 speakers, are able to integrate the filler with its subcategorizing verb in their sentence

232 processing. The authors conclude that L2 learners "do not use native-like, phrase-

233 structure-based processing mechanisms … during online comprehension." (p. 72)

234   On the basis of results of this type (also results from Felser, Roberts, Marinis, and

235 Gross, 2003; Papadopoulou and Clahsen, 2003; among others), Clashen and Felser

236 (2006a) propose the Shallow Structure Hypothesis that adult L2 learners are guided by

237 lexical-semantic cues in their sentence processing in the same way as native speakers, but

238 L2 learners' sensitivity to syntactic information is restricted and therefore their syntactic

239 representations in sentence processing are shallower than those of native speakers.

240 According to Clahsen and Felser, the mental processes involved in L2 learners' sentence

241 processing are qualitatively different from those used in native speakers' L1 processing;

242 unlike native speakers, L2 learners do not rely on structure-based processing strategies

243 when solving ambiguities in the L2. Instead, they process L2 sentences primarily on the

244 basis of lexical-semantic and pragmatic information.[3]

245   However, the SSH has been challenged by an increasing number L2 sentence

246 processing studies in the literature. Omaki and Schulz (2011) conducted a self-paced

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[3] Some other studies in the literature, e.g. Frenck-Mestre and Pynte (1997), Juffs (1998), Dussias and Piñar (2010), Dinçtopal-Deniz (2010), do provide evidence in support of the SSH.

247 reading experiment, comparing the extent to which advanced Spanish-speaking L2

248 learners of English and native English speakers make use of the relative clause (RC)

249 island constraint in constructing filler-gap dependencies like (7).

250

251 (7)a. The murder case$_i$ that the law students [RC who learned about the constitution]

252   discussed ____$_i$ was going to be on the exam.

253   b. *The murder case$_i$ that the law students [RC who learned about ____$_i$] discussed

254   ____$_i$ was going to be on the exam.

255

256 In the grammatical condition (7a), the dependency between the filler *the murder case* and

257 the verb *discussed* does not cross the RC island.[4] The ungrammatical counterpart in (7b)

258 is constructed by taking the sentence in (7a) and deleting the object of an obligatorily

259 transitive preposition inside the RC, such that the dependency between *the murder case*

260 and the preposition *about* crosses the RC island. The results show that L2 learners pattern

261 with native speakers in postulating a gap in non-island conditions but not in island

262 conditions, suggesting that syntactic island constraints successfully blocked

263 ungrammatical long-distance dependency formation in both native and non-native

264 speakers' sentence processing, contra to the prediction of the SSH.

265   Williams (2006) also conducted a study of L2 processing of wh-dependencies, which

266 was based on an earlier study by Williams, Mobius and Kim (2001). In the study,

267 participants read sentences like (8a) and (8b) word-by-word in a self-paced fashion and

268 pressed a button as soon as the sentence stopped making sense to them.

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[4] It was acknowledged by the authors that the acceptability of (7a) is somewhat degraded due to the large processing cost incurred by the presence of more than one temporarily incomplete clause,

269

270   (8) a. Which car$_i$ did the tourist buy the really expensive radio for e_i two months ago?

271   b. Which friend$_i$ did the tourist buy the really expensive radio for e_i two months ago?

272

273   It was hypothesized that increased RTs should be found in the region after the determiner

274   and prior to the noun, i.e. the region of *really expensive,* if L2 learners process the

275   syntactic cues similarly to native speakers. On the other hand, if native English speakers

276   start the reanalysis process based on syntactic cues from the determiner which informs

277   the parser that an NP follows, while L2 learners do the reanalysis only based on lexical

278   information after encountering the noun *radio*, this would indicate that L2 learners ignore

279   the syntactic cue from the determiner and do the reanalysis on the basis of the noun, i.e.

280   *radio*. The results showed that both native English speakers and L2 learners had longer

281   RTs before the noun, indicating that the reanalysis started after the determiner and before

282   the noun. This suggests that both native speakers' and L2 learners' sentence processing

283   can be structurally driven, which is not in accordance with the SSH.[5]

284   In a more recent study, Pliatsikas and Marinis (2013) investigated the effect of

285   naturalistic exposure in processing wh-dependencies. They used the same experimental

286   sentences as in Marinis, Roberts, Felser and Clashen (2005), and examined the processing

287   of sentences involving intermediate gaps like those in (6a) and (6b). The participants

288   included 26 advanced Greek-speaking learners of L2 English with an average 9 years of

289   naturalistic exposure, 30 with classroom exposure and 30 native English speakers.

290   Results from a self-paced reading task show that L2 learners with naturalistic exposure

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[5] See Aldwayan, Fiorentino and Gabriele (2010) for another L2 study of wh-movement processing, which also disconfirms the SSH.

291   are able to have native-like processing of the intermediate gaps like those in (6a) and (6b).

292   That is, the naturalistic exposure L2 group converged with the native English group in

293   revealing facilitation in processing the final gap when an intermediate gap was present.

294   This suggests that extended immersion in naturalistic target language environments can

295   lead to native-like abstract syntactic processing in L2, a case not predicted by the SSH

296   but a case confirming VanPatten and Jegerski's (2010) prediction that differences in

297   populations can be a factor affecting native-like abstract syntactic processing in L2.

298   As indicated above, the majority of L2 sentence processing studies in the literature,

299   whether in support of or against the SSH, use filler-gap dependencies in either relative

300   clauses or wh-questions in their investigations of L2 sentence processing, and there seems

301   to be a lack of structural varieties in examining L2 sentence processing. In this aspect, the

302   BGT sentence in L2 Chinese provides a good alternative for the investigation of L2

303   sentence processing. It has several advantages. Firstly, it has a "gapless" structure in a

304   sense that neither its syntactic structure nor its argument structure contains any empty

305   category as no movement of any constituent takes place from inside the sentence, thus no

306   "gap" in the sentence. Secondly, unlike English wh-questions or relative clauses, in

307   which the fronted wh-word, when it is processed, can reveal its "filler" status because of

308   the *wh-* marking on the wh-word, the word in the topic position in the Chinese topic

309   sentence does not have any overt marking whatsoever, and therefore it does not give

310   away any information as to whether it is a potential filler or whether there is a gap in the

311   sentence.

312

313   **6. Research Questions**

314 Based on the analyses above, we had the following research questions for the empirical

315 study:

316

  317   1. In what way would the topic and the subject, i.e. the first NP and then the second

318   NP, in the Chinese topic sentence be processed initially and subsequently in L1 and

319   L2 processing? According to the SSH, there would be differences between native

320   speakers and L2 learners when solving syntactic ambiguities, because L2 learners,

321   unlike native speakers, do not rely on structure-based processing strategies when

322   solving syntactic ambiguities in L2 processing.

323   2. Since the topic in Chinese can be either base-generated in the sentence-initial

324   position or derived from movement of a constituent from inside the sentence, and

325   given that there is no overt marking at all on the topic NP as a potential filler, would

326   the syntactic (re-)analysis of the first NP as the topic of the sentence assign to the

327   topic NP a role of potential filler in L1 and L2 BGT sentence processing?

328   3. Would L2 learners be sensitive to the semantic requirement, i.e. the hyponymy

329   relationship between the topic and a relevant item in Chinese BGT sentences, an

330   ability predicted to be available in L2 processing by the SSH?

331

332   Unlike the wh-word in English wh-questions and relative clauses, which reveals itself

333 as a potential filler by the overt wh-marking attached to it, any possible acquisition of the

334 topic role by the first NP in Chinese topic sentences would be triggered by the syntactic

335 (re-)analysis of the first NP (and probably also the second NP) in the processing of

336   Chinese BGT sentences. This would be triggered syntactically, rather than lexical-

337   semantically or morphologically.

338

339   **7. Experiment**

340   Four tasks were included in the experiment: a) a self-paced reading task, which was used

341   to examine the on-line processing of Chinese BGT sentences by English-speaking

342   learners of Chinese as well as native Chinese speakers; b) a grammaticality judgment task,

343   which was to check whether participants in the experiment had the grammatical

344   knowledge of the Chinese BGT sentences, which is believed to be a prerequisite for

345   processing this type of sentences; c) a cloze test for measuring participants' Chinese

346   language proficiency; d) a questionnaire to collect information about participants'

347   Chinese language learning background and the self-evaluation of their own Chinese

348   language proficiency. The tasks were presented in the above order.

349

350   **7.1 Participants**

351   A total of 44 English-speaking learners of L2 Chinese and 23 native Chinese speakers

352   participated in the experiment. The learners were highly proficient in Chinese and they

353   were diplomats and business people working and living in China as well as English-

354   speaking academics and students teaching or studying in universities in the U.K. or

355   China.[6] The native Chinese speakers were graduate students, academics at universities in

356   the U.K. or China, or office workers in China. Moderate payment was given to each

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[6] It had originally been designed to divide the English-speaking learners of Chinese into two Chinese
language proficiency groups, but it was decided to collapse the two groups into one because of similar
results of the two groups in the experiment.

357   participant as a token of thanks for their participation in the experiment. Before data

358   analyses were conducted, each participant's data underwent a screening check on the

359   basis of their performance in the grammaticality judgment task, which was designed to

360   identify participants who can demonstrate clear knowledge of the BGT structure in

361   Chinese. Ensuring that participants could handle the Chinese BGT structure is important

362   in order for us to rule out the possibility that any possible problem in their sentence

363   processing in the experiment is due to the lack of grammatical competence in this area.

364   As a result of this screening check, 10 participants from the Learner Group (L-Group)

365   and 4 from the Native Group (N-Group)[7] were excluded because of their failure to pass

366   the screening check (see below for detailed information about the screening check).

367   Participants in the learner group were also asked to do a self-evaluation of their L2

368   Chinese with regard to speaking, listening, reading and writing. Table 1 provides

369   information about participants included in the study. All participants had normal or

370   corrected-to-normal vision at the time of the experiment.

371

372   **Table 1.** Information about the participants included in the study (standard deviations in

373   parentheses)

	L-Group *(SD)*	N-Group *(SD)*
Number	44 - 10 = 34	23 - 4 = 19
Mean score of the cloze test (maxi =40)	35 *(2.7)*	38 *(1.6)*

[7] The four native speakers were excluded not because of their Chinese language competence but because of their carelessness in doing the experiment as they admitted afterwards that they were not paying careful attention while doing the experiment.

Mean age		31 *(15)*	28 *(5.6)*
Mean age starting Chinese		18.6 *(3.3)*	N/A
Years of learning Chinese		12.25 *(13.17)*	N/A
Years of residence in China/Taiwan		6.3 *(9.29)[a]*	N/A
Self-evaluation of Chinese:[b] Speaking		4.6 *(0.78)*	N/A
	Listening	4.5 *(0.83)*	N/A
	Reading	4.6 *(0.89)*	N/A
	Writing	3.9 *(0.84)*	N/A

374   [a] The range is 1 year to 34 years.

375   [b] On a 1-6 scale where 1 = beginner level, 2 = post-beginner level, 3 = intermediate level,

376   4 = post-intermediate level, 5 = advanced level, 6 = very advanced level.

377

378   **7.2 Cloze Test**

379   A cloze test with 40 blanks was administered to all participants to assess their Chinese

380   language proficiency. Although the result of an independent-sample t-test indicates that

381   the native Chinese group performed significantly better than the learner group in the

382   cloze test ($t(51)$=5.544, p<0.001), participants in the learner group are considered to be

383   advanced learners of Chinese, given the information about the average number of years

384   of their residence in Chinese-speaking environments (6.3 years), the average number of

385   years of their studying Chinese (12.25 years) and their mean score in the cloze test (35),

386   as shown in Table 1.

387

388   **7.3 Self-paced Reading Task**

389 In total, there were 28 types of stimuli in the self-paced reading task, and each type had 6

390 test sentences in it. Altogether, there were 168 sentences included in the self-paced

391 reading task, out of which 3 counterbalanced presentation lists were constructed on the

392 basis of a Latin square design, with each list containing 56 sentences. The stimuli

393 relevant to the study reported in this article are the 4 types presented in Table 2, with each

394 type having 6 test sentences (see the Appendix for all the 24 test sentences used in these 4

395 types). These 24 sentences were embedded in the other 144 sentences, which tested

396 processing of other language structures (e.g. word orders of unaccusative and unergative

397 verbs, etc.) in Chinese and are considered as suitable fillers for the examination of the 4

398 types relevant to this study.

399

400 **Table 2.** Sample set of experimental stimuli[8]

Types	Regions								
	1	2	3	4	5	6	7	8	9
A. BGT sentence with S-H	水果 fruit	我 I	最 most	爱吃 like eat	香蕉 banana	，所以 so	我 I	经常 often	买香蕉。 buy banana
B.*BGT sentence with H-S	香蕉 banana	我 I	最 most	爱吃 like eat	水果 fruit	，所以 so	我 I	经常 often	买水果。 buy fruit
C. *BGT sentence with sisterhood	苹果 apple	我 I	最 most	爱吃 like eat	香蕉 banana	，所以 so	我 I	经常 often	买香蕉。 buy banana
D. Non-BGT sentence	以前 before	我 I	最 most	爱吃 like eat	香蕉 banana	，所以 so	我 I	经常 often	买香蕉。 buy banana

401

402
403 The rationale for including these 4 types of sentences is that any locally increased

404 processing efforts should be detected in longer reading times on a given region in

405 comparison with the same region in a controlled sentence. For example, processing the

406 pronoun *wo* "I" in Region 2 in Types A, B, and C is predicted to take longer times than

---

[8] The English gloss is given here only for the reader of this article, and it was not available in the experiment. Also, in Column 1, "S-H" stands for the superordinate-hyponym relationship between the topic and the relevant NP in the sentence, "H-S" stands for a hyponym-superordinate relationship, and "sisterhood" for a sisterhood relationship.

407 processing the same pronoun in Region 2 in Type D because the parser is likely to go

408 back to the first NP (i.e. *shuiguo* "fruit", *xiangjiao* "banana" or *pingguo* "apple" in

409 Region 1 in Types A, B, and C to correct the initial assignment of the first NP as the

410 subject of the sentence and to re-analyze it as a topic. However, processing the pronoun

411 *wo* "I" in Region 2 in Type D is unlikely to incur any extra cost or re-analysis because the

412 first element that the parser processes is an adverb *yiqian* "before" in Region 1, which

413 frequently appears at the beginning of the sentence in human languages, and the parser

414 can easily integrate the pronoun *wo* "I" in Region 2 into the subject position without any

415 reanalysis.[9]

416   Similarly, it is predicted that processing the NPs in Region 5 in Types A, B, and C (i.e.

417 *xiangjiao* "banana" or *shuiguo* "fruit" will increase processing costs if the topic in Region

418 1 is temporarily stored in working memory as a topic resulted from topicalization. (Recall

419 that in Chinese, a topic can be a result of topicalization of a constituent from inside the

420 sentence, or a base-generated topic in the sentence initial position.) If the topic is stored

421 in working memory as a potential filler, the parser may be looking for a gap in the

422 sentence for the topic to fill as a result of the Filler-Driven Strategy (cf. Frazier and

423 Clifton, 1989) or the Principle of Immediate Association (cf. Pickering and Barry, 1991).

---

[9] It should be noted that *wo* in Chinese does not have any case marking. That is, there is no morphological change whatsoever when *wo* is used as a subject pronoun, or as a (topicalized) object pronoun as in (i), or as a possessive pronoun as in (ii).

    (i)   Wo$_i$ ta bu   renshi t_i.

                  Me he not know

                  *"Me, he doesn't know."

    (ii)   Shuiguo wo mama xihuan chi xiangjiao

                 Fruits   my mother like   eat bananas

                 "As for fruits, my mother likes to eat bananas."

424   When the verbal phrase *ai chi* "like to eat" in Region 4 is processed, the parser may treat

425   it as the subcategorizer for the topic. However, once the NP in Region 5 in Types A, B

426   and C is encountered, the parser will have to cancel its previous analysis and re-analyze

427   the topic in working memory as a base-generated topic rather than a topic as a result of

428   topicalization. Furthermore, the NPs in Region 5 in Types B and C are predicted to take

429   even longer times for the parser to process than the NP in the same region in Type A

430   because the former violate the hyponymy relationship between the base-generated topic

431   in Region 1 and the NP in the object position in Region 5, with the topic being a

432   hyponym of the object, i.e. a hyponym-superordinate (H-S) relationship, in Type B and

433   with the topic and the NP in the object position forming a sisterhood relationship in Type

434   C. Processing these semantic conflicts is likely to incur additional processing costs.

435   However, this kind of processing delay is predicted not to occur in Type D because there

436   is no topic in working memory for the NP *xiangjiao* "banana" in Region 5 in Type D to

437   check against and therefore the parser can process the NP much faster.

438   Given the predictions made above, we treat Region 2 and Region 5 as *critical regions*,

439   and as there may possibly be spill-over effects, we also consider Region 3 and Regions 6

440   and 7 as *post-critical regions* respectively.

441   In order to make sure that participants paid attention to the content of the test

442   sentences, they were required, after reading each test sentence, to answer a true/false

443   comprehension question about the sentence that they had just read. Below each

444   comprehension question, there were two options on the screen, i.e. *dui* "true" and *bu dui*

445   "false", with one on the left-hand side and the other on the right-hand side. Participants

446   were instructed to press a designated key on the left half of the keyboard or a designated

447   key on the right half to answer the true/false comprehension question. For half of the

448   comprehension questions, the correct answers appeared on the left-hand side of the screen,

449   and for the other half, the correct answers on the right-hand side. Comprehension

450   questions eliciting true or false answers were evenly distributed across all test sentence

451   types. See the Appendix for comprehension questions for all test sentences, and the

452   correct answers.

453   All sentences were presented in Chinese characters, and efforts were made to ensure

454   that the number of characters in the same region across all the sentence types was the

455   same, particularly in the critical regions and post-critical regions.

456

457   **7.4 Grammaticality Judgment Task**

458   As successful processing of the BGT sentence is dependent upon the availability of the

459   relevant knowledge of the sentence structure, a grammaticality judgment task was

460   designed to help to identify participants who had acquired the knowledge of the BGT

461   sentence in Chinese and to exclude participants who lacked the relevant grammatical

462   knowledge. All participants did the grammaticality judgment task after they had done the

463   self-paced reading task, and this order was to try to minimize any possible effect of

464   participants' awareness of the focuses of the experiment on the processing of similar

465   structures in the self-paced reading task. Test sentences used in the grammaticality

466   judgment task were exactly the same as those 168 sentences used in the self-paced

467   reading task, except that irrelevant parts of the test sentences were deleted. That is, the

468   words like those in Regions 6-8 in test sentences presented in Table 2 were deleted and

469   the comma was replaced with a full stop. In the grammaticality judgment task, each

470   participant judged the 168 sentences in the same order as presented in the self-paced

471   reading task. Test sentences were presented on the screen one at a time, and participants

472   were instructed to judge whether the sentence was grammatically correct in Chinese or

473   not. Below each sentence, there were two options on the screen, i.e. *zhengque* "correct"

474   and *bu zhengque* "incorrect", with one on the left-hand side and the other on the right-

475   hand side. Participants were instructed to press a designated key on the left or right half

476   of the keyboard to judge the grammaticality of each sentence.

477

478   **7.5 Procedures**

479   In the self-paced reading task, the 24 sentences represented by the 4 types exemplified in

480   Table 2 were embedded in 144 sentences, which were used to examine other linguistic

481   phenomena in L2 Chinese. In the experiment, 3 counterbalanced presentation lists were

482   constructed out of these 168 sentences, and one third of the participants did the 3 lists in

483   the order to 1-2-3, one third in the order of 2-3-1 and one third in 3-1-2. The test

484   sentences in each list were pseudo-randomized and mixed with the fillers. It took

485   proximately 10 minutes for a participant to finish each list, and there was a break of

486   minimally 10 minutes and maximally 4 days between any two lists.[10]

487   The main paradigm used in the experiment was a segment-by-segment non-

488   cumulative self-paced moving windows task (c.f. Just, Carpenter, and Woolley, 1982), in

489   which the participant read each sentence on a computer screen one segment at a time.

490   Participants were aware that they were participating in a language experiment and that

491   they would be reading sentences presented on a computer screen segment by segment.

---

[10] The majority of participants had a break of 10 minutes, and only a few had to have a longer break of 1 to 4 days due to their other commitments.

23

492   They were asked to read each segment as carefully and quickly as they could, and they

493   were then prompted to answer a comprehension question when the last segment of the

494   sentence disappeared from the screen. They were told that their reading time of each

495   segment and their answer to the comprehension question would be recorded by the

496   computer and would be used for the study. Each sentence began with an asterisk on the

497   left edge of the screen, and participants were instructed to press the space bar on the key

498   board to obtain the first segment. They then pressed the space bar for the next segment,

499   which appeared to the right of the preceding segment after the preceding segment had

500   disappeared. They continued doing this until they saw a segment followed by a full stop,

501   which indicated the end of the sentence. When they pressed the space bar again at this

502   moment, a true/false comprehension question appeared on the screen, and they had to

503   press an appropriate key to indicate "true" or "false". The presentation of the sentences

504   and the collection of the data were done with DMDX presentation software (Forster and

505   Forster, 2003).

506   Participants were tested individually and the experiment was conducted in a quiet

507   room in various cities in the UK and China. Efforts were made to include only daily-life

508   vocabulary in the test sentences. A short list of relatively less common words was sent to

509   each participant a few days before the experiment, and each English-speaking participant

510   had to orally translate the words on the list into English at the very beginning of the

511   experiment. This was to ensure that participants had no problem understanding the words

512   used in the experiment, and none of the participants had problems with the vocabulary list.

513   The participant received both written and oral instructions on how to do the tasks, and the

514   self-paced reading task was preceded by 6 practice sentences to familiarize participants

515   with the procedure.

516   The self-paced reading task was followed by the grammaticality judgement task, and

517   after both the self-paced reading task and grammaticality judgment task were completed,

518   each participant also did a language background questionnaire for biographical

519   information and the cloze test.

520   As the availability of the relevant grammatical knowledge of Chinese BGT sentences

521   is a prerequisite for successful processing of BGT sentences in Chinese and incomplete

522   knowledge of the target language can affect processing behaviours, a rather stringent

523   criterion was used to identify participants who showed clear knowledge of the BGT

524   sentence in Chinese. That is, to be included in the study, a participant must correctly

525   judge at least 10 of the 12 grammatical sentences in Types A and D (83% accuracy) and

526   the same participant must correctly reject at least 10 of the 12 ungrammatical sentences in

527   Types B and C (83% accuracy). As a result of this screening procedure, 10 participants

528   from the learner group and 4 from the native Chinese group were excluded from the study,

529   as indicated in Table 1. The high percentages of the learner group and the native Chinese

530   group in correctly judging the grammatical and ungrammatical sentences, as shown in

531   Table 3, suggest that both groups had knowledge of the BGT sentence in Chinese.

532

533   **Table 3.** Percentage of each group in correctly judging the grammatical and
534   ungrammatical sentences in the grammaticality judgment task

	Grammatical	Ungrammatical
Learner group	93%	95%
Native Chinese group	93%	98%

535

536   **7.6 Results**

537 Recall that in the self-paced reading task, each test sentence was followed by a true/false

538 comprehension question to make sure that participants paid attention to the content of test

539 sentences. The native Chinese group's percentage in correctly answering the

540 comprehension questions related to the 4 types of sentences is 96.1%, and the learner

541 group's is 90.2%. This indicates that both the native Chinese speakers and L2 Chinese

542 learners were, in general, paying attention to the contents of test sentences in the self-

543 paced reading task. Test items for which comprehension questions were not answered

544 correctly were excluded from the reading time (RT) analyses.

545   Before analyzing the RT data, we also dealt with RT outliers. Any RT longer than

546 2000ms was eliminated, and any RT that was 2 standard deviations from the relevant cell

547 mean of the relevant participant was also eliminated. The percentage of data thus affected

548 was 5.3% in the native Chinese group and 9.8% in the learner group.[11]

549

550 *7.6.1 Native Chinese Speakers*

551 As we can see from the second column of Table 4 and Region 1 in Figure 1, native

552 Chinese speakers' mean RTs for the first region of all the 4 sentence types are similar and

553 no significant difference is found in a one-way ANOVA between any first region of the

554 four types of sentences, $F(3, 432) = 0.346$, $p=0.792$. This is unsurprising because

---

[11] A disproportionate number of outliers were found in the last region, i.e. Region 9, in both learner group's data and native Chinese group's data. These outliers are mainly RTs longer than 2000ms. This is likely to be due to the appearance of the full stop in the last region, which triggered participants to start to anticipate the comprehension question even before they were prompted. It could also be due to the increased number of characters in Region 9, i.e. 3 characters, or to the fact that this was the last region. If Region 9 is to be excluded, the total percentage of data thus affected would be 4.0% in the native Chinese group and 6.1% in the learner group.
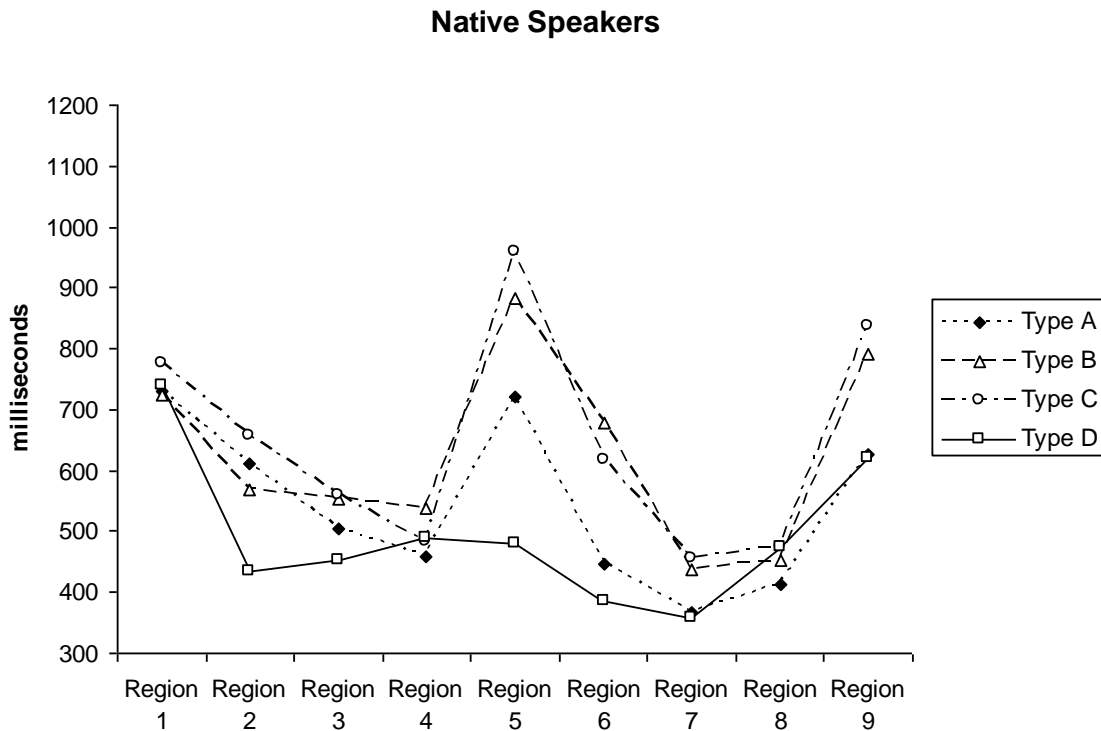
555 theoretically no reanalysis or restructuring is expected in Region 1 of any of the 4

556 sentence types.

557

558 **Table 4.** Native Chinese group's mean reading times (in milliseconds) and standard
559 deviations (in parentheses) for each of the regions of the 4 types of test sentences

Types	Regions								
	1	2	3	4	5	6	7	8	9
A. BGT sentence	729	612	504	459	722	446	368	412	625
with S-H	(409)	(334)	(322)	(206)	(431)	(206)	(200)	(246)	(320)
B.*BGT sentence	723	570	555	537	884	681	437	453	792
with H-S	(355)	(358)	(316)	(307)	(461)	(496)	(271)	(210)	(458)
C. *BGT sentence	777	657	561	484	960	616	456	474	838
with sisterhood	(539)	(455)	(317)	(192)	(420)	(385)	(396)	(284)	(595)
D. Non-BGT	739	433	453	491	480	385	357	474	621
sentence	(368)	(235)	(276)	(228)	(221)	(187)	(201)	(244)	(242)

560

Figure 1. Native speakers' mean reading times for the regions in the 4 sentence types

563

564   However, significant differences are found in Region 2 in native Chinese speakers' RTs,

565    $F(3, 430) = 8.121$, $p < 0.001$, in spite of the fact that Region 2 of all the four types of

566   sentences includes the same word, i.e. the first-person pronoun *wo* "I" (see Table 2).

567   Post-hoc Scheffé tests indicate that native Chinese speakers' RTs for Region 2 of Type C

568   sentences are significantly longer than their RTs of the same region of Type D sentences.

569   This is believed to be due to the fact that restructuring takes place in Region 2 of Type C

570   sentences, where Region 1, which was originally processed and stored in working

571   memory as a subject of the sentence, is revised and re-assigned to the topic position and

572   Region 2 is then analyzed as the subject of the sentence. This restructuring results in

573   longer RTs when native speakers read Region 2 of Type C sentences. The restructuring

574   does not take place in Region 2 of Type D sentences because Region 1, i.e. *yiqian*

575   "before", was processed and is stored as an adverbial of time, and when Region 2, *wo* "I",

576   in Type D sentences is processed, it is stored in working memory as the subject of the

577   sentence, without triggering any restructuring, and therefore it takes shorter RTs than

578   Region 2 in Type C sentences. As the possible restructuring may not necessarily take

579   place immediately after a relevant region is processed, we decide to combine Region 2,

580   i.e. *wo* "I", and Region 3, i.e. *zui* "most", to see whether there is any spill-over effect (cf.

581   Pearlmutter, Garnsey, and Bock, 1999; Sharkey and Sharkey, 1987; Warren and Gibson,

582   2002; Jiang 2013) of the restructuring. A one-way ANOVA indicates that there is a

583   significant difference in native speakers' RTs of Regions 2 and 3 combined, $F(3, 423)$

584    $= 9.405$, $p < 0.001$, and post-hoc Scheffé tests suggest that native speakers' RTs of the two

585   regions in Types A, B and C are significantly longer than their RTs of the two regions in

586   Type D sentences. This confirms our analysis above. That is, restructuring takes place

587   when Region 2 of Type C sentences is processed and this results in longer RTs. In

588   addition, our data show that the effect of the restructuring is spilled over to Region 3 of

589   Types A, B and C sentences. No restructuring is necessary in Region 2 of Type D

590   sentences and as a result, it leads to shorter RTs.

591   No significant difference is found in native Chinese speakers' RTs for Region 4 of the

592   four types of sentences, $F(3, 437) = 2.139$, $p=0.095$. This is expected because the verbs

593   like *ai chi* "like to eat" in Region 4 have the same function across all the four types of

594   sentences, and therefore result in similar RTs. However, significant differences are found

595   in native Chinese speakers' RTs for Region 5 of the four types of sentences, $F(3, 396)$

596   $=30.784$, $p<0.001$. Post-hoc Scheffé tests reveal that native Chinese speakers' RTs for

597   Region 5 in Types B and C are significantly longer than that in Type A, which is also

598   found to be significantly longer than that in Type D. The shortest RT of Region 5 in Type

599   D is believed to be due to the fact that Region 5, i.e. *xiangjiao* "banana", is the object of

600   the verbal phrase in Region 4 *ai chi* "like to eat" and no restructuring is needed here.

601   However, processing sentences of Types A, B and C is different. Recall that a topic is

602   stored in working memory after Regions 1, 2 and probably also 3 of Types A, B and C

603   sentences are processed, and also recall that a topic in Chinese can be base-generated in

604   the sentence initial position or derived from topicalization of a constituent from inside the

605   sentence. In the latter case, the parser will look for a gap in the sentence where the topic

606   is originally derived, as predicted by the Filler-Driven Strategy (cf. Frazier and Clifton,

607   1989). After the verbs in Region 4 are processed, the parser is likely to expect a gap in

608   the object position in Region 5. However, the encounter of *xiangjiao* "banana" in Region

609   5 in Types A, B and C forces the parser to revise its previous analysis and re-analyse the

610 topic in working memory as a base-generated topic rather than a topic derived from

611 inside the sentence. This re-analysis is costly and increases the RTs of Region 5 in Types

612 A, B and C.

613   Chinese BGT sentences are subject to semantic constraints, and one of the constraints

614 is that the base-generated topic and its related NP in the sentence are required to have a

615 hyponymy relationship. However, the topic in Region 1 and the NP in Region 5 in Types

616 B and C violate such a requirement, with the topic being a hyponym of the NP in Region

617 5 in Type B, and the topic in Type C having a sisterhood relationship with the NP in

618 Region 5. The longer RTs of Region 5 in Types B and C are considered to represent

619 native Chinese speakers' sensitivity to the violation of the required semantic relationship

620 involved in Chinese BGT sentences. Obviously, detecting such a semantic violation will

621 further prolong the RTs of Region 5 in Types B and C, which are found to be

622 significantly longer than the RT of the same region in Type A, where the topic in Region

623 1 is a superordinate of the NP in Region 5, meeting the requirement of the semantic

624 relationship for Chinese BGT sentences. To check the spill-over effects, the RTs in

625 Region 5 and 6 are combined, and then those in Regions 5, 6 and 7 are also combined.

626 The data in the two combinations reveal that the effects of re-analyzing the topic in

627 working memory as a base-generated topic rather than a topic derived from inside the

628 sentence and detecting the violation of the required semantic relationship between the

629 base-generated topic and the relevant NP in the sentence are spilled over, not only to

630 Region 6 but also to Region 7; native Chinese speakers' RTs of the combination of

631 Regions 5 and 6 and their RTs of the combination of Regions 5, 6 and 7 for Types B and

632 C are significantly longer than that in Type A, which in turn is significantly longer than

633 that in Type D. No significant difference is found in native Chinese speakers' RTs

634 between Types B and C with regard to Region 5, or the combination of Regions 5 and 6,

635 or the combination of Regions 5, 6 and 7.

636 There is no significant difference in native Chinese speakers' RTs of Region 8 ($F(3,$

637 $447) =1.590$, $p=0191$) and Region 9 ($F(3, 410) =0.706$, $p=0.549$) between any of the four

638 sentence types.

639

640 *7.6.2 L2 Chinese Learner Group*

641 Table 5 and Figure 2 provide the learner group's mean RTs for each of the regions of the

642 four types of test sentences. As we can see from the second column of Table 5 and

643 Region 1 in Figure 2, the learner group's mean RTs for the first regions of all the 4

644 sentence types are similar, and no significant difference is found in a one-way ANOVA

645 between any of the first regions of the four types of sentences, $F(3, 730) =0.214$, $p=0.887$.

646 This is expected because no restructuring is predicted in our theoretical analysis of

647 Region 1 in any of the 4 sentence types.

648 In Region 2, however, significant differences are found ($F(3, 635) =11.229$, $p<0.001$),

649 and post-hoc Scheffé tests reveal that the learner group's RTs of Region 2 in Types B and

650 C are significantly longer than their RTs in Type D. This is in spite of the fact that the

651 second regions across all sentence types are the same word, i.e. the first-person pronoun

652 *wo* "I". The learner group's longer RTs of Region 2 in Types B and C are believed to be

653 due to some restructuring that takes places at this point, which is similar to what occurs in

654 native Chinese speakers' processing of Region 2. That is, unlike Region 1 in Type D,

655 which is an adverbial of time, the first regions in Types B and C are initially processed as

656   the subject of the sentence. When the first-person pronoun *wo* "I" is processed in Region

657   2 in Types B and C, the parser has to restructure its initial analysis, re-analyze Region 1

658   and store it as a topic rather than a subject in working memory. In the restructuring and

659   re-analysis, the subject position is vacated and this makes it possible for the first-person

660   pronoun *wo* "I" in Region 2 to be assigned to it. There is no significant difference in the

661   learner group's RTs between Region 2 in Type A and the same region in Type D, and the

662   restructuring and re-analysis scenario above apparently does not work for Region 2 in

663   Type A although the first four regions in Types A, B and C share the same grammatical

664   structure. However, we cannot rule out the possibility that the restructuring and re-

665   analysis may be slightly delayed. With this in mind, we calculate the data for Regions 2

666   and 3 combined across all the four sentence types. A one-way ANOVA reveals that the

667   learner group has significantly different RTs of Regions 2 and 3 combined between the

668   four sentence types, $F(3, 787) = 9.948$, $p < 0.001$, and post-hoc Scheffé tests indicate that

669   learners' RTs of the combination of Regions 2 and 3 in Types A, B and C are

670   significantly longer than their RTs of the same regions in Type D, which suggests that the

671   restructuring and re-analysis take place when they process Regions 2 and 3 in Types A, B

672   and C, but not in Type D. This finding is similar to what we have found in native Chinese

673   speakers' processing of Regions 2 and 3 of the four sentence types.[12]

674

675   **Table 5.** Learner group's mean reading times (in milliseconds) and standard deviations
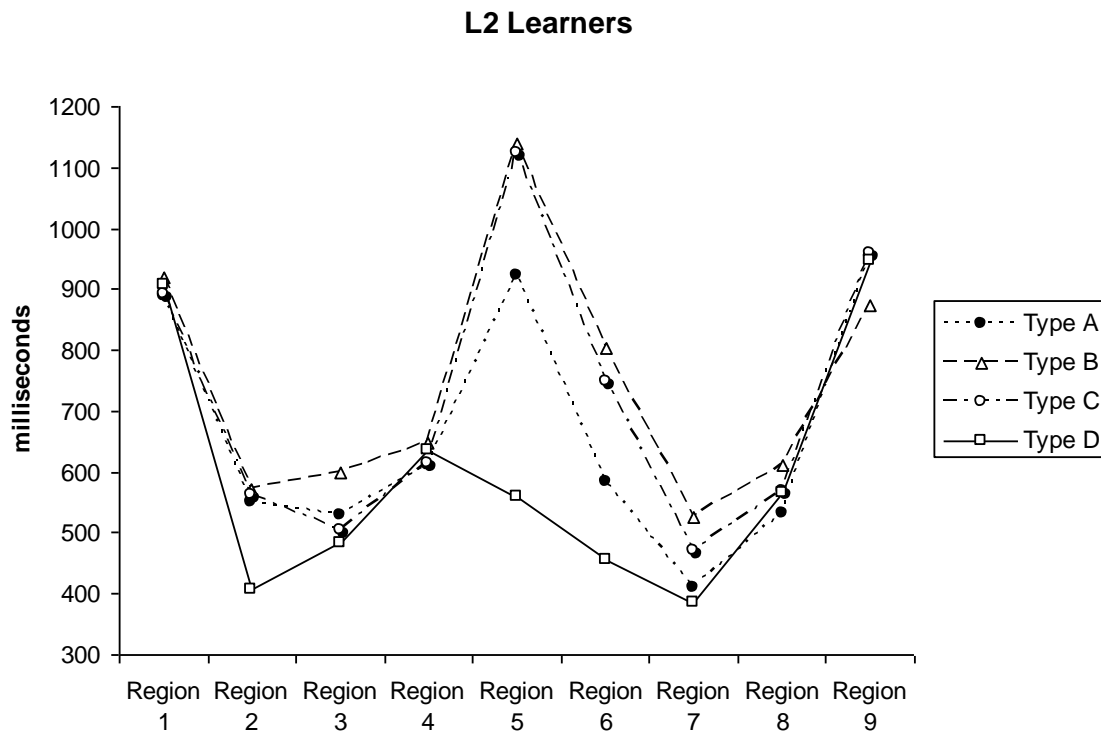676   (in parentheses) for each of the regions of the 4 types of test sentences

---

[12] The longer RTs in L2 learners' and native Chinese speakers' processing of Regions 2 and 3 of Types A,

B and C sentences could also be due to the ambiguity of *wo* in Region 2 as a subject pronoun, or a

possessive pronoun, or a (topicalized) object pronoun (see Note 8 above). This would provide further

evidence that L2 learners are sensitive to syntactic cues and structure-based information.

Types	Regions								
	1	2	3	4	5	6	7	8	9
A. BGT sentence with S-H	889	552	529	610	922	583	411	532	954
	(395)	(344)	(299)	(315)	(398)	(312)	(198)	(334)	(479)
B.*BGT sentence with H-S	918	572	600	647	1139	804	527	611	874
	(402)	(340)	(362)	(264)	(480)	(442)	(355)	(378)	(582)
C. *BGT sentence with sisterhood	893	562	504	614	1125	749	472	568	959
	(353)	(307)	(232)	(264)	(556)	(405)	(316)	(319)	(496)
D. Non-BGT sentence	906	405	483	636	558	454	387	564	947
	(371)	(314)	(425)	(264)	(269)	(331)	(234)	(244)	(682)

677

Figure 2. L2 learners' mean reading times for the regions in the 4 sentence types

680

The learner group's RTs for Region 4 of the four sentence types show no significant difference, $F(3, 779) = 0.782$, $p=0.504$, and this is, to a large extent, expected as verbs in this region like *ai chi* "love to eat" have the same functions in all the test sentences and therefore, similar RTs of Region 4 are expected across all sentence types. However, the learner group's RTs of Region 5 are found significantly different between each of the

33

686　sentence types, $F(3, 639)=70.942$, $p<0.001$. Post-hoc Scheffé tests reveal that the learner

687　group's RTs of Region 5 are significantly different between each sentence type, except

688　for between Types B and C. The learner group's RTs of Region 5 in Types B and C are

689　significantly longer than the same region in Type A, which in turn is significantly longer

690　than that in Type D. It seems that our analysis of native Chinese speakers' data of Region

691　5 can also be used to account for the variation in the learner group's processing of the

692　same region in different types of sentences. That is, processing Region 5 in Type D

693　requires no restructuring or re-analysis, but restructuring and re-analysis have to take

694　place when learners process the same region in Types A, B and C, with more complicated

695　processing in Types B and C. Recall that when Regions 2 and 3 in Types A, B and C are

696　processed, the first-person pronoun *wo* "I" in Region 2 will trigger the re-analysis of

697　Region 1 as a topic rather than the subject of the sentence, as initially analyzed, and this

698　topic will be stored in working memory. As a topic in Chinese can be base-generated or

699　derived from topicalization of a constituent from inside the sentence, the parser, while

700　processing the rest of the sentence, is likely to look for a gap from which the topic in

701　working memory is originally derived, a similar strategy as we described for native

702　Chinese speakers above. When the transitive verbal phrase *ai chi* "love to eat" in Region

703　4 is processed, it could be taken by the parser as the subcategorizer of the topic, and if

704　this occurs, the parser would expect a gap in Region 5. The parser is forced to revise its

705　earlier analysis when the NP in Region 5, e.g. *xiangjiao* "banana", is processed, re-

706　analyzing the topic in working memory as a base-generated topic rather than a topic

707　derived from inside the sentence. The restructuring and re-analysis obviously lengthen

708　the RTs of Region 5 in Types A, B and C. What makes the learner group's RTs of Region

709   5 in Types B and C even longer is believed to be due to the learner group's native-like

710   sensitivity to the violation of the hyponymy relationship required in the Chinese BGT

711   sentence. In Type B sentences, the topic is the hyponym of the NP in Region 5, and in

712   Type C sentences, the topic has a sisterhood relationship with the NP in Region 5. Both

713   of these two sentences violate the constraint that the base-generated topic should be the

714   superordinate of the relevant NP in the Chinese BGT sentence. The learner group's

715   longer RTs of Region 5 in Types B and C reflect their detection of the violation of the

716   semantic requirement in these two types of sentences, in addition to the re-analysis of the

717   topic in the working memory as a base-generated topic rather than a topic derived from

718   inside the sentence. The re-analysis and the checking of the semantic requirement

719   obviously do not apply to Type D sentences, which do not have a topic, thus the learner

720   group's shortest RTs of Region 5 in Type D. Our data also show that the effects of the

721   learner group's re-analysis and their sensitivity to the semantic violations have spilled

722   over to Regions 6 and 7; in both the combination of Regions 5 and 6 ($F(3, 686) = 91.748$,

723    $p<0.001$), and the combination of Regions 5, 6 and 7 ($F(3, 686) = 88.395$, $p<0.001$), the

724   learner groups' RTs in Types B and C are significantly longer than their RTs in Type A,

725   which are in turn significantly longer than their RTs in Type D.

726   No significant difference is found in the learner group's RTs of Region 8 ($F(3, 788)$

727    $=1.969$, $p=0.117$) or Region 9 ($F(3, 604)=0.681$, $p=0.564$) between any of the four

728   sentence types. On average, the RTs of Region 9 are longer than the RTs of many other

729   regions, and this is probably due to what is called the sentence *wrap-up* effect in sentence

730   processing (Just and Carpenter 1980).

731

8. Discussion

The data in our grammaticality judgment task show that English-speaking learners of L2 Chinese can acquire the explicit knowledge of Chinese BGT sentences as they are able to accept grammatical BGT sentences and reject those violating the semantic constraint of the hyponymy relationship. This is in conformity with the findings reported in the literature (Jin, 1994; AUTHOR, 1995; Jung, 2004; Cao, Yang, Huang, Gao, and Cui, 2006) that speakers of a subject-prominent language like English are able to acquire the knowledge of the BGT structure in their L2 acquisition of a topic-prominent language. There is plenty of positive evidence of BGT sentences in their L2 input, which is likely to enable L2 learners to be aware of the existence of BGT sentences in the target language.

We have seen in Tables 4 and 5 as well as Figures 1-2 that native speakers' RTs of test sentences are, in general, faster than those of L2 Chinese learners. This is expected as native speakers are fast and efficient in sentence processing while L2 learners lack automaticity in L2 processing (cf. Segalowitz, 2003; Dekydtspotter and Miller, 2013). In this sense, native speakers and L2 learners are expected to be different when automaticity in sentence processing is considered. What is more, the orthographic difference between English, which uses a romanization spelling system, and Chinese, which adopts a character script system, is likely to make English speakers' processing of Chinese sentences even slower and less automatic than native Chinese speakers'.

Although L2 learners are found to be generally slower than native Chinese speakers in processing test sentences, they pattern with native Chinese speakers in processing all critical regions and post-critical regions of the test sentences. Recall that unlike English, which is a subject prominent language, Chinese is a topic-prominent language and allows

36

755   a topic to appear at the sentence initial position preceding a subject NP. At the same time,

756   it is common for Chinese sentences to have just one preverbal NP, as exemplified by

757   *niurou* "beef" in (8), which can be analyzed as the subject of the sentence[13].

758

759   (8) *Niurou zai zheli feichang gui.*

760   beef   at   here   very expensive

761   Beef is very expensive here.

762

763   How does the parser deal with input that is compatible with more than one grammatical

764   analysis? When the first NP of a BGT sentence is processed, there is no information

765   available that the parser can refer to in processing it as the topic or the subject of the

766   sentence. If the processing default of the parser is to analyze the first NP as the topic of

767   the sentence, no reanalysis of the BGT sentence is necessary when the second NP is

768   processed as the subject of the sentence. However, if the default is for the parser to

769   process the first NP as the subject of the sentence, syntactic reanalysis will have to take

770   place when the second NP in the BGT sentence is processed. That is, the first NP, which

771   was originally analyzed as the subject of the sentence, has to vacate the subject position,

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[13] It is also possible to assume that the single NP in the preverbal position in Chinese sentences like (8) is the topic of the sentence with an empty subject, as in (i), or the subject of the sentence with an empty topic, as show in (ii). Interpretations of this type of sentences depend on appropriate contexts, and we will not go into these details, as what was included in our experiment was individual sentences without contexts.

       (i) Niurou (zhe zhong dongxi) zai zheli feichang gui.

         beef   this type thing   at here   very expensive

        "Beef (*this kind of thing) is very expensive here."

       (ii) (chide dongxi) niurou zai zheli feichang gui.

         edible thing   beef   at here very   expensive.

        "(*Food) beef is very expensive here.

772 be processed as the topic and be assigned to the topic position. The subject position thus

773 vacated is then filled with the second NP. The parser will obviously have to make efforts

774 to do the syntactic reanalyses and restructuring, and as a result, it takes longer RTs for the

775 parser to process the second NP, and possibly the following region as well because of the

776 spill-over effect. This is what the native Chinese speakers' and L2 Chinese learners' data

777 of Regions 2 and 3 in Types A, B and C sentences have suggested, which form a striking

778 contrast with their data of the same regions of Type D sentences, where the NP following

779 the adverbial of time is analyzed by the parser as the subject of the sentence and no

780 reanalysis or restructuring is required afterwards. Consequently, it takes shorter RTs for

781 the parser to process Regions 2 and 3 of Type D sentences than the same regions of

782 Types A, B and C sentences. The data also implicate that for both native Chinese

783 speakers and English-speaking learners of L2 Chinese, the processing default of Chinese

784 BGT sentences is to initially analyze the first NP as the subject of the sentence, rather

785 than as a topic. While it is not clear whether L2 Chinese learners' initial decision of

786 processing the first NP in Types A, B and C sentences as the subject of the sentence is

787 due to the transfer of the subject-prominence of their L1 English into their L2 sentence

788 processing, it seems possible to account for the default in both native Chinese speakers'

789 and L2 Chinese learners' initial analysis of the first NP as the subject on the basis of the

790 "least effort" principle by Frazier (1978, 1987). That is, the parser prefers the structurally

791 simplest analysis. Obviously, the S-V-O structure is simpler than the Topic-S-V-O

792 structure, which has a Topic in addition to the S-V-O structure.

793   Recall that Clahsen and Felser (2006a, b) argue in their SSH that adult L2 learners are

794 guided by lexical-semantic cues in their sentence processing in the same way as native

795   speakers, but L2 learners' sensitivity to syntactic information is restricted and therefore

796   their syntactic representations in sentence processing are shallower than those of native

797   speakers. According to the SSH, unlike native speakers, L2 learners do not rely on

798   structure-based processing strategies when solving ambiguities in L2 sentence processing,

799   and instead, they process L2 sentences primarily on the basis of lexical-semantic and

800   pragmatic information. However, the SSH is not supported by our data here. As we

801   discussed above, L2 Chinese learners, like native Chinese speakers, are sensitive to

802   syntactic cues in solving ambiguities in processing Chinese BGT sentences. Obviously,

803   there are no semantic or pragmatic cues in the reanalyses of the first two NPs of the BGT

804   sentences, and the disambiguation has to be solved by structure-based strategies. Our data

805   clearly demonstrate that L2 Chinese learners, like native Chinese speakers, are sensitive

806   to syntactic information in dealing with ambiguities in processing BGT sentences.

807   The majority of studies in L2 sentence processing literature use filler-gap

808   dependencies in either English relative clauses (e.g. Juffs, 1998; Papadopoulou and

809   Clahsen, 2003; Marinis, Roberts, Felser and Clashen, 2005; Felser and Roberts, 2007;

810   Dinçtopal-Deniz, 2010; Omaki and Schulz, 2011) or English wh-questions (e.g. William,

811   Möbius and Kim, 2001; William, 2006; Dussias and Piñar, 2010; Aldwayan, Fiorentino

812   and Gabriele, 2010) in their investigations of L2 sentence processing, where the fronted

813   wh-word is identified as a potential filler because of the morphological marking of -wh

814   on the wh-word, and there is a gap which can potentially trigger trace-based antecedent

815   reactivation in processing because of the subcategorization requirement. However, the

816   topic in Chinese BGT sentences is syntactically identified, and there is no gap in the

817   sentence. An interesting question is whether the syntactically identified topic will be

818   processed by the parser as a potential filler or a structurally displaced constituent, in spite

819   of the fact that there is no gap in the BGT sentence and that all subcategorization

820   requirements in the sentence are met. That is, Types A, B and C sentences in Table 2

821   would be complete and grammatical sentences, even with the topic deleted. Our data

822   suggest that the syntactically identified topic in Chinese BGT sentences is indeed stored

823   as a potential filler or a structurally displaced constituent in working memory in both

824   native Chinese speakers' and L2 Chinese learners' processing, and that the transitive

825   verbal phrase *ai chi* "love to eat" in Region 4 is initially processed by both native Chinese

826   speakers and L2 Chinese learners as the subcategorizer of the topic. More specifically,

827   the parser seems to postulate a gap in working memory and immediately analyze the

828   topic as the object of the verbal phrase as soon as the verbal phrase is processed, i.e.

829   before the object of the verbal phrase in Region 5 is processed. This can be accounted for

830   by a processing principle that requires the parser to complete grammatical dependencies

831   as soon as possible (de Vincenzi, 1991; Frazier, 1987; Pritchett, 1992) or on the basis of

832   the need to reduce the cost of retaining the filler in memory (Gibson, 1998). When the

833   object (i.e. Region 5) of the verbal phrase *ai chi* "love to eat" in Types A, B and C is

834   processed, the parser is forced to revise its earlier analysis and re-analyze the topic in

835   working memory as a base-generated topic rather than a topic derived from inside the

836   sentence. The revision and re-analysis obviously require extra efforts, which explains the

837   longer RTs of native Chinese speakers' and L2 Chinese learners' processing of Region 5

838   (and also Regions 6 and 7 because of the spill-over effect) in Types A, B and C sentences

839   than their RTs of the same regions in Type D sentences, where no topic is stored in

840   working memory. Recall that while there are BGT sentences in Chinese, it is also

841 common in Chinese to have topic structures in which the topic is a result of movement, as

842 exemplified in the sentence in (2), repeated in (9), where the topic *Zhe ben shu* "this

843 book" is originally based-generated as the object of the verb *xihuan* "like" in the sentence

844 before it is topicalized to the Specifier of TopP at the initial position of the sentence.

845

846 (9)   *Zhe ben shu$_i$ wo bu xihuan t_i.*

847   this CL book I not like

848   This book, I don't like.

849

850 Positive evidence like the sentence in (9) is likely to set a default in both native Chinese

851 speakers' and L2 Chinese learners' processing, treating the syntactically identified topic

852 as a topic derived from inside the sentence and store it as such in working memory until

853 contradicting information is processed, as in the case of Region 5 in Types A, B and C

854 sentences. Note that unlike the filler-gap dependencies in processing English relative

855 clauses or English wh-questions, which can be morphologically and semantically

856 triggered in a bottom-up fashion, processing the Chinese topic by both native Chinese

857 speakers and L2 Chinese learners as a potential filler is syntactically induced in a top-

858 down manner, and no semantic, morphological or pragmatic cues are available that the

859 parser could rely on in processing the topic as a potential filler and store it as such in

860 working memory. This top-down structure-based processing strategy provides further

861 counter-evidence against the SSH because our data demonstrate that both native Chinese

862 speakers and L2 Chinese learners are similarly sensitive to syntactic information in

863 processing Chinese BGT sentences.

864   There is strong evidence in the literature that L2 proficiency is an important factor for

865   L2 syntactic processing (Frenck-Mestre, 2002; Hahne, 2001; Hopp, 2006; Jackson, 2008).

866   Given that L2 learners in our study were all very proficient L2 speakers of Chinese, it is

867   highly likely that L2 learners' native-like sentence processing is positively co-related

868   with their proficiency of the target language, as proposed by Mendés, Farmer and

869   Slabakova (2014). In addition, L2 learners in our study had an average stay of 6.3 years

870   in China/Taiwan, as shown in Table 1, and in accordance with the suggestions by Frenck-

871   Mestre (2002), more than five years of exposure to the target language can lead to the use

872   of native-like processing strategies by L2 learners. This helps to account for English

873   speakers' native-like structure-based processing of Chinese BGT sentences. The extended

874   periods of immersion in naturalist Chinese environments are expected to play a

875   facilitating and crucial role in L2 learners' ability to process Chinese BGT sentences in a

876   native-like manner. Our findings here are also in conformity with the finding in Pliatsikas

877   and Marinis (2013), where Greek-speaking L2 learners of English with an average of 9

878   years of immersion in English environments are found to be able to have native-like

879   processing of intermediate traces in long distance wh-dependencies in English. This

880   suggests that differences in populations do indeed play a role in assessing L2 processing,

881   as pointed out by VanPatten and Jegerski (2010). BGT sentences are not allowed in

882   English, but English-speaking L2 Chinese learners' structure-based processing of

883   Chinese BGT sentences provides us supporting evidence that native-like L2 processing is

884   achievable, even for L2 features that do not have equivalents in the L1 (Foucart and

885   Frenck-Mestre, 2012).

886   Recall that the SSH predicts that L2 learners, like native speakers, are able to make

887   use of semantic and pragmatic information available in sentence processing, and this part

888   of the SSH is confirmed by data in our study. Chinese BGT sentences are subject to

889   semantic constraints, one of which is that the base-generated topic and its related NP in

890   the sentence are to have a hyponymy relationship. However, the topic in Region 1 and the

891   NP in Region 5 in Types B and C sentences violate such a requirement, with the topic

892   being a hyponym of the NP in Region 5 in Type B, and the topic in Type C having a

893   sisterhood relationship with the NP in Region 5. The longer RTs of Region 5 in native

894   Chinese speakers' and L2 Chinese learners' processing of Types B and C sentences are

895   believed to reflect their sensitivity to the violation of the required semantic relationship

896   involved in Chinese BGT sentences, as detecting such a semantic relationship violation

897   will, obviously, further prolong the RTs of Region 5 in Types B and C, which are found

898   to be significantly longer than the RT of the same region in Type A, where the topic in

899   Region 1 is a superordinate of the NP in Region 5, meeting the requirement of the

900   semantic relationship for Chinese BGT sentences. This implicates that the semantic

901   information of the hyponymy relationship is stored together with the syntactically

902   identified topic in working memory and can be made use of in both native Chinese

903   speakers' and L2 Chinese learners' sentence processing to check against the

904   corresponding semantic information on the relevant NP in the sentence.

905

906   **9. Conclusion**

907   No evidence is found in our study which shows that L2 structures are shallow in sentence

908   processing, disconfirming the prediction by the SSH. Data in our study demonstrate that

909 like native speakers, L2 learners are sensitive to and are able to make use of syntactic

910 cues as well as semantic information in their L2 sentence processing. As participants in

911 this study were highly proficient L2 learners of Chinese with long periods of immersion

912 in Chinese-speaking environments, we cannot rule out the possibility that L2 learners at

913 earlier stages or with only classroom exposure are not able to rely on syntactic cues in

914 their L2 sentence processing. However, our data do suggest that native-like structure-

915 based processing of L2 Chinese BGT sentences is possible, at least for highly proficient

916 L2 Chinese learners with extended periods of immersion in naturalistic Chinese

917 environments.

918

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1056   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

1057

1058   **APPENDIX:** Experimental stimuli (Only Chinese characters were used in the

1059   experiment. Pinyin, English gloss and English translation are provided here for readers of

1060   this article. Comprehension questions are in parentheses; √=true, ×=false)

1061

1062   *Type A. BGT sentences with a superordinate NP as the base-generated topic*

1063

1064   水果我最爱吃香蕉，所以我经常买香蕉。（"我"喜欢水果。√）

1065   *shuiguo wo zui ai   chi xiangjiao, suoyi wo jingchang mai xiangjiao ("wo" xihuan shuiguo. √)*

1066   fruit   I most like eat bananas, so   I   often   buy bananas ("I"   like   fruit √)

1067   "As for fruits, I like to eat bananas most. Therefore I often buy bananas. ("I" like fruits. √)"

1068

1069   动物我最喜欢小狗，所以我有两只小狗。（"我"家里没有动物。×）

1070 *dongwu wo zui xihuan xiao gou, suoyi wo you liangzhi xiao gou. ("wo" jiali   mei you dongwu. ×)*

1071 animal   I most like   little dog, so   I   have two   little dog. ("my" home not have animal. ×)

1072 "As for animals, I like little dogs most. Therefore I have two little dogs. ("I" have no animal at home. ×) "

1073

1074 外语他只会说法语，所以他常常去法国。（他常常去国外。√）

1075 *waiyu ta zhi hui shuo Fayu, suoyi ta changchang qu Faguo. (ta changchang qu guowai√)*

1076 foreign language he only can speak French, so he often go to France (he often go abroad√)

1077 "As for foreign languages, he can only speak French. Therefore he often goes to France. (He often goes

1078 abroad. √)"

1079

1080 中国她只去过上海，可是她没去过别的城市。（她去过北京。×）

1081 *Zhongguo ta zhi qu guo Shanghai, but ta mei qu guo biede chengshi. (ta qu guo Beijing. ×)*

1082 China she only go EXP Shanghai, but she not go EXP other city. (She go EXP Beijing. ×)

1083 As for China, she has only been to Shanghai, but she has not been to other cities. (She has been to Beijing.

1084 ×)

1085

1086 海鲜我最爱吃大虾，所以我常常买大虾。（"我"经常吃海鲜。√）

1087 *haixian wo zui ai   chi daxia, suoyi wo changchang mai daxia. ("wo" jingchang chi haixian. √)*

1088 seafood I most like eat prawn, so   I   often   buy prawn. ("I"   often   eat seafood. √)

1089 "As for seafood, I like to eat prawns most. Therefore I often buy prawns. ("I" often eat seafood. √)"

1090

1091 体育他最喜欢足球，所以他经常踢足球。（他讨厌体育。×）

1092 *tiyu   ta zui xihuan zuqiu, suoyi ta jingchang ti   zuqiu. (ta taoyan tiyu. ×)*

1093 sport he most like football, so   he often   play football. (he hate sport. ×)

1094 "As for sports, he likes football most. Therefore he often plays football. (He hates sports. ×)"

1095

1096 **Type B. *BGT sentences with a hyponym NP as the base-generated topic**

1097

1098   *香蕉我最爱吃水果，所以我经常买水果。（"我"讨厌水果。×）

1099   *xiangjiao wo zui ai chi shuiguo, suoyi wo jingchang mai shuiguo. ("wo" taoyan shuiguo. ×)*

1100   banana I most like eat fruit, so I often buy fruit. ("I" hate fruit. ×)

1101   *"As for bananas, I like to eat fruits most. Therefore I often buy fruits. ("I" hate fruits. ×)"

1102

1103   *小狗我最喜欢动物，所以我有两只小动物。（"我"害怕动物。×）

1104   *xiao gou wo zui xihuan dongwu, suoyi wo you liangzhi xiao dongwu. ("wo" haipa dongwu.)*

1105   little dog I most like animal, so I have two small animal. ("I" am afraid of animal.)

1106   *"As for little dogs, I like animals most. Therefore, I have two small animals. ("I" am afraid of animals.)

1107

1108   *法语他只会说外语，所以他外语很好。（他学过外语。√）

1109   *Fayu ta zhi hui shuo waiyu, suoyi ta waiyu hen hao. (ta xue guo waiyu. √)*

1110   French he only can speak foreign language, so he foreign language very good. (he study EXP foreign

1111   language. √)

1112   *"As for French, he can only speak foreign languages. Therefore his foreign languages are very good. (He

1113   has studied foreign language before.√)

1114

1115   *上海她只去过中国，可是她没去过别的国家。（她去过法国。×）

1116   *Shanghai ta zhi qu guo Zhongguo, keshi ta mei qu guo biede guojia. (ta qu guo Faguo. ×)*

1117   Shanghai she only go EXP China, but she not go EXP other country. (she go EXP France. ×)

1118   *"As for Shanghai, she has only been to China, but she has not been to any other country. (She has been to

1119   France. ×)"

1120

1121   *大虾我最爱吃海鲜，所以我常常买海鲜。（"我"吃过海鲜。√）

1122   *daxia wo zui ai chi haixian, suoyi wo changchang mai haixian. ("wo" chi guo haixian. √)*

1123   prawns I most like eat seafood, so I often buy seafood. ("I" eat EXP seafood. √)

1124   *"As for prawns, I like to eat seafood most. Therefore I often buy seafood. ("I" have eaten seafood before.

1125   √)"

1126

1127　*足球他最喜欢体育，所以他经常做体育活动。（他喜欢运动。√）

1128　*zuqiu　ta zui xihuan tiyu, suoyi ta jingchang zuo tiyu huodong. (ta xihuan yundong.)*

1129　football he most like sports, so　he often　　do sport exercises. (he likes exercise.)

1130　*"As for football, he likes sports most. Therefore he often does sport exercises. (He likes exercises.)"

1131

1132　***Type C. *BGT sentences with a sisterhood relationship***

1133

1134　*苹果我最爱吃香蕉，所以我经常买香蕉。（"我"不常常买水果。×）

1135　*pingguo wo zui ai chi xiangjiao, suoyi wo jingchang mai xiangjiao.("wo" bu changchang mai shuiguo.×)*

1136　apple　I most like eat banana,　so　I　often　buy banana. ("I"　not often　　buy fruit. ×)

1137　*"As for applies, I like to eat bananas most. Therefore I often buy bananas. ("I" do not often buy fruits. ×)"

1138

1139　*小猫我最喜欢小狗，所以我有两只小狗。（"我"家里有动物。√）

1140　*xiao mao wo zui xihuan xiao gou, suoyi wo you liangzhi xiao gou. ("wo" jiali you dongwu. √)*

1141　little cat　I most like little dog, so I have two little dog. ("my" home have animal. √)

1142　*"As for little cats, I like little dogs most. Therefore I have two little dogs. ("I" have animals at home. √)"

1143

1144　*日语他只会说法语，所以他常常去法国。（他很少去外国。×）

1145　*Riyu ta zhi hui shuo Fayu, suoyi ta changchang qu Faguo. (ta hen shao qu waiguo. ×)*

1146　Japanese he only can speak French, so he often go France. (he rarely go abroad. ×)

1147　*"As for Japanese, he can only speak French. Therefore he often goes to France. (He rarely goes abroad.×)"

1148

1149　*北京她只去过上海，可是她没去过别的城市。（她去过中国。√）

1150　*Beijing ta zhi qu guo Shanghai, keshi ta mei qu guo biede chengshi. (ta qu guo Zhongguo. √)*

1151　Beijing she only go EXP Shanghai, but she not go EXP other city　　(she go EXP China. √)

1152　*"As for Beijing, she has only been to Shanghai, but she has not been to any other cities. (She has been to

1153　China. √)"

1154

1155 *海鱼我最爱吃大虾，所以我常常买大虾。（"我"喜欢海鲜。√）

1156 *hai yu wo zui hai chi daxia, suoyi wo changchang mai daxia. ("wo" xihuan haixian. √)*

1157 sea fish I most like eat prawn, so I often buy prawn. ("I" like seafood. √)

1158 *"As for sea fish, I like to eat prawns most. Therefore I often buy prawns. ("I" like seafood. √)"

1159

1160 *篮球他最喜欢足球，所以他经常踢足球。（他讨厌体育。×）

1161 *lanqiu ta zui xihuan zuqiu, suoyi ta jingchang ti zuqiu. (ta taoyan tiyu. ×)*

1162 basketball he most like football, so he often play football. (he hates sports. ×)

1163 *"As for basketball, he likes football most. Therefore he often plays football. (He hates sports. ×)"

1164

1165 **Type C. Non-BGT sentences**

1166

1167 以前我最爱吃香蕉，所以我经常买香蕉。（过去"我"很少吃水果。×）

1168 *yiqian wo zui ai chi xiangqiao, suoyi wo jingchang mai xiangjiao. (guoqu "wo" hen shao chi shuiguo. ×)*

1169 before I most like eat banana,   so   I   often   buy banana. (in the past "I"   rarely   eat fruit. ×)

1170 "Before I liked to eat bananas most. Therefore I often bought bananas. (In the past "I" rarely ate fruits. ×)"

1171

1172 过去我最喜欢小狗，所以我有两只小狗。（"我"养过动物。√）

1173 *guoqu wo zui xihuan xiao gou, suoyi wo you liangzhi xiao gou. ("wo" yang guo dongwu. √)*

1174 past   I most like little dog, so   I have two   little dog. ("I" raise EXP animal. √)

1175 "In the past I like little dogs most. Therefore I had two dogs. ("I" once had animals. √)"

1176

1177 那时他只会说法语，所以他常常去法国。（那时候他不会说别的外语。√）

1178 *na   shi ta zhi hui shuo Fayu, suoyi ta changchang qu Faguo. (na shihou ta bu hui shuo   biede waiyu.)*

1179 that time he only can speak French, so   he often   go France. (that time he not can speak other foreign

1180 language.)

1181 "At that time he could only speak French. Therefore he often went to France. (At that time he could not

1182 speak other foreign languages.)"

1183

1184 那时候她只去过上海，可是她没去过别的城市。（那时候她没去过北京。√）

1185 *na shihou ta zhi qu guo Shanghai, keshi ta mei qu guo biede chengshi. (na shihou ta mei qu guo Beijing.√)*

1186 that time she only go EXP Shanghai, but she not go EXP other city.   (that time she not go EXP Beijing.√)

1187 "At that time, she had only been to Shanghai, but she had not been to other cities. (At that time, she had not

1188 been to Beijing. √)"

1189

1190 从前我最爱吃大虾，所以我常常买大虾。（"我"没买过海鲜。×）

1191 *congqian wo zui ai   chi daxia, suoyi wo changchang mai daxia. ("wo" mei mai guo   haixian. ×)*

1192 before   I most like eat prawn, so   I   often   buy prawn. ("I"   not buy EXP seafood. ×)

1193 "Before I liked to eat prawns most. Therefore I often bought prawns. ("I" have never bought seafood. ×)"

1194

1195 小时候他最喜欢足球，所以他经常踢足球。（他没踢过足球。×）

1196 *xiao shihou ta zui xihuan zuqiu, suoyi ta jingchang ti zuqiu.   (ta mei ti   guo zuqiu. ×)*

1197 small time he most like football, so   he   often   play football. (he not play EXP football. ×)

1198 "When he was small he liked football most. Therefore he often played football. (He has never played

1199 football. ×)"

1200
1201